新 高 中 生 物 精 要 測 試 站 答 案

Check point 測試站 (1)

1. What is the basic unit of structure and function of living organisms?
生物的最基本結構和功能單位是什麼？
細胞 cell

2. Explain cell theory.
解釋細胞理論。

1. The cell is the basic unit of life.
   細胞是生命的基本單位；
2. All living organisms are made up of cells and their products.
   所有生命都是由細胞或它的產品所組成；
3. Growth and reproduction are due to the division of cells.
   生長及生殖都是基於細胞分裂。

3. State the general structure of a cell.
簡述細胞的一般性結構。

1. It consists of a mass of protoplasm surrounded by a plasma membrane,
   基本上是一團被細胞膜所包圍著的原生質；
2. can exist singly or in group,
   可單獨或以組的形式存在；
3. contains various organelles.
   含有許多細胞器。

4. State the definition of organelle
說出細胞器的定義。
Specialised part of a cell for performing a specific function. eg. Chloroplast, mitochondrion.
細胞器是細胞內的特化部分，能進行特定的功能，例如：葉綠體、粒線體等。

5. Describe the structure and properties of cell membrane.
簡述細胞膜的性質及其結構。

1. Thin and flexible.
   薄而有彈性；
2. Differentially permeable
   具差異透性；
3. Made up of protein (60%) and phospholipid (40%) molecules.
   細胞膜是由蛋白質(60%)和磷脂分子(40%)所組成。

6. Describe the property of phospholipid with related to water affinity.
簡述磷脂對水親和力的特性。
Phospholipids contain a hydrophilic (water-loving) head and a hydrophobic (water-repelling) tail.
磷脂含有一個親水頭和一個疏水尾。

7. How is phospholipid arranged in the cell membrane?
磷脂如何在細胞膜內排列?

The phospholipid molecules formed a bimolecular layer.
兩層磷脂分子排列成一個磷脂雙分子層(脂雙層)。

The hydrophobic tails associated with each other at the center of the membrane with the hydrophilic heads extending towards the surface.
脂雙層的疏水尾排列在胞膜的中心，而親水頭排在兩表面。

8. What substance is attached to the surface of phospholipid bilayer?
脂雙層的表面貼有什麼東西?

Each side of these phospholipids was a layer of protein molecules, rather like the bread on either side of a sandwich.
在兩層磷脂的表面皆貼有一層蛋白質分子，很像位於三文治表面的兩層麵包。

9. Why does cell membrane model is called "fluid mosaic model" ?
爲什麼細胞膜模型名叫「流體鑲嵌模型」?

Viewed from the surface, the proteins are dotted throughout the phospholipid layer in a mosaic arrangement. The phospholipid layer is capable of movement, i.e. is fluid. It was these facts which gave rise to its name, the fluid-mosaic model.
從表面看，蛋白質就像鑲嵌(散佈)在整個磷脂層似的，磷脂可作大幅度運動，即是流體的，故稱這個模式爲「流體鑲嵌模型」。

10. What is the function of the surface protein?
胞膜表面的蛋白質有什麼功能?

They give structural support. They are very specific which allows cells to be recognized by other agents in the body (act as recognition markers), eg. enzymes, hormones and antibodies.
它們可給予結構性支持，它們是非常獨特的，可作爲識別標記，體內的酶、激素和抗體等物質便可對細胞加以識別。

11. State some functions of cell membrane.
說出細胞膜的一些功能。

1. With the help of cell membrane, compartmentalization of the cell and organelles is possible which aids in protection of the cell and maintenance of the cell shape.
   有了細胞膜，細胞便可分隔成許多部分，又可形成細胞器，幫助保護細胞及維持細胞的形狀。
2. It is differentially permeable, hence it can control the entrance and exit of molecules and ions.
   它是差異透性的，故可控制分子和離子的進出。
3. It provides surface for the accommodation of enzymes. eg. the electron transfer system in respiration.
   它可提供安放　的表面，例如爲呼吸作用中的電子傳遞系統提供表面。
4. It can recognize stimulus. eg. rod cells can recognize different wavelength.
   它可識別刺激，例如視桿細胞可識別不同的光波。
5. It provides identity to the cell. eg. antigens on red blood cell in relation to blood group.
   它可爲細胞提供身分，例如紅血球表面的抗原使血液有血型。

6. It aids in food ingestion (endocytosis) by forming food vacuole.
   它可形成食物胞幫助細胞攝入食物（胞吞作用）
7. It forms vesicle that functions in secretion. eg. synaptic vesicle releases neurotransmitter.
   它可形成負責分泌的小囊，例如會釋出神經遞質的突觸小囊。
8. It forms the myelin sheath of nerve fibres which facilitates the transmission of nerve impulse and insulates against cross-talks.
   它可形成神經纖維的磷脂髓鞘，幫助傳遞神經脈衝及作絕緣體防止脈衝泄漏。
9. Due to the fluid nature of the phospholipid bilayer, it is flexible so that the cell can grow and divide. It can change shape and seal back on itself during growth and cell division.
   因脂雙層的流動性質，使它具彈性，細胞膜可改變形狀，自行封合缺口，這對細胞的生長和分裂十分重要。

12. Explain the selective permeability of the plasma membrane.
解釋細胞膜的選透性能力。

The molecules of the lipid bilayer have a hydrophilic "water-loving" end which is soluble in water and a hydrophobic "water-repelling" end which is soluble in fat. The hydrophobic ends are repelled by water but are attracted to each other, and therefore they tend to line up in the centre of the membrane, leaving the hydrophilic ends projecting from the two outer surfaces. Because of the hydrophobic core, **the lipid bilayer is almost entirely impermeable to water and all water-soluble substances.** However, **fat-soluble substances**, such as oxygen, carbon dioxide, alcohols and steroids, **can penetrate the lipid bilayer. Water and dissolved ions** cannot pass through the cell membrane by simple diffusion, they **diffuse through channel protein molecules** which span the membrane to form pores.

磷脂雙分子層有一個親水的末端，使它能溶於水中，它亦有一個疏水的末端，使它能溶於脂肪中。

疏水的一端被水排斥，但它們相互吸引，故此它們傾向於排列在胞膜的中心，留下親水的一端伸出胞膜的兩面。

因爲有一個疏水的核心，這磷脂雙分子層幾乎是完全不透水和所有水溶性物質，但是脂溶性物質，例如：氧氣、二氧化碳、酒精和類固醇等都可穿過它。

水和可溶性離子雖不能靠簡單的擴散作用穿過細胞膜，但是它們可透過跨膜蛋白分子所建立的渠道來穿過細胞膜。

13. State the factors that can affect the cell membrane permeability.
說出並解釋影響胞膜透性的因素。

The cell membrane is composed of phospholipids and proteins, **any chemicals that can dissolve the lipids or alter the arrangement of the lipoprotein molecules may affect the permeability of cell membrane. Heat can denature the protein** so it can also affect the membrane permeability. The common chemicals that can affect the permeability are **organic solvents** such as chloroform, acetone and alcohol. Besides, ionic concentration, membrane structure, present or absent of inhibitors will also affect its permeability.

胞膜是由磷脂和蛋白質所組成的，任何可以溶解脂肪或改變磷脂蛋白排列模式的化學品，都可影響胞膜的選透性。

熱力可將蛋白質變質，所以它可影響胞膜的選透性。

常見可影響胞膜選透性的化合物是有機溶劑，例如：氯仿(哥羅芳)，丙酮和酒精。

其他影響胞膜選透性的因素有：溫度、離子濃度、膜的結構、抑制物的存在與否等。

14 .Explain what happens when beetroot (甜菜根) tissues are immersed in

(1) acetone and (2) paraffin oil.

當甜菜根浸入以下溶液時有什麼事發生：(1)丙酮、(2)石蠟油？

(1) The **acetone solution turns red**. Acetone can **dissolve the lipid components** in the cell membranes of beetroot cells, therefore, the **red pigment is able to diffuse out** through the destroyed cell membrane (1).

(2) The **paraffin oil stay colourless.** Paraffin oil will not affect the cell membrane of the beetroot cells, cells remain intact.

(1) 丙酮溶液轉爲紅色，因爲丙酮可溶解細胞膜中的脂肪成分，故此甜菜根的紅色素可擴散出損壞了的細胞膜。

(2) 石蠟油仍然保持無色，石蠟油不會影響甜菜根細胞的細胞膜，故此細胞仍然完整無損。

<u>Check point 測試站 (2)</u>

15. Describe the structure of endoplasmic reticulum.

簡述內質網膜的結構。

1. This is **a complex system of membrane** throughout the whole cytoplasm.
2. It is **continuous with the plasma membrane and the nuclear membrane** at some places.
3. Some of them **may be attached by ribosomes** and they are called rough ER, while those without the ribosomes are called smooth ER.

1. 這是一個充滿整個細胞質的複雜網狀系統結構。
2. 它和胞膜接通，在某些地方和核膜相連。
3. 有些被核糖體 (核蛋白體)附著，稱爲粗內質網膜，沒有核糖體附著的就稱爲滑內質網膜。

16. State the functions of endoplasmic reticulum.

說出內質網的功能。

1. Providing a large surface area for chemical reactions.
2. Providing a pathway for the transport of materials through the cell,
3. Producing proteins, especially enzymes (rough ER).
4. Producing lipids and steroids. (smooth ER).
5. Collecting and storing synthesized material.
6. Providing a structural skeleton to maintain cellular shape.

1. 給化學作用提供最大的表面積。
2. 爲細胞內的運輸提供路徑。
3. 生產蛋白質，尤其是酶(粗內質網膜)。
4. 產生脂肪及類固醇 (滑內質網膜)。
5. 收集和儲存合成的物質。
6. 提供架構組織以維持細胞的形狀。

17. Describe the structure of mitochondria and its occurrence.
描述粒線體的結構和它的分佈。

1. They can be **spherical or rod-shaped**.
2. It is **bound by two unit membranes**,
3. the inner membrane **folds inwards to form projections called cristae** which greatly increase the surface area for respiratory reactions.
4. They are **abundant in cells which require a lot of energy to do works**, e.g. in muscle cells and in cells with active transport.

1. 它可以是楕圓形或棒形的，通常直徑一微米。
2. 它被兩層單元薄膜(胞膜)所包圍。
3. 內膜向內摺疊而成稱爲**內脊**的凸出物，這可增加呼吸作用的表面積。
4. 在需要大量能量工作的細胞有很多粒線體，例如：肌肉細胞和參與主動運輸的細胞。

18. State the functions of mitochondria and its occurrence.
說出粒線體的功能。

The mitochondrial cristae **contain respiratory enzymes involved in the Krebs cycle and electron transfer**, i.e. **their functions is synthesis of ATP**.
粒線體內的內脊含有許多參與克雷伯氏循環和電子傳遞的呼吸作用酶，它的功能是合成 ATP。

Check point 測試站 (3)

21. Describe the structure or cell wall.
描述細胞壁的結構。

Thick and rigid. Freely permeable.
It is a non-living structure composed of mainly of cellulose and with pores (pits) which allow protoplasmic connections between adjacent cells.
厚而硬，自由滲透。
沒有生命的構造，由纖維組成，細胞壁有小孔可容許鄰近細胞間以原生質作聯繫。

22. State the functions of the cell wall.
說出細胞壁的功能。

1. It provides mechanical support and protection to the plant. (Especially in sclerenchyma and xylem which possess very thick cell wall and thus serve as the main supporting tissues in the plant.)
爲植物提供機械性支持及保護。(這功能在厚壁細胞和導管中特別重要，因爲該等細胞含有很厚的細胞壁，可作爲植物的主要支持組織。)

2. Cell walls are resistant to expansion and allow development of turgidity when water enters the cell by osmosis. This contributes to the support of all plants and is the main source of support in herbaceous plants and organs such as leaves which do not undergo secondary growth.
   細胞壁可抗拒因滲透作用引起的細胞吸水膨脹，因而令細胞硬脹，爲所有植物提供支持，這對於沒有次回生長的草本植物和樹葉等器官尤其重要。
3. The rigid and yet permeable nature of the cell wall makes it an ideal protective layer without interfering with the movement of materials in and out of the cell.
   細胞壁雖硬但具透性的性質使它可作爲理想的保護層，因爲不會干預物質進出細胞。

23. Tabulate the differences between the cell membrane and the cell wall.
用表比較細胞膜和細胞壁的不同處。

	Cell membrane **細胞膜**	**Cell wall** **細胞壁**
Chemical composition 化學成份	Lipoprotein 脂蛋白	Cellulose 纖維
Thickness 厚度	Thin 薄	Thick 厚
Permeability 穿透性	Differentially permeable 差異透性	Completely permeable 自由滲透
Rigidity 硬度	Not rigid 不硬	Rigid and strong 硬且強
elasticity 彈性	More elastic 較有彈性	Less elastic 沒有彈性
Methods of movement of substances across the membrane/wall 物質穿過細胞膜或細胞壁的方法	Diffusion, osmosis and active transport 擴散、滲透、主動運輸	Diffusion 擴散
Receptor sites 受體部位	With specific receptor sites 有特別的受體部位	Without specific receptor sites 沒有特別的受體部位

24. Describe the structure of chloroplast.
描述葉綠體的結構。

1. Large and green, containing chlorophyll.
   綠色大型物體，含有葉綠素。
2. Each chloroplast consists of a double membrane enclosing a homogenous matrix, the stroma, in which a number of grana are embedded.
   由雙層薄膜包圍，內含基質，基質內有許多基粒。

25. State the function of chloroplasts.
說出葉綠體的功能。

It is the site of photosynthesis during which carbohydrate is manufactured.
這是進行光合作用製造碳水化合物的地方。

26. Describe the structure of vacuole.

描述液胞的結構。

1. It is bounded by a single membrane called the tonoplast.
   由一層名爲液胞膜的單層薄膜所包圍著；
2. Large and located at the centre of the cell.
   佔細胞相當大範圍，位於細胞中央；
3. It contains cell sap, a concentrated solution of various substances, such as mineral salts, sugars, pigments, organic acids and enzymes.
   液胞內的液體名爲細胞液，含有各種物質，例如：礦物鹽、糖分、色素、有機酸和酶。

27. State the functions of vacuole.

說出液胞的功能。

1. It collects wastes and food.
   它儲存廢物和食物。
2. It facilitates water uptake by osmosis.
   它藉滲透作用幫助植物吸收水分。
3. It provides support to the herbaceous plant.
   它爲草本植物提供支持。

Check point 測試站 (4)

28. What is meant by prokaryotic?

原核是什麼意思？

1. Hereditary material, DNA, is not enclosed within a nuclear membrane.
   遺傳物質 DNA 不被核膜所包圍。
2. No true nucleus or chromosomes.
   沒有眞正的細胞核或染色體。
3. Circular DNA lying naked in the cytoplasm.
   環狀 DNA 赤裸地藏於細胞質內。
4. No membrane-bounded organelles.
   沒有被細胞膜所包圍著的細胞器。
5. Infolding of cell membrane (mesosome) for respiration.
   細胞膜內摺形成間體以助呼吸作用。
6. No mitosis. eg. bacteria and blue-green bacteria (blue-green algae)
   沒有有絲分裂。例如：細菌和藍綠細菌(藍綠藻)。

29. What is meant by eukaryotic?

真核是什麼意思？

1. Development of membrane-bounded organelles, such as mitochondria and chloroplasts.
   此類細胞有被細胞膜包圍著的細胞器，例如：線粒體及葉綠體。
2. Distinct, membrane bounded nucleus.
   明顯的細胞核被核膜包圍著。
3. Chromosomes present.
   有染色體。
4. Nuclear division is by mitosis or meiosis. eg. plant and animal cells
   核分裂可以是有絲分裂或減數分裂。例如：動植物細胞。

30. What are the advantages of eukaryotic organization over prokaryotic organization?
真核比原核有什麼的優點？

Eukaryotic organization enables a cell to function in a more organized and systematic way compared to prokaryotic organization. Eukaryotic cells possess :
比起原核細胞，眞核細胞可令細胞更有組織及更有系統地運作，眞核細胞擁有：

1. **Longer DNA** — stores more genetic information.
   更長的 DNA－可儲藏更多的遺傳資訊。
2. **Nucleus**－DNA is confined to and replicates in it; cell division follows nuclear division which ensures each daughter cell receives the same amount of genetic information.
   細胞核－DNA 局限於細胞核內進行自我複製，細胞核分裂後才到細胞質分裂，這可確保每個子細胞都擁有相同分量的遺傳物質。
3. **Membrane bounded organelles**, eg. ER, rER, mitochondria－increases the efficiency of protein synthesis.
   被薄膜包圍著的細胞器，例如：內質網膜，線粒體，可增加蛋白合成的效率。
4. **Mitochondria**－better distribution of enzymes enables the cells to carry out aerobic respiration efficiently.
   線粒體－酶的更佳分佈可讓細胞更有效地進行有氧呼吸。
5. **Chloroplasts** - present in certain eukaryotic cells, arrange the photosynthetic pigments in such a way so as to maximize the rate of photosynthesis.
   葉綠體－只存在於某些眞核細胞，可將光合作用色素更佳地排列以促進光合作用。

31. What are the advantages of having membrane-bounded organells?
有被薄膜包圍著的細胞器有什麼的優點？

1. Many metabolic processes involve enzymes being embedded in a membrane. As cells become larger, the proportion of membrane area to cell volume is reduced. This proportion is increased by the presence of organelle membranes.
   許多代謝作用都涉及附於薄膜表面的酶，當細胞變大，薄膜面積對體積的比例便相對地減少，細胞器薄膜的出現，可使此比例增加。
2. Regulating the rate of the first reactant enters can control the biochemical reaction rate inside an organelle.
   利用細胞器薄膜控制最初反應物的進入，可調節細胞器內的生化作用率。
3. Potentially harmful reactants or enzymes can be isolated inside an organelle so they won't damage the rest of the cell.
   潛在的有害反應物或酶可局限在細胞器內，被隔離以免傷害細胞的其他部分。

32. Name all the cellular organelles which are surrounded by two layers of membrane.
說出所有被兩層薄膜包圍著的細胞器。

Mitochondrion, chloroplast, nucleus
線粒體、葉綠體、胞核

33. What is the importance of double membrane in organelles?
擁有兩層薄膜的細胞器有什麼好處？

Double membranes help compartmentalization and increase surface area for enzymatic reactions.
雙層膜可將細胞器分隔成不同部位，增加表面積，有利酶促作用的進行。

34. What are the benefits of multicellularity over acellularity (unicellularity).
多細胞性比非細胞性或單細胞性擁有什麼的優點？

Multicellularity confers greater independence of the environment by :

多細胞性令生物在環境中有較大的獨立性。

1. **Freedom of movement:**

   自由行動：

   Organisms are heavy enough to overcome surface tension of water and turbulence in air, thus the organisms can avoid being swept aimlessly about like unicellular animals. Organisms can move at their own will due to development of locomotory organs. This increases the chance of finding food and mating partners, escaping from enemies and exploiting new habitats.

   生物可長得較大以對抗水的表面張力和空氣中的湍流，使這等生物可避免像單細胞生物般被水流或氣流盲目地沖走，因爲擁有行動器官，牠們可按意願來移動，這可增加牠們找尋食物和伴侶、逃避敵人、及開發新環境的機會。

2. **Better chances of overcoming desiccation:**

   有較大的抗旱能力：

   Multicellularity reduces the body surface area to volume ratio which in turn reduces water loss by evaporation, thus the organisms would be dry up at a slower rate when compared to unicellular organisms.

   多細胞性可減少身體表面積對體積的比例，因此可減少因蒸發作用而引致的缺水現象，多細胞生物比單細胞生物較慢乾化。

3. **Increased heat conserving ability:**

   增加保溫能力：

   A smaller surface area to volume ratio reduces heat loss in cold environments, thus the organisms can withstand fluctuations in atmospheric temperatures much better than unicellular organisms.

   身體較小的表面積對體積比例會減低在寒冷環境中熱能的散失，結果多細胞生物比單細胞生物更能在溫差較大的環境中生存。

4. **Division of labour:**

   分工合作：

   Division of labour allow some cells to specialize for a specific function. Usually the cells are differentiated into tissues which will lead to a higher level of organ organization.

   多細胞性可使細胞分工合作，容許某些細胞特化起來作某種特別功能，通常細胞會被分化成各種組織，最終會達到器官層面的分化。

35. What are the similarities between plant cells and animal cells..
動植物細胞有什麼相同處。

Similarity 相同處:

1. They have similar chemical constituents including water, proteins, lipids, carbohydrate, mineral salts, vitamins, nucleic acids, etc.

   它們有相似的化學結構，包括：水、蛋白質、脂肪、碳水化合物、礦物質、維生素和核酸等。

2. They are structurally similar to each other, consisting of the cytoplasm in which organelles and the nucleus are embedded, and enclosed by the cell membrane.

   它們結構上非常相似，兩者都有被細胞膜包圍著的細胞質，內藏細胞器及細胞核。

3. Both of them have cell membrane, cytoplasm, mitochondria, endoplasmic reticulum and nucleus.
   兩者都有細胞膜、細胞質、線粒體、內質網和細胞核。

36. What are the differences between plant cells and animal cells.
動植物細胞有什麼不同處。

Differences 不同處：

		Plant cells 植物細胞	Animal cells 動物細胞
1.	**Cell wall** **胞壁**	With a rigid cell wall. 有堅硬的胞壁。	No cell wall. 沒有胞壁。
2.	**Vacuole** **液胞**	Vacuole is present 有液胞。	No vacuole or very small 沒有液胞或很小。
3.	**Chloroplasts** **葉綠體**	Have chloroplasts containing chlorophyll. 有盛載著葉綠素的葉綠體。	No chloroplasts. 沒有葉綠體。
4.	**Food storage** **食物儲備**	Food storage is starch. 儲藏的食物是澱粉質。	Food storage is glycogen. 儲藏的食物是糖原。
5.	**Location of nucleus** **胞核的位置**	Usually at the edge of the cell 位於細胞的邊緣。	Usually at the center of the cell. 位於細胞的中心。

37. Arrange the different level of organization of an organism in order.
將生物的結構層次按複雜性從低至高排列。
細胞 → 組織 → 器官 → 系統 → 個體
Cells → tissues → organs → systems → organism

38. Give the definition of tissue.
說出組織的定義。
A group of similar cells bounded together by middle lamella in plant or intercellular matrix in animal, that perform the same function. eg. epidermis.
一群相似而且一起工作的細胞，它們有同一樣的功能，例如：表皮。

39. Give the definition of organ.
說出器官的定義。
Grouping of a variety of tissues to perform a specific function for an organism. eg. leaf, heart.
由數種不同組織所組成的工作單元，例如：樹葉、心臟。

40. Give the definition of system.
說出系統的定義。
A system is made up of several organs that perform related functions. eg. digestive system.
系統是由數個一起工作的器官所組成的，例如：消化系統。

Check point 測試站 (5)

1. Briefly describe some biological significance of water.
簡述一些水對生物的重要性。

1. Water is a **good solvent** for many substances. Substances must be in aqueous form before they can enter the cells. Its aids in transportation of nutrients, hormones and excretory wastes.
   水是多種物質的**良好溶劑**，物質需在溶解形式才能進入細胞，它幫助運輸營養、激素、及排泄廢物。
2. Water provides a **medium for chemical reactions** to take place.
   水提供**化學反應所需的介質**。
3. Water can act as a **reactant** in metabolic reactions. For example, water provides hydrogen ions in photosynthesis. Hydrolysis of many organic compounds in digestion also requires water.
   水可作爲代謝活動的**反應物**，例如水爲光合作用提供氫離子，消化作用中的有機物水解都需要水。
4. Water can be used as **cooling agent**. Heat can be lost through evaporation of water. eg. in sweating of man and panting of dogs.
   水可作爲**降溫劑**，水蒸發時可帶走熱能，例如人類的出汗及狗的熱喘。
5. Water has a **high specific heat capacity**, so the temperature of an organism does not fluctuate too much despite of the rapid change in the temperature of the environment.
   水有**高熱容**，雖則環境的溫度可能急速轉變，但生物的體溫仍不會有很大的波動。
6. The **cohesive and adhesive force** of water aids in capillarity in soil and in plants. The cohesive force between water molecules leads to the upward movement of water molecules in xylem during transpiration.
   水**有很大的內聚力及附著力**，可助植物藉毛細管作用吸收泥土的水分，在蒸騰作用時，水分子間的內聚力使水可沿木質部內上升。
7. Water is **incompressible** so that it provides hydroskeleton in earthworm and turgor potential in plants.
   水的**抗壓性**令它可作蚯蚓的水骨骼及爲植物提供硬脹。
8. Water provides **buoyancy** for plants and animals in water.
   eg. pond skater can be supported on the water surface.
   水爲水生動植物提供**浮力**。例如水較剪可浮於水面上。

2. Name some inorganic ions which are important in keeping organisms healthy.
說出於維持生物健康非常重要的無機離子。
Nitrate, magnesium, calcium and iron.
硝酸鹽、鎂、鈣及鐵。

3. Explain the importance of nitrate in maintaining heath.
解釋硝酸鹽於維持健康的重要性。

1. A source of nitrogen in plants for making proteins.
   氮的來源，植物需要用它來製造蛋白質。
2. Animals obtain nitrogen by feeding on plants and other animals.
   動物可透過進食其他生物獲取氮。

4. Explain the importance of magnesium in maintaining heath.
解釋鎂於維持健康的重要性。

1. Forming chlorophylls in plants.
   製造葉綠素。
2. A activator for some enzymes.
   活化酶。

5. Explain the importance of calcium in maintaining heath.
解釋鈣於維持健康的重要性。

1. Keeping bones and teeth hard and strong.
   維持骨骼與牙齒堅固。
2. Required in muscle contraction and blood clotting.
   用於肌肉收縮及凝血過程。

6. Explain the importance of iron in maintaining heath.
解釋鐵於維持健康的重要性。

1. Needed for forming hemoglobin (a pigment in red blood cell for carrying oxygen).
   製造血紅素(紅血球運送氧氣的色素)。
2. A activator for some enzymes.
   活化酶。

7. Describe the structure and properties of monosaccharides.
說出單糖的結構和性質。

Formula : $C_6H_{12}O_6$. They are soluble in water, crystallizable, sweet, able to pass through a selective-permeable membrane and all have reducing property.

方程式: $C_6H_{12}O_6$，它們能溶於水，可結晶，很甜，能夠穿越選透膜，全都擁有還原性質。

8. Describe the structure and properties of disaccharides.
說出雙糖的結構和性質。

Formula : $C_{12}H_{22}O_{11}$

方程式: $C_{12}H_{22}O_{11}$

They are soluble in water, crystallizable and sweet.

它們全都溶於水，可結晶和很甜。

9. What is mean by condensation?
什麼是縮合反應？

Condensation : the combination of two simple molecules to form a complex one with the release of water.

縮合反應: 兩個簡單分子透過排除一個水分子而結合成一個複雜的化合物。

10. Describe the structure and properties of polysaccharides.
說出多糖的結構和性質。

They are insoluble, tasteless non-crystallizable.

它們不溶於水，無味和不能結晶。

Formula : $(C_6H_{10}O_5)n$ where n may be 300 to 400 in starch and 10000 in cellulose.

方程式: $(C_6H_{10}O_5)n$，n 的數目在澱粉是 300 到 400，在纖維則是 10000。

11. What happened to polysaccharides in hydrolysis?
水解作用時多糖會變成什麼？

polysaccharides can be converted to their constituent monosaccharides.

水解時，多糖可轉回組成它的單糖。

12. Why are starch and glycogen suitable for storage?
爲什麼澱粉及糖原適合作儲藏？

1. Starch and glycogen are **insoluble** in water. They does not affect the water potential of cytoplasm and hence, the metabolic processes in cells.
   澱粉及糖原皆**不溶於水**，不會影響細胞質的水潛能，所以不會影響細胞的代謝活動。
2. Their **molecules can be packed closely** in cells so that they do not occupy a lot of space.
   它們的**分子可緊貼在一起**，故不會佔據太多空間，方便儲藏。
3. They can be **easily hydrolyzed** to simple sugar which can be oxidized to release energy in respiration.
   它們**很容易水解**爲簡單的葡萄糖，於呼吸作用中作爲基質以釋出能量。

13. What are the functions of carbobydrates?
說出碳水化合物的功能。

1. As the main **respiratory substrates** (hexose sugar)
   作爲主要**代謝基質**(己糖)。
2. As food **storage materials** (starch, glycogen, sucrose)
   作爲**食物儲備**(澱粉、糖原、蔗糖)
3. As **structural materials** (cellulose)
   作爲主要**結構物質**(纖維素)

14. Describe the structure and properties of lipids.
說出脂肪的結構和性質。

They are compounds containing carbon, hydrogen and oxygen, and the ratio of hydrogen to oxygen is greater than two. Lipid is formed from 3 molecules of fatty acids and one molecule of glycerol, joined together by the removal of 3 molecules of water. They are insoluble in water, but soluble in organic solvents.

這是含有碳原子、氫原子和氧原子的化合物，而氫原子對氧原子的比例通常大過二。脂肪是由三個脂肪酸分子和一個甘油分子透過排除三個水分子而接合而成的。它們不溶於水，但溶於有機溶劑。

15. What are the functions of lipids?
脂肪有什麼功用？

1. As **energy source**, greater energy yield than carbohydrates.
   作爲**能源**，它的能量值比碳水化合物還要大。
2. Chief **storage materials**
   作爲主要的儲藏物質。
3. Provide protection.
   提供**保護**。
4. As **structural component** of the body.
   作爲身體的**結構**物質。

Check point 測試站 (6)

16. What is protein made up of?
蛋白質由什麼物質組成？
Proteins are made up of amino acids
蛋白質是由氨基酸所組成的。

17. Which two groups does an amino acid contain?
氨基酸由那兩部分組成?
Amino acid contains an amino group (-NH2) and a carboxyl group (-COOH).
氨基酸具有一個氨基和一個羧基

18. What bond helps to bind amino acids together?
氨基酸用什麼鍵連接在一起?
Peptide bond. 肽鍵。

19. What determine the protein's individuality?
蛋白質的性質取決於什麼?

1. Sequence of amino acid.
   氨基酸排列的次序。
2. Pattern of branching, folding and cross-linkages.
   多肽鏈的分支、摺疊和交聯交接的模式。

20. Explain what denaturation of protein is.
解釋何謂蛋白質的變質。
Three dimensional structure of a protein is due to fairly weak ionic and hydrogen bonds. Any agent which breaks these bonds will cause the three dimensional shape to be changed. In many cases the globular proteins revert to a more fibrous form. This is called denaturation.
蛋白質的三維構造是靠脆弱的離子鍵和氫鍵所維持的，任何能破壞這些鍵的因素都可以引起三維結構的改變，通常球狀蛋白會轉爲纖維狀，這便稱爲變質。

21. State all the factors which cause protein denaturation
說出影響蛋白質變質的所有因素。

(1) Heat 熱能
(2) Acids 酸
(3) Alkalis 鹼
(4) Inorganic chemicals 無機化學物品
(5) Organic chemicals 有機化學物品
(6) Mechanical force 機械力量

22. State the functions of proteins.
說出蛋白質的功能。

1. They are the **structural component** of the body and thus the raw materials for growth.
   它們是身體的**結構物**及生長的原料，它們組成原生質和細胞膜。
2. As **energy source**.
   作爲**能源**。

2. As **functional molecules**. The three dimensional conformation of proteins and their **binding sites** are essential in various body functions.

   作爲**功能分子**，蛋白質的三維結構及它們的**結合部位**在身體的各種功能上非常重要。

   (a) They form **enzymes** which regulate cellular chemical reactions.
   它形成可控制細胞生化活動的**酶**。

   (b) They form **hormones** which regulates physiological process.
   它形成可協調生理活動的**激素**。

   (c) They form **haemoglobin** which transport oxygen.
   它形成可運輸氧氣的**血紅素**。

   (d) They form **actin and myosin** which provide movement through muscle contraction.
   它形成可令肌肉收縮的**肌動蛋白和肌球蛋白**。

   (e) They form **antibodies** which are essential in body defence.
   它形成可對抗病菌的**抗體**。

   (f) They act as **carrier molecules** in active transport and transport across membrane.
   它作爲主動運輸及跨膜運輸的**載體**。

   (g) They act as **receptor molecules** in the membrane surface.
   它作爲**胞膜表面的受體**。

   (h) They act as the **electron carriers** in respiration.
   它作爲呼吸作用中的**電子載體**。

23. What is nucleotide made up of?
核苷酸由什麼物質組成？

Each nucleotide consists of a **ribose sugar** which links to a **phosphoric acid** and to an **organic base**.
每個**核苷酸**都是由一個**核糖**、一個**磷酸**及一個**鹼基**所組成。

24. Describe the functions of nucleotides in living organisms.
說出核苷酸在生物上的功能。

1. Nucleotides are the **basic unit of nucleic acids** DNA and RNA. DNA is the genetic materials which code for the synthesis of proteins. As some proteins become enzymes, nucleic acids play a part in **controlling cellular activity**.

   核苷酸是核酸－DNA 和 RNA 的基本結構單位，DNA 含有指令蛋白合成的遺傳資料，因某些蛋白質會變成酶，核酸參與**控制細胞活動**。

2. Nucleotide **involved in heredity**. DNA and RNA can self-replicate. The genetic materials can pass from one generation to the next.

   核苷酸**參與遺傳**，DNA 和 RNA 可自我複製，故遺傳物質可代代相傳。

3. Nucleotide **forms energy rich compounds such as adenosine triphosphate (ATP)**. ATP is the immediate energy source.

   核苷酸可**形成高能化合物腺苷三磷酸（ATP）**，ATP 是即時的能量來源。

4. Nucleotides also **form co-enzymes**.

   核苷酸**形成許多種輔酶**。

Check point 測試站 (7)

1. **Explain the term diffusion.**
   解釋名詞擴散作用
   Molecules move from a region of higher concentration to a region of lower concentration.
   分子會由一個高濃度的地區移往一個低濃度的地區。

2. **Explain the old meaning of the term osmosis.**
   解釋名詞滲透作用的舊意義。
   Osmosis is the diffusion of water molecules from a less concentrated solution to a more concentrated solution through a differentially permeable (selective permeable) membrane.
   水分子透過差異透性膜(選透膜)由含水分子高的溶液(稀溶液)移往含水分子低的溶液(濃溶液)。

3. **Explain the new meaning of the term osmosis.**
   解釋名詞滲透作用的新意義。
   The net movement of water molecules across a differentially permeable membrane from a region of higher water potential to a region of lower water potential.
   水分子通過差異透性膜，從高水勢區向低水勢區的淨移動。

4. **Explain the meaning of the term water potential.**
   解釋名詞水勢。
   Water potential describes the tendency of water molecules to move from one place to another.
   水勢形容水分子由一個區域移至另一個區域的傾向。

5. **State the direction of water movement in different water potential.**
   說出在不同水勢，水的流動方向。
   Water moves from a higher water potential solution to a lower one.
   水分子從高水勢流往低水勢。

6. **How does the presence of solute affect water potential?**
   溶質的存在如何影響水勢?
   Presence of solutes reduces the water potential, becomes negative.
   溶質的存在會降低水勢，出現負值。

7. **What happens to the plant cell when water flows into it?**
   當水流入植物細胞，會發生什麼變化？
   Cell expands and becomes turgid.
   細胞膨脹及變得硬脹。

8. **What change occurs on the water potential as water keeps flowing into the cell?**
   當水不斷流入植物細胞水潛能會發生什麼變化？
   Water potential rises.
   水勢上升。

9. What is the state and water potential of the cell when water stops flowing in the cell.
當水不再流入植物細胞，說出細胞的狀態及其水潛能。
Full turgor is reached; the cell can expand no more; the water potential reaches zero and the osmotic potential of the cell sap is exactly counterbalanced by the wall pressure (pressure potential).
達至完全硬脹，細胞不能再膨脹，水勢達至零，而液泡的溶質勢完全被胞壁壓(壓力勢)所抵消

10. What is the state of the plant cell when water potential is equal to the solute potential?
當水勢等如溶質勢時，植物細胞在什麼狀態？
Plasmolysis 質壁分離

11. Explain the meaning of the term plasmolysis.
解釋名詞質壁分離。
water is drawn out and the cytoplasm shrinks, cell membrane pulls away from the cell wall
水分子被抽出細胞，細胞質因而收縮，細胞膜拉離細胞壁。

12. What happened to a red blood cell when it is placed in a hypotonic solution?
當紅血球被放進低滲性溶液時有什麼變化？
Osmosis occurs so that water enters the cells which increase in volume and finally burst.
滲透發生使水進入紅血球，紅血球增加體積至最終爆破。
Haemoglobin is released and water turns pink. (haemolysis)
血紅素被釋出，使水變成粉紅色。(稱爲溶血)

13. Explain the term active transport.
解釋名詞主動運輸。
Active transport is a process in which enzymes and carrier molecules carry substances across membranes. This process requires energy, and substances may be transported against concentration gradient.
主動轉運是一個利用酵素和載體分子將物質運過細胞膜的作用，這作用需要 ATP 作能量，物質的運送可對抗濃度坡度。

14. Describe the characteristics of cells and tissues which have active transport.
說出那些經常進行主動運輸的細胞和組織有何特徵。
1. The presence of numerous mitochondria.
   有很多線粒體。
2. A high concentration of ATP.
   有很高濃度的 ATP。
3. A high respiratory rate.
   有很高的呼吸率。

15. State the different ways by which material pass through cell membranes.
說出物質穿越細胞膜的不同方法。
1. Diffusion 擴散作用
2. Osmosis 滲透作用
3. Active transport 主動轉運
4. Endocytosis 胞吞作用 (phagocytosis 吞噬作用)

16. Explain the term phagocytosis.
解釋名詞吞噬作用。
Large particles (eg. Bacteria or dead tissues) are engulfed by pseudopodia of specialized cells
大粒子(例如細菌和已死組織)會被特殊細胞的僞足包圍而形成食物胞。

17. Explain the importance of phagocytosis.
解釋吞噬作用的重要性。
1. The feeding method of some single-celled organisms. eg. Amoeba engulf food particles.
一些單細胞生物的進食方法，例如變形蟲吞噬食物粒。
2. The defense mechanism of most animals. eg. White blood cells engulf harmful microorganisms
許多動物的防衛機制，例如白血球吞食有害的微生物。

Check point 測試站 (8)

1. What is enzyme?
酶是什麼？
Enzymes can be defined as biological **catalyst** that speed up reactions.
酶是促進生化作用的生物催化劑。

3. Explain how do enzymes speed up reactions without altering the temperature.
解釋爲什麼酶可促進化學作用而又無需改變溫度。
Enzymes act as catalyst, can reduce the activation energy required for a chemical reaction to take place.
酶的功能像催化劑，可將某種化學作用所需的活化能大爲降低。

3. Describe the properties of enzyme with respect to nature, working rate, durability and direction.
描述與下列有關的酶的性質: 本質、工作速度、耐用性及催化方向。
a) All enzymes are globular proteins
所有酶都是球蛋白。
b) Enzymes generally work very rapidly.
酶的工作速度通常非常快。
c) Enzymes are not destroyed by the reactions they catalyse and so **can be used again**
酶不會用掉，亦不會被化學作用破壞，它可重複使用。
d) An enzyme can work in either direction
酶可以在向前和向後兩個方向上工作。

4. Describe the properties of enzymes with respect to inactivation, pH and specificity.
描述與下列有關的酶的性質: 鈍化、酸鹼度(pH)、專特性。
a) Enzymes are denatured by excess heat
酶在低溫被鈍化而在高溫則被變性而變得不活躍。
b) Enzymes are sensitive to pH
酶對酸鹼度(pH)非常敏感。
c) Enzymes are specific in the reactions they catalyse
酶對於它們的化學作用有專特性，這比無機催化劑尤甚。

5 Explain the mechanism of enzymatic reaction.
解釋酶促作用的機制原理。

Each enzyme has a special site called the active site where reaction occurs. The substrate molecule would bind to the active site and then reaction can undergo. The active site has a specific configuration. Only substrate with complementary shape to the active site can bind to the active site.
每種酶都有一個特別的位置名爲活性部位，那裡可促進化學作用的發生，基質分子們會和活性部位結合，然後基質間發生化學作用。基質分子和酶的形狀互相切合，基質間的化學作用會因酶將它們拉在一起而加速。

6 What is meant by active site?
何謂活性部位？

Each enzyme has a special site called the active site where reaction occurs. The substrate molecule would bind to the active site and then reaction can undergo. The active site has a specific configuration. Only substrate with complementary shape to the active site can bind to the active site.
每種酶都有一個特別的位置名爲活性部位，那裡可促進化學作用的發生，基質分子們會和活性部位結合，然後基質間發生化學作用，活性部位具特別形態，只有那些形狀合適的基質才能和它結合，其他形狀不相稱的便不能。

7. How can the backward reaction be avoided?
如何避免反向作用？

The product is immediately removed and therefore the backward reaction is avoided
在自然的情況下，產品會被立即移走，這可避免反向作用。

8. Explain the specificity of enzymes.
解釋酶的專特性。

The enzyme has no reaction on other substrate because their shapes may not fit each other.
酶對其他的基質是沒有作用的，因爲它們的形狀不能互相切合。

Check point 測試站 (9)

9. Explain why heat can destroy enzymes.
解釋爲什麼熱力可破壞酶。

Heat disrupts the structure of the enzymes, denaturing the enzymes. The enzyme lost its catalytic ability.
熱力會破壞酶的構造，酶分子的三維形狀亦隨之而改變，即是使酶變性，令酶失去催化的能力。

10. Why the reaction rate is speeded up at a higher temperature?
爲什麼在高溫酶促作用的速率會增加？

1. Higher temperature enables enzyme and substrate molecules to collide more frequently and therefore facilitates the substrate molecule bind to the active site of the enzyme.

當溫度升高時，酶分子和基質的動能會增加，使它們運動的速率較快，這些分子運動得越快，它們相互碰撞的機曾就越多，因而反應的速率也就越高。

2. Heat provides activation energy and increases molecular motion.
   高溫亦令到基質分子獲取它們的活化能，因而增加酶促作用的速率。

11. Why is the change of pH may lead to a loss of catalytic power of an enzyme?
爲什麼改變酸鹼度可使酶失去催化能力？

The precise shape of enzyme is due to the hydrogen bonding between positive and negative charges on the enzyme molecule. Changes in pH may break these bonds, weakens the forces holding the enzyme molecules together. Thus leads to an alteration in enzyme shape, particularly at its active site. Hence the substrate no longer fits easily into the active site and catalytic activity is diminished.

酶的三維分子形狀對它的功能是極爲重要的。要維持這形狀，有部分須依靠酶分子上的氫鍵，而氫離子(H^+)濃度的變化可能會打破這些鍵，改變活性部位的形狀，從而有效地使酶變性。

12. Explain competitive inhibition.
解釋競爭性抑制。

In competitive inhibition, a compound, structurally similar to that of the usual substrate, associates with enzyme's active site, but is unable to react with it. While it remains there, it prevents access of any molecules of true substrate. The substrate and inhibitor compete for position in the active site. As the substrate can still use the unaffected enzymes, so the amount of product is the same, however the required time is longer. This is because the substrate is competing with the inhibitor directly, the more the substrate, the higher is the chance of finding the active site and the less free active sites left for the inhibitor. It is possible to be reversed, if the substrate concentration increased, the rate of reaction will be increased.

競爭性抑制物具有一個能與活性部位結合的形狀，所以它能與基質競爭酶分子的活性部位，當它仍然與活性部位連結時，便阻止了基質分子與活性部位結合，因而降低反應的速率。因爲基質和抑制物處於直接競爭時，基質分子越多，找到活性部位的機曾就越多，留給抑制物佔有的活性部位就越少，所以基質的濃度增加，抑制便較少。

13. Explain non-competitive inhibition.
解釋非競爭性抑制。

This type of inhibitor has no real structural similarity to the substrate and forms an enzyme-inhibitor complex at a point other than its active site. It has the effect of altering the globular structure of the enzyme, so that even though the real substrate may be able to bind with the enzyme, catalysis is unable to take place. As the inhibitor binds to the other sites of the enzyme, they won't compete for the active site. So, increase in substrate concentration will not decrease the inhibition.

非競爭性抑制物不會結合到酶的活性部位上，而是結合到酶分子其他的部位，繼而將酶分子的形狀改變，使活性部位不再切合基質。因爲抑制物結合在酶的其他位置，兩者便不需競爭相同部位，因此，增加基質濃度不會減少抑制物的影響。

14. Compare competitiv and non-competitive inhibitions.
比較競爭性與非競爭性抑制。

	Competitive 競爭性	**Non-competitive 非競爭性**
Molecular structure **分子結構**	Similar to substrates 與受質相似	Different from substrates 與受質不同
sites that bind with enzyme molecules **與酶分子結合的部位**	Active sites 活性部位	Parts other than active sites 活性部位以外的部位
Effect on enzyme **對酶的影響**	Occupying active sites loosely 只會鬆散地佔據活性部位	Altering shape of active sites temporarily 暫時改變活性部位的形狀。
Examples **例子**	Malonic acid 丙二酸	Cyanide 氰化物
Factors affecting degree of inhibition **影響抑制程度的因素**	Relative concentrations of substrate and inhibitor 受質與抑制物的相對濃度	Inhibitor concentration and binding affinity for enzyme 抑制物的濃度及其對酶的親和力

15. Explain why does the reaction rate slow down as the reaction proceed.
爲什麼當化學作用進行時其速率會漸漸減慢？

At the beginning, the substrate concentration is high so the chance of fruitful collision between the substrate molecules and enzyme molecules is higher. Later, the substrate concentration becomes lower because some substrates have been converted into products. Thus the chance of collision between the substrate molecules and enzyme molecules becomes lower. Furthermore, the product produced may inhibit the reaction.
當化學作用進行時其速率會漸漸減慢，起初，基質的濃度相當高，所以基質分子和酶因互相碰撞而產生有效碰撞的機會亦是非常高，其後，基質的濃度漸降，因爲有些基質已被轉成產品，結果基質分子和酶分子發生有效碰撞的機會便被降低，再者，產生的產品會抑制此化學作用(最終產品抑制)。

16. The reaction curve will finally level off and will not reach 100 %. Explain this phenomenon.
爲什麼催化作用的曲線最終轉會趨於平緩而非達至 100%?

The reaction is a reversible reaction. The end product produced would favour the backward reaction until an equilibrium is reached. So the product concentration would never reach 100%.
因爲催化作用是一個可逆轉的化學作用，最終產品的生成會有利於反向作用，直至達到平衡，故此產品的水平永不會達至 100%。

17. Cite two applications of enzymes.
說出酶的兩個應用例子。

1. 生物活性洗衣粉：

由蛋白質引起的污漬如蛋漬及血漬等很難清除，生物活性洗衣粉含有蛋白酶，可將蛋白質分解爲可溶於水的小分子，有助去除衣服上的污漬。有些隱形眼鏡的清潔劑亦含有蛋白酶。

Biological washing powders

The most difficult stains to remove are from protein foods like eggs or blood stains. The biological washing powder contains proteases (sometimes also lipase) can break down proteins into smaller molecules which dissolve in water, leaving the clothes stain free. Some cleaning solutions of contact lens also contain proteases.

2. 鬆肉粉：

有些肉類，特別是牛肉，煮熟後變得很韌，很難食用，爲了令牛肉沒有那麼韌，我們可在煮食前的數小時加入鬆肉粉，肉鬆粉含有一種從木瓜分離出來的酶－木瓜酶，木瓜酶可消化蛋白質，將牛肉纖維部分分解，使它沒有那麼韌。

Meat tenderizers

Meats, particularly beef, are sometimes too tough to eat after cooking. To make meats more tender, meat tenderizer contains a protease called papain, which is isolated from papaya, is added to them several hours before cooking. The protease will loosen the meat fibres by partially breaking down the proteins inside.

18 What are the advantages of using enzymes in industrial process?
在工業中使用酶有何優點?

1. It can speed up chemical reactions in industrial process for mass production of proteins.
   它可加速工業過程的化學反應以大量製造如蛋白質的產物。
2. Enzymes are specific in action, therefore, it can catalyze specific processes and is less likely to generate undesirable products.
   酶促作用具專一性，它可催化特定的過程，故較少機會產生不合意的產物。
3. It enable artificial manipulation of rate of industrial process by controlling reaction temperature or pH.
   生產時，可透過調節反應的溫度或 pH，人工調控工業過程的速度。

Check point 測試站 (10)

1. What is meant by holozoic nutrition?
何謂動物式營養?

Consumption of complex food which is broken down inside the organism into simple molecules which are then absorbed.
攝入有機食物，食物在體內消化成簡單的分子，然後透過擴散作用吸進體內。

2. Why is food important to us?
食物對我們有甚麼重要性?

1. It provides energy for activities and keeps us warm.
   提供活動所需能量和保持體溫。
2. It provides us with raw materials for growth and repair.
   提供原料，用作生長和修補破損組織。
3. It contains substances that are important for maintaining health.
   提供營養素，保持身體健康。

3. What substances does food contain?
食物含有那些物質?

7 types: carbohydrates, lipids, proteins, vitamins, minerals, dietary fibre and water.
7 種: 碳水化合物、脂肪、蛋白質、維生素、礦物質、食用纖維和水。

4. What is meant by balanced diet?
何謂均衡飲食?

A balanced diet should contain enough carbohydrates, protein ands fats (6:3:1) and enough vitamins, minerals and water so as to maintain health, growth and repair, with enough roughage (dietary fibre) to stimulate the peristalsis of guts.
均衡飲食是指膳食中含有足夠的碳水化合物、蛋白質和脂肪 (6:3:1)及足夠的維生素和水分以維持健康及生長，有足夠的食用纖維刺激腸的蠕動。

5. Why do we need a balanced diet?
爲甚麼膳食要均衡?

A balanced diet maintains good health and supplies the right amount of energy for body activity.
爲了保持體魄強健，並爲活動提供所需的能量。

6. State the function of vitamin A and the result of deficiency.
說出維生素 A 的功能及缺乏它的症狀。

For the building of visual purple in the rod cells of the eye.
形成視網膜上視桿細胞的色素(視紫紅質)
Night-blindness
夜盲症

7. State the function of vitamin C and the result of deficiency.
說出維生素 C 的功能及缺乏它的症狀。

Maintenance of healthy epithelium and wall of blood vessels, healing of wounds.
維持健康的上皮組織及微血管壁，使傷口癒合。
Scurvy
壞血病

8. State the function of vitamin D and the result of deficiency.
說出維生素 D 的功能及缺乏它的症狀。

Increase absorption of calcium and phosphorus at the intestine. Proper formation of bone and teeth.
增加鈣質及磷質的吸收，幫助形成正常的骨骼及牙齒。
Rickets
佝僂病

9. Why is it not advised to take too much fat-soluble vitamins?
爲什麼我們不宜進食過量脂溶性維生素?

Excessive intake of fat-soluble vitamins is undesirable because they are not readily excreted in urine. They may accumulate in the body to reach toxic levels which are harmful to the body.
我們不宜進食過量脂溶性維生素，因爲脂溶性維生素不容易經尿液排泄，它們會積聚在體內達致毒性水平，使身體受損。

10. State the function of calcium and the result of deficiency.
說出鈣的功能及缺乏它的症狀。

Building of bones and teeth. Blood clotting.
建造骨骼及牙齒、凝血
Rickets, Bleeding
佝僂病、出血

11. State the function of iron and the result of deficiency.
說出鐵的功能及缺乏它的症狀。

Forms haemoglobin.
形成血紅素
Anaemia
貧血

12. What is roughage?
什麼是粗糙食物?

1. The indigestible material in food.
   在食物中不能被消化的物質。
2. Contain mainly cellulose.
   主要含有纖維素。

13. What is the function of roughage and the result of deficiency?
粗糙食物有什麼功用，缺乏它有什麼症狀?

1. Stimulated muscular movement along the gut.
   能刺激腸的蠕動。
2. Deficiency leads to constipation.
   缺乏會引起便秘。

<u>Check point 測試站 (11)</u>

14. What food stuff should be increased in children diet?
兒童需要吃多些何種食物?

Children need more proteins, calcium and iron for building new tissues.
兒童需要多些蛋白質、鈣質及鐵質去形成新組織。

15. Why is the energy requirement per unit body mass decreases from age 4 to 20?
爲什麼每單位體重所需的能量從四歲至二十歲逐漸下降?

Reasons : In a younger person
理由：在年輕人：

1. the metabolic rate is faster ;
   代謝率較快。

2. the growth rate is faster; and
   生長率較快。
3. the body size is smaller and so the relative surface area is larger. The relative heat loss is also greater so that more energy is required to maintain a high body temperature.
   體積較細，身體表面積相對較大，故此，熱量的散失相對地較多，需要較多的能量以維持體溫。

16. Why does a male expend more energy than a female?
爲什麼男性比女性消耗更多的能量?

(1) The male may have a higher metabolic rate.
男性有較高的代謝率。
(2) The male is more muscular.
男性擁有更多肌肉。

17. Explain why does a labour need more food than a clerk?
解釋爲什麼勞工較文員需要吃多些食物?

Labour doing more muscular activities requires more energy. A construction worker requires more energy than an office worker. The former needs a diet rich in carbohydrates to supply energy, and proteins for muscle development.
勞工需要較多能量，一個修路工人較文員需要更多能量。他們的膳食應多含碳水化合物和蛋白質，以提供足夠的能量作勞動和令肌肉發展。

18. Explain the dietary requirement of a pregnant woman.
解釋懷孕中的女人的膳食需求?

1. more calcium in her diet for the growth of the bones of the foetus.
   更多鈣質以幫助胎兒的骨骼生長。
2. more food (energy) for the body growth and respiration of the foetus.
   更多食物(能量)以供胎兒生長及呼吸。

19. State and explain a test for protein.
說出並解釋一個蛋白質測試。

Albustix paper test: Dip the yellow end of Albustix paper into the sample.
Positive result: A greeen colour appears
尿蛋白試紙額測試：將試紙黃色的一端浸入樣本。
陽性反應：呈現綠色

20. State and explain a test for fats.
說出並解釋一個脂肪測試。

Spot test: Put a drop of food on a filter paper
Positive result: A permanent translucent spot appears
油漬試驗：放一塊食物在濾紙上。
陽性反應：有一恆久的半透明斑點出現

21. State and explain a test for reducing sugars.

說出並解釋一個還原糖測試。

Benedict's test: Add 1 ml of Benedict's solution to the food and boil

Positive result: An orange precipitate

本立德試驗：加一毫升本立德試劑進食物然後煮沸

陽性反應：有橙紅色沉澱物

22. State and explain a test for starch.

說出並解釋一個澱粉測試。

Iodine solution test: Add 1 drop of iodine solution to the food.

Positive result: A blue black colour

碘液試驗：加一滴碘液進食物

陽性反應：呈現藍黑色

23. State and explain a test for vitamin C.

說出並解釋一個維生素 C 測試。

DCPIP test: Add food solution drop by drop to the DCPIP solution to see if it is decolourized.

Positive result: DCPIP solution becomes colourless.

二氯酚靛酚試驗：將食物溶液逐滴加入 DCPIP 溶液，看可否將 DCPIP 脫色。

陽性反應：DCPIP 溶液變成無色

<u>Check point 測試站 (12)</u>

1. State the five processes of human nutrition?

說出人的營養所包括的五個過程。

Ingestion, digestion, absorption, assimilation and egestion.

攝食、消化、吸收、同化和排遺。

2. State all the digestive glands?

說出所有消化腺。

Digestive glands : salivary gland, gastric gland, liver, intestinal gland, pancreatic gland.

消化腺 ： 唾液腺、胃腺、肝、腸腺、胰腺

3. Explain the need of digestion.

解釋消化的需要。

The food we eat are usually starch, proteins and fat whose molecules are too large to pass through the cell membranes.

我們常吃的食物是澱粉、蛋白質和脂肪，它們的份子過大，不能穿過細胞膜。

4. **What is digestion?**
   解釋消化作用。
   The process of breaking down the solid food into smaller, simpler and diffusible molecules such as glucose, amino acids, fatty acids and glycerol by the digestive enzymes.
   利用消化酵素將固體食物分解爲細小、簡單和可擴散的份子，例如葡萄糖、氨基酸、脂肪酸和甘油。

5. **Describe the shape and function of incisor.**
   簡述門齒的形狀和功能。
   Chisel shape. For cutting.
   鑿形，用作切斷食物。

6. **Describe the shape and function of canine.**
   簡述犬齒的形狀和功能。
   Sharply pointed, for killing the prey.
   尖銳，用作殺死獵物。

7. **Explain the importance of chewing food.**
   解釋咀嚼動物的重要性。
   The importance of chewing food is to break food into small pieces so that the surface area can be greatly increase for enzyme action. Furthermore small piece of food can be easily swallowed.
   咬碎食物，使表面積增加從而加快酵素作用。它亦使食物容易吞嚥。

8. **State the function of enamel, dentine, pulp cavity, cement, nerve and blood vessel?**
   說出琺瑯質、齒質、齒髓腔、白堊質、神經和血管的功用？
   The hardest material in the body, to prevent the wearing of the tooth.
   身體上最硬的物質，防止牙齒磨損。
   The bony material of the tooth, very hard.
   構成牙的主體，頗硬。
   It contains blood vessels and nerves.
   含有血管和神經。
   To attach the tooth to the jaw bone.
   將牙齒固定於顎骨。
   For the sensitivity of the tooth.
   負責牙齒的感覺。
   To supply oxygen and nutrients to the tooth.
   供應氧氣和養份給牙齒。

9. **What type of teeth is absent in milk teeth?**
   乳齒缺少了何種牙齒？
   Molar 臼齒

10. Explain the causes of tooth decay.

解釋蛀牙的成因。

1. By the action of acids produced by the bacteria.
   由細菌所產生的酸所造成。
2. Bacteria turns the food into weak organic acids.
   細菌將食物變成弱有機酸。
3. The acids corrode the enamel of the teeth.
   這些酸腐蝕牙齒的琺瑯質。

11. State the cause of periodontal disease and its effect.

簡述牙周病的成因及其影響?

If plaque gets between th gum and teeth, then a condition called periodontal disease may result. This affects the gum and bone structure, and may result in bad breath, bleeding gums and loose teeth.

如果牙石出現在牙肉和牙縫間，便可能引致牙周病。牙周病會影響牙肉和顎骨的結構，造成口氣、牙肉出血和牙齒鬆脫。

12. Suggest some ways to reduce tooth decay.

建議一些減少蛀牙的方法。

1. Use tooth paste when brushing.
   每次刷牙用牙膏。
2. Brush the teeth after eating so as to remove food debris and plaque .
   每次進食後都應刷牙。
3. Add fluoride to the tap water
   食水中加入氟化物。

13. Describe the functions of saliva.

簡述唾液的功能。

1. Saliva sticks food particles together and act as a lubricant when swallowing.
   唾液可將食物粒黏在一起和當吞嚥時作爲潤滑劑。
2. It contains an enzyme → amylase which digest starch into maltose.
   它含有一種酵素→唾液澱粉叠，可將澱粉消化成麥芽糖。

14. What is meant by peristalsis?

蠕動是什麼意思？

Involuntary rhythmic waves of muscular contraction stimulated by roughage.

由粗糙食物刺激所引起的不自主節奏性波浪式肌肉收縮。

15. State the function of stomach?

胃有什麼功用？

1. Stores food
   儲藏食物。
2. Absorption of simple molecules.
   吸收簡單的份子。
3. Partial digestion of protein
   部份消化蛋白質。

16. Name the components of gastric juice and state their functions.

說出胃液的成分和它們的功能。

1. 鹽酸 HCl (pH=2)
   HCl kill bacteria (sterilizing) and activate enzymes.
   鹽酸可殺菌 (消毒) 和活化酵素。
2. Protein digestive enzymes 蛋白消化酵素
   Only partial digestion of protein, no digestion of carbohydrates.
   只能部份消化蛋白質，沒有碳水化合物的消化。

17. Why does baby can digest milk but most adult cannot?

爲什麼嬰兒能消化鮮奶，但成人卻不能?

Baby has casein which can coagulate liquid protein, enhance the digestion of protein by increasing the time of it to stay in the stomach

幼兒含有凝乳酵素，把可溶蛋白質凝固，加長蛋白質在胃中停留的時間，讓蛋白消化酵素工作。

18. Why is the stomach is not digested by its own enzymes?

爲什麼胃不會被自己的酵素所消化？

1. Protected by mucus.
   由黏液保護。
2. Digestive enzymes are produced in inactive forms
   剛製造的消化酵素是不活躍的。

Check point 測試站 (13)

19. Name the sources that small intestine receives digestive juice.

說出小腸所接收的消化液的來源。

Receives digestive juices from three sources : gall bladder (bile juice), pancreas (pancreatic juice) and wall of small intestine (intestinal juice).

從三處接收消化酵素 ： 膽囊(膽汁)、胰臟(胰液)和小腸壁(小腸液)。

20. Name the components of small intestine.

說出小腸的成員。

It is composed of duodenum and ileum.

由十二指腸和迴腸組成。

21. Which ducts are connected to duodenum?

有那些管接往十二指腸？

Bile duct and pancreatic duct are connected to duodenum.

膽管和胰管連接著十二指腸。

22. Name the finger like projections in ileum and state its importance.

說出迴腸內的手指狀突出物的名稱和它的重要性。

Villi, to increase surface area for absorption of digested food.

絨毛，增加表面積以利吸收食物。

23. Where is the bile juice produced and stored?

膽汁是在何處產生和儲在何處？

produced by liver.

由肝臟製造。

stored at gall bladder.

儲存在膽囊。

24. What is bile pigment?

膽色素是什麼？

break down products of haemoglobin.

分解血紅素後的產品。

25. What is the function of sodium bicarbonate?

重碳酸鹽有什麼作用？

alkaline, neutralize the acid chyme.

鹼性，可中和酸性的食糜。

26. What is the function of bile juice (salts)?

膽汁(鹽)有什麼功用？

Emulsify the fats (converts the oil into microscopic droplets), increase surface area for the latter enzymes to act on, speed up the digestion of fat.

乳化脂肪(將油變成微小的油點)，增加脂肪與脂肪　接觸的表面積，加速脂肪的分解。

27. Will the bile salts be affected by heat, why?
膽鹽會否被熱力所影響，爲什麼？
No, it is not an enzyme thus not affected by heat.
它不是酵素所以不受熱影響。

28. Will the secretion of bile stop after the removal of gall bladder, why?
切除膽囊後是否沒有膽汁分泌，爲什麼，這對消化有什麼影響?
In the absence of the gall bladder, bile is still continuously secreted by the liver although it cannot be stored in the gall bladder. This will affect fat digestion because only a small amount of bile would be released into the duodenum when food enters this region.
沒有膽囊，膽汁仍會由肝繼續分泌，雖然它不能儲在膽囊。這會影響脂肪的消化，因爲當食物進入腸道時只有少量膽汁分泌進十二指腸。

29. Can bile digest fat into fatty acids and glycerol?
膽汁能否將脂肪消化成脂肪酸和甘油?
Bile does not digest fat. It emulsifies fat into fine droplets.
膽汁不會消化脂肪，它只能將脂肪乳化成小油點。

30. What is the function of pancreatic juice?
胰液有什麼功能?
（1）alkaline, neutralizes the acid from stomach and provides an alkaline medium for enzyme action.
鹼性，可中和胃酸和提供一鹼性環境給酵素作用。
（2）contain enzymes which digest carbohydrates, proteins and fats
含有可消化碳水化合物、蛋白質和脂脂的酵素，可消化食物。

31. Name the different parts of large intestine.
說出大腸的不同部分。
Composed of caecum, colon and rectum.
由盲腸、結腸和直腸組成。

32. State the function of colon.
說出結腸的功用。
absorb water ,minerals and salts
吸收水、鹽和礦物質。

33. State the function of rectum.
說出直腸的功用。
Temporary storage of faeces
暫時儲藏糞便。

34. State the components of faeces.

說出糞便內含的物質。

Indigestible material (cellulose), intestinal cells, bacteria, bile pigment.

不能消化的食物(纖維)、腸細胞、細菌、膽色素。

35. At which part of the gut is water absorption mainly take place?

腸的那一部分是吸水的主要地方？

Small intestine

小腸

36. Name the site of food absorption in small intestine.

說出小腸用作吸收食物的組織名稱。

villus

絨毛

37. State and explain the features of absorptive surface.

說明和解釋吸收面的特徵。

1. 薄→只有一層細胞，供消化了的食物快速擴散通過。
2. 有充足的血液供應以使吸收了的食物能快速地運走。
3. 有很大的表面積使到吸收面能大為增加。

1. Thin → one layer of cells, for rapid diffusion of digested food.
2. Well supplied with blood so that absorbed food can be transported away easily.
3. With large surface area so that the absorptive area can be greatly increased.

38. Which part of the villus absorbs glucose and amino acids?

絨毛的那一部分會吸收葡萄糖和氨基酸？

Capillaries

微血管

39. Which part of the villus absorbs fats?

絨毛的那一部分會吸收脂肪？

lacteals

乳糜管

40. Explain why does the lacteal become milky afer a meal of fatty food.

解釋爲什麼一個人吃了肥膩食物後，他體內的乳糜管變爲乳白。

Fatty food contains a lot of fats. After digestion, fats become fatty acids and glycerol. They are absorbed into the lacteal of the villi. In the lacteal they recombine to form fat again. Therefore, the lymph of the lacteal contains lot oil droplets. The agglutination of these oil droplets appears milky.

因爲肥膩食物含有大量脂肪，而脂肪會經消化和以脂肪微滴形式吸收到乳糜管，乳糜管內的淋巴液會進入淋巴管，所以乳糜管內淋巴液有大量的小油滴。而這些小油滴在集結時呈乳白色。

41. Explain the absorption of vitamins and minerals.

解釋如何吸收維生素和礦物質。

water soluble enter capillaries, fat soluble (ADEK) enter lacteals.

水溶性的進入微血管，脂溶性的(ADEK)進入乳糜管。

42. By what mechanism is the food absorbed into the villi?

食物的吸收是靠什麼機制的?

The absorption is due to diffusion because the concentration of amino acids, glucose, fatty acids and glycerol are higher in the lumen of the intestine than in the blood and in the lymph. There are also active transport of the substances into the blood and lymph.

食物的吸收是源於擴散作用，因爲腸內的氨基酸、葡萄糖、脂肪酸和甘油的濃度高於血和淋巴液內的。除此亦有主動運輸運載物質進入血液內和淋巴液內。

43. Describe the fate of the absorbed glucose and amino acids.

簡述被吸收了的葡萄糖和氨基酸將往何處。

Glucose and amino acids are absorbed into the blood capillaries. They are carried along the hepatic portal vein to the liver. Then they are transported to every part of the body by blood.

葡萄糖和氨基酸被微血管吸收，它們從肝門靜脈輸往肝臟，跟著由血運往身體各部份。

44. Describe the fate of the absorbed fatty acids and glycerol.

簡述被吸收了的脂肪酸和甘油將將往何處。

Fatty acids and glycerol are absorbed into the lacteal of the villi. In the lacteal they recombine to form fat again. Fat carried by the lymphatic system would be emptied into the blood stream at the base of the neck. Therefore, blood will contain fat.

脂肪酸和甘油被絨毛內的乳糜管吸收，在乳糜管內它們再次結合爲脂肪，脂肪被淋巴系統運往頸底的血管，所以血液含有脂肪。

45. How do different nutrients assimilate in the body?

不同的營養素怎樣在細胞內被同化?

營養素 nutrients	同化作用 assimilation
葡萄糖 glucose	提供能量 provide energy
氨基酸 amino acids	製成蛋白質 make protein
脂肪 fats	形成細胞膜 form cell membrane 缺乏碳水化合物時，作爲另一種能量的來源 as secondary engry source. 過多的脂肪會儲存在脂肪組織 excess fats store at adipose tissue

Check point 測試站 (14)

1. **What is the function of hair in nasal cavity?**
   鼻毛有什麼功用？
   To filter dust particles.
   過濾塵粒。

2. **What is the function of mucus in nasal cavity?**
   鼻腔內的黏液有什麼功用？
   Trap dust particles and germs.
   黏住塵粒和病菌。

3. **What is the function of blood capillaries in nasal cavity?**
   鼻腔內的微血管有什麼功用？
   Warm the air.
   將空氣加熱。

4. **What is the function of cilia in nasal cavity?**
   鼻腔內的纖毛有什麼功用？
   To push the mucus out of the nasal cavity
   把黏液推出鼻腔

5. **What changes have occurred in the inhaled air?**
   吸入的空氣有什麼轉變？
   The inhaled air is filtered, moistened and warmed by the nasal cavity.
   吸入的空氣被鼻腔過濾、暖化和濕潤。

6. **Describe and explain the function of epiglottis during swallowing.**
   解釋會厭在吞嚥時的功能？
   During swallowing, epiglottis moves downwards to cover the trachea, thus preventing food from entering the lung. If food drops into the trachea, coughing will occur to expel the food out of the trachea.
   當吞嚥時，會厭會向下移遮蓋食道，阻止食物進入肺部，如果食物誤進氣管，便會不停咳嗽將食物排出氣管。

7. **Some ring like structures are found in the trachea, name it and give its function.**
   氣管有環狀結構，說出它的名稱和功能。
   Incomplete rings of cartilage, to prevent the trachea from collapsing.
   不完全環狀軟骨，支持氣管以防止下陷。

8. What are the functions of the mucus and cilia found in respiratory tract?
呼吸道上(氣管、支氣管和小支氣管)的黏液和纖毛有什麼功用？
The lining (inner surface) contains mucus-secreting cells and cilia which traps dust and germs. The cilia move the mucus upward to the throat. The trapped dust particles are swallowed or cough out and prevented from entering the lung.
三種氣管內壁都含有黏液分泌細胞和纖毛用以阻擋塵粒和病菌，纖毛不斷擺動，被黏著的塵粒會被吞嚥或咳出以阻止它們進入肺部。

9. What are the characteristics of a respiratory surface?.
肺泡（呼吸面）有什麼特徵？
Thin - one layer of flattened cells to decrease the diffusion distance.
很薄 - 只有一層扁平的細胞以減少擴散的距離。
Moist - covered with a film of water to dissolve the respiratory gases so that diffusion can occur.
濕潤 - 表面被一層水膜所覆蓋，因爲氣體必須先溶於液體才可藉擴散作用通過肺泡壁。
It must be richly supplied with blood capillaries to transport the gases away.
必須充滿微血管以便運送氣體。
Numerous- to provide large surface area for diffusion.
數目很多 - 提供大面積作擴散之用。

10. Name the cavity that lung is situated inside.
說出肺部所在的空腔的名稱。
thoracic cavity
胸腔

11. Name and explain the function of the fluid that is secreted by pleural membrane.
說出胸膜所分泌的液體的名稱和解釋它的功用。
Pleural fluid reduces friction during breathing.
胸膜液，能減低呼吸時的磨擦力。

12. Describe the pathway of air in breathing.
描述吸入空氣的路途。
Nasal cavity → pharynx → trachea → bronchi → bronchioles → alveoli (air sacs)
鼻腔 → 咽喉 → 氣管 → 支氣管 → 小支氣管 → 肺泡

13. Which substance is used to transport oxygen?
氧氣由什麼物質運載？
haemoglobin
血紅素

14. Which substance is used to transport CO_2?
二氧化碳由什麼物質運載？

(i) Most of it dissolves in the plasma as bicarbonate ion (HCO_3)
大部份以碳酸氫鹽離子形式溶於血漿中。

(ii) Small portion is transported as carbaminohaemoglobin in the red blood cell
小部份被紅血球以碳胺血紅素形式運送。

15. Explain how does the oxygen in the alveoli enter blood?
解釋肺泡內(潮氣內)的氧如何到達血液。

Oxygen in the alveoli first dissolves in the film of water. Since the oxygen concentration in the alveolar air is higher than that in blood, oxygen diffuses across the alveolar wall and then capillary wall to the blood.
肺泡內(潮氣內)的氧會先溶於薄水膜中，因肺泡內的氧氣濃度高於血，氧氣會以擴散作用穿過肺泡壁及微血管壁，進入血液中。

16. If the lung (pleural membrane) is punctured by accident, what will happen to the shape of his lung? Explain.
如果胸膜被刺穿，肺部的形狀會變成怎樣?試加以解釋。

The lung will collapse. The leaking of air into pleural cavity increases the pressue between pleura, the elasticity of the lung's tissue causes the lung to collapse.
肺部會萎縮(塌陷)，空氣會漏入，因爲肺有彈性，故肺會下陷起來。

17. If the pleural membrane of a man's left lung is punctured but right lung not, what will happen to his (1) respirtory activities? (2) air flow of his left and right lung?
若一男子的左胸胸膜被刺穿，右胸無恙，請描述以下的變化:
(1) 他的呼吸活動，(2)他的左肺和右肺的空氣流動情況。

(1) Respiratory rate increase.
呼吸活動變得較快。

(2) Air flow decrease in left lung but increase in righ lung.
在左肺，氣流減少; 在右肺，氣流增加。

18. Describe and explain the poisonous effect of CO?
形容和解釋一氧化碳的毒性。

Carbon monoxide is highly poisonous because it combines strongly with haemoglobin to form carboxyhaemoglobin. Thus there would be less haemoglobin for carrying oxygen and the body cells may die because of lacking oxygen.
一氧化碳是非常毒的，因它可和血紅素強烈結合爲碳氧血紅素。因此可帶氧的血紅素會減少，身體細胞會因缺氧而死亡。

19. Describe and explain the breathing mechanism.

形容和解釋呼吸的機制原理。

吸 氣

橫隔膜肌肉收縮 → 拱形的橫隔膜變成扁平

肋間肌收縮 → 肋骨向外和向上移

} 胸膜腔的體積增大 → 內部氣壓降低 → 空氣被吸進肺內

呼 氣

橫隔膜肌肉放鬆 → 橫隔膜回復拱形

肋間肌放鬆 → 肋骨向內和向下移

} 胸膜腔的體積減少 → 內部氣壓增加 → 肺部因本身的彈力而收縮 → 空氣被迫出肺外

Inhalation :

Diaphragm muscles contract → the dome-shaped diaphragm is flattened

Intercostals muscles contract → ribs move outwards and upwards

} pleural volume is increased → pressure inside is reduced → air is drawn into the lung

Exhalation :

Diaphragm muscles relax → the diaphragm returns to its dome-shape

Intercostals muscle relax → the ribs move inwards and downwards

} pleural cavity decreases in volume → pressure inside increases → the lung contracts due to its own elasticity → air is forced out

20. Which part of the brain control breathing?

腦的那一部分控制呼吸？

Controlled by respiratory center on the medulla of the brain.

由位於延腦內的呼吸中心所控制。

21. What is the stimulus to affect the rate and depth of breathing?

何種刺激會影響呼吸的速率和深度？

The rate and depth is directly affected by the carbon dioxide concentration in blood.

血中的二氧化碳濃度

22. What will be the change to the rate and depth of breathing, composition of exhaled air after Exercise?

運動時，呼吸的速度和深度、呼出的空氣的成份有什麼變化?

During exercise , both the rate and depth of breathing will increase, but the composition of the exhaled air will not change.

運動時，呼吸的速度和深度兩者都會增加，但是呼出的空氣的成份不會變。

23. What is the importance of increasing the rate and depth of breathing during exercise?
運動時呼吸率和深度的增加有什麼重要性?

The rate and depth of breathing is increased to supply more oxygen to the muscle, so that more energy can be released to meet the need.
呼吸率和深度增加是要增加氧氣的供應，以釋放更多能量應付劇烈的肌肉運動。

Check point 測試站 (15)

1. Explain the need for a transport system.
解釋爲什麼需要循環系統。

1. To supply nutrients to body cells and remove metabolic wastes from them.
   供應營養給身體細胞和排除它們的代謝廢物。
2. To distribute hormones, antibodies and heat.
   分佈激素、抗體和熱能。

2. What is contained in plasma?
血漿內有些什麼？

百分之九十是水。
90% water, 10% dissolved materials including :
foods, salts, hormones, metabolic wastes (CO_2 , urea), fibrinogen.
百分之十溶解物質包括 : 食物、鹽、代謝廢物(二氧化碳、尿素)、血纖維蛋白原。

3. Describe the shape and state the importance of this shape in red blood cell
描述紅血球的形狀並說出此形狀的重要性？

biconcave, disc-shaped, provide greater surface area to facilitate gaseous exchange.
雙凹盤形，增大表面積以利氣體交換。

4. Name the pigment in red blood cell and state its importance.
說出紅血球內的色素名稱和它的重要性。

Haemoglobin, it can carry oxygen.
血紅素，可運載氧氣。

5. Where is the red blood cell formed?
紅血球在那裏製造？

formed in the red bone marrow.
在紅骨髓製造。

6. Where is the red blood cell destroyed?
紅血球在那裏拆毀？

destroyed in the liver
在肝臟拆毀。

7. What is the shape of white blood cell?
白血球是什麼形狀？
amoeboid shape (no definite shape).
可變形 (沒固定形狀)。

8. Where is the white blood cell produced?
白血球在那裏製造？
produced by the lymphatic tissues and bone marrow.
由淋巴組織和骨髓製造。

9. State the functions of white blood cells.
說出白血球的功能。
1. To remove dead tissues. 清除死去組織。
2. To ingest bacteria. 吞食細菌。
3. To produce antibodies to act against the bacteria (clump the germs together).
產生抗體對抗細菌（將病原體黏在一起）。

10. What is the shape of blood platelets?
血小板是什麼形狀？
Irregular, very small.
不規則，非常細小。

11. How is the blood platelet produced?
血小板在那裏製造？
Minute fragments from cells of bone marrow.
從骨髓細胞斷裂的微小碎片。

12. State the function of blood platelets.
說出血小板的功能。
To initiate blood clotting at wounds.
在傷口引發血凝固。

13. What should we add to the blood to prevent blood clotting in doing experiment.
在血的實驗中，爲什麼我們在血液中加入檸檬酸鈉？
Prevent blood clotting
防止血凝固。

14. What is the colour of oxygenated and deoxygenated blood?
帶氧的血和吸收了二氧化碳的血是什麼顏色?
Oxygenated blood is bright red, when taking up CO2 change to dull red colour.
帶氧的血是鮮紅色，吸收了二氧化碳後會變成紫(暗)紅色。

15. State the functions of blood

說出血液的功能。

1. Transport oxygen and nutrients, metabolic wastes, hormones and antibodies.
   運送氧氣和營養、代謝廢物、激素和抗體。
2. Protection :
   保護作用 ：
   a) ingest bacteria by white blood cells.
      用白血球吞食細菌。
   b) prevent entering of bacteria and loss of blood by blood clotting at the wound.
      有傷口時利用血凝固防止細菌入侵和減少血液流失。
3. Regulation of body temperature : Distribute heat evenly throughout the body.
   控制體溫 ： 將熱力均勻地分佈於身體。

Check point 測試站 (16)

16. What kind of blood does the right atrium receive?

右心房接收什麼種類的血液？

The right atrium receives deoxygenated blood from vena cava.
從大靜脈來的缺氧血液。

17. What kind of blood does the left atrium receive?

左心房接收什麼種類的血液？

The left atrium receives oxygenated blood from lungs.
從肺部來的帶氧血液。

18. To where does the right ventricle pump blood?

右心室泵血往何處？

The right ventricle pumps deoxygenated blood to the lung.
將缺氧血液泵往肺部。

19. To where does the left ventricle pump blood?

左心室泵血往何處？

The left ventricle pumps oxygenated blood to all parts of the body (except the lungs).
將帶氧血液泵往身體各部份(除了肺部)。

20. Why is the wall of right ventricle thicker than right atrium?

爲什麼右心室壁比右心房壁厚？

The wall of right ventricle is thicker than right atrium because right ventricle pumps blood out of the heart to the lungs but right atrium pumps blood to the adjacent right ventricle only, therefore more muscle is developed in right ventricle to produce greater force
右心室壁比右心房壁厚因爲右心室需將血泵往距離較遠的肺部而右心房只需將血泵往鄰近的右心室，故此右心室需要較厚的肌肉來產生更大的力量。

21. Why does the left ventricle have the thickest wall?
爲什麼左心室的肌肉最厚？
The wall of right ventricle is thicker than right atrium because right ventricle pumps blood out of the heart to the lungs but right atrium pumps blood to the adjacent right ventricle only, therefore more muscle is developed in right ventricle to produce greater force.
左心室的肌肉最厚因爲右心室只需將血液從心臟泵往肺部而左心室需將血泵往身體各部份(除了肺部)，故此需要多些肌肉來產生較大的力量。

22. What is the function of valves?
活瓣有什麼功用？
To prevent the backflow of the blood.
防止血液倒流。

23. What is the function of heart tendon?
心腱索有什麼功用？
To prevent the valves from overturning.
防止活瓣反轉。

24. To where is the blood transported? (1) aorta (2) vena cava
下列血管的血液輸往何處？ (1)大動脈 (2)大靜脈
(1) all parts of the body except the lungs.身體各部份除了肺部。
(2) right atrium.右心房。

25. To where is the blood transported? (1) pulmonary artery (2) pulmonary vein
下列血管的血液輸往何處？ (1)肺動脈 (2)肺靜脈
(1) Lungs.肺部。
(2) Left atrium.左心房。

26. Compare artery and vein with respect to 1. direction, 2. smoothness, of blood flow.
從 1.血流方向 2.血流順暢度，比較動脈及靜脈。

動脈 Artery	**靜脈 Vein**
1. The blood is carried away from the heart. 血液由心臟流出。	1. The blood is carried to the heart. 血液流向心臟。
2. Blood flows in spurts. 血液以鼓動的形式流動。血壓較高。	2. Blood flows smoothly. 血液流動很流暢。血壓較低。

27. Compare artery and vein with respect to 1. wall, 2. valve, 3. lumen.
從 1.血管壁 2.活瓣 3.內腔，比較動脈及靜脈。

動脈 Artery	靜脈 Vein
1. The wall is thicker, more muscular and more elastic to resist high blood pressure. 管壁較厚、較多肌肉和較有彈性以應付高血壓。	1. The wall is thinner, less muscular and less elastic. 管壁較薄、較少肌肉和彈性。
2. There is no valve. 沒有活瓣。	2. valves are present at intervals. 每隔一段距離有活瓣。
3. The lumen is smaller. 內腔較細。	3. The lumen is larger. 內腔較大。

28. Compare artery and vein with respect to 1. situation, 2. driving force of blood flow.
從 1.位置 2.血的推動力，比較動脈及靜脈。

動脈 Artery	靜脈 Vein
1. It is more deep-seated in the body. 較深藏於肌肉內。	1. It is generally more superficial. 通常位於身體表面。
2. The flow is maintained by the pumping action of the heart. 倚靠心臟的泵壓活動來維持流動。	2. The flow is maintained by the rhythmic contraction of skeletal muscles. 倚靠骨骼肌節奏性的收縮來維持流動。

29. What is the function of blood capillaries?
微血管有什麼功用？
To allow exchange of materials between blood and tissue fluid.
促使血液和組織液進行物質交換。

30. Capillaries form a net and have many branches, what is the importance of having these features?
微血管呈網狀及有許多分支，這有什麼重要性?
The net like appearance of capillaries provides a large cross-sectional area, which reduce the flow rate of blood. This can increase the time for exchange of materials. The numerous branches can provide a large surface area, which facilitate the rapid exchange of materials between tissue cells and blood.
多分枝的網絡能提供一個很大的總橫切面面積，它可以減慢血液流動的速度，以致有更多的時間進行物質交換。無數的分支能提供一個很大的表面積，讓血液和組織細胞能迅速進行物質交換。

31. Name the blood vessel that has highest oxygen concentration.
說出含氧量最高的血管。
pulmonary vein
肺靜脈。

32. Name the blood vessel that has lowest oxygen concentration.
說出含氧量最低的血管。
pulmonary artery
肺動脈。

33. Name the blood vessel that has highest blood pressure.
說出最高血壓的血管。
Aorta
大動脈。

34. Name the blood vessel that has lowest blood pressure.
說出最低血壓的血管。
vena cava
大靜脈。

35. Name the blood vessel that has lowest urea concentration.
說出含尿素最低的血管。
renal vein
腎靜脈。

36. Name the blood vessel that has highest urea concentration.
說出含尿素最高的血管。
hepatic vein
肝靜脈。

37. Name the blood vessel that has highest glucose concentration after a meal.
說出飽餐後含最高葡萄糖量的血管。
hepatic portal vein
肝門靜脈。

38. Name the blood vessel that has highest glucose concentration during starvation.
說出飢餓時含最高葡萄糖量的血管。
hepatic vein
肝靜脈。

39. Draw a flow chart to show the route of a red blood cell from renal vein to renal artery through kidney.

畫一流程圖以顯示一紅血球從腎靜脈出發，經過腎臟而到達腎動脈的路途。

Renal vein → inferior vena cava → heart → pulmonary artery → lungs → pulmonary vein → heart → aorta → renal artery

腎靜脈→下腔大靜脈→心臟→肺動脈→肺部→肺靜脈→心臟→大動脈→腎動脈

40. What is meant by double circulation?

雙循環是什麼意思？

Blood passes through the heart twice for one complete circulation.

每一次完整循環血液都流經心臟兩次。

Check point 測試站 (17)

41. Draw the flow chart of pulmonary circulation.

寫出肺循環的流程圖。

right atrium → right ventricle → pulmonary artery → lung → pulmonary vein → left atrium

右心房→右心室→肺動脈→肺部→肺靜脈→左心房

42. Draw the flow chart of systemic circulation.

寫出體循環的流程圖。

left atrium → left ventricle → aorta → capillaries of body tissues → vena cava → right atrium

左心房→左心室→大動脈→身體組織的微血管→大靜脈→右心房

43. What is the importance of double circulation?

雙循環有什麼重要性？

Complete separation of oxygenated and deoxygenated blood permits more oxygen supply to tissue cells for respiration. Blood pressure is higher, blood flow is faster so that a higher metabolism can be maintained. Therefore the mammal will be more active.

帶氧血液和缺氧血液可完全分隔開，這樣可容許更多氧氣供應給組織呼吸，同時血壓可高些，血流可快些，這可維持較高的新陳代謝，哺乳類因而變得更活躍。

44. What is lymph?

淋巴液是什麼？

It is plasma leaked out from the capillaries.

漏出微血管外的血漿。

45. What substances contained in lymph?

淋巴液內含什麼？

It contains all the substances in blood except red blood cells, blood platelets and blood proteins.

含有血中所有的物質，除了紅血球、血小板和血蛋白

46. Describe how tissue fluid is formed from plasma.

描述組織液如何由血漿形成。

The blood pressure at the end near the arteriole is greater than that near the venous end. Parts of the plasma, except the larger blood proteins, red blood cells and blood proteins, will leak out from the capillaries to form the tissue fluid.

在近動脈的一端，血液的壓力比組織液的大。除了較大的蛋白質、紅血球和血小板外，部分的血漿會因而被擠出微血管外，形成組織液。

47. How does the lymph return to the blood?

淋巴液如何返回心臟?

The lymph vessels collect the lymph and join the vena cava . Thus the lymph will return to the blood again.

淋巴管收集淋巴液然從將它排放入大靜脈，所以淋巴液最終會返回血液。

48. Is there any pump in lymphatic system?

淋巴系統中有沒有推動裝置？

No.沒有。

49. How can the flow of lymph be maintained?

如何維持淋巴液的流動。

The flow is maintained by the contraction of the adjacent skeletal muscles which compress the lymph vessels.

淋巴液的流動倚靠鄰近的骨骼肌收縮時壓迫淋巴管。

50. How to prevent the back flow of lymph?

如何防止淋巴液倒流？

Valves are present so that the lymph can flow towards the heart only.

因有活瓣存在故此淋巴液只能流向心臟。

51. Give the function of lymph related to exchange or materials.

說出淋巴液交換物質方面的功能。

It forms a link between the blood stream and the cells, providing a medium for the exchange of materials between blood and cells.

形成血流和細胞間的一個連繫，提供媒介給血液和細胞交換物質。

52. Give the function of lymph related to protection.

說出淋巴液保護方面的功能。

To protect the body against bacteria by the lymphocyte.

淋巴球可保護身體免受細菌的襲擊。

53. Give the function of lymph related to transportation.
說出淋巴液運輸方面的功能。
To transport fatty acids and glycerol in lacteals.
在乳糜管幫助運輸脂肪酸和甘油。

54. Give the two functions of lymph nodes.
說出淋巴結的兩個功能。
1. To produce lymphocytes.
   製造淋巴球。
2. To filter foreign materials, kill bacteria.
   過濾外來物質，消滅細菌。

55. When a patient suffers from sore throat, his lymph nodes enlarge, explain.
當病人患了喉嚨痛，淋巴結會變大，請加以解釋。
Due to the stimulation of the pathogens which cause the sore throat, the lymph nodes enlarge to produce more white blood cells to act against these pathogens.
淋巴結變大是由於導致喉嚨痛的病原體刺激淋巴結內的白血球增生來預防疾病發生。

56. Draw a flow chart to show the route of a red blood cell from small intestine to lung.
畫一流程圖以顯示一紅血球從小腸出發，到達肺部的路途。
small intestine →hepatic portal vein → liver → hepatic vein→ inferior vena cava → heart → pulmonary artery → lungs
小腸→肝門靜脈→肝臟→ 肝靜脈→下腔大靜脈→心臟→肺動脈→肺部

<u>Check point 測試站 (18)</u>

1. What are the raw materials of photosynthesis?
光合作用用什麼作原料？
carbon dioxide and water
二氧化碳和水

2. State the products of Photosynthesis.
說出光合作用的產品。
glucose/glucose and oxygen
葡萄糖/葡萄糖和氧氣

3. What is the by-product of photosynthesis?
光合作用的副產品是什麼？
oxygen
氧氣

4. **What happens to the product after its formation?**
   產品形成後會變成什麼？
   Glucose converted to starch for storage.
   葡萄糖隨即轉化爲可儲藏的澱粉

5. **What is the source of oxygen?**
   說出氧氣的來源。
   water 水

6. **What is the function of light in light reaction?**
   光在光反應中有什麼用？
   Water is split by light energy to give hydrogen atom and oxygen gas.
   葉綠素吸收光能把水光解成氫原子和氧氣，氧釋放到植物體外。

7. **What happens in dark reaction?**
   暗反應有什麼事發生？
   Carbon dioxide is reduced by hydrogen to form carbohydrates.
   二氧化碳被氫原子還原爲碳水化合物。

8. **Can dark reaction take place in light?**
   暗反應可否在光中進行？
   可以 yes

9. **Write the word equation of photosynthesis.**
   寫出光合作用的文字方程式。

   二氧化碳 + 水 $\xrightarrow[\text{葉綠素}]{\text{光}}$ 葡萄糖 + 氧氣

   carbon dioxide + water $\xrightarrow[chlorophyll]{light}$ glucose + oxygen

10. **What is the fate of carbohydrate produced in the plant?**
    植物所製造的碳水化合物的最終命運爲何？
    for energy release, for storage and conversion into other products for growth.
    提供能量，儲起或轉化成用作生長的物質。

11. State the two importance of photosynthesis?
說出光合作用的兩個重要性。

1. Ultimate food source for all living organisms
   生物的最終極食物來源
2. Produce oxygen and remove carbon dioxide.
   產生氧氣並排除二氧化碳

12. State the factors that affect the rate of photosynthesis?
說出影響光合作用的因素。

light, carbon dioxide, water supply, temperature
光、二氧化碳、水的供應、溫度

13. How does light intensity affect the rate of photosynthesis?
光度如何影響光合作用？

Photosynthetic rate increase with light intensity.
光合作用速率隨光度增加而增加

14. What happens to chlorophyll when the light intensity is too high?
光度過強對葉綠素有何影響？

destruction of chlorophyll
葉綠素被破壞

15. Which light colours are most effective in photosynthesis?
何種光色最爲有效？

red and blue light
最有效的光是紅光和藍光

16. Which light colour is ineffective in photosynthesis?
何種光色最爲無效？

green light
綠光

17 What happens to the chlorophyll in the absence of light?
缺少陽光對葉綠素有何影響？

chlorophyll degenerate and the leaves turn yellow
葉綠素會退化樹葉便變成黃色

18. How does CO2 concentration affect the rate of photosynthesis?
二氧化碳的濃度如何影響光合作用的速率？

Photosynthetic rate increase with concentration of carbon dioxide up to 1%
光合作用速率隨二氧化碳濃度增加而增加直至 1%

19. How to increase CO_2 concentration in water?
如何在水中增加二氧化碳的濃度？
It can be increased by adding sodium hydrogen carbonate into water. (aquatic plants only)
二氧化碳濃度可以透過在水中加入碳酸氫鈉來增加

20. How does water supply affect photosynthetic rate?
水的供應如何影響光合作用的速率？
In short of water, stomata close, carbon dioxide supply reduces, and the photosynthetic rate drops.
水源短缺，氣孔關閉，二氧化碳供應減少引致光合作用速率下降

21. How does temperature affect photosynthesis?
溫度如何影響光合作用的速率？
Photosynthetic rate increase with temperature up to 40°C.
光合作用速率隨溫度增加而增加直至 40°C

22. Explain why does the photosynthetic rate drop when temperature is over 40°C.
解釋超過 40°C 時爲什麼光合作用的速率會下降？
Over 40°C, enzymes is denatured
超過 40°C 酵素會變質

23. Describe the process of photosynthesis in detail
詳細解釋光合作用怎樣進行?
Photosynthesis occurs inside chloroplasts. There are 2 stages namely light and dark reaction.Light reaction : chlorophyll absorb light, water is split by light energy to give hydrogen atom and oxygen gas. Oxygen gas is released.
Dark reaction : Carbon dioxide is reduced by hydrogen atom to form carbohydrates.
光合作用在葉綠體進行，分爲光反應和暗反應兩個階段。在光反應中，葉綠素吸收光能把水光解成氫原子和氧，氧釋放到植物體外。在暗反應中，氫原子與二氧化碳結合成碳水化合物。

24. Name a chemical that is used to absorb carbon dioxide.
說出一種可吸收二氧化碳的藥物。
Potassium (or sodium) hydroxide
氫氧化鉀(或鈉)

25. Name a chemical that is used to supply carbon dioxide to water plants.
說出一種可供應水生植物二氧化碳的藥物。
Sodium hydrogen carbonate (sodium bicarbonate)
碳酸氫鈉

26. What happen to lime water when CO_2 is added to it?
當二氧化碳加進石灰水時有何轉變？
Carbon dioxide turns lime water milky
二氧化碳可將石灰水變爲奶白色

27. What is the purpose of using lime water in the experiment?
在實驗中使用石灰水的目的爲何？
It is used to check whether all carbon dioxide has been removed).
用來測試二氧化碳是否已除盡

28. State the colour changes of bicarbonate indicator when
(1) a little of CO_2 (2) CO_2 is 0.03% (3) a lot of CO_2
說出碳酸氫鹽指示劑顏色上的轉變當
(1) 很少 CO_2 (2) CO_2 是 0.03% (3) 很多 CO_2
(1) purple 紫色， (2) red 紅色， (3) yellow 黃色

29. State the function of epidermis and cuticle.
說出表皮和角質層的功能。
Epidermis: protect the inner layers of leaf cells.
Cuticle: prevents water loss and bacterial (or fungal) infection on leaf surface.
表皮:保護樹葉內層的細胞，
角質層: 在葉的表面保護水份的散失和免受細菌(或真菌)感染

30. State the function of stoma and guard cell.
說出氣孔和保衛細胞的功能。
stoma :for gases exchange and water loss by transpiration.
氣孔:用作氣體交換和蒸騰作用時的水份流失
guard cell : control the size of stomatal opening.
保衛細胞: 控制氣孔開關的大小

31. State the features of palisade mesophyll.
說出柵狀葉肉的特徵。
It is on the upper side of leaf, closely packed, contains many chloroplasts.
在葉的上層，緊密排列，含有許多葉綠體

32. State the features of spongy mesophyll.
說出海綿葉肉的特徵。
It is loosely packed with large air spaces, allow rapid diffusion of gases to promote photosynthesis, contains less chloroplasts.
鬆散排列和有大氣室，容許氣體快速擴散以促進光合作用，含有較少葉綠體

33. What will be the advantages of having closely packed palisade mesophyll at the upper side and a lot of chloroplasts within it?
柵狀葉肉在上層緊密排列並含有許多葉綠體有什麼好處?
This arrangement can speed up the rate of photosynthesis. For the chlorplast are much more concentrated in the paliside mesophyll and it is on the upper side of the leaf. Both features can help it to obtain more light when compare with spongy mesophyll.
這種分佈模式使葉片能較快速地進行合作用。由爲柵狀葉肉的葉綠體密度較高，再加上柵狀葉肉是位於葉片的上層，所以可以比海綿葉肉吸收更多光。

34. State the function of xylem and phloem.
說出木質部和韌皮部的功能。
xylem : It contains vessels for carrying water and mineral salts, provide mechanical support.
木質部: 含有用來運輸水份和礦物鹽的導管，提供機械性支持
phloem : It contains sieve tubes for carrying food away from the leaf.
韌皮部: 含有運輸食物遠離樹葉的篩管

35. Before the photosynthesis experiment, what will be the treatment on the plant? explain.
在光合作用實驗開始前，應如何處理植物? 試加以解釋。
Destarch the plant by keeping it in dark for two days.
將植物置於黑房中二天以作去澱粉

36. Explain why do the plants can destarch after putting a dark environment for 2 days.
解釋爲什麼植物置於黑暗處二天後，便可以脫澱粉。
In darkness, the starch in leaf will be converted to sugar and transported to other part of the plant.
黑暗中，葉片內的澱粉會被轉化爲糖，並運到植物的其他部份。

37. What is the general effect of deficiency of different elements?
缺少不同元素的一般性病狀是什麼?
The general effect of deficiency of different elements are Stunted growth and chlorosis.
缺少各元素的一般性病狀是生長減慢及萎黃病(黃化綠葉病)。

38. Where does gases exchange occur in terrestrial plant?
陸生植物的氣體交換在什麼地方發生?
Plants exchange gases by diffusion. For terrestrial plants, gas exchange takes place through leaves, stems and roots.
植物藉擴散進行氣體交換，在陸生植物中，氣體交換發生於葉、莖和根。

39. Explain the meaning of compensation point.
解釋補償點的含意。
At low light intensity, photosynthetic rate equals to respiration rate. No net exchange of gases occurs
在低光強度，光合作用速率等如呼吸作用速率，沒有淨氣體交換。

Check point 測試站 (19)

1. **By which structure does root absorb water?**
   根透過什麼結構來吸收水份?
   Root hair.
   根毛

2. **How can the root absorb minerals?**
   根如何吸收礦物質?
   Minerals is absorbed through root hairs by active transport.
   礦物質透過主動轉運被根毛吸收

3. **State and explain the features of root hair for water absorption.**
   說明根毛有利吸收水份的特色。
   1. Elongated, can penetrate the space between soil particles.
      幼長，可伸進泥土顆粒間之空隙。
   2. Small and numerous, great surface area for absorption.
      細小和數量很多，提供大面積給吸收作用。
   3. It is not covered by cuticle.
      沒有角質層覆蓋。

4. **How does water move across the cortex?**
   水如何穿過皮層
   After water has entered the root hairs, their protoplasm is diluted so that the protoplasm of the inner cells has a higher concentration than that of the root hairs. Water then moves inwards due to osmosis.
   當水進入根毛後，它的原生質會被稀釋，內層細胞原生質的濃度便高於根毛的，內層細胞有較低水潛能，結果水便因滲透作用而向內移。

5. **How does water move across the leaf?**
   水如何在樹葉裏移動
   Water moves from cell to cell by osmosis starting from xylem to palisade mesophyll.
   水透過滲透由一個細胞移往另一個細胞，由木質部開始至到達柵狀葉肉組織。

6. **Give the three forces that responsible for the upward movement of water in stem.**
   說出使水分在莖部向上升約三種力量。
   1. Root pressure 根壓
   2. Capillarity 毛細管作用
   3. Transpiration pull 蒸騰牽引力量

7. Explain the term transpiration.
解釋蒸騰作用。
Transpiration is the giving off of water vapour (mainly evaporation from the mesophyll cells) from the surface of a plant into the atmosphere.
蒸騰作用是指水份以水蒸氣形態從植物表面散失到大氣層的過程。

8. How does transpiration occur?
蒸騰作用怎樣發生?
Since water vapour concentration is lower in the air spaces inside leaves than in the leaf cell walls or cytoplasm, water on the walls of mesophyll cells surrounding the air spaces evaporates into the air spaces. The air spaces become saturated with water vapour and the vapour diffuses through the stomata into the atmosphere.
由於氣室內的水汽濃度較細胞壁和細胞質的低，因此氣室周圍的葉肉細胞表面的水分會蒸發至氣室內。氣室內充滿水汽，水汽會經氣孔擴散到大氣。

9. State the three conditions for transpiration to occur.
說出使蒸騰作用得以發生的三個必要條件。
1. The cohesion force between water molecules must be great enough to prevent the water column in xylem from breaking.
   水份子間的內聚力應夠大以防止木質管內的水柱中斷。
2. The xylem must be continuous from the leaves to the root.
   木質部開必須由根部至樹葉連續不斷。
3. No air bubbles in the xylem.
   在木質部內沒有氣泡。

10. List the factors that affect rate of transpiration.
列出影响蒸騰作用速率的因素。
Light, temperature, humidity, wind, water supply
光度、溫度、濕度、風力、水的供應

11. Explain the effect of light on transpiration rate.
解釋光度對蒸騰作用的影響。
rate of transpiration increase with light intensity.
蒸騰作用的速率隨光度增加而增加。
1. Stomata open in the presence of light (main reason)
   有光會令氣孔張開（主要原因）
2. Light increases the temperature of the leaves.
   光會增加樹葉的溫度。

12. Explain the effect of temperature on transpiration rate.
解釋溫度對蒸騰作用的影響。

rate of transpiration increase with temperature.
蒸騰作用的速率會隨溫度增加而增加。

1. Rate of evaporation from the mesophyll cell is faster.
   水份從葉肉細胞蒸發的速率會快些。
2. Rate of outward diffusion of water vapour is faster.
   水蒸氣向外擴散的速率會快些。

13. The rate of transpiration in day time is higher than at night, explain.
蒸騰作用速率在日間較夜間爲高，試加以解釋

In day time, stomata open due to the presence of light. In addition, Light increases the air temperature. Both favour the outward diffusion of water vapour through stomata.
在日間有日光存在，氣孔因而打開，而且空氣溫度較高，因此水蒸氣經氣室散失得較快。

14. Explain the effect of humidity on transpiration rate.
解釋濕度對蒸騰蒸騰作用作用的影響。

rate of transpiration decrease with increasing humidity.
蒸騰作用的速率會隨濕度增加而減低。

1. Rate of evaporation of water from the cells is slower.
   水份由細胞蒸發的速率會減低。
2. Rate of outward diffusion of water vapour is slower.
   水蒸氣向外擴散的速率會減低。

15. Explain the effect of wind on transpiration rate.
解釋風力對蒸騰作用的影響。

wind increase the rate of transpiration because water vapour is prevented to accumulate around the stomata.
風會增加蒸騰作用的速率因爲風會將氣孔附近的水蒸氣吹走。

16. Explain the effect of water supply on transpiration rate.
解釋水的供應對蒸騰作用的影響。

As soil dries out, plants wilt and stomata close. This will cut down the rate of transpiration.
當土壤乾燥，植物凋謝，氣孔會關閉，這樣會減低蒸騰作用的速率。

17. Give the importance of transpiration.
說出蒸騰作用的重要性。

1. Responsible for the distribution of mineral salts throughout the plant.
   負責將礦物質分佈至植物全身。
2. Cools the plant.
   幫植物降溫。

18. How to measure the transpiration rate by using the bubble potometer?
如何使用氣泡蒸騰計量度帶葉枝條的蒸騰作用速率。

The distance travelled by the bubble in the capillary tube within a fixed time is measured. This is the rate of transpiration.
量度毛細管內氣泡在一定時間內所行走的距離，這便是蒸騰作用的速率。

19. State and explain the precautions in setting up bubble potometer.
說出和解釋裝置汽泡蒸騰計時的注意事項。

a) Cut the shoot under water to prevent air-lock. (prevent the entry of air bubbles into the xylem vessels)
要在水中切割枝條以防止氣泡進入木質部阻塞吸水管道。
b) Fit the apparatus under water and make sure there is no air bubble inside.
要在水中裝配儀器以確保沒有氣泡進入。
c) The whole apparatus must be air tight.
整個儀器須密氣。

20. Explain why the air bubble moved during the experiment.
解釋在實驗進行時氣泡爲何會移動。

The plant lost water by transpiration, so it absorbs water from the apparatus. This would make the air bubble moves to the left of the capillary tube.
植物因蒸騰作用而失去水份，所以它便從裝置吸收水分，令氣泡向毛細管的左邊移動。

21. How would you adjust the position of the bubbles before taking a new set of readings?
在量度另一組讀數前，如何調校氣泡的位置？

Open the tap of the reservoir.
打開貯水器的喉掣。

22. State the limitations of the bubble potometer.
說出汽泡蒸騰計的局限性。

1. The potometer can be used for a shoot but not the entire plant.
蒸騰計只可用作量度枝條而非整株植物。
2. It only measure the rate of water uptake of plants. The rate of water uptake is not equal to the rate of transpiration because some water (1-2%) is used as raw material in photosynthesis.
它只可量度植物的吸水速度，吸水速度不等於蒸騰作用速率，因爲有些水(1-2%)會作爲光合作用的原料被用掉。

23. How to measure the transpiration rate by using the weight potometer?
如何使用重量蒸騰計量度帶葉枝條的蒸騰作用速率。

1. At the beginning of the experiment, weight the whole set-up.
   開始實驗時，先量度整個裝置的重量。

2. After a certain time interval, weight the set-up again.
   過了一段時間，再量度裝置的重量。
3. The difference in weight is calculated.
   計算重量的差異。
4. The loss in weight divided by the time interval is equal to the rate of water loss by the leafy shoot.
   失去的重量除以時間便是帶葉枝條失水的速度。

24. What is the purpose of adding a layer of oil on top of the water?
在水面加一層油的目的是什麼?

To prevent the evaporation of water from the water surface.
防止水份從水面蒸發。

25. Describe the distribution of stomata.
描述氣孔的分佈。

Mainly in the lower epidermis of the leaves.
主要在樹葉的下表皮。

26. Why are stomata usually absent in the epidermis of submerged leaves?
爲什麼水生植物通常缺乏氣孔?

It is because there is no problem of evaporation, the epidermis of submerged leaves usually has thin cell wall and no cuticle. It would be freely permeable to dissolved gases in water, and there is no need to have stomata for gaseous exchange as in the aerial leaves.
因爲沒有蒸發的問題，水生植物表皮細胞的細胞壁較薄和沒有角質，溶於水中的氣體可自由進出細胞，故無需像陸上植物般擁有氣孔以作氣體交換。

27. Name some methods that plant used to reduce transpiration.
說出一些植物用以減低蒸騰作用的方法。

1. The leaf roll up into a cylinder with the stomata on the inside.
   樹葉捲成一個氣孔都在內面的圓筒。
2. Sunken stomata : stomata are in depressions.
   下陷的氣孔 ： 氣孔藏在陷坑內。
3. Development of thick cuticle.
   擁有厚角皮。
4. Reduction of leaf surface area. eg. needle-shaped leaves.
   減少葉面面積，例 ： 針狀葉。

Check point 測試站 (20)

28. How do young plants support themselves?
幼嫩植物如何獲取支持?
Mainly by the turgidity of the cells and partly by xylem.
主要靠細胞的硬脹，部份靠木質部。

29. How do older plants support themselves?
年長植物如何獲取支持?
By the rigid lignified wall of sclerenchyma and xylem vessels
靠厚壁細胞和木質部導管，這些細胞有用木質素增硬了的細胞壁。

30. How do leaves gain support?
樹葉如何獲取支持?
By mid rib, veins and the turgidity of parenchyma.
葉脈和薄壁細胞的硬脹。

31. What is the importance of support in plants?
植物的支持作用有何重要性?
1. To display the leaves in the best position so as to absorb the maximum amount of sunlight for photosynthesis.
   可將枝葉放置於最有利位置，爲光合作用吸收最大的光能。
2. To resist powerful winds from breaking or uprooting the plants.
   可抵抗強風，避免枝幹折斷及強風將植物連根拔起。
3. To keep shape of an organ so as to facilitate its functioning. eg. by providing turgidity to guard cell so that stoma opens to allow transpiration to take place.
   可維持各種器官的形狀，以協助發揮它們的功能，例如給保衛細胞提供硬脹度，令氣孔張開，使蒸騰作用得以進行。
4. Flowers are put in a favourable position for pollination.
   於傳粉時，將花朵放置於最佳位置。
5. Seeds and fruits can be dispersed efficiently.
   種子和果實更易散播。

32. Describe and explain the distribution of supporting tissues in root.
描述和解釋支持組織在根部的分佈。
Centralized, the stress is mainly uprooting effect by wind
在根部的中央，壓力主要是來自風的拔起拉力。

33. Describe and explain the distribution of supporting tissues in stem.
描述和解釋支持組織在莖部的分佈。
Around the periphery, the stress is mainly bending stress by wind.
在根部的在外圍，壓力主要是風的彎曲壓力。

Check point 測試站 (21)

1. **Arrange the stages of the cell cycle in correct order.**
   將細胞週期的各階段順序排列。
   Interphase → prophase → metaphase → anaphase → telophase
   間期 → 前期 → 中期 → 後期 → 末期

2. **What is mitosis?**
   有絲分裂是甚麼?
   The cell carries out cell division to produce two daughter cells which are genetically indentically to the parent cell .
   有絲分裂是指細胞進行分裂，產生兩個遺傳物質與親本細胞完全相同的子細胞的過程。

3. **In what circumstances does mitosis occur?**
   有絲分裂在何種情況下發生？
   This kind of cell division occurs in the production of somatic cells.
   只在產生體細胞時發生。

4. **Compare the chromosome between the daughter cell and the parent cell in mitosis.**
   在有絲分裂比較子細胞和母細胞的染色體。
   The daughter cells have the same kind and same number of chromosomes as the parent cell.
   子細胞有與母細胞相同種類與數目的染色體。

5. **When do the chromosomes replicate?**
   染色體何時進行複製?
   Chromosomes will replicate before cell division take place.
   有絲分裂前(休息狀態)，染色體會自我複製。

6. **Describe the events occur in interphase.**
   描述在間期所發生的事情。
   DNA is duplicated.
   DNA 進行複製。
   Formation of new organelles.
   形成新細胞器。
   The cell builds up a store of energy.
   細胞積存能量。

7. **Describe the events occur in prophase.**
   描述在前期所發生的事情。
   (a) The chromosomes shorten and thicken
   染色體變短變粗。

(b) The nuclear membrane and nucleolus disappear.
核膜及核仁消失。

(c) The chromosomes duplicate so that each is made up of two chromatids attaching at the centromere.
染色體進行複製，形成兩條由著絲點連著的染色單體。

(d) Spindles extend from the centrioles attach each chromosome at the centromere.
中心粒伸出紡錘絲在著絲點連接著染色體。

8. Describe the events occur in metaphase.
描述在中期所發生的事情。

The chromosomes are arranged in the equatorial plane.
染色體排列在赤道板上。

Each chromosome is attached at the centromere by spindles from both sides.
每條染色體的著絲點都被兩面的紡錘絲連著。

9. How would you recognise the metaphase stage of mitotic division in a plant cell?
你如何分辨植物細胞有絲分裂時的中期？

There would be no nuclear membrane. Spindle fibres would be present. The chromosomes are duplicated into sister chromatids. Finally, the chromosomes are arranged in the equatorial plane.
此時沒有核膜，有紡錘絲，染色體被複製成姊妹染色單體，及染色體排列在赤道板上。

10. Describe the events occur in anaphase.
描述在後期所發生的事情。

The spindle fibre contracts, requires energy, pulling the chromatids apart (now the chromatid is called a chromosome).
紡錘絲收縮，此過程需要能量，將染色單體拉開 (現在染色單體稱爲染色體) 當染色體到達兩極，後期便完成。

11. Describe the events occur in early telophase.
描述在末期所發生的事情。

(a) The two sets of chromosomes have reached the two poles of the cell.
兩套染色體到達兩極。

(b) Furrows are formed at the center of the cell.
細胞的中心形成陷坑。

(c) New nucleoli are produced and a new nuclear membrane forms around the chromosomes.
重新形成核仁及包圍著染色體的核膜。

(d) The spindles disappear.
紡錘絲消失。

(e) Cytokinesis takes place.
細胞質進行分裂。

12. What is the significance of mitosis.

有絲分裂有何重要性?

1. The essence of mitosis is that the daughter cells have the same number of chromosomes and genetic constituents as the parent cells. In this way, the **constancy of the species** can be maintained.
   子細胞有與母細胞相同的染色體數目及遺傳成分，如此，**品種的穩定性**便得以維持。
2. It takes place in the production of **somatic cells**, eg. during the **growth** of an individual; and takes place in **asexual reproduction**, eg. binary fission in **Amoeba** and budding in Hydra.
   它在產生**體細**胞時進行，幫助個體的**生長**，又在進行**無性繁殖**時進行，例如**變形蟲**的二分體分裂及水螅的出芽生殖，故此它有助繁殖。
3. It gives new cells for **growth** and to replace the dead cells and thus **repairs** the damaged body parts.
   它產生新的細胞以**生長**及替代死去的，故此幫助身體**修理**破損的部分。

13. Draw a flow chart to show the various stage of mitosis.

繪一流程圖以顯示有絲分裂各個階段。

At resting stage, chromosomes exist as chromatin → chromosomes appear as long threads → each chromosome duplicates to two chromatids, nuclear membrane disappear → Chromosomes lie up individually at equator, spindles form → the spindles pull the chromatids apart and they move to the poles → the furrows deepen to separate the two daughter cells, nuclear membranes reform.

細胞在休息狀態，染色體以染色質形式出現 → 染色質凝聚成染色體 → 每條染色體自我複製,變成兩條染色單體,核膜消失 → 染色體單獨地排列在赤道板上,紡錘絲正在形成 → 紡錘絲收縮將染色單體拉開，染色單體變成染色體並循相反方向移到兩極 →染色體到達兩極，細胞質沿著赤道板收縮，形成兩個子細胞，核膜再次形成。

14. Distinguish between haploid and diploid.

分辨單倍體與雙倍體。

Haploid means that the cell contains only half the full number of chromosomes. i.e. only one of each homologous pair.

Haploid means that the cell contains the full complement of chromosomes. i.e. two of each homologous pair. Normal body cells (somatic cells) are diploid, only sex cells (gametes) are haploid.

單倍體是指細胞只含有全部染色體數目的一半，即只有每對同源染色體的一個。

雙倍體是指細胞含有全部染色體，即每對同源染色體都有齊兩個。

一般細胞(體細胞)爲雙倍體，性細胞爲單倍體。

15. What is meiosis?

減數分裂是甚麼?

The cell carries out cell division to produce four daughter cells which contain half the numbr of chromosomes of the parent cell.

減數分裂是指細胞進行分裂，產生四個只有親本細胞一半染色體的子細胞的過程。

16. In what circumstances does meiosis occur?
減數分裂在何種情況下發生？
This kind of cell division occurs in the production of gametes.
在產生配子時發生。

17. Describe the number of set of chromosome in daughter cells after meiosis.
簡述減數分裂後子細胞的染色體數目。
The daughter cells have only one set of chromosomes (haploid) instead of two sets as in the parent cell.
子細胞只有一套染色體(單倍體)而非像母細胞般有兩套。

18. Sate the peculiar event occurs in prophase I.
說出前期 I 所發生的特別事情。
Homologous chromosomes pair together.
同源染色體配對。

19. State the peculiar event occurs in metaphase I.
說出中期 I 所發生的特別事情。
Each pair of chromosomes lies on the equatorial plane. Each chromosome is attached by a spindle from one side only so that when the spindles contract, the homologous chromosomes are pulled apart.
染色體配對排列在赤道板上。
每條染色體的著絲點都只被一面的紡綞絲連著，故此當紡綞絲收縮，同源染色體會被拉開。

20. State the peculiar event occurs in anaphase I.
說出後期 I 所發生的特別事情。
Homologous chromosomes separate
同源染色單體被拉開。

21. What is the significance of meiosis?
減數分裂有什麼重要性?
1. After meiosis, the gametes contain only half of the hereditary materials as the parent cell. Thus when the two gametes unite, the resulting zygote will have the normal complement of hereditary substances. That is **the chromosome number will not be doubled after fertilization**.
減數分裂將子細胞的染色體數目減半，配子融合後，雙倍體的染色體數目得以復原，即是**合子的染色體數目不會因受精作用而加倍。**
2. The independent assortment of chromosomes as well as crossing over occurs during prophase I can produce gametes with different genetic make up. This leads to variations in the offspring and thus helps them to adapt the changing environment.
同源染色體的獨立分配及在前期 I 發生的互換皆可產生具有不同遺傳組合的配子，這使同種生物的後代之間存有差異，有助適應轉變中的環境。

22. What are the main observable difference between mitosis and meiosis?
於顯微鏡觀察下，有絲分裂與減數分裂有何重大差異?
mitosis：Chromosomes lie up individually at the equator
meiosis：Homologous chromosomes paired up at the equator
有絲分裂：染色體單獨地排列赤道板上
減數分裂：同源染色體成對地排列赤道板上

Check point 測試站 (22)

1. **Why is there a need of reproduction?**
爲什麼需要生殖作用？
To produces new individuals to replace the deaths, is necessary for the perpetuation of the species
爲了產生新的個體以取代死去的，對物種的延續是必需的。

2. **What are the features of asexual reproduction?**
無性繁殖有何特色？
Only one parent is involved.
No specialized sex organs and therefore no gametes are involved.
The offspring has the same gene with the parent.
只需要一個親代。
沒有特化的性器官，所以沒有配子的參與。
基因與親本完全相同。

3. **Give 3 ways of asexual reproduction in primitive organisms.**
說出三種在低等生物的無性繁殖方法。
Binary fission : eg. Amoeba
二分體分裂 ： 例：變形蟲
Budding : eg. Yeast
出芽生殖 ： 例：酵母菌
Spore formation : eg. Mucor
孢子生殖 ： 例：白黴

4. **Explain binary fission.**
解釋何謂二分體分裂法。
A cell divides into two equal parts (equal share of cytoplasm).
細胞分裂成相同的兩部份。

5. **Explain rhizome with an example.**
用例子解釋根莖。
Rhizome : underground stem grow horizontally, eg. ginger.
根莖 ： 水平生長的地下莖，例: 薑。

6. Explain corm with an example.
用例子解釋球莖。
Corm : underground stem grows vertically, eg. taro.
球莖 ： 垂直生長的地下莖，例：芋。

7. With an example, explain how the vegetative organ developes to a new shoot.
用例子解釋營養繁殖器官如何發育成一新植株。
The buds develop into aerial shoot by taking food from the corm, eg. taro. Then the aerial shoots make food by photosynthesis and the food made is stored in the base of the stem to form new daughter corms. These new corms may propagate vegetatively in the next growing season.
利用球莖繁殖，例：芋。
芽從球莖吸取營養發育而成地上莖，地上莖利用光合作用製造食物，過剩的食物儲在莖部底下，用作形成新的球莖，這些新球莖下一年可進行營養繁殖。

8. Explain tuber with an example.
用例子解釋塊莖。
Tuber **:** swollen end of an underground stem, eg. potato.
塊莖 ： 莖端膨大的地下莖，例：馬鈴薯。

9. Explain bulb with an example.
用例子解釋鱗莖。
Bulb : a reduced stem with swollen scale leaves, eg. Onion
鱗莖 ： 有肥厚鱗葉的短莖，例：洋蔥。

10. Give 3 functions of underground stems.
說出地下莖的三種功能。
1. For food storage. 儲藏食物。
2. For vegetative propagation. 營養繁殖。
3. For perennation (over wintering). 過冬。

11. What is the disadvantage of reproducing by underground stems?
用地下莖繁殖有什麼缺點？
Overcrowding may occur because many shoots may develop at the same time from the same rhizome.
可能發生過於擠迫，因爲許多嫩枝同時從同一母莖發芽生長。

12. What are the advantage and disadvantage of asexual reproduction?
無性繁殖有什麼優點知缺點？

Advantage : Rapid - produces a large number of offspring within a short period of time. Does not involve another parent. Desirable characters can be transmitted and retained in the offspring.
優點：快捷簡單，生存率高，優良的特性能無缺傳至後代。
缺點：後代擁有較少遺傳變異，它們較難適應轉變中的環境，母株所擁有的疾病較易傳給後代。

13. What are the advantage and disadvantage of sexual reproduction?
有性繁殖有什麼優點知缺點？

Advantage : more genetic variation in the offspring. Better quality may be obtained.
Disadvantage : slower and more complex.
優點：後代擁有較多遺傳變異，有機會獲取更佳的體質。
缺點：緩慢和繁複。

14. Give 2 ways of asexual reproduction in higher plants.
說出二種在高等植物進行的無性繁殖方法。

Vegetative propagation
營養繁殖
Artificial propagation
人工繁殖

Check point 測試站 (23)

15. What are the features of sexual reproduction?
有性繁殖有何特色？

1. The uniting of two sex cells (gametes) to form a fertilized egg called zygote.
   兩個配子結合成一個叫合子的受精卵（受精作用）。
2. It usually involves two parents, a male and a female.
   通常需要兩性的參與。
3. The genes of the offspring are different from the parent.
   基因與親本完全不同。

16. Are two parents must be involved in sexual reproduction?
有性繁殖是否必須兩性的參與?

It usually involves two parents, a male and a female, but may involve one parent only. Some bisexual organisms such as flowering plants and tapeworm can carry out sexual reproduction by itself alone.
通常需要兩性的參與，但有時一個親代亦可，有些雙性生物例如有花植物及絛蟲，可以自己進行有性繁殖。

17. Describe the structure and function of calyx.
描述花萼的結構和功能。
Calyx : This consists of sepals, usually green in colour.
Function : To protect the flower at the bud stage.
花萼：由萼片組成，通常是綠色的。
功能：在花還是花蕾的時候保護花朵。

18. Describe the structure and function of corolla.
描述花冠的結構和功能。
由花瓣組成，在蟲媒花通常色彩鮮豔。
This consists of petals, which are usually brightly coloured in insect pollinated flowers.
Function : (1) To protect the internal structure of flower.
(2) In insect pollinated flowers, it is used to attract insects and provide landing place for them.
功能 ：（1）保護花的內部構造。
（2）在蟲媒花，用來吸引昆蟲及爲牠們提供落腳點。

19. Describe the structure and function of nectary.
描述花蜜腺的結構和功能。
Nectary : This secretes nectar (a sugary fluid) to attract insects to crawl into the flowers. The insects help in pollination.
花蜜腺：分泌花蜜吸引昆蟲爬入花內，昆蟲可幫助傳播花粉。

20. State the function of anther.
說出花藥的功能。
To produce pollen grains, which contain the male nucleus.
產生內含雄胞核的花粉粒。

21. State the function of ovule.
說出胚珠的功能。
This contains the female nucleus.
它內含卵細胞。

22. State the function of stigma.
說出柱頭的功能。
To receive the pollen grains and serve as a place for their germination.
接受花粉粒及作爲花粉粒萌發的地方。

23. Is self pollination possible in plant?
在花卉有沒有可能自花傳粉?
Most flowers are bisexual, so self pollination is possible.
大多數花都是兩性花，故自花傳粉是可能的。

24. What is the <u>disadvantage</u> of self pollination?
自花傳粉有什麼<u>缺點</u>？
The offspring are usually weaker. Lesser genetic variation.
後代通常較弱，遺傳變異較少。

25. What is the advantage of self pollination?
自花傳粉有什麼優點？
Greater chance of fertilization.
受精的機會較大。

26. What is the advantage of cross pollination?
異花傳粉有什麼優點？
1. Stronger offspring.
2. Greater variations among offspring.

1. 後代較強。
2. 後代中較多遺傳變異。

27. Suggest some methods to avoid self pollination.
建議一些避免自花傳粉的方法。
1. Unisexuality : have either the stamens or the ovaries
   單一性別 :花藥和子房只有其一。
2. Self-sterility : pollen grains would not germinate on the same plant.
   自我不育 ： 來自同一棵植物的花粉粒不能萌發。
3. Stigma is placed above the anther.
   花柱的位置高過花藥。

28. Distinguish between insect pollination and wind pollination.
分辨蟲媒傳粉和風媒傳粉。
Insect pollination : pollen are carried to stigma by insects.
Wind pollination : pollens are carried to stigma by wind.
蟲媒傳粉 ： 利用昆蟲將花粉帶往柱頭。
風媒傳粉 ： 利用風將花粉帶往柱頭。

29. Compare insect pollinated flowers with wind pollinated flowers with respect to (1) size, (2) petals, (3) nectary.

在下列各方面比較蟲媒花與風媒花。

(1) 體積, (2) 花瓣, (3) 花蜜腺

	蟲媒花 Insect pollinated flowers	風媒花 Wind pollinated flowers
1. Size 體積	large and conspicuous 大而明顯	small and inconspicuous 小而不明顯
2. Petals 花瓣	brightly coloured 顏色鮮豔	green or dull coloured 綠色或暗淡
3. Nectary 花蜜腺	often present 常在	no nectary 不存在

30. Compare insect pollinated flowers with wind pollinated flowers with respect to (1) scent, (2) anthers.

在下列各方面比較蟲媒花與風媒花。

(1) 香味, (2) 花藥

	蟲媒花 Insect pollinated flowers	風媒花 Wind pollinated flowers
1. Scent 香味	often strongly scented 通常香味濃烈	no scent 沒有香味
2. Anthers 花藥	inside the flower, insects have to brush pass anthers to reach the nectaries. 位於花內，昆蟲需擦過花藥才可到達蜜腺	hanging out of the flower, catching the wind. 吊出花外，迎風招展。

31. Compare insect pollinated flowers with wind pollinated flowers with respect to (1) pollen, (2) stigma.

在下列各方面比較蟲媒花與風媒花。

(1) 花粉粒, (2) 柱頭

	蟲媒花 Insect pollinated flowers	風媒花 Wind pollinated flowers
1. Pollen 花粉粒	heavier with spikes 較重和表面帶釘	lighter with smooth surfaces 較輕及表面平滑。
2. Stigma 柱頭	inside flower, Sticky 藏在花內，帶有黏性，可黏昆蟲身上的花粉粒。	feathery (greater surface area) 露出花外，羽毛狀（以增加表面積）。

32. Explain the term fertiization.

解釋名詞受精作用。

Fertilization means the fusion of the male and female gametes.

受精作用指雌雄配子的結合。

33. Describe the process fertilization with respect to the germination of pollen tube.
以花粉管的發芽解釋受精作用的過程。

Once a pollen has landed on a stigma, it sends out a pollen tube which grows down the style and the ovary, towards the micropyle of the ovule. Fertilization occurs when the male nucleus (male gamete) fuses with the female nucleus (female gamete) in the egg cell. The ovary will then develop into a fruit and the ovules become the seeds.
當花粉降落在柱頭，它會長出一條花粉管，花粉管穿越花柱向著子房生長，直至到達胚珠的珠孔。當雄胞核(雄配子)和卵細胞內的雌胞核(雌配子)結合時，受精作用便會發生，子房壁會發育成果實，胚珠會變成種子。

34. Is pollen grain the male gamete of flowering plant, explain.
花粉粒是否雄配子，請解釋。

No, the pollen grains are carriers of male gametes.
否，花粉粒是雄配子的載體。

35. Pollen grain being light and produced in large number, will this aid in the dispersal of the offspring?
花粉粒很輕和數量很多，這些特徵會否幫助後代的散播?

These features will help the pollen grains to reach the stigma of another flower so as to achieve cross fertilization, but is not related to the dispersal of the offspring at all.
這些特徵可幫助花粉粒到達其他的花的柱頭以達成異體受精，但和後代的散播無關連。

36. What is the function of pollen grain?
花粉粒有什麼功能?

It carries the male gamete to the female gamete for fertilization to take place.
負責把雄配子帶到雌配子進行受精。

37. What is the function of fruit?
果實有什麼功能?

It protects the seed and aids in dispersal.
保護並散播種子。

38. Whatis the function of seed?
種子有什麼功能?

It protects the embryo, provides food to the embryo, aids in dispersal.
保護胚胎、爲胚胎提供食物、幫助植物散播。

39. What are the advantages of seed dispersal?
種子散播有什麼優點？

1. It prevents the spread of diseases.
   防止疾病的傳播。
2. It reduces competition
   減少彼此的競爭。

40. State the four methods of seed dispersal.
說出四種種子散播的方法。

1. 利用風力散播 Wind dispersal
2. 利用水力散播 Water dispersal
3. 自我散播 Mechanical dispersal
4. 利用動物散播 Animal dispersal

41. State some structural modification of wind dispersal.
說出一些以風力散播的結構上的適應。

Large surface area : 1. Hairs in parachute form 2. Wings
大的表面積 ： 有像降落傘狀的毛和翼。

42. State some structural modification of animal dispersal.
說出一些以動物散播的結構上的適應。

1. Attaching devices - carried by animals' hooks, spines and sticky hairs.
2. Succulent fruits - eaten by animals. Fruits brightly coloured, sweet and fleshy.

1．利用果實表面的鉤刺和硬毛，依附在動物的毛髮、烏類的羽毛和人類的衣服上。
2．肥厚多汁的果實成爲動物的食物，這些果實顏色鮮豔，鮮甜多肉。

43. State some structural modification of water dispersal.
說出一些以水力散播的結構上的適應。

Floating devices : 1. Protected by a water proof surface. 2. Fibrous layer traps air.
有幫助浮起的結構，有防水的外皮作保護。

44. State some structural modification of mechanical dispersal.
說出一些以自我散播的結構上的適應。

Explosive pericarp (fruit wall). Tension set up in pericarp springs the segments apart to jerk the seeds out.
利用莢果在成熟時慢慢脫水，突然爆裂把種子彈到遠處。

45. Is genetic variation caused by seed dispersal?
遺傳變異是否由種子散播所做成?

Genetic variation is not caused by seed dispersal.
遺傳變異不是由種子散播所做成的。

46. What is the embryo consists of?
種子的胚胎由什麼組成？
The embryo consists of the **plumule, radicle** and two **cotyledons**.
胚胎由胚芽、胚根及兩片子葉組成。

47. State the fate of plumule and radicle.
說出胚芽和胚根的命運。
Plumule → shoot 胚芽變成枝幹
Radicle → root 胚根變成根

48. What is the function of cotyledons?
子葉有什麼功用？
Cotyledons contains food for embryo development.
子葉含有供胚胎生長的營養。

49. What are the differences between seeds and fruits?
種子和果實有什麼分別?
A fruit on the other hand, has two scars, one from the remains of the style and one from the attachment to the receptacle.
A seed has a scar left from breaking the placenta which attaches the ovule to the ovary wall.
種子有胚珠脫落子房壁所留下的疤痕－種臍(只有一個疤痕)。
果實有兩個疤痕，一個是花柱的殘餘，另一個是脫離花托(果柄)時所留下的。

<u>Check point 測試站 (24)</u>

1. State the function of scrotal sac.
說出陰囊的功用。
To contain and protect the testis.
盛載和保護精巢。

2. State the function of testis.
說出精巢的功用。
To produce sperms and sex hormones
產生精子和性激素。

3. State the function of penis.
說出陰莖的功用。
To introduce sperms into the vagina of the female.
將精子送入女性的陰道。

4. State the function of urethra.
說出尿道的功用。
A common passage for both urine and semen
尿液和精液的共同通道。

5. State the function of seminal vesicle, Prostate gland and Cowper's gland.
說出貯精囊、前列腺、尿道球腺的功用。
To produce fluids to nourish and activate the sperms.
產生液體營養和活化精子。

6. How does sperm move?
精子如何移動？
The sperm moves by movement of its tail.
精子靠尾巴游動。

7. Explain the details of the transfer.
解釋輸送的詳情。
During copulation, the penis of the man becomes erect and is inserted into the vagina of a woman where semen is then ejaculated.
性交時，男性的陽具可充血勃起，然後插入女性的陰道內，隨後射精。

8. Why is the testes are outside the abdominal cavity?
爲什麼精巢位於腹腔外？
The testes are outside the abdominal cavity to avoid the high body temperature which is not favourable for the development of sperms.
精巢(睪丸)位於腹腔外是爲了降低溫度以利製造精子，過高的體溫不利精子的發育。

9. State the function of ovary.
說出卵巢的功用。
To produce ova and sex hormones.
產生卵子和性激素。

10. State the function of oviduct.
說出輸卵管的功用。
The inner wall has ciliated cells to move the ova down the oviduct.
內壁有纖毛細胞，將卵子沿管向下移動，送往子宮。

11. State the function of uterus.
說出子宮的功用。
It serves as the place where the embryo develops ; it contracts to push the baby out during birth.
作爲胎兒發育的地方 ； 生產時它會收縮將胎兒推出體外。

12. State the function of vagina
說出陰道的功用。
For receiving sperms from the male; as a passage for the birth of the baby.
從雄性接受精子 ； 作爲生產的通道。

13. How does the egg move along the oviduct?
卵子如何在輸卵管移動？
The egg moves along the oviduct by the beating of the cilia and muscular contraction of the oviduct.
靠纖毛的蠕動和輸卵管肌肉收縮的推動。

14. Where is fertilization occurs?
受精作用在那裏發生？
Fertilization occurs at oviduct.
在輸卵管內發生。

15. Where is the development of the fertilized egg occurs?
受精卵在那裏發育？
The development of the fertilized egg is at uterus.
受精卵則在子宮內發育。

16. Explain the ovulation cycle and the relevant changes in the uterus.
簡述排卵週期和子宮所作出的變化。
In human, ovulation occurs regularly for every 28 days. The maturation of the ovum is accompanied by the thickening and vascularization of the uterine lining so that the ovum, if fertilized, can develop immediately on the thicken uterine wall.
在人類，每隔 28 天排卵一次，隨著卵子的成熟，子宮內膜(壁)慢慢充血和變厚，準備讓受精的卵子立即植入增厚了的子宮內膜內發育。

17. What happens to the uterine lining if fertilization does not occur?
如果沒有受精，子宮內壁會怎樣？
If fertilization does not occur, the uterine lining will break down. The discharge of the debris and a little blood is called menstruation. This repeats for every 28 days and the cycle is called menstrual cycle.
卵子若遇不到精子，便會死亡，子宮壁上的新生組織脫落，混和少量血液和黏液 通過陰道流出體外，形成月經。

18. State the day of ovulation with reference to the menstruation cycle.
指出在月經週期中的排卵日子。
Ovulation occurs at the 14th day when menstruation starts.
排卵在月經開始計第十四天。

19. Describe the process of implantation.
簡述受精卵植入子宮內膜期間的發育過程。

The embryo implants into the uterine wall. The placenta and the umbilical cord are formed. The zygote divides forming a ball of cells as it passes down the oviduct to uterus where an embryo is formed.
當合子由輸卵管往下移到子宮時，會分裂成細胞球，在子宮內形成胚胎。
胚胎植入於子宮內膜上，形成胎盤和臍帶。

20. Why is embryonic blood and the maternal blood are separated by thin membranes?
爲什麼胎兒的血和母體的血被薄膜分隔？

This is necessary because the embryo and the mother may have different blood groups. Besides, this can prevent the greater blood pressure of the mother from breaking down the delicate blood vessels of the embryo.
因胎兒和母親可以有不同血型。此外，分隔血液可避免高血壓的母體血液沖破胎兒幼小的血管。

21. How can the foetus obtains nutrients from the mother.
胎兒如何從母體獲取營養?

They carry out their nutrition through the placenta. Food and oxygen have a higher concentration in the maternal blood so that they diffuse from the maternal blood to the embryonic blood.
胎兒透過胎盤獲取養份，食物和氧氣的濃度在母體的血內較高，故它們從母體的血擴散至胎兒的血。

22. State the adaptations of the placenta?
說出胎盤所作的適應。

1. The folding (villi) increase the surface area for diffusion.
   有許多摺縐（絨毛）以增加擴散的面積。
2. The umbilical artery breaks up into capillaries at the villi and therefore there is greater surface area for the exchange of materials with the maternal blood.
   臍帶動脈在絨毛內分枝成許多微血管，於是和母體的血交換物質的表面積便可大大增加。
3. The membranes separating the embryonic blood and maternal blood are relatively thin so as to allow materials to diffuse through easily.
   分隔胎兒的血和母體的血的膜很薄，物質很容易擴散通過。

23. What are the functions of the placenta?
說出胎盤的功用。

1. For the attachment of the embryo.
   給胎兒附著的地方。
2. For the nutrition, respiration and excretion of the embryo.
   給胎兒提供營養作用、呼吸作用和排泄作用。

24. What is the fate of placenta?
說出胎盤的命運。
Shortly after the birth, the placenta will be expelled out of the uterus by contraction of the muscular wall of uterus.
分娩後不久，胎盤脫離子宮，子宮肌肉收縮將胎盤排出體外。

25. What is the function of the amniotic fluid?
羊水有什麼功用？
1. To act as a shock absorbent for the embryo.
   不使母體的移動而令胎兒受到震盪。
2. To help to maintain a uniform temperature for the embryo.
   減低溫度轉變。
3. To act as a lubricant during birth.
   分娩時作爲潤滑劑。

26. What are the advantages of breast feeding?
母乳餵養有什麼好處?
Breast milk is the best food for babies. It contains antibodies which protect the babies from pathogens.
母乳能爲嬰兒提供均衡飲食，它還含有抗體，使嬰兒免受感染。

27. Name some birth control methods.
說出一些節育的方法。
1. The natural method
   安全期
2. Contraceptive pills
   避孕丸
3. Barriers : condom, diaphragm, intra-uterine device
   阻擋精子的屏障 ： 避孕套、子宮帽、子宮環
4. Surgical methods : Sterilization in male and female
   外科手術(絕育) ： 結紮輸精管、結紮輸卵管

28. Explain the natural method in birth control.
解釋安全期。
Avoid sexual intercourse during ovulation period. Not reliable.
在排卵期避免性交，在所有方法中效率最低。

29. Why is the natural method not reliable?
爲什麼安全期在所有方法中效率最低?
It is difficult to known the exact time of ovulation, the duration of the menstruation period varies with person.
很難準確預測排卵的時間，因月經週期的長短因人而異。

30. How to increase the accuracy of natural method?
如何增加安全期的準確性?
By measuring the wake up body temperature, in the ovulation period, body temperature will drop slightly and then rise up again.
早上量度體溫，排卵期間，體溫輕微下降再上升。

31. Explain the use of contraceptive pills.
解釋避孕丸的功用和效用。
含有可阻止排卵的性激素，最可靠。
Contain sex hormones which prevent ovulation. Most reliable.

32. Explain the use of condom.
解釋避孕套的功用和效用。
Thin rubber sheath worn on the erect penis.
Very effective if used carefully and undamaged.
軟薄的橡膠套，套在勃起的陽具上進行性交。
如膠套沒有破損又能適當使用則非常有效。

33. Explain the use of diaphragm.
解釋子宮帽的功用和效用。
Thin dome shaped rubber put in the vagina of a woman over the cervix.
Sperm cells are then prevented from entering the uterus.
Quite effective if used with spermicidal cream.
拱形薄橡膠膜放在陰道後部的子宮頸端，用以隔絕精子。
如與滅苗藥膏一起使用則頗有效。

34. Explain the use of intra-uterine device.
解釋子宮環的功用和效用。
Small plastic loop put in the uterus. The uterus reacts by rejecting the implantation of the fertilized egg. Effective but may be displaced.
塑膠製成的環狀物，擺在子宮裏，使子宮抗拒受精卵的植入。雖有效但常會移位。

35. Explain sterilization in male.
解釋男性的絕育手術。
The vas deferens is cut and the ends are tied off.
Totally effective, normally irreversible.
結紮輸精管 ： 切斷輸精管然後結紮切口。
絕對有效，一般不可逆轉。

36. Explain sterilization in female.

解釋女性的絕育手術。

Cutting of the oviducts and tying off the cut ends.

This prevents the sperms from meeting the eggs, thus fertilization cannot occur.

Totally effective but irreversible.

結紮輸卵管 ： 切斷輸卵管然後結紮切口，這可防止精子遇到卵子，使受精作用不能發生。絕對有效但不可逆轉。

37. Will sterilizations have any effect on secondary sexual characteristics, explain?

絕育對第二性徵有沒有影響，請解釋?

There is no effect on secondary sexual characteristics, female still have menstruation, male can eject semen, because sex hormones can still be produced by ovaries (testes). These hormones are transported by blood to the target organs to exert their effects.

絕育對第二性徵無影響，女性仍有月經，男性仍可射精(沒有精子的精液)，因爲卵巢(精巢)仍繼續製造性激素，這些激素是由血液運往目標器官來發揮它的效應的。

Check point 測試站 (25)

1. What is growth?

何謂生長?

Growth is an almost **irreversible increase in size, weight and complexity** due to the incorporation of new protoplasm in the tissues.

生長是生物不可逆轉的體積、重量和複雜性的增加，因爲在組織之中加入新的原生質。

2. How to measure growth?

如何量度生長?

1. By height or length 量度高度或長度
2. By area or volume 量度面積或體積
3. By fresh weight or dry weight 量度鮮重或乾量

3. What are the drawbacks of measuring height and volume?

量度高度、面積及體積有什麼缺點?

1. By height or length 量度高度或長度

   Drawback: these may be misleading. e.g. a bush while not increasing in height, may continue to grow in size by spreading sideways.

   缺點 ： 可能發生誤導，灌木可在不增加高度時，橫向生長。
2. By area or volume 量度面積或體積

   Drawback: impractical to measure.

   缺點 ： 難於量度。

4. What is meant by (1) fresh weight, (2) dry weight?
試解釋何謂鮮重及乾量。

(1) The fresh weight of an organism is the weight including the water it contains.
鮮重指生物連同體內水分的總重量。

(2) The dry weight of an organism is the weight excluding the water it contains. (the organism is dried and then weighted.) this represents the actual amount of solid materials in the body of the organism.
乾重是指生物體除去水分後的重量 (生物先焗乾再量重)，這代表生物真正固體物質的多少。

5. State the advantage of using (1) fresh weight, (2) dry weight.
說出用乾重及鮮重量度生長的優點。

(1) 鮮重:

1. **more convenient**
較方便。
2. the organisms **need not be killed**
不須殺死那生物。
3. **continuous readings can be obtained** with the same organism
可獲取同一生物連續不斷的生長數據。

(2) dry weight 乾重:

More accurate because it is not affected by the fluctuations of water content in the organisms.
較準確，不會受生物體內的含水量影響。

6. State the disadvantages of using (1) fresh weight, (2) dry weight.
說出用乾重及鮮重量度生長的缺點。

(1) fresh weight 鮮重:

Less accurate because of the fluctuation of water content in the organisms.
不太準確，受生物體內的含水量影響。

(2) dry weight 乾重:

1. **more troublesome** 費時，較麻煩。
2. the organisms **have to be killed** 需殺死那生物。
3. **only one reading is obtained** from one organism (different organisms have to be used to give continuous readings of growth)
只能獲得一個數據，需要大量樣本來獲取連續不斷的生長數據。

7. What is the first step in seed germination?
種子萌發的第一步是什麼?

The first step in seed germination is **uptake of water by absorption through the micropyle and testa**.
種子萌發的第一步是透過臍孔和種皮吸收水分。

8. What happens to the testa after imbibition of water?
種皮吸收水分後有什麼變化?
The testa will be softened and ruptured by the emerging radicle.
種皮被軟化，胚根可從破裂了的種皮長出。

9. State 3 importances of water in seed germination?
說出水分在種子萌發時的三個重要性。
1. Water is the **medium of metabolism**
   水是使化學作用發生的重要媒介。
2. It is a **important reactant in hydrolysis** of food reserves,
   亦是水解食物儲備的重要反應物。
3. Water also **activates the enzymes** needed for germination.
   水亦用作活化種子萌發時所需的酶。

10. How does the embryo grow?
胚胎怎樣生長？
Embryo **grows rapidly by cell division, enlargement and differentiation** at the expense of the food reserve.
胚胎利用所儲藏的食物儲備，透過有絲分裂、增大和分化作快速的生長。

11. In seed germination which organ emerge first? Explain its importance.
種子萌發時，何種器官首先出現？解釋它的重要性。
Radicle is the first organ to emerge. It can **anchor the embryo firmly and seek water source**.
萌發時，胚根首先出現，它是正向地性的，故此它幫助胚胎植根於地上和吸收水分。

12. In seed germination which organ emerge second? Explain its importance.
種子萌發時，何種器官第二個出現？解釋它的重要性。
The **plumule** is the second organ to emerge. It can **receive maximum amount of sunlight for photosynthesis.**
胚芽第二個出現，它是負向地性的，可使植物吸收最大量的陽光作光合作用。

13. State the region of growth of the roots.
說出根部的生長區域。
The region of growth of the root is limited to about several millimeters at the tip.
根的生長區局限於根尖處的數毫米。

14. Describe the structure and function of root cap.
簡述根冠的結構和功能。
It consists of layers of loose cells to protect the delicate meristematic cells.
由數層鬆散的細胞組成，用以保護頂端幼嫩的分生細胞。

15. What is meristematic cell?

分生細胞是什麼？

They are actively dividing cells.

正在活躍分裂的細胞。

16. Where does cell division occur in plant?

植物的細胞分裂在哪裏進行?

In meristematic tissue like bud tip and root tip

在有分生組織的區域進行，如芽尖、根尖。

17. Describe the feature of the region of cell division.

簡述細胞分裂區的特色。

produce new cells by mitosis.

細胞通過有絲分裂產生新細胞

18. Describe the feature of the region of elongation.

簡述延長區的特色。

They are newly produced cells, absorb water and enlarge to increase the length of the root.

新近產生的細胞，吸水後可急速膨大以增加根的長度。

Check point 測試站 (26)

19. Describe the feature of the region of differentiation and maturation.

簡述分化和成熟區的特色。

The cells mature, will not elongate but differentiate into different tissues.

細胞成熟，分化成各組織，不再延長。

20. Give the importance of root hairs.

說出根毛的重要性。

It provides large surface area to facilitate water and mineral absorption

提供大面積以助水份和礦物質的吸收。

21. How does growth of the stem occur?

怎樣增加莖部直徑？

Cambium has active cell division during secondary growth of the stem. This produces secondary xylem and secondary phloem, thus increase the thickness of the plant.

當莖部進行次回生長時，形成層會進行活躍的細胞分裂，這產生後生木質部和後生韌皮部，增加莖部的直徑。

22. Why does the dry weight decrease during the first few days of seed germination?
爲什麼萌發初期乾重減少？
The decrease of dry weight is due to the **respiration of the cells** of the seed, in which food is oxidized.
萌發初期，由於種子內所貯藏的食物在呼吸作用中用去，乾重減少。

23. Why does the fresh weight increase rapidly during the beginning of seed germination?
爲什麼萌發初期鮮重快速地增加？
The rapid increase in fresh weight is due to the **absorption of water**.
鮮重的增加是因爲種子吸收了水分。

24. Explain the increase of fresh and dry weight of the seeds after leaves have emerged?
爲什麼葉子長出後鮮重和乾重都增加？
The increase of dry weight and fresh weight are due to **photosynthesis**.
當葉子長出並利用光合作用製造食物，鮮重和乾重都增加。

25. What is the purpose of marking the radicle of the seedling with lines at equal intervals?
在胚根上畫等距線有什麼目的?
The purpose is to compare the growth rate of different parts of the radicle.
在胚根上畫上等距的線是用來比較胚根不同部位的生長速度。

26. Why does a large sample size of seeds is used in the experiment?
爲什麼在實驗中使用大量的種子?
To minimize the error due to individual variation.
爲了減少因個別差異而引起的誤差。

<u>Check point 測試站 (27)</u>

1. Draw a flow chart to show the regulatory process.
繪一流程圖以顯示協調的過程。
Stimulus → receptor → regulator → effector → response
刺激 → 感受器 → 協調器 → 反應器 → 行爲

2. Use a real example to show the regulatory process.
用一真實的例子以顯示協調的過程。
angry dog(Stimulus) → eye(receptor) → nervous system(regulator) → leg muscle(effector) → run away(response)
惡犬(刺激) → 眼睛(感受器) → 神經系統(協調器) → 腿肌(反應器) → 逃跑(行爲)

3. Describe the structure and function of sclerotic coat.

簡述鞏膜的結構和功能。

Tough and fibrous. To give shape to the eye. To protect the eye.

堅韌和無彈性的纖維組織。固定眼球形狀，保護眼內組織。

4. Describe the structure and function of cornea.

簡述角膜的結構和功能。

The front part of the sclerotic coat. Transparent.

To allow light to pass through. To protect the front part of the eye.

鞏膜的前面，透明。讓光線通過，保護眼睛的前面。

5. Describe the structure and function of choroid.

簡述脈胳膜的結構和功能。

Pigmented.. To prevent the reflection of light inside the eye. This makes the pupil always dark in colour

With rich blood supply. To supply oxygen and nutrients to the eye.

內含黑色色素細胞，能吸收光線，防止光線在眼球內反射，所以瞳孔總是黑色。

有充足的血管供應， 給眼球供應氧和食物。

6. Describe the structure and function of retina.

簡述視網膜的結構和功能。

Contains two types of light sensitive cells : rods and cones.

Rods for vision in dim light; cones for vision in bright light and for colour vision.

含有兩種感光細胞： 視桿和視椎。

視桿專在黑暗中看物，不能分辨顏色。 視椎在光亮中看物，可分辨顏色。

7. Describe the structure and function of lens.

簡述晶狀體的結構和功能。

Convex, transparent and elastic. To focus the image on the retina.

雙凸，透明有彈性。將影像聚焦在視網膜。

8. Describe the structure and function of suspensory ligament.

簡述懸韌帶的結構和功能。

Fibrous structure. To hold the lens in position.

纖維組織。固定晶狀體的位置。

9. Describe the function of ciliary bodies.

簡述睫狀體的功能。

For accomodation.

調節晶狀體的聚焦能力。

10. Describe the function of iris.

簡述虹膜的功能。

To control the size of the pupil and hence the amount of light entering the eye. In bright light, to cut down the amount of light that enters the eye so as to prevent the eye from over stimulation by light.

虹膜環狀肌可收縮，透過控制瞳孔的大小來控制進入眼球的光線的多寡，當光線過強時，減低進入眼睛的光線，避免視網膜受到傷害。

11. Describe the function of pupil.

簡述瞳孔的功能。

An aperture for light to pass through.

給光線通過的孔道。

12. Describe the function of aqueous and vitreous humour.

簡述水狀液和玻璃狀液的功能。

To maintain the shape of the eye. To help to refract light on the retina. To transport oxygen and nutrients to the lens and cornea.

維持眼球的形狀，幫助將光折射在視網膜，給晶狀體和角膜運送氧氣和營養。

13. Describe the function of eye muscle.

簡述眼肌的功能。

To move the eyeball in the orbit.

在眼窩內移動眼球。

14. Describe the function of conjunctiva.

簡述結膜的功能。

To protect the front part of the eye.

保護眼睛的前面。

15. Describe the function of yellow spot.

簡述黃點的功能。

This region contains the highest density of cones. This is the region which gives the clearest vision.

此處含有最高密齊度的視椎，在此得到的視覺最爲清晰。

16. Describe the function of blind spot.

簡述盲點的功能。

This is the region where nerve from the rods and cones leave the eye.

這是視桿和視椎的神經線離開眼球之處。

17. Explain the formation of colour vision.
解釋顏色視覺的形成。

There are 3 types of photoreceptors (cones) for red, green and blue colours. The various colours are detected by different combinations of the 3 types of photoreceptors.
視網膜有三種視錐，分別對紅光、綠光和藍光敏感，三種視錐的組合便可分辨不同顏色。

18. Describe the accommodation of distant object.
簡述遠物的視覺調節。

放射睫狀肌收縮 The radial ciliary muscle contracts
↓
懸韌帶被拉緊 Suspensory ligament is stretched
↓
晶狀體因拉力而變薄 The lens is pulled and becomes less convex
↓
晶狀體的焦距增加 Focal length of the lens increases
↓
遠物的影像落在視網膜 Image of distant object falls on the retina

19. Explain why the eye becomes fatigue when looking a t a nearby object for a long time.
爲什麼觀看近物一段長時間，眼睛會覺得疲勞?

The eye becomes fatigue when looking at a nearby object for a long time because ciliary muscle needs to contract to maintain convexity of the lens.
觀看近物一段長時間，眼睛會覺得疲勞，因爲睫狀環需要長期收縮以維持晶狀體的厚度。

20. Describe the defect in short sight.
簡述近視的缺陷。

Distant objects focus at a point in front of the retina. It cannot be clearly seen.
遠物在視網膜前聚焦，影像變得不清楚。

21. Give the reasons of short sight.
說出近視的成因。

The lens is too thick or the eyeball is too long.
晶狀體過厚或眼球過長。

22. Suggest the correction of short sight.
建議矯治近視的方法。

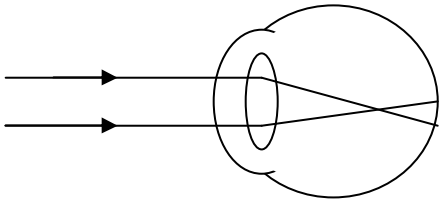
By wearing a concave lens.
配戴凹透鏡。

23. Describe the defect in long sight.
簡述遠視的缺陷。
Close objects focus at a point behind the retina. It cannot be clearly seen.
近物在視網膜後聚焦，影像變得不清楚。

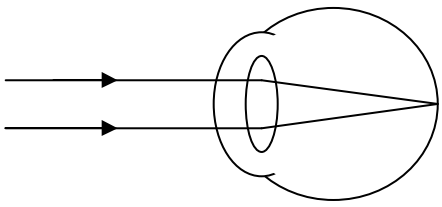
24. Give is the reasons of long sight.
說出遠視的成因。
The lens is too thin or the eyeball is too short. In old-aged people, the lens has lost its elasticity.
晶狀體過薄或眼球過短。在老人，晶狀體失去彈力。

25. Suggest the correction of long sight.
建議矯治遠視的方法。
By wearing a convex lens.
配戴凸透鏡

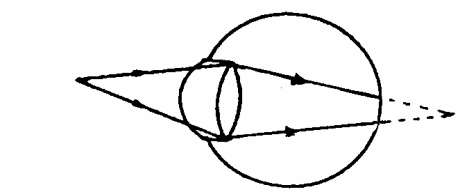
26. A student sits at the back, he cannot see the words on the blackboard clearly. Draw the path of rays in his eyes when he trys to focus on the words.
一學生坐在後面，不能清楚看見黑板上的字，繪一光線圖以顯示當眼睛聚焦於字體時光線的途徑。



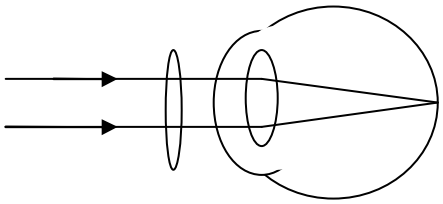
27. For the above question, suggest what glasses shoud he wear, and draw the path of rays in his eyes after this correction.
根據以上題目，建議該生該戴什麼眼鏡，並繪出矯治後的光線圖。
By a concave lens.
配戴凹透鏡。



28. A student cannot see the words on his watch clearly. Draw the path of rays in his eyes when he trys to focus on the watch.
一學生不能清楚看見手錶上的字，繪一光線圖以顯示當眼睛聚焦於字體時光線的途徑。



29. For the above question, suggest what glasses shoud he wear, and draw the path of rays in his eyes after this correction.
根據以上題目，建議該生該戴什麼眼鏡，並繪出矯治後的光線圖。
By a convex lens.
配戴凸透鏡



30. Describe how the formation of image on the retina can bring about the vision in the brain.
描述視網膜上的影像如何導致腦部產生視覺。
When the light sensitive cells on the retina are stimulated by light, nervous impulses are generated. Through the optic nerve, the impulses will be sent to the optic center of the cerebrum where they will be interpretted as vision.
視網膜上的感光細胞受到刺激，便會產生神經脈衝，這些脈衝沿視神經傳至大腦皮層。大腦皮層會將接收到的經脈衝詮釋成影像。

31. Distinguish between rods and cones.
分辨視桿和視錐。
The rods are stimulated by dim light while the cones are stimulated by bright light. Cones can detect colours while rods cannot. Cones have high visual acuity while rods have not.
視桿觀測夜間事物，而視錐觀測日間事物。視錐可分辨顏色給予高視銳度，而視桿不能。

Check point 測試站 (28)

32. State the function of pinna.
說出外耳的功能。
To collect more sound waves.
收集更多聲波。

33. State the function of external auditory canal.
說出的外耳道功能。
To transmit sound wave to the tympanum.
傳送聲波到鼓膜。

34. State the function of ear drum.
說出鼓膜的功能。
To convert the sound wave into the vibration of the ossicles.
將聲波化爲聽骨的振動。

35. State the function of middle ear ossicles.
說出聽骨的功能。
To amplify the vibration. To conduct sound wave to the inner ear.
把鼓膜的振波擴大，傳送至內耳。

36. State the function of Eustachian tube.
說出耳咽管的功能。
Connect to pharynx. To equalize the pressure in the middle ear with that of the atmosphere.
連接咽喉，平衡中耳與大氣的壓力，以免鼓膜受損。

37. State the function of oval window.
說出橢圓窗的功能。
To transmit the vibration from the ossicles to the cochlea.
將耳骨的振動傳送至耳蝸。

38. State the function of round window.
說出正圓窗的功能。
To damp the vibration of the perilymph in the cochlea.
凸出或凹入，抵消耳蝸管內液體波動壓力。

39. State the function of cochlea.

說出耳蝸的功能。

For the detection of sound virbration, (low frequency at the end) converting sound waves to nerve impulses. Through the auditory nerve, the impulses will be sent to the auditory center of the cerebrum where they will be interpretted as sound.

感應聲音的振動，發出神經脈衝，經聽神經傳送至大腦作分析，翻譯爲聲音。

40. State the function of auditory nerve.

說出聽神經的功能。

Carry impulses from the cochlea to the cerebrum.

將神經脈衝由耳蝸傳至大腦。

41. Explain how does the cochlea make hearing possible.

解釋耳蝸如何協助聽聲。

The vibration of the perilymph is detected by the sensory cells in the cochlea. Through the auditory nerve, the impulses will be sent to the auditory center of the cerebrum where they will be interpretted as sound.

耳蝸內的敏感毛細胞可探測外淋巴液的振動，發出神經脈衝，經聽神經傳送至大腦作分析，翻譯爲聲音。

42. Explain why there is a temporary deafness when there is a sudden change of atmospheric pressure. How to restore the normal hearing?

解釋當氣壓突然改變時，爲什麼有短暫的耳聾，如何可回復聽覺？

Deafness sometimes occurs when there is a sudden change of atmospheric pressure because the pressure on the two sides of the ear drum becomes unbalanced, thus affecting the normal functioning of the ear drum. Hearing can be restored to normal by opening of mouth to allow air to enter the middle ear through Eustachian tube so that the air pressure on the two sides of the ear drum can be balanced.

當氣壓突然改變時，可能有短暫的耳聾，因爲鼓膜兩面的壓力不平衡，影響了鼓膜的正常運作。欲回復聽覺，可張開口部令空氣經耳咽管進入中耳，使鼓膜兩面的氣壓得以平衡。

43. A girl had an infection in the middle ear shortly after suffering from a sore throat. Suggest how her middle ear might have become infected.

一女孩患上喉嚨痛後不久，她的中耳受到感染。試加以解釋。

It was because the bacteria can enter the middle ear through the Eustachian tube and infect it.

因喉嚨裏的細菌能經耳咽管進入並感染中耳。

Check point 測試站 (29)

1. **Name the stimulus and response in phototropism.**
   說出向光性的刺激和反應。
   Stimulus : unilateral light.
   Response : The shoot grows towards light (positive phototropism)
   刺激 : 單向光。
   反應 : 枝幹向光生長 (正向光性)。

2. **What is the importance of phototropism?**
   向光性有什麼重要性？
   Shoot can obtain more light for photosynthesis.
   Root can grow into the soil to obtain more water and to get better anchorage.
   枝幹能獲取更多陽光作光合作用。
   根可生入泥土獲取水分和營養，並固定整株植物。

3. **What is the function of the clinostat?**
   旋轉器有什麼功用？
   The **clinostat** rotates the plant to nullify the unilateral stimulus (the unilateral light). This is used in the control to show that the response in the "test" is due to the unilateral light and not to other factors.
   旋轉器旋轉植物以抵消單向光的刺激，這應用於對照實驗以顯示被測試的植物的向光性是因單向光而起，而非因其他的因素。

4. **Which region of the plant can show bending?**
   植物的那一區域能作彎曲?
   The region of curvature is at the region of maximum growth.
   能作彎屈的區域位於最大生長區。

5. **What is auxin?**
   生長素是什麼？
   Auxins are plant hormones produced from the tips of the root and shoot.
   生長素是由根尖和莖尖所產生的植物激素。

6. **What is the action of auxin on the growth of the plant?**
   生長素對植物的生長有什麼作用？
   They diffuse downward in the shoot and upward in the root. They stimulate growth of the growing tissues at optimum concentrations.
   它們在莖向下擴散而在根則向上擴散，在最佳濃度下刺激生長組織的生長。

7. Describe and explain the requirement of auxin in root.
描述和解釋根部對生長素的需求。
The roots require relatively low auxin concentration for maximum growth. Thus further increase of auxin concentration in the roots would retard their growth.
相對於莖，根只需少許生長素便可達到最大的生長，更高濃度的生長素會減慢根部的生長。

8. Describe and explain the requirement of auxin in shoot.
描述和解釋莖部對生長素的需求。
The shoots require relatively high auxin concentration for maximum growth. Thus further increase of auxin concentration in the shoots would stimulate their growth.
莖需要相對較高的生長素濃度以達致最大的生長，增加生長素的濃度會刺激它的生長。

9. What is the effect of light on auxin?
光對生長素有什麼影響？
(1) Auxin is partially inactivated by light.
光令生長素喪失部份活躍性。
(2) Auxin migrates away from light.
生長素會游離光源。

10. Explain positive phototropism of stem by auxin distribution.
用生長素的分佈解釋莖部的正向光性
Light affects the auxin distribution, more auxin on the shaded side, because auxin migrates away from light. In the shoot, more auxin on the shaded side stimulates growth on this side. The shoot grows towards the unilateral light.
單向光影響生長素的分佈，生長素會被光抑制及游離光源，較多生長素在陰暗面，在莖部，較多生長素在陰暗面會刺激此面的生長，莖便彎向單向光生長。

11. Explain negative phototropism of root by auxin distribution.
用生長素的分佈解釋根部的負向光性
Light affects the auxin distribution, more auxin on the shaded side, because auxin migrates away from light. In the root, more auxin on the shaded side inhibits growth on this side. The root grows away from the unilateral light.
單向光影響生長素的分佈，生長素游離光源，較多生長素在陰暗面，在根部，較多生長素在陰暗面會抑制此面的生長，根便彎離單向生光長。

12. How is tropism brought about?
向性反應是如何造成的?
The response is a growth movement, brought about by (1) enlargement of cell, (2) uneven distribution of auxin in plant tissues.
向性反應是一種生長移動，是由於(1)細胞體積增大、(2) 生長素不平均分佈所做成。

Check point 測試站 (30)

1. **Name the components of nervous system.**
   說出組成神經系統的兩個系統。
   central nervous system and peripheral nervous system
   中樞神經系統和外圍神經系統

2. **State the components and functions of central nervous system**
   說出組成中樞神經系統的成員及其功能。
   This includes the brain and spinal cord.
   It serves as an integration center that interprets incoming signals and then commands proper responses.
   包括腦和脊髓。
   作爲翻譯外來訊息及發出適當指令的協調中心。

3. **State the components and functions of peripheral nervous system.**
   說出組成外圍神經系統的成員及其功能。
   This includes the cranial nerves and spinal nerves.
   These connect the central nervous system with the receptors and effectors.
   包括腦神經和脊髓神經。
   將中樞神經系統和感受器及反應器連接起來。

4. **What is the structural unit of nervous system?**
   神經系統由什麼結構單元組成？
   The nervous system consists of billions of neurons.
   神經系統由數以億計的神經元組成。

5. **Name the three kinds of neurons.**
   說出神經元的三個種類。
   1. 感覺神經元 sensory neuron
   2. 運動神經元 motor neuron
   3. 中間神經元 interon

6. **State the function of sensory neuron.**
   說出感覺神經元的功能。
   It carry impulses from the receptors to the central nervous system.
   將脈衝由感受器傳送至中樞神經系統。

7. State the function of motor neuron.
說出運動神經元的功能。
It carry impulses from the central nervous system to the effectors.
將脈衝由中樞神經系統傳送至反應器。

8. State the function of interon.
說出中間神經元的功能。
It link up the sensory neuron with the motor neurons.
將感覺神經元與運動神經元連接起來。

9. State the function of dendron.
說出樹突的功能。
This is the branch carrying impulses from the receptors to the cell body.
接收由感受器所發出的神經脈衝，傳送至細胞體。

10. State the function of axon.
說出軸突的功能。
This is the branch carrying impulses **away** from the cell body.
將神經脈衝傳離細胞體，傳送至另一樹突或效應肌肉。

Check point 測試站 (31)

11. State the function of myelin sheath.
說出髓鞘的功能。
This is a fatty tissue acting as an insulating layer to prevent the nervous impulses from leaking out. It increase the speed of impulse transmission.
脂肪組織，作爲防止神經脈衝泄漏的絕緣體，有助加快傳送脈衝的速度。

12. State the function of the synapse.
說出突觸的功能。
They control the one way movement of the impulses, from the sensory neuron to the motor neuron, and not in the backward direction. They also transmit the impulses to many neurons.
當脈衝由軸突傳至突觸，突觸會分泌化合物，擴散經過突觸到另一個神經元，引發新的脈衝並傳送下去，突觸只容許脈衝單向傳送，由感覺神經元至運動神經元，不容許反向傳送。另一功能是把脈衝傳遞至多個神經元。

13. What are the inner layer and outer layer of the spinal cord consists of?
脊髓的內層和外層由什麼物質組成？
It consists of an inner layer, the grey matter (cell bodies) and an outer layer, the white matter (nerve fibers).
由內層灰質(細胞體)和外層白質(神經纖維)組成。

14. What fluid is found in the central canal?
中央管內有什麼液體？
The central canal is filled with a cerebrospinal fluid.
中央管充滿腦脊髓液。

15. What is the function of the cerebrospinal fluid?
腦脊髓液有什麼功用？
It nourishes the nerve cells and serve as a shock absorber.
腦脊髓液營養神經細胞及吸收震盪。

16. In what form do the fibers of sensory neurons enter the spinal cord?
感覺神經元的纖維以什麼形式進入脊髓?
It enter the spinal cord as the dorsal root.
感覺神經元的纖維以背根形式進入脊髓，

17. What is the function of the grey matter in spinal cord?
脊髓內的灰質有什麼功用？
The grey matter is the centers of many reflex actions.
灰質是許多反射作用的中心。

18. What is the function of the white matter?
白質有什麼功用？
The white matter is made of fibers that transmit impulses to and from the brain.
白質由纖維組成，負責傳送脈衝來回腦部。

19. State the characteristics of reflex action.
反射動作有什麼特性？
This is a simple form of behaviour in which a certain stimulus always results in the same response.
這是一種簡單的行爲模式，同一種刺激經常引發同一種反應。

20. What is the advantage of having reflex action?
反射動作有什麼優點？
The response is inborn and thus need no prior thought, and does not require the action of the cerebrum. The response is involuntary and relatively fast. It provides rapid protection and avoids danger of our body.
這種反應是天生的，不需預先的思考或計劃，亦不需大腦的參與，因此，此反應是不隨意和非常快捷的，它提供快速的保護，避免身體受傷。

21. What is a reflex arc?
何謂反射弧?
Structurally the reflex action involves a sensory neuron, an interon and a motor neuron. This arrangement is called a reflex arc.

反射弧是反射動作中神經傳遞的路線，結構上它包含一個感覺神經元，一個中間神經元和一個運動神經元。

22. Describe the pathway of the withdrawal reflex of the arm.
簡述手臂退縮反射的路徑。

A pin pricking the hand → pain receptor stimulated and sends out impulses → sensory neuron → association neuron → motor neuron → the biceps (effector) contracts → the hand is withdrawn
針刺到手 → 痛楚感受器受刺激而發出脈衝 → 感覺神經元 → 聯合神經元 → 運動神經元 → 二頭肌(反應器)收縮 → 手臂縮回

23. Will the cerebrum know about the reflex?
腦部會否知悉進行中的反射動作?

In the spinal cord, the interon involved in the reflex forms connection with another interon which informs the cerebrum about the reflex.
神經脈衝在反射弧傳送時，會刺激連接脊髓和腦部的神經，把訊息傳到腦部，故腦部知悉進行中的反射動作。

24. Write out the nervous pathway of feeling the touch and to speak out.
寫出從接觸到說出的神經路線圖。

When a pin pricks the hand, the touch receptor is stimulated to produce a nerve impulse. This impulse passes along the sensory neuron to the interons in the brain. The brain interprets the nerve impulse as sensation of touch. Through a motor neuron, the nerve impulse is sent from the brain to the muscles responsible for speech.
當針刺手時，觸壓感受器受刺激產生神經脈衝，脈衝沿感覺神經元傳至腦內的聯合神經元，大腦將脈衝翻譯爲觸覺，透過運動神經元，脈衝從腦部傳送至負責說話的肌肉。

25. Which 3 parts is the brain divided to?
腦部可分爲那三部分？

cerebrum, cerebellum and medulla.
大腦、小腦和延腦。

26. What is the outer layer of the cerebrum?
大腦的外層由什麼組成？

The outer layer of the cerebrum is the grey matter (cerebral cortex).
大腦外層是灰質(大腦皮層) 。

27. What is the inner layer of the cerebrum?
大腦的內層由什麼組成？

The inner layer is the white matter.
內層是白質。

28. Why is the cerebral cortex highly folded?
大腦皮層爲什麼高度縐摺？

The cerebral cortex is folded. This increases its surface area for containing more neurons to increase its efficiency.
大腦皮層高度縐摺，這可增加表面積，容納更多腦細胞，增加它的效率。

29. State the functions of the cerebrum.
說出大腦的功能。

1. Control the voluntary muscular movements (at the motor area).
   控制隨意肌的運動。
2. For receiving and interpreting sensory impulses from various parts of the body (at the sensory area).
   接收和翻譯從身體各部份而來的感覺神經脈衝。
3. For higher mental activities such as memory, learning, imagination and reasoning (at the association areas).
   負責各種高等神經活動，例如：記憶、學習、幻想和理解。

30. State the functions of the cerebellum.
說出小腦的功能。

(1) To maintain the body posture and balance.
   協調肌肉活動。
(2) To adjust and coordinate muscular movements.
   平衡身體，保持正常姿勢。

31. State the functions of the medulla oblongata.
說出延腦的功能。

(1) It is the centers of some vital activities of the body, eg. control rate of breathing and heart beat.
   控制許多重要不隨意活動，例如：呼吸率和心跳。
(2) It is the centers of some reflex actions, eg. sneezing, coughing.
   是許多反射動作的中心，例如：打噴嚏和咳嗽。
(3) It is the pathways for the nerve fibers between the brain and the spinal cord.
   是連接腦和脊髓的神經纖維的通道。

32. Explain the roles of different parts of the brain when riding a bicycle
說出踏單車時腦各部份的功能：

When a man is riding a bicycle, cerebrum sends nerve impulses to the leg muscles to control the movement. Cerebellum coordinates the action of the skeletal muscle and to maintain balance of the body. Medulla oblongata controls the rate and depth of breathing so as to supply more oxygen to the leg muscles.

踏單車時，大腦發出通往腿部肌肉的神經脈衝以控制腿部運動，小腦協調各組肌肉活動及維持身體平衡，延腦控制呼吸的速度和深度，確保腿部肌肉有充足的氧氣供應。

33. Compare simple reflex actions with voluntary actions with respect to :
從下列各方面比較反射動作及自主動作：
(1) parts of brain involve, (2) modes of response.
(1) 腦部的參與、 (2) 反應的模式：

Simple reflex actions **簡單反射動作**	**Voluntary actions** **自主動作**
1. Do not involve the cerebrum. 不需大腦。	Involve the cerebrum 必需大腦。
2. The same stimulus always evoke the same response. 相同的刺激經常引發相同的反應。	The same stimulus may evoke different responses. 相同的刺激可引發不同的反應。

34. Compare simple reflex actions with voluntary actions with respect to :
從下列各方面比較反射動作及自主動作：
(1) voluntary or not, (2) speed of response, (3) coordination center.
(1) 隨意與否、 (2) 反應的速度、 (3) 協調中心的位置

Simple reflex actions **簡單反射動作**	**Voluntary actions** **自主動作**
1. Involuntary, inborn and do not require learning or experience. 不隨意，與生俱來，不需學習或經驗。	Under the control of the will, require learning or experience. Not inborn. 由意志控制，非與生俱來，需要學習或經驗。
2. The response is faster and immediate. 反應快捷及即時。	The response is slower and may be delayed. 反應較慢及可押後。
3. The centers are usually on the spinal cord or medulla. 協調中心位於脊髓或延腦。	The centers are on the cerebrum. 協調中心位於大腦。

35. The pupil response is a kind of reflex. By using a flow chart, show the related nervous pathway.
瞳孔對光強度的反應是一項反射動作，利用一流程圖，顯示有關的神經傳遞途徑。
light sensitive cells → sensory neuron → optic nerve → interon at brain → motor neuron → iris muscle.
光敏細胞 → 感覺神經元 → 視覺神經 → 腦部內的中間神經元 → 運動神經元 → 虹膜肌肉

Check point 測試站 (32)

1. What are hormones?
激素是什麼？

Hormones are organic substances produced from endocrine glands into the blood steam. They are transported by the blood all over the body and produce great effects on the target organs.
It regulates a number of physiological process.
激素是由內分泌腺製造釋放於血液中的有機質，它們被血液運送至全身，在目標器官發揮作用，調節不同的生理過程。

2. State the major endocrine glands.
說出主要的內分泌腺。

Pituitary gland, Thyroid gland, Islets of Langerhans, Adrenal gland, Ovaries (in female), Testes (in male)
腦下垂體、甲狀腺、胰島、腎上腺、卵巢(女性)、睪丸(男性)

3. State the functions of thyroxin.
說出甲狀腺素的功能。

1. It controls the basal metabolic rate, especially the rate of respiration.
   它控制基本代謝率，尤其是呼吸率。
2. It promotes growth in young mammals.
   它促進年幼哺乳類的生長。

4. Explain the five basic components of the coordinating system by thyroxin secretion.
請以甲狀腺素的分泌來解釋協調系統的五個基本元素。

Stimulus : prolonged period of cold.
刺激： 長期的寒冷。

Receptor : thermo-receptors of the skin and brain.
感受器： 皮膚的溫度接收器和腦。

Regulator: brain will detect the drop in blood temperature and inform the effector thyroid gland with thyroid-stimulating hormone.
調節器： 腦可探測到血的溫度下降，然後用促甲狀腺素通知效應器－甲狀腺。

Effector : thyroid gland.
效應器： 甲狀腺。

Response : increased secretion of thyroxin will increase basal metabolic rate.
反應： 增加甲狀腺素的分泌，這會增加身體的基本代謝率。

5. Compare nervous coordination with hormonal coordination.
比較神經協調和激素協調。

Nervous coordination 神經協調	Hormonal coordination 激素協調
1. The message is nervous impulse which travels along **nerve fibre**. 訊息是以**神經線傳送**的神經脈衝。	The message is hormones which travel by **blood**. 訊息是以**血流傳送**的激素。
2. The nervous impulse is electrical in nature. 脈衝的性質是**電**。	The hormone is chemical in nature. 激素的性質是**化合物**。
3. The effect is **localized**. 效應是**局部的**。	The effect is more **generalized**. 效應更爲廣泛，**遍及全身**。
4. **Faster** in action, the nervous impulses are transmitted along nerve fibers at a very high speed. **反應快速**，因脈衝在神經線以高速傳送。	**Slower** in action. It takes time for the transportation of hormones to the target cells through the blood circulation. **反應緩慢**，因爲血流運送激素需要時間。
5. The effect is comparatively **short-termed**. **效應短暫**（應付突然的刺激）。	The effect is comparatively **long-termed**. **效應持久**（應付一些漸漸改變的刺激）。

Check point 測試站 (33)

1. What is endoskeleton made up of?
內骨骼由什麼組成?
Made up of bones and cartilages.
由骨和軟骨組成。

2. What is bone?
硬骨是什麼?
Living cells surrounded by dead mineral materials (calcium phosphate and carbonate).
由礦物質(磷酸鈣和碳酸鈣)包圍著的活細胞。

3. Is bone a living tissue? Give reasons.
骨是否活組織，請給予理由。
It is living because it can grow and produce red blood cells. The ability of healing in bone proves that bone is a living tissues.
它是有生命的，因它可生長和製造紅血球。折骨能再癒，証明骨是活組織。

4. Describe the structure and function of cartilage.
描述軟骨的構造和功能。
No calcium, for flexible support, act as shock absorber and reduce friction between bones.
不含鈣質，具伸縮性，可作彈性的支持、吸收震盪和減低骨頭間的磨擦。

5. Outline the functions of the skeleton.
簡述內骨骼的各種功能。

1. 保護重要的器官。Protect the important organs
2. 維持體形。To maintain the body shape.
3. 支持身體，使身體離開地面。To support the body, raise it off the ground.
4. 形成槓桿系統使動物能夠活動。Form a lever system by which animal moves.
5. 給肌肉一附著面。Provide a surface for the attachment of muscles.
6. 紅骨髓製造紅血球和白血球。Red bone marrows produce red blood cells and white blood cells.
7. 儲藏磷酸鈣。Storage of calcium phosphate.

6. How is support provided in mammals?
哺乳動物怎樣把身體支撐起來?

By muscles contracting across the joints of the bony skeleton.
哺乳動物通過連接骨骼的肌肉收縮來支撐身體。

7. What supports the skeleton?
骨骼怎樣使身體保持直立?

Muscles are attached to the skeleton. Balanced contractions of muscles, usually in pairs, on each side of a joint will give support to the whole skeleton.
當附在骨塊兩側的肌肉收縮達至平衡時，骨骼便可獲得支持，使身體保持直立。

8. Name two types of movable joints.
說出二種可動關節的名稱。

Ball and socket joint, Hinge joint.
球窩關節、鉸鏈關節。

9. Give example of ball and socket joint and state its possible movement.
說出球窩關節的例子和它的活動範圍。

Hip joint ; shoulder joint, Allow movement in all planes.
股關節、肩關節，骨塊能在三個平面作迴旋運動。

10. Give example of hinge joint and state its possible movement.
說出鉸鍊關節的例子和它的活動範圍。

Elbow joint ; knee joint, Allow movement in one planes only
肘關節、膝關節，骨塊的移動只限於一平面上。

11. State the function of capsular ligament.
說出囊狀韌帶的功能。

To enclose the joint ; holding the bones together.
包圍關節；將骨頭連在一起。

12. State the function of synovial membrane.
說出滑液膜的功能。
To secrete the synovial fluid.
分泌滑液。

13. State the function of synovial fluid.
說出滑液的功能。
Act as a lubricant to reduce the friction between the articular cartilage.
作爲潤滑劑減低關節軟骨間的磨擦。

14. State the function of articular cartilage.
說出關節軟骨的功能。
To prevent the friction between the bones
減低骨端間的磨擦。

15. Name all types of muscles.
說出各種肌肉的名稱。
1. Voluntary muscle 隨意肌
2. Involuntary muscle 不隨意肌
3. Cardiac muscle 心臟肌

16. Describe the characteristics of voluntary muscle.
說出隨意肌的特徵。
Fast in action, but easily become fatique.
動作迅速但容易疲倦。

17. How do muscles attach to the bones?
骨骼如何連接在骨頭上?
Attach to the skeleton by tendons.
用筋腱連接於骨骼。

18. What is meant by fatique?
疲勞是什麼意思?
Muscles refuse to contract. (anaerobic respiration produce lactic acid, accumulation of lactic acid cause fatique)
肌肉拒絕收縮，乳酸積聚所引起。

19. Why does mammal can move with its limbs?
爲甚麼哺乳動物的四肢能夠行動?

The movement is performed by the antagonistic muscle. The limb bones are connected by movable joints. Opposing muscles/antagonistic muscles are attached to the limb bones and they work in pairs. Often, the opposing muscles are called a flexor and an extensor. When the flexor contracts, it bends the joint. When the extensor contracts, it straightens the joint.
肢體的運動是靠拮抗肌來進行的，肢骨靠活動關節連接，附在肢骨上的拮抗肌成對地活動，當一組收縮時，另一組會放鬆，這對肌肉分別稱爲屈肌和伸肌。屈肌收縮會使關節屈曲; 伸肌收縮則使關節伸直。

20. Explain the formation of lever system by bones and muscles.
解釋骨頭和肌肉如何組成槓桿系統?

The bones act as the lever and the joint act as the pivot (fulcrum). These two, together with the muscle (act as effort), constitute a lever system during movement.
骨頭作爲槓桿，關節作爲支點，這兩者加上肌肉(施力)，便組成一個可以運動的槓桿系統。

21. Distinguish between tendon and ligament.
分辨筋腱和韌帶。

Tendon : A structure that attaches a muscle to a bone.
筋腱 ： 連接肌肉和骨的結構。
Ligament : A structure that attaches a bone to another bone.
韌帶 ： 連接骨和骨的結構。

22. Give two structural features of the backbone which allow it to bend to a smooth and curved shape.
寫出脊的兩項構造特徵，使它能彎成順滑的弧形。

Backbone is formed from many pieces of vertebras. Joints connect the vertebras. Besides, in between the vertebras are compressible cartilage disc.
脊柱是由很多椎骨組成，而椎骨間由關節連接。此外，椎骨間有可壓縮的軟骨盤。

23. What is the function of a joint?
關節有什麼功能?

When a bone meets another bone, a joint is formed. Movement is possible only if there is a joint between them. Joint act as a fulcrum which the adjoining bones can work as levers for muscles to contract and bring about movement.
當骨頭相遇，就會形成關節，只有擁有關節才可容許骨頭間的運動。關節作爲一個支點，與相鄰的骨頭組成槓桿系統，使肌肉收縮時能引致肢體的運動。

24. Explain why ligaments and tendons are necessary for locomotion in mammals.
爲什麼哺乳類運動時需要韌帶和筋腱？

Locomotion in mammals involves lever system consisting of bones whose relative position must be fixed and maintained to prevent dislocation. This is the function of the ligaments which hold bones together. In addition, ligament is elastic to allow movements of bones.

For every lever system, there must be an effort applied to move the lever. It is provided by muscle contraction in the lever system of the mammals. Force produced by the muscle can be transmitted to the bones through tendons as they are tough and relatively inextensible.

哺乳類需要槓桿系統作運動，槓桿系統由骨塊組成，必須維持和固定此等骨塊的相對位置，以免脫骸，韌帶正好解決此問題，它將骨塊連接在一起。除此，韌帶有彈性，可容許骨塊間輕微的移動。

每一個槓桿系統，都需要一個施力來移動槓桿，在此情況，施力是由肌肉收縮來提供，肌肉所產生的力量，可藉筋腱傳送到骨塊，因爲它們很強韌和幾乎不可伸張。

25. Explain the initiation of muscle contraction.
解釋肌肉收縮的引發。

When an impulse reaches the neuromuscular junction (motor end plate), neurotransmitter is released from the synaptic vesicles into the synaptic cleft.

The neurotransmitter diffuses across the cleft to the muscle fibre and stimulate it to generate an electrical impulse. The electrical impulse spreads along the muscle fibre and the muscle contracts.

當神經脈衝到達神經肌肉接點(運動終板)時，突觸小囊釋出神經遞質，進入突觸間隙。

神經遞質藉擴散通過間隙，到達肌纖維，刺激它產生電脈衝，電脈衝散佈至整條肌纖維，引發肌肉收縮。

Check point 測試站 (34)

1. What is the advantage of homeostasis?
體內平衡有什麼優點？

The body cells have a relatively constant environment and can function properly irrespective of the changes in the external environment. Thus the whole organism can tolerate wider range of habitats and seasonal changes.

因身體細胞處身一穩定的環境，便可不受外界的影響而正常運作，個體可適應較廣闊的生境和季節的轉變。

2. Which two hormones regulate blood glucose level?
那兩種激素控制血糖水平?

Insulin and glucagon.

胰島素與高血糖素。

3. State the action of insulin.
說出胰島素的作用。

1. Stimulates the conversion of glucose to glycogen at the liver.
   促使肝把血中的葡萄糖轉化爲糖原。
2. Stimulates the absorption and oxidation of glucose by the body cells. Decreases the blood glucose concentration.
   促使身體細胞吸收並氧化葡萄糖，減低血糖濃度。

4. State the action of glucagons.
說出高血糖素的作用。

The function of glucagons is opposite to those of insulin.
高血糖素的作用和胰島素相反

1. It decreases glucose oxidation.
   它減低葡萄糖的氧化.
2. It stimulates glycogenolysis (breakdown of glycogen) in the liver
   它刺激糖原在肝臟分解爲葡萄糖。

As a result, it elevates the blood glucose level.
結果高血糖素提升血糖濃度。

5. State the cause of diabetes.
說出引致患上糖尿病的因素。

The cause of diabetes is both genetic and environmental factors such as obesity and lack of exercise are involved.
糖尿病與遺傳及環境因素有關，例如過度肥胖及缺乏運動。

6. State the symptoms of diabetes.
說出糖尿病的病徵。

This include frequent urination, unusual thirst, changes in appetite, weight loss, extreme fatigue
尿頻、消渴、食慾不振、消瘦、容易疲倦

7. How to test diabetes?
如何測試糖尿病？

The presence of glucose can be tested by adding equal amount of Benedict's solution in a boiling tube and then heat it in water bath. The appearance of a red precipitate indicates the presence of glucose.
可用本立德試驗，加與尿液等份的本立德試劑入試管然後用水浴法加熱至沸騰，若有紅色沉澱物則顯示有葡萄糖存在。

8. Explain the rise of blood glucose level after a meal.
解釋餐後血糖濃度上升的原因。

It is because the carbohydrates in the meal was digested to glucose, which was then absorbed into the blood of the intestine.
因爲飯中的澱粉被消化成葡萄糖，再被吸收入小腸的血液中。

9. **Explain why does the blood glucose level drop some times after the rise of blood glucose level.**
解釋血糖濃度上升後不久即下降的原因。
For a normal man, the rise of blood glucose level stimulates the secretion of more insulin from the islets of Langerhans. More glucose is converted to glycogen at the liver. The blood glucose level thus drops.
在正常人，血糖濃度的上升會刺激胰島分泌更多的胰島素，更多的葡萄糖會在肝臟轉化爲糖原，血糖濃度會因而下降

10. **Explain why does the diabetic patient have a prolonged high level of blood glucose level when compare with the normal person.**
解釋糖尿病人血糖濃度持續高企的原因。
In the diabetic patient, there is insufficient insulin. The excess glucose in blood cannot be converted to glycogen at the liver. Therefore the glucose level is higher than a normal man.
在糖尿病人，因胰島素不足，血內過多的葡萄糖不能在肝臟內轉化爲糖原，血糖濃度長期高於正常人。

11. **Explain why does the blood glucose level of the diabetic patient drop after reaching a very high level of it.**
解釋糖尿病人的血糖濃度到達一高水平後會下降的原因。
The glucose concentration is so hight that exceeds the reabsorption ability of the kidney and thus kidney excrete glucose in urine.
血糖濃度持續高企，高過腎臟的再吸收能力，腎臟排泄葡萄糖，葡萄糖濃度便下降。

12. **The control of insulin secretion is a negative feedback control, explain.**
解釋爲什麼胰島素的分泌稱爲負反饋控制。
Insulin causes a drop of blood glucose level. A drop of blood glucose level would inhibit the secretion of insulin. Such mechanism illustrates the principle of negative feedback control.
胰島素的產生由血糖水平控制，胰島素令血糖水平下降，下降了的血糖水平會抑制胰島素的分泌，此機制說明了負反饋控制。

13. **Explain the importance of feedback mechanism.**
解釋負反饋控制的重要性。
The importance of feedback mechanism is to maintain a constant internal environment for the functioning of the life processes.
反饋機制的重要性在於維持一個穩定的內在環境，使各種生理作用得以正常運作。

Check point 測試站 (35)

1. State the 7 characteristics of living organisms.
說出生物的七個特徵。

1. 行動作用 locomotion
2. 營養作用 nutrition
3. 感應作用 irritability
4. 生長作用 growth
5. 呼吸作用 respiration
6. 排泄作用 excretion
7. 生殖作用 reproduction

2. What are the criteria of classifying living organisms?
將生物分類所根據的假設是什麼?

The closely related organisms should have similar structures. Living organisms are classified by their characteristics.
關係密切的生物(同一類的生物)應有相似的構造，生物可按特徵分類。

3. Arrange the levels of classification in correct order beginning with the largest group.
將分類的層次從最大的一組順序排列。

Kingdom, Phylum(division), Class, Order, Family, Genus, Species
界 、 門 、 綱 、 目、 科 、 屬 、 種

4. Define the term species.
給品種下一定義。

The same species can interbreed to produce fertile offspring.
同一品種可以交配產生有生殖能力的後代。

5. State the kingdoms included in the Six kingdom classification method.
說出六界分類法的六界。

Eubacteria	真細菌界
Archaebacteria	古細菌界
Protista	原生生物界
Fungi	真菌界
Plantae	植物界
Animalia	動物界

6. State the three domains of the classification system .
說出分類系統的三域。

Bacteria, Archaea and Eukarya.
細菌域、古細菌域和真核域。

Check point 測試站 (36)

7. **Explain eubacteria with an example**
   用例子解釋真細菌界
   The single-celled prokaryotic organisms such as bacteria.
   單細胞原核生物，如細菌。
   Cell wall made of peptidoglycan.
   細胞壁由肽聚糖組成。

8. **Explain the features of archaebacteria**
   解釋古細菌界的特徵。
   Single-celled prokaryotic organisms, smaller than bacteria.
   單細胞原核生物，比細菌還細。
   Cell walls contain no peptidoglycan.
   細胞壁沒有肽聚糖。

9. **Explain protoctist with an example**
   用例子解釋原生生物界
   Single-celled eukaryotic organisms, eg. amoeba.
   具真核單細胞生物，如變形蟲。

10. **Explain fungi with an example**
    用例子解釋真菌界
    They have a nucleus but with non-cellulose cell wall, eg. mucor, yeast
    沒有植物細胞壁的真核生物，如白黴、酵母菌

11. **Explain plant with an example**
    用例子解釋植物界
    Photosynthetic organisms with nucleus, eg. algae, bryophyte, fern, conifers, flowering plants
    具真核的生合作用生物，細分爲藻類、苔蘚類、羊齒類、針葉植物及有花植物五大類。

12. **Explain animal with an example**
    用例子解釋動物界
    Non-photosynthetic multicellular organisms, they can be grouped into vertebrate and invertebrate.
    具真核的非生合作用多細胞生物，細分爲脊椎動物及無脊椎動物兩大類。

13. **State two physiological process carried out by animal but not by plant.**
    說出只在動物而非植物進行的兩種生理作用。
    Locomotion and excretion.
    行動作用、排泄作用。

14. State one process which occurs in green plant but not in animal.
說出只在植物而非動物進行的一種生理作用。
photosynthesis
光合作用

15. Name the non-green organisms that are either saprophytic or parasitic.
說出一種以腐生或寄生生活的非綠色生物。
fungi
真菌

16. How does mucor absorb nutrients?
麵包霉如何吸收營養？
Mucor is saprophytic, its rhizoid secrete enzymes to carry out digestion. The soluble food is then absorbed.
麵包霉是腐生的，它的假根能分泌酵素作体外消化，溶解了的食物終被吸收。

17. State the characteristics of algae..
說出綠藻的特徵。
Simple plants without root, stems, or leaves.
一種居於水中，身體沒有分爲根、莖、葉的綠色植物。

18. State the characteristics of bryophytes
說出苔蘚類的特徵。
The small green plants with simple leaves and stems, but no vascular tissues.
一種細小綠色，身體分爲簡單莖和葉，但是沒有維管的綠色植物。

19. Name all groups of plants that have vascular tissues.
說出所有含有維管的植物種類。
ferns, conifers, flowering plants
羊齒類、針葉植物、有花植物

20. State the characteristics of ferns
說出羊齒類的特徵。.
Have proper roots, stems and leaves and vascular tissues. Reproduce by spores. Have sori at the lower epidermis.
有正當根、莖、葉和維管組織，用孢子繁殖，葉底有孢子囊

21. Name the two groups of plants that produce seeds.
說出以種子繁殖的兩類植物。
Conifers, flowering plants
針葉植物、有花植物

22. Distinguish between conifers and flowering plants.
分辨針葉植物和有花植物。

Conifers 針葉植物	Flowering plants 有花植物
Seeds not enclosed in a fruit. 子種並非藏於果實內。	With flowers; the seeds are enclosed in a fruit. 有花；種子藏於果實內。

23. Name the group of animal that is microscopic, unicellular and live in water.
說出那一類動物是微小、單細胞和生活於水中。
Protozoans/ protista
原生動物

24. Name the group of animals that have backbones.
說出那一類動物有脊椎骨。
vertebrates
脊椎動物

25. Name the groups of animals that are warm blooded.
說出那幾類動物是熱血的。
bird and mammal
鳥類、哺乳類

26. Name the groups of animals that have lungs for breathing.
說出那幾類動物用肺呼吸。
amphibian, reptile, bird and mammal
兩棲類、爬蟲類、鳥類、哺乳類

27. Name the group of animals that have gill for breathing.
說出那一類動物用鰓呼吸。
fish
魚類

28. Name the group of animals that have moist soft skin.
說出那一類動物有濕軟皮膚。
amphibian
兩棲類

29. Name the group of animals that have scales on their body surface.
說出那幾類動物身體有鱗片。
fish, reptile and bird(legs have scales)
魚類、爬蟲類、鳥類(腳有鱗片)

30. Name the group of animals that have feathers.
說出那一類動物有羽毛。
bird
鳥類

31. Name the group of animals that have mammary glands.
說出那一類動物有乳房。
mammal
哺乳類

32. Name the group of animals that have hair and sweat gland.
說出那一類動物有毛髮和汗腺。
mammal
哺乳類

Check point 測試站 (37)

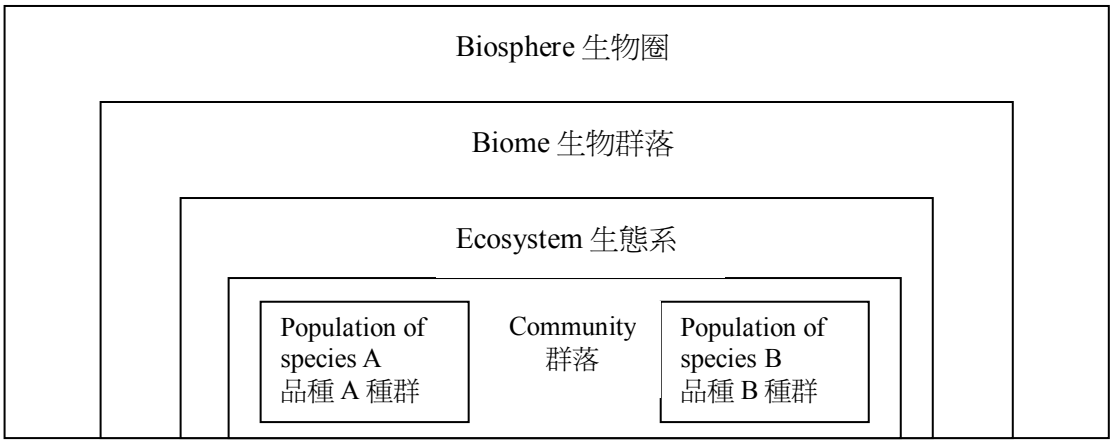
1. Name the biotic components of an ecosystem.
說出生態系統的生物環境。

1. **Producer** 生產者：
   They use light energy to synthesize complex organic compounds from simple inorganic raw materials. This energy is the source of energy for all the organisms in the ecosystem.
   它們可進行光合作用，將光能固定於所生產的食物中，這能量是生態系統中所有生物的能量來源。
2. **Consumers 消費者：**
   They are organisms that feed on others. All animals fall into this category and they can be further separated into primary, secondary and tertiary consumers according to their positions in the food chain.
   牠們是進食其他生物的動物，所有動物都可根據它們在食物鏈的位置，再歸類爲初級、次級和三級消費者。
3. **Decomposers 分解者：**
   They are saprophytic organisms, such as bacteria and fungi, which break down the dead bodies of producers, or consumers to simpler substances and release them back into the environment.
   它們是腐生生物，例如細菌和真菌，它們會將生產者和消費者的死屍分解爲簡單的物質。

2. Explain what a decomposer is and state its role in ecosystem.
解釋何謂分解者及其在生態系的功能。
Decomposers are **saprophytic organisms**, such as bacteria and fungi, which **break down the dead bodies of producers or consumers to simpler substances** and release them back into environment. Through their metabolic activities, **vital organic materials are prevented from being locked up** in the bodies of dead organisms. They **facilitate the re-cycling of nutrients in the ecosystem.**

它們是腐生生物，例如細菌和真菌，它們會將生產者和消費者的死屍分解爲簡單的物質，然後將它們釋放回環境中，透過它們的代謝活動，可防止有機物積聚，避免重要的元素被鎖死於死屍的體內，故此，它們有助養份在生態系統內循環。

3. **With the aid of a diagram, explain the relationship between 'biosphere, biome, ecosystem, community, population and species'**
   用圖解釋生物圈、生物群落、生態系、群落、種群和品種的關係。



4. **Explain the meaning of detritus-feeder and its role in ecosystem.**
   解釋何謂食腐質者及其在生態系的功能。
   They are **small animals feeding on fragments of tissues** or dead organic matter detached from dead bodies or excreta. eg small insects, earthworms.
   They **speed up decomposition of dead bodies** and excretory remains by breaking up detritus into small pieces thus increasing the surface area available for microbial action.
   They **add proteins and microorganisms onto the soil** by their faeces.
   它們是進食死物的的微小動物，例如小昆蟲和蚯蚓(它們是消費者)，它們的食物包括死組織破片、從死屍脫落的有機物和排泄物等。
   它們將腐爛的物質分解爲細小的碎片，增加給微生物作用的表面積，故此它們加速死屍及排泄物的分解，透過它們的排泄物，可增加土壤的蛋白質和微生物。

5. **State the beginning and the end of a food chain.**
   說出食物鏈的始與終。
   Any food chain must always have photosynthesis at the beginning and decay at the end.
   任何食物鏈都是始於光合作用，終於腐爛作用。

6. **Explain grazing food chain with an example**
   用例子解釋牧食性食物鏈。
   Starts from a green plant and goes to grazing herbivores and then onto carnivores. Prompt transfer of energy and nutrient along food chain.
   green plants → aphids → ladybirds → sparrows
   能量和營養從綠色植物開始，先傳送至牧食性動物，跟著傳送至肉食性動物，能量和營養在

食物鏈中即時傳送。

綠色植物 →蚜虫→飄虫 →麻雀

7. Explain detritus food chain with an example
用例子解釋腐食性食物鏈。

Starts from dead organic matter to microorganisms (bacteria and fungi) and then goes to detritivores and their predators. There is a great delay in the transfer of energy and nutrient.

dead body of plants and animals → microorganisms → detritivores

開始時能量和營養從已死有機物傳送至微生物(例如細菌和真菌)，跟着傳送至食腐質者和捕食它們的捕食者，能量和營養在傳送過程中有延遲。

動植物屍骸→微生物 →食腐質者

8. Explain parasitic food chain with an example
用例子解釋寄生性食物鏈。

Starts from large host and goes to parasites and then protozoan.

dog → flea → protozoan → virus

開始時能量和營養從大型的寄主傳送至寄生者，跟著傳送至原生動物。

小狗→跳蚤 → 原生動物→病毒

9. Why are there seldom more than four trophic levels in a food chain?
爲什麼食物鏈甚少超過四或五個食性層次?

Because of the **loss of energy from one trophic level to the next**, there is less energy left to support the higher trophic levels. Therefore, it is not energetically feasible to try to harvest the small amount of energy available in the highest trophic level. **The longer the food chain, the greater will be the loss of energy** and hence the smaller will be the number of top consumers that can be supported in an ecosystem. Thus, in an ecosystem, the number of trophic levels seldom exceed 4 or 5.

因爲能量在食性層次傳送途中會有散失，故此留給下一個更高食性層次的能量會減少，所以在能量層面上來看，在較高的食性層次來獲取能量是不智的。一個生態系統在產出食物的效能上，受制於食物鏈所經的部驟，食物鏈越長，則越多能量會散失，故此只能支持小量的頂級消費者，所以在生態系統中，食性層次的數目甚小超過四或五。

10. Explain why the efficiency of energy transfer during photosynthesis is less than 10%.
解釋爲什麼被光合作用所固定的能量，效能通常小於 10%。

1. Much of sunlight is being reflected from the surface of the leaf.
   大部份的光能被葉面反射。
2. Some being passed straight through the leaf.
   有些陽光因直接穿過樹葉而不被利用。
3. Only part of wavelength of light from red to blue can be absorbed by chlorophyll
   只有部份陽光光譜的光波，如紅光和藍光等，會被葉綠素吸收。

11. Explain why does a great deal of the grass eaten by a cow does not contribute to the nourishment of the cow.
解釋爲什麼被牛所吃掉的草，草內的大部份成份都不會變成牛的身體。

1. Some energy is used in the respiration of the organism and is dissipated to the environment as heat
   有些能量在生物的呼吸作用中用掉，然後以熱能形式散失於環境中。
2. Some part of the food is not ingested or absorbed and is returned to the environment in the faeces
   有部份食物的身體未被攝食或雖被攝食但未被吸收。
3. Energy is used in various activities of the organisms.
   能量在各種活動中用去。

12. What are the disadvantages of using pyramid of number?
使用數目塔有什麼缺點？

1. Since the producers vary greatly in size and a single grass plant or algae, for example, is given the same status as single tree, **a true pyramid shape is not often obtained.** Also, parasitic food chains may give inverted pyramids.
   因爲各生產者的體積有很大的差異，一棵草、一個綠藻和一棵樹有相同的地位，故此很難獲得一個真正金字塔的形狀，而寄生性食物鏈亦會給出一個倒轉金字塔。
2. The range of number is so great that it is often difficult to draw the pyramids to scale, although logarithmic scales may be used.
   數目的範圍很大，故此很難按比例畫出數目金字塔，雖然我們可以用對數的方式來表示。

13. What are the advantages of using pyramids of number?
使用數目金字塔有什麼優點：

1. Easy to count
   容易數算。
2. No need to kill the organisms.
   不需要殺死那生物。

14. Why does the standing crop give no indication of the rate of production?
爲什麼現存的生物量並不能顯示出生產力或生物量的消耗率？

1. **If the rate of consumption more or less equal the rate of production**, the standing crop does not necessarily give any indication of productivity. For example, a fertile, intensively grazed pasture may have a smaller standing crop of grass, but a higher productivity, than a less fertile and ungrazed pasture.
   如果消耗率大致和生產率相等，現存的作物不一定能顯示出真正的生產力，例如一個經常被牧食的肥沃草地，可能只有很少的現存青草，但是它的生產力較一個不經常牧食但沒有那麼肥沃的草地爲高。
2. If the producers are small, such as algae, they have a higher turnover rate, that is high rate of growth and reproduction balanced by a high rate of consumption or death. Thus, although the standing crop may be small compare with large producers such as trees, the productivity may be the same.

如果生產者非常細小，例如綠藻，它們有一個很高的轉換數，即是雖然它的生長和繁殖率都很高，但是卻被高消耗率和死亡率所抵消，故此，雖然和大型生產者如大樹比較，作物的現存量可能很少，但是它的生產力可能和大樹一樣。

15. What are the advantages of using pyramids of biomass?
使用生物量塔有什麼優點？

No need to consider the effect of the size of organisms. More accurate than pyramids of number.
不需要考慮個體的體積效應，比數目金字塔更準確。

16. What are the disadvantages of using pyramids of biomass?
使用生物量塔有什麼缺點？

1. Some organisms grow at a much faster rate than the others, eg. Grass does not have a large biomass but it carries on growing at a very fast rate.
   有些生物比其它的生長得快，例如青草沒有一個很大的生物量，但是它可以不斷高速生長。
2. The biomass of an individual can vary with the seasons. eg. In winter a tree will have lost the leaves, flowers and fruits that grow in the summer
   個體的生物量會有季節性的轉變，例如在冬季，一棵樹會失去樹葉、花朵和果實，故此比夏季時爲輕。
3. Inverted pyramid of biomass may be obtained if the producers are small but have a higher turnover rate.
   若果生產者非常細小，但有一個很高的轉換數，可能會給出一個倒轉的生物量塔。

17. Why is the pyramids of biomass may sometimes be inverted?
爲什麼生物量塔有時會倒轉？

If the producers are small, such as algae, they have a higher turnover rate, that is a high rate of growth and reproduction balanced by a high rate of consumption or death. Thus, although the standing crop may be small compare with large producers such as trees, the productivity may be the same. An inverted pyramid of biomass is found in plankton community. The zooplankton has a higher biomass than the phytoplankton on which it feeds.
如果生產者非常細小，例如綠藻，它們有一個很高的轉換數，即是雖然它的生長和繁殖率都很高，但是卻被高消耗率和死亡率所抵消，故此，雖然和大型生產者如大樹比較，作物的現存量可能很少，但是它的生產力可能和大樹一樣。在浮游生物群落裏面經常找到倒轉的生物量塔，在此情況下，動物性浮游生物的生物量較牠的食物─植物性浮游生物爲高。

18. What are the advantages of using pyramid of energy?
使用能量塔有什麼優點？

1. **It takes into account the rate of production**. Each bar of pyramid of energy represents the amount of energy that flows through tropic level in a given time period, i.e. the unit is energy flow.
   它已考慮生產率，在能量塔的每一條棒都代表在一定時間內流過食性層次的能量值，即是量度單位是能量流。

2. **Weight for weight, two species do not necessarily have the same energy content.** Comparison based on biomass may therefore be misleading.
   以重量而言，就算重量一樣，兩個品種並不一定會有相同的能量值，故此，基於生物量的比較，有時會引致誤導。
3. **Inverted pyramids are not obtained**. For example, the great importance of decomposers in terms of energy flow is not obvious from their small biomass.
   不會得到倒轉金字塔，例如分解者的質量非常小，但它的重要性在以能量流的形式表達時，就非常明顯了。
4. **The pyramid of energy is always upright**. As energy flows along a food chain, there is energy loss due to respiration, heat loss or excretory waste etc. so the energy along a food chain decreases gradually.
   能量塔的形狀永遠都是正向上的，當能量流經一條食物鏈時，會因呼吸作用、熱散失或排泄物等失去，故此，能量必定沿食物鏈遞減。

19. What are the disadvantages of using pyramid of energy?
使用能量塔有什麼缺點？

Although pyramids of energy are the most useful of the three types of ecological pyramids, they are the most difficult to obtain data because they require even more measurements than pyramid of biomass. One extra piece of information needed is the energy values for the given masses of organisms. This requires combustion of representative samples. In practice, pyramids of biomass can sometimes be converted to pyramids of energy with reasonable accuracy, based on previous experiment.
雖然能量塔在三種生態金字塔中最爲有用，但是它是最難獲取數據的，因爲獲取數據時，它比生物量塔更繁複和更困難，它需要額外的資料，那是生物每一個單位質量的能量值，這需要燃燒具代表性的樣本，實際上，基於前人所作的實驗，生物量塔可以轉換爲能量塔，這有一定程度的準確性。

20. Explain the role of producer in energy flow.
解釋生產者在能量流的角色。

They carry out photosynthesis, in which they fix the energy in sunlight and store the energy in the food they produce. This energy is the source of energy for all the organisms in the ecosystem.
它們可進行光合作用，將光能固定於所生產的食物中，這能量是生態系統中所有生物的能量來源。

21. Explain the role of producer in cycling of materials.
解釋生產者在物質循環的角色。

(1) Take in carbon and nitrogen in the form of inorganic compounds from the environment and turn them into organic compounds.
   把環境中的無機碳和氮轉化爲有機化合物。
(2) Release carbon into the environment in the form of carbon dioxide through respiration.
   透過呼吸作用，把碳以二氧化碳的形式釋放進環境。

22. Explain the role of producer in energy flow.
解釋消費者在能量流的角色。
They transfer the chemical energy along the food chain in the form of food.
牠們將化學能以食物形式，沿食物鏈傳遞。

23. Explain the role of producer in cycling of materials.
解釋消費者在物質循環的角色。
(1) They produce carbon dioxide and nitrogenous compounds to the producers.
牠們爲生產者提供二氧化碳和氮化物。
(2) They speed up the cycling of materials in the ecosystem.
牠們加速生態系統內的物質循環。

24. Explain the role of producer in energy flow.
解釋分解者在能量流的角色。
They enable energy flow by returning the inorganic compounds into the environment.
它們把無機化合物釋放回環境，使能量流繼續發生。

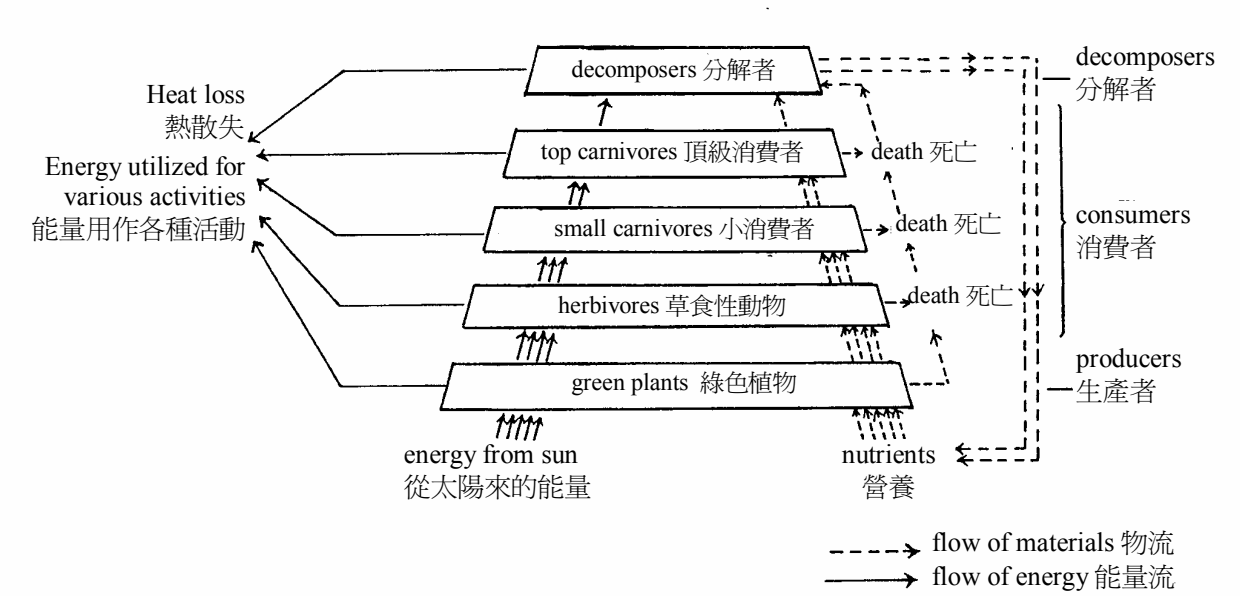
25. Explain the role of producer in cycling of materials.
解釋分解者在物質循環的角色。
Through their metabolic activities, vital organic materials are prevented from being locked up in the bodies of dead organisms. They facilitate the re-cycling of nutrients in the ecosystem.
透過它們的代謝活動，可防止有機物積聚，避免重要的元素被鎖死於死屍的體內，故此，它們有助養份在生態系統內循環。

Check point 測試站 (38)

26. As energy passes through an ecosystem, it becomes less and less available.
Explain the statement with the aid of a diagram.
當能量經過生態系，可供利用的能量變得越來越少。試用流程圖解釋這句說話。
Producers, the green plants, accumulate energy by means of photosynthesis and lose it in three ways:
生產者如綠色植物以光合作用積聚能量，會透過以下三個途徑散失能量:
(i) Some energy is used in the respiration of the organism and is dissipated to the environment as heat
有些能量在呼吸作用中用掉，然後以熱能形式散失於環境中；
(ii) **being eaten by consumers**
被消費者所捕食；
(iii) **being decomposed by microorganisms**
被微生物所分解。

In turn, the herbivores and carnivores lose energy by the similar pathways. In the energy flow, **only a small percentage of energy reserve is transferred (through predation) from one trophic level to the subsequent one,** e.g. plants eaten by herbivores, **most of the energy reserve is lost into the ecosystem through respiration as heat**.

跟著，草食性動物及肉食性動物以同樣方法散失能量，在能量流中，只有一小部分能量能從一個食性層次(透過獵食)轉移至下一個食性層次，例如，植物被草食性動物吃掉，植物內大部分的能量都是在草食性動物的呼吸作用以熱能形式散失到環境中。



27. Describe the ways nitrate is removed from soil.

試述從土壤中移除硝酸鹽的各種方法。

1. Nitrate is removed from soil through **absorption by plants**
   被植物所吸收。
2. **Denitrifying bacteria** convert nitrate to nitrogen.
   脫氮細菌把硝酸鹽轉化爲氣態氮(脫氮作用，又名反硝化作用)。

28. What is denitrification?

何謂脫氮作用？

Denitrification is **part of the nitrogen cycle** in which **nitrate (NO_3) is converted to nitrous oxides** and **to atmospheric nitrogen**. The process is carried out **by a group of free living heterotrophic bacteria under anaerobic or low oxygen conditions** such as in a water-logged soil.

脫氮作用是氮素循環的一環，在此作用中硝酸鹽(NO_3^-)被轉化爲氧化氮，釋放到大氣層中，這作用是由一組居於積水土壤中的細菌在缺氧狀況下所做成的。

29. Describe the ways nitrate is added to soil.
試述在土壤中增加硝酸鹽的各種方法。

1. Atmospheric nitrogen can be converted to nitrate during **lightning**.
   在閃電時，大氣中的氮氣可以直接轉化成硝酸鹽。
2. Nitrogen can be converted to nitrate **by nitrogen-fixing bacteria** which live in the nodules at the root of the leguminous plants
   大氣中的氮氣亦可被固氮細菌轉化爲硝酸鹽，此種細菌包括自由生活和寄生的形式，寄生的固氮細菌居於豆科植物的根瘤中。
3. After the death of organisms, the nitrogen in their body can be returned to the soil by **the action of microorganisms**. The dead bodies are first converted by putrefying bacteria to ammonia or ammonium compounds. These are then acted upon by nitrifying bacteria to nitrite and then nitrate.
   生物死亡後，它體內的氮素亦可透過微生物的作用，回到泥土中。首先，死屍會被腐敗細菌轉化爲氨或氨化物，氨和氨鹽經某些硝化作用後，可被硝化細菌進一步轉化爲硝酸鹽，這作用稱爲硝化作用。

30. Distinguish between nitrogen fixation and nitrification.
分辨固氮作用和硝化作用。

Nitrogen fixation is the conversion of nitrogen gas to ammonia.
固氮作用將氮氣轉化爲氨。
Nitrification is the conversion of ammonia to nitrate
硝化作用將氨轉化爲硝酸鹽。

31. Explain the effect of denitrification on a natural ecosystem
解釋脫氮作用對自然生態系統的影響：

This results in a l**oss of inorganic nitrogen** from the soil.
In crop production, nitrogen is usually the limiting nutrient.
這使土壤損失無機氮，在耕作上氮素的含量通常是限制植物生長的營養因素。

32. With an example, explain how denitrification could be utilized to the benefit of mankind.
用例子解釋如何利用脫氮作用以做福人群。

In a body of water rich in organic materials, **the removal of nitrate effectively limits the overgrowth of microscopic algae** and in turn protozoa. This **reduce the pollution level.**
在富含有機物的污水中，移除硝酸鹽可有效地限制藻類的生長，從而限制原生動物的生長，這可大大地減低污染的水平。

Denitrification is also **one of the advanced wastewater treatment processes** to reduce the nitrogen level in sewage plant effluent
脫氮作用亦常被高級污水處理系統所採用，它減低經處理後污水的氮素水平。

33. Explain the term predation.
解釋名詞捕食

One organism (predator) obtains food by catching and eating other organism.
一種生物(捕食者)透過捕捉另一種生物，然後將牠吃掉以獲取食物。

34. What will be the relationship between predator and prey population growth pattern?
捕食者與獵物的生長模式有什麼的關係？

The predator-prey relationship regulate the abundance of the predator and prey. The number of the prey and predator increases and decreases in the same pattern but with a time lag.
捕食者與獵物的關係，可以調節捕食者與獵物的數量，獵物與捕食者數量的增減會有相同的模式，但是存有時差。

35. Explain why the predator and prey relationship is beneficial to the population of the prey.
解釋爲什麼捕食者與獵物的關係，在整體來說是對獵物是有益的。

The predation relationship help to check the population size of the prey preventing them from competing for food and space.
此種獵食關係可抑制種群 A 的增長，防止它們因數量過多而引起食物和居地的嚴重競爭。

36. Explain the term competition.
解釋名詞競爭。

More than one species or individuals of the same species attempt to make use of the same resources in the environment because there are not enough resources to satisfy the needs of all the organisms
當多過一個品種或生物居住於同一環境中，便會發生競爭，他們都想盡量利用環境的資源，結果便沒有足夠的資源以滿足所有的生物。

37. Explain commensalism with an named example.
用例子解釋名詞片利共生。

One obtains benefit while the other is neither harmed nor benefited. e.g. Barnacles living on the shell of the crab.
一個獲得利益而另一個既無損亦無益。例：藤壺寄居於蟹殼上。
Barnacles living on the back of the crabs and gains the benefit of locomotion, food remains and dispersal.
藤壺：可吃到蟹吃剩的食物；亦能藉着蟹把牠帶到別處去。
The crab is not harmed nor benefited
蟹：既無損亦無益。

38. Explain mutualism with an named example.
用例子解釋名詞互利共生：

Both organisms obtain benefits.
兩者皆獲得利益。
e.g. Nitrogen-fixing bacteria living in the nodules at the roots of the leguminous plants.
例：固氮細菌居於豆科植物的根瘤裏，此菌可將大氣中的氮氣轉化成硝酸鹽。

Nitrogen-fixing bacteria obtain water, nutrients and shelter from the plant.
固氮細菌：可獲取水分、營養及居住的地方。
Leguminous plants obtain nitrogenous compounds from the bacteria.
豆科植物：可從細菌獲取氮化物。

39. Explain parasitism with an named example.
用例子解釋名詞寄生
One of them (the parasite) obtains benefit at the expense of the other (the host)
一方(寄生者)受益而另一方(寄主)受損。
e.g. Tapeworm living in the intestine of man
例：條蟲居於人的腸內。
Tapeworm obtains water, nutrients and shelter
條蟲：獲得水分、營養及居住的地方。
Man is harmed
人：受到傷害。

40. List all the biotic interactions which regulate the size of natural populations.
列出所有能調節生物數量的生物互動性關係。
Predation, competition, commensalism, mutualism, parasitism.
捕食、競爭、片利共生、互利共生、寄生。

Check point 測試站 (39)

41. Explain how to use a line transect to measure the relative abundance and distribution of species.
解釋如何用樣線量度品種的數量和分佈。
A string with markings at 1m intervals is stretched out along the ground in a straight line. The organisms touching or covering the line all along its length are recorded. This is particularly useful where there is a transition of flora or fauna across an area or down seashore. It is usually use with a quadrat.
那是一條每隔一米具標記的幼繩或膠帶，放在地面上，呈直線拉開，沿線把接觸到或覆蓋著這條線的所有生物都記錄下來，該項技術特別適用於動植物相有逐漸變化的地方，通常配合樣方使用。

42. Explain how to use a quadrat to measure the relative abundance and distribution of species.
解釋如何用樣方量度品種的數量和分佈。
A metal frame, often designed can be folded to make it more compact for storage and transport. The internal dimension is 1m, but for sake of transport, it is better being 0.5m. It is placed on the ground and the species present within the frame are identified and their abundance recorded.
這是一個金屬框，通常設計爲可摺疊式以方便收藏和運輸，此框內徑 1 米，但爲了方便攜帶，最好設計成內徑 0.5 米。使用時把樣方置於地上，被樣方圍着的各種品種會被鑒定，它們的數量也會記錄下來。

43. Explain how to use a belt transect to measure the relative abundance and distribution of species.

解釋如何用樣帶量度品種的數量和分佈。

A transect line is laid along the area to be studied, and quadrats are placed at fixed intervals (eg. 2m) on one side of the transect line. The organisms enclosed by the quadrat are recorded.

在探究地點放置一條樣線，然後沿樣線的定距(例如每隔兩米)放置一個樣方，紀錄樣方內生物的數量。

44. What are the limitations of using line transect and quadrat?

使用樣線及樣方有什麼局限性？

It can only measured plants, stationary animals and slow moving animals. The fast moving ones will escape when disturbed.

它只可量度植物、靜止不動的動物或者移動緩慢的動物，因爲快速移動的動物在被騷擾時，便會立即逃跑。

45. Suggest some methods to determine the feeding relationships between the organisms.

建議一些找出生物間進食關係的方法。

1. Direct field observations.
   在野外直接觀察。
2. Test with different types of preys found in the habitat in the laboratory (see whether it eat).
   在實驗室中，用在生境找到的不同獵物，給目標生物作測試(看牠吃不吃)。
3. Analysis of their stomach contents.
   分析牠們胃中的成份。

46. Explain the term succession.

解釋名詞演替。

Succession is a progressive change in composition of a community of organisms towards a large stable ecosystem at the same place over a period of time. It is the result of gradual change in the abiotic factors imposed by the living organisms.

演替是群落在同一地點經過一段時期的逐漸轉變，最後會變爲一個大而穩定的生態系統，它是由生物所帶動而令非生物因素慢慢轉變的結果。

47. Describe the events that occur in succession.

簡述在原生演替所發生的事情。

Pioneer plants (lichens, mosses, grasses) brings about changes in the environment such as addition of humus to soil, changes in pH, and increased water retention of soil.

Eventually, **the environment is altered** to a point that another community can replace the pioneer community from the area. As a result, the ground will soon be covered by **herbaceous plants.**

Later, the **slower-growing shrubs and trees** will make their appearance and as they grow taller, they will **shade the ground flora,** which will die out for the lack of adequate light.

Later still, the **trees are close together**. This means that at each stage of this course, **there is always at least one dominant species** which is then replaced by some other of a higher class **until finally the forest structure is achieved.**

首先出現於禿石上的生物是**地衣**—綠藻與真菌的共生體，此種共生關係使地衣能夠在乾旱而不肥沃的土地上生存，故此，地衣被名爲**先鋒植物(群落)**。

隨着地衣殘骸的分解，它會爲環境帶來轉變，例如增加土壤的腐植質、改變酸鹼度、和增加土壤的保水能力等。

稍後**藻類與苔蘚類**會入侵地衣的區域，它們有較高的光合作用活動，使它們能夠成功地和地衣競爭。

岩石不斷被侵蝕，藻類與苔蘚類不斷腐化，可供植物吸收的營養物數量進一步增加，更厚的泥層漸漸積聚起來。

環境逐漸改變，當達至某個程度，變得適合**草本植物和蕨類**的生長，它們的出現會將藻類與苔蘚類植物從該區排擠出來。

稍後，生長緩慢的**灌木**會出現，它們會長得高些，遮蓋其它較矮的低等植物，此等植物便會因缺少陽光而漸漸死亡。

最後，**喬木**會出現，因它長得比灌木還高，若它們一起生長，有些灌木便會因缺少光線而死亡，喬木繼續不斷地生長，直至形成一個大森林，在此情況下，便不會被其它植物群落所取代，即是已到達**頂級群落**。

48. What are differences between primary and secondary succession?
原生演替與次生演替有什麼分別?

Primary succession is the succession occurring at an area which has not been previously occupied by a community, eg, newly exposed rock surface.

Secondary succession is the succession occurring at a place which has a community removed. Secondary succession results when there are severe changes in climate or fire and cultivation. Secondary succession progresses more rapidly than primary succession because soils and physical conditions has been altered to a certain extent by previous communities and have not been completely removed. Spores, seeds and organs of vegetative propagation may remain viable in the soil, and there will be an influx of animals and plants through dispersal and migration from the surrounding area. In these circumstances the succession will not begin with pioneer species but with organisms from subsequent successional stages.

原生演替是發生於某荒地的演替，而該區以前未有任何群落居住過，例如新開發的裸露石面。

次生演替發生在曾有群落居住，但是已被移除的地方。

它多發生於氣候急變、森林火災、或農地廢棄後。

次生演替進行的速度較原生演替爲快，因爲土壤和各種物理性條件都已被改變爲較適合高等的植物群落居住，而且孢子、種子和植物繁殖器官可能存活於土壤中，而相鄰地區亦有動植物以擴散和遷移的形式湧入，在此種情況下，演替將不會自先鋒植物從頭開始，而是始於後來演替階段的生物。

49. Draw the flow diagram of primary succession.
繪出原生演替的流程圖。

Bare land → lichen→ algae and moss → herb and fern → shrub → tree

禿石 → 地衣 → 藻類和苔蘚類 → 草本植物和蕨類 → 灌木 → 喬木

50. Explain the harmful effects of air pollution and its control method.
解釋空氣污染的害處及其防治法。

Exhaust fumes contain many pollutants that are harmful to our health and the environment.
廢氣含有多種污染物，對人體和環境有害。

Exhaust fumes may pass over purifiers (electrostatic precipitator) to clear the harmful components.
廢氣須先經過過濾器(靜電過濾器)，清除掉有毒物質才可排放。

Better fuels (eg. containing fewer sulphur, lead free) should be used.
使用更佳燃料(含較少硫磺、無鉛汽油)。

51. Explain the harmful effects of noise pollution and its control method.
解釋聲音污染的害處及其防治法。

Too much noise may result in mental stress or even deafness.
噪音會導致精神緊張，甚或失聰。

The sounds from vehicles and machines can be reduced by mufflers.
汽車及機器應裝上滅音器。

People working under noisy conditions should use ear plugs.
在噪音下工作的人應戴上耳塞。

52. Explain the harmful effects of water pollution and its control method.
解釋水質污染的害處及其防治法。

Sewage from factories may contain toxic chemicals that kill aquatic organisms.
工廠排放的廢水含有化學物，殺害水中生物。

Control by legislation.
立法管制。

Effluents from factories should be controlled and treated.
控制工廠排放的污水，污水須經處理。

53. Explain the harmful effects of land pollution and its control method.
解釋土地污染的害處及其防治法。

Decomposition of solid waste in landfills may release toxic chemicals.
堆填區固體廢物的分解會釋出有毒化學物。

Reduce wastage. Employ the 3 R policy: Reduce, Reuse and Recycle the resources.
減少浪費，採用 3 R 政策，對資源的使用實行：減少使用、再三使用及循環再用。

53. State impacts of human activities on the ecosystem other than pollution.
說出污染以外的人類活動對生態系的影響。

1. Destruction of tropical rain forests
   破壞熱帶雨林
2. Soil erosion
   引致土壤侵蝕
3. Over fishing
   過度捕魚
4. Reclamation destroys marine and costal habitats
   填海破壞沿岸及海洋生境
5. Land clearance destroys natural habitats
   闢地破壞天然生境
6. Green house effect leads to global warming
   溫室效應引致全球暖化
7. Ozone depletion
   臭氧層缺損
8. Formation of endangered species
   形成瀕危物種

54. Explain the need for conservation.
解釋資源保護的重要性。

Conservation is the wise management of our environment so as to maintain a balance between harvest and renewal so that there will be a continual yielding of natural resources.
資源保護是良好地運用天然資源以使它們不會受損，在收獲與重生間取得平衡，使資源可源源不絕的供應。

55. Briefly explain the program of conservation.
簡單地解釋保護資源的具體措施。

1. Wildlife management 管理野生生物
2. Prevention of forest fire 防止山火
3. Control of pollution 控制污染
4. Correct use of land 正確使用土地
5. Reduce the loss of non-renewable resources 減少不可再生資源的消耗
6. Regeneration of renewable resources 令可再生資源重生
7. Human population control 控制人口的增長

Check point 測試站 (40)

1. **Give the evidence of the presence of light reaction.**
   請爲光反應提出証明。
   Photolysis of water:
   When **isolated chloroplasts are suspended in water** with some **ferric salts as hydrogen acceptor** and **illuminated with light**, **bubbles of oxygen will be released.** This result indicates that **water is split into oxygen and hydrogen by the chloroplast** with the aid of light energy.
   水的光解作用。
   當分離出來的葉綠體和一些鐵鹽懸浮於水中的時候，鐵鹽作爲氫受體，被光照射時有氧氣泡釋出，顯示出水分子被葉綠體及光能分解爲氫氣和氧氣，氧氣被釋出，而氫原子被氫受體所接收。

2. **Where does the light reaction take place?**
   光反應在那裡進行?
   Light reactions **take place at the grana of the chloroplast** where chlorophyll can be found on their surface.
   光反應在葉綠體的**葉綠層**進行，而葉綠素佈滿葉綠層的表面。

3. **What happens to the chlorophyll after absorption of light?**
   葉綠素在吸收光能後有什麼事發生?
   Absorption of light by chlorophyll results in an electron jumping from its ground state to a higher, excited state. The excited electron will be emitted from the chlorophyll molecule and pass down an electron transport chain. During the transport energy is released which has two functions:
   葉綠素在吸收光能後，基層的電子會被激活至一較高能量的激活層，激活的電子於是被釋出，它沿電子傳遞鏈傳送，傳送途中會有能量釋出，釋出的能量有以下兩個用途:
   1. **Production of ATP** (photophosphorylation)
      ATP 的生成（光磷酸化作用）
   2. Photolysis of water and **production of NADPH**
      水的光解與 **NADPH 的生成**

4. **What are the significance of light reaction?**
   光反應有什麼重要性？
   1. **To generate ATP and $NADPH_2$** (reduced coenzyme) for use in the dark reactions for carbon fixation.
      產生 ATP 和 NADPH 以用作暗反應中的固碳作用。
   2. **Release of oxygen** from the cell as by-product of photosynthesis.
      在光合作用中，以副產品形式釋出氧氣。

5. Where does the dark reaction take place?
暗反應在那裡進行?
Dark reactions take place **at the stroma of the chloroplast.**
暗反應在葉綠體的基質中進行。

6. What happens to CO_2, where is the required energy and hydrogen come from in dark reaction?
在暗反應中，二氧化碳會變成什麼，所需的能量及氫原子又來自何處?
Through dark reaction, carbon dioxide is reduced to form carbohydrates. The required energy comes from ATP, and the hydrogen required for the reduction comes from NADPH . Both of these are derived from the light reactions.
透過暗反應，二氧化碳被還原爲碳水化合物，所需的能量來自 ATP，所需的氫原子則來自 NADPH，它們全都是由光反應而來的。

7. Describe the events occur in Calvin cycle.
試述在卡爾文循環所發生的事情。

1. **Carbon dioxide** (diffuses from outside through the stomata or from the respiration of its own cells) combines with a 5-carbon compound to form a 6-carbon compound which will split immediately to give two molecules of a **3-carbon compound**.
二氧化碳(從氣孔滲入或從自己細胞呼吸作用所釋出)和一個五碳化合物結合成一個六碳化合物，隨即分裂成兩個**三碳化合物**。
2. The 3-carbon compound is then reduced to a 3-carbon sugar, **triose phosphate**. The hydrogen required in this reduction comes from the **NADPH,** and energy required from **ATP.** Both formed during the light reactions.
三碳化合物被還原爲三碳糖－**丙糖磷酸**，所需的氫原子來自 **NADPH**，所需的能量來自 **ATP**，兩者皆從光反應而得。
3. The triose phosphate then goes through a series of steps to form a **hexose sugar** (glucose).
丙糖磷酸跟著進入一連串的化學作用，**形成六碳糖**(葡萄糖)。
4. Some of the 6-carbon sugar produced is **converted to starch for storage** while some triose phosphate enter a series of reactions leading to the **regeneration of CO_2 acceptor** that will enter the Calvin cycle again. This kind of conversion needs more ATP that comes from light reaction.
有些六碳糖跟著會**轉化成澱粉作儲藏**，而有些丙糖磷酸會進入一連串的化學作用，**重新生成二氧化碳受體**，再次進入卡爾文循環，這種轉化需要更多來自光反應的 ATP。

8. What is the importance of regeneration of CO_2 acceptor?
二氧化碳受體的再生有什麼重要性?
The regeneration of **CO_2 acceptor** is very important because only by **ensuring a continuous supply of ribulose biphosphate** can the continued fixation of carbon dioxide take place.
二氧化碳受體的再生是非常重要的，因爲它可確保有充足的二磷酸核酮酸供應，使到固碳作用能夠繼續進行。

9. Give the chemical equation for photosynthesis. From the equation, what changes in the substances taken up and produced might be used to measure the rate of photosynthesis?
寫出光合作用的化學方程式。從方程式中，什麼物質的轉變(被吸收及產生)可用作量度光合作用的速率？

$$6CO_2 + 12H_2O \xrightarrow[\text{葉綠素 chlorophyll}]{\text{光 light}} C_6H_{12}O_6 + 6O_2 + 6H_2O$$

Uptake of carbon dioxide, **liberation of oxygen** and **increase dry weigh**t/ carbohydrate content can be measured to indicate the rate of photosynthesis.
二氧化碳的吸收、氧氣的釋出、碳水化合物成份或乾重的增加等，都可作爲量度光合作用速率的指標。

10. Explain the role of ATP in photosynthesis.
解釋 ATP 在光合作用中所扮演的角色。

ATP is synthesized in light reaction. It is used in the dark reaction to **supply energy for reducing** 3-carbon compound to **triose phosphate**.
ATP 在光反應中合成，在暗反應中，它是用作**供應能量**將三碳化合物**還原成丙糖磷酸**。

11. Explain the role of NADP in photosynthesis?
解釋 NADP 在光合作用中所扮演的角色。

NADP is an acceptor molecule which **accepts hydrogen from the photolysis of water** to form **NADPH**. **NADPH** reduces 3-carbon compound to triose phosphate in the dark reaction.
NADP 作爲受體，**接收從光解水所產生的氫原子**，NADP 與氫原子結合形成 NADPH，其後 NADPH 在暗反應將三碳化合物還原成丙糖磷酸。

12. Which two products of the light-dependent stage are used in the light-independent (dark) stage of photosynthesis?
那兩種光反應生成的產品被用於暗反應中?
ATP 和 NADPH。

13. Explain the formation of starch from the products of Calvin cycle.
解釋如何從卡爾文循環的成品合成澱粉質。
Tow molecules of triose phosphate (3-C) combine to form one molecule of glucose phosphate (6-C). Glucose can then be converted to starch.
二分子的丙糖磷酸結合爲一分子的葡萄糖磷酸，葡萄糖可按需要轉換爲澱粉。

14. Explain the formation of lipids from the products of Calvin cycle.

解釋如何從卡爾文循環的成品合成脂肪。

The 3-carbon compound enters into the glycolytic pathway and is converted to pyruvate. Pyruvate is converted to **acetyl coenzyme A**, then to fatty acids in both cytoplasm and chloroplast.
Glycerol is made from triose phosphate. Glycerol and fatty acids combine to form lipids.

三碳化合物進入解糖路徑後被轉化爲丙酮酸鹽，丙酮酸鹽被轉化**乙酰輔酶 A** ，乙酰輔酶 A 在細胞質和葉綠體內轉化爲脂肪酸，丙糖磷酸亦會轉化爲甘油，甘油與脂肪酸結合成脂肪。

15. Explain the formation of proteins from the products of Calvin cycle.

解釋如何從卡爾文循環的成品合成蛋白質

The 3-carbon compound enters into the glycolytic pathway and is converted to pyruvate. Pyruvate is then converted to acetyl coenzyme A. Acetyl coenzyme A enters the Krebs cycle of respiration. It is then converted to carboxylic acids. Subsequently amino acids are formed by amination. Amination is enzymatic transfer of NH_3 to an acid to form an amino acid. Proteins are formed by condensation of amino acids.

三碳化合物進入解糖路徑後被轉化爲丙酮酸鹽，丙酮酸鹽被轉化乙酰輔酶 A ，乙酰輔酶 A 進入呼吸作用的克雷伯氏循環，被轉化爲羧酸，其後透過氨基化作用形成氨基酸（氨基化作用是以酶促傳遞將 NH_3 加到羧酸中以形成氨基酸），而蛋白質是由衆多的氨基酸所縮合而成的。

16. Describe the concept of limiting factors.

試述限制因素的概念。

The rate of a biochemical process will theoretically be limited by the slowest reaction in the series.

一個生化過程如光合作用等，會有很多一連串的化學反應，理論上，它的速率會受制於最慢的一個反應。

17. Using carbon dioxide, illustrate the concept of limiting factor.

試用二氧化碳闡釋限制因素的概念。

Under normal field conditions, **carbon dioxide is the major limiting factor in photosynthesis**. Its concentration in the atmosphere is about 0.03%, and **an increase in photosynthetic rate can be achieved by increasing its concentration to about 0.1%.**

暗反應需要二氧化碳，它被固定於有機化合物中，在正常的野外狀況中，二氧化碳是主要的光合作用限制因素，光合作用的速率直接取決於二氧化碳在空氣中的濃度(假使光強度並非一個限制因素)，它的濃度在大氣層中大約是 0.03%，故此將它的濃度增加至 0.1%時可大大地增加光合作用的速率。

Check point 測試站 (41)

1. **Distinguish between gaseous exchange and respiration.**
   分辨氣體交換和呼吸作用。
   Gaseous exchange refers to the processes by which oxygen from the atmosphere reaches the cells and carbon dioxide produced from the cells moves in the opposite direction.
   氣體交換是指氧氣從大氣到達細胞，而從細胞釋出的二氧化碳循反方向排出的過程。
   Respiration refers to the cellular chemical reactions by which oxygen oxidizes glucose to release the energy stored inside it.
   呼吸作用是指細胞內的化學作用，用氧氣將葡萄糖氧化，釋出內含的能量。

2. **What is the first stage of cellular respiration, where does it occur'?**
   細胞呼吸作用的首階段是甚麼？它在那裡進行?
   Glycolysis is the first stage ofcellular respiration. It **takes place in the cytoplasm of a cell**.
   糖酵解作用是細胞呼吸作用的首階段，它在細胞內的細胞質進行。

3. **Does glycolysis depend on oxygen?**
   糖酵解作用需不需要氧氣?
   The process is **independent of oxygen**, i.e. it can take place in the presence or absence of oxygen.
   這作用不須依賴氧氣，即是它可在有氧或無氧的情況下進行。

4. **Describe the first step of glycolysis.**
   描述首階段的糖酵解作用。
   The first step is the activation of a glucose molecule by phosphate group. **Two ATP are required.** The activated glucose then split into two molecules of **triose phosphate** (3-C compound).
   第一步是葡萄糖分子的被磷組活化，這步驟需要兩個 ATP，活化後的葡萄糖分裂爲兩個三碳的丙糖磷酸分子。

5. **What happens to triose phosphate?**
   丙糖磷酸跟著會變成甚麼?
   The triose phosphate then changes to two molecules of pyruvate with the liberation of four ATP, ie. There is a net gain of two ATP in glycolysis.
   丙糖磷酸隨即變成兩個丙酮酸鹽分子，及釋出四個 ATP，即是在糖酵解作用有兩個 ATP 的淨獲得。

6. **What is the fate of the two pairs of hydrogen atoms produced?**
   在此過程中產生的兩對氫原子有甚麼用?
   The two pairs of hydrogen atoms produced may yield a further six ATP giving an overall total of eight ATP in the presence of oxygen.
   在有氧的情況下，兩對氫原子可在其後的呼吸作用中再產生六個 ATP，使糖酵解作用的 ATP 總產量達到八個。

7. **What happens to pyruvate in the presence of oxygen, and what thing is produced？**
   在有氧的情況下，丙酮酸鹽會轉化成甚麼? 有甚麼產生?
   In the presence of oxygen, the pyruvate are **changed to acetyl coenzyme A** which **enters the Krebs cycle.** In this process, **a molecule of CO_2 and a pair of hydrogen atoms are produced**.
   在有氧的情況下，丙酮酸鹽會轉化成乙醯輔酶 A，跟著進入克雷伯氏循環。在這個過程中，有一分子的二氧化碳和一對氫原子產生。

8. **Where does Krebs cycle occur?**
   克雷伯氏循環在那裡進行?
   It occurs at **the matrix of the mitochondria which contain all the necessary enzymes**.
   在粒線體的基質內進行。

9. **What happens to acetyl coenzyme A in and the subsequence products in Krebs cycle?**
   在克雷伯氏循環中，乙醯輔酶 A 及其後的產品會變成甚麼?
   Acetyl coenzyme A enters Krebs cycle (tricarboxylic cycle) and combines with 4-C compound to give the 6-C compound.
   乙酰輔酶 A 這個二碳分子會進入克雷伯氏循環(三羧酸循環)與四碳化合物結合，形成一個六碳化合物。
   The **6-C compound** is degraded to the 5-C compound and then a number of different **4-C compounds**, by the progressive loss of two carbon dioxide molecules. Finally, regeneration of the 4-C compound that can combine with another acetyl coenzyme A, thus completes the cycle.
   六碳化合物逐次失去二氧化碳分子，總共兩個，先降解爲五碳化合物，再變成不同的四碳化合物，最終重新產生可用於結合另一個乙酰輔酶 A 的四碳化合物，從而完成了整個循環。

10. **What are produced in each turn of the Krebs cycle'?**
    每次循環有甚麼產生?
    For each turn of the cycle, a total of four pairs of hydrogen atoms are formed.
    In addition, each turn of the cycle produces a single molecule of ATP
    每次循環有四對氫原子生成，除此以外，還會產生一個 ATP 分子。

11. **Where does hydrogen transfer occur?**
    電子傳遞在那裡進行?
    Electron transfer occurs at the inner membrane of the mitochondrion.
    電子傳遞在粒線體的內膜上進行。

12. **Describe the process of hydrogen transfer.**
    試述電子傳遞的過程。
    The hydrogen atoms of NADH and FADH (actually proton) pass through a series of **hydrogen acceptors** and is finally accepted by oxygen to form water. In this way, NAD and FAD are regenerated to accept hydrogen in glycolysis and the Krebs cycle again.
    NAD 和 FAD 所載的氫原子(其實是質子)會於一連串的氫受體間傳送，最後與氧結合，形成水。過程中，NAD 和 FAD 再生，並可重新接受從糖酵解及克雷伯氏循環所產生的氫。

By passing through the hydrogen transfer chain, energy in NADH and FADH is released to form ATP.

透過電子傳遞系統，儲於 NADH 和 FADH 的能量會用於合成 ATP。

13. Describe the effect of cyanide on the inhibition of respiration.

試述氰化物於呼吸作用的抑制作用。

The transfer of hydrogen atoms to oxygen is catalyzed by the enzyme cytochrome oxidase. This enzyme is inhibited by cyanide, so preventing the removal of hydrogen atoms at the endof the respiratory chain. In this case, the hydrogen atoms accumulate and aerobic respiration ceases, making cyanide a most effective respiratory inhibitor.

氫原子向氧的傳遞，由細胞色素氧化酶催化，此酶受氰化物抑制，氫原子不能從呼吸鏈末端除去，在這種情形下，氫原子便會積聚，需氧呼吸也就停止，所以氰化物是最有效的呼吸抑制物。

Check point 測試站 (42)

14. What is the main difference between anaerobic and aerobic respiration?

缺氧呼吸與有氧呼吸的主要分別是甚麼?

Anaerobic respiration differs from aerobic respiration only in that **the former is an incomplete oxidation which stops at the first stage** of the reactions **while aerobic respiration proceeds to the end and is a complete oxidation.** Only **2 ATPs are formed in anaerobic respiration** while **38 ATPs are formed in aerobic respiration.**

缺氧呼吸與有氧呼吸的分別在於前者是一個不完全的氧化作用，在呼吸作用的首階段便停止運作(只產生 2 個 ATP)，而有氧呼吸是一個進行到尾的完全氧化作用(可產生 38 個 ATP)。

15. Describe the process of alcoholic fermentation.

試述酒精發酵的過程。

The pyruvate loses a carbon dioxide molecule, then combines with the hydrogen ions, which are transported by the hydrogen carrier NAD, to form the alcohol, ethanol.

糖酵解產生的丙酮酸鹽會首先去掉一個二氧化碳分子，然後與由氫載體 NAD 所運送的氫原子結合，生成酒精(乙醇)。

16. What is the importance of lactic acid fermentation?

乳酸發酵有甚麼重要性?

Unlike alcoholic fermentation, the lactic acid can be further broken down in the presence of oxygen and releasing its remaining energy or it may be resynthesized into carbohydrate. Lactic acid fermentation not only yields a little energy, but removes the pyruvate which would otherwise accumulate. Tissues have a relatively higher tolerance of lactic acid than **pyruvate.**

與酒精發酵不同，乳酸在有氧條件下可進一步分解，從而釋放剩餘的能量，亦可重新合成碳水化合物，這種形式的發酵在動物是很常見的，因爲能使動物忍耐短期無氧機制對生存具重要意義。乳酸發酵不但能產生少量能量，還能除掉積聚的丙酮酸鹽，但乳酸也會積聚，在一定時間內亦會達致飽和，從而抑制肌肉運動，不過肌體組織對乳酸有較高的耐受性。

17. What is oxygen debt?

甚麼是氧氣債?

In the shortage of oxygen, muscles carry out anaerobic respiration. Lactic acid is a product of this process. Lactic acid causes muscle fatigue and prevents muscle from contracting. It has to be broken down by oxygen. As the lactic acid accumulates, the organism has an oxygen debt.
在缺氧的情況下，身體會進行缺氧呼吸，乳酸便是這作用的產品，乳酸引起肌肉疲勞，阻止肌肉進一步收縮，必須用氧氣來把它分解掉，當乳酸積聚時，生物便有一個氧氣債。

18. How to repaid the oxygen debt?

如何償還氧氣債？

This is repaid as soon as possible after the activity, by continued deep and rapid breathing. The oxygen is used to oxidize the lactic acid to carbon dioxide and water, thereby removing it.
這氧氣債可在活動後藉連續不斷的快速深呼吸來償還掉，氧氣是用來將乳酸氧化，變成二氧化碳和水，從而將它清除掉。

19. What is the physiological significance of oxygen debt?

氧氣債在生理上有什麼重要性?

It allows the animal to **produce more ATP when extra energy is needed** to get food or escape.
當動物需要額外的能量以作覓食及逃生時，可產生更多的 ATP。

20. Compare aerobic with anaerobic respiration.

比較有氧呼吸和缺氧呼吸。

	Aerobic respiration **需氧呼吸**	**Anaerobic respiration** **缺氧呼吸**
Oxygen requirement 氧氣的需要	Yes. 需要。	No. 不需要。
Oxidation of sugar 糖的氧化	Complete. 完全氧化。	Incomplete. 不完全氧化。
Amount of energy (ATP) released from glucose 能量的釋出	Large amount (38ATP). 大量　(38ATP)	Small amount (2ATP) 小量　(2ATP)
End products 最終產品	carbon dioxide, water and more ATP are produced. 二氧化碳、水和更多的能量。	lactic acid (in animals), ethanol and carbon dioxide (in plants) and less ATP are produced. 在動物是乳酸、在植物是二氧化碳和酒精，和較少的能量。
Hydrogen acceptor in glycolysis 在糖酵解作用中的氫載體	NAD.	Pyruvate 丙酮酸鹽
Krebs cycle 克雷伯氏循環	Involved. 牽涉	Not involved. 不牽涉
Electron transport system 電子傳遞系統	Involved. 牽涉	Not involved. 不牽涉

Occurrence in cells 在細胞內的發生地	Cytoplasm (glycolysis) and mitochondria (Krebs cycle and electron transport system). 細胞質（糖酵解作用）和線粒體內（克雷伯氏循環和電子傳遞系統）。	Cytoplasm only. 只在細胞質發生。
Occurrence in organisms 在何種生物發生	Most organisms 大部份生物細胞。	In lower organisms, eg. yeast, plant and muscle cells when the oxygen supply cannot cope with the energy demand. 在低等生物，例如酵母菌，植物細胞和肌肉細胞，當氧氣供應不足以應付所需時。

21. Why the number of ATP molecules released from glucose in aerobic respiration is much more than from anaerobic respiration.

爲甚麼在有氧呼吸的氧化葡萄糖時所釋出的 ATP 分子數目遠較缺氧呼吸的爲多？

Taking glucose as the respiratory substrate, both aerobic and anaerobic respiration produce a net amount of 2 ATP in glycolysis with the formation of 2 pyruvate.

以葡萄糖作爲呼吸基質而論，有氧呼吸和缺氧呼吸都會在糖酵解時淨產生兩個 ATP 和形成兩個丙酮酸鹽。

In aerobic respiration the pyruvate combines with coenzyme A to form acetyl coenzyme A. This enters the Krebs cycle with the formation of more ATP during decarboxylation and hydrogen atoms are accepted by hydrogen acceptors. The hydrogen acceptors release electrons which pass through the electron transport chain on the inner membrane of the mitochondria. Movement of electrons is coupled with the formation of ATP in the process of oxidative phosphorylation.

在有氧呼吸中，丙酮酸鹽和輔酶 A 結合成乙酰輔酶 A，跟著進入克雷伯氏循環，在脫羧作用中形成更多的 ATP，而氫原子被氫受體(氫載體)所接收，氫受體會在電子傳遞系統中放出電子，在粒線體的內膜進行一連串的傳送，傳送途中會有 ATP 產生，這過程是氧化磷酸化作用。

In anaerobic respiration, the pyruvate formed is converted to energy rich lactic acid or alcohol, so less ATP is formed.

在缺氧呼吸中，所產生的丙酮酸鹽會轉化成高能量的乳酸或酒精，故此只有較少的 ATP 產生。

22. Explain the role of ATP in energy transfer,

解釋 ATP 在能量傳遞上的功能。

The importance of ATP is that it is a means of transferring free energy from foods to cellular reactions requiring it. It is the immediate energy source for metabolic process. When ATP is hydrolyzed to ADP and phosphate, energy is released.

ATP 的重要性在於它能將食物中的自由能儲藏，將能量傳送至需要它的細胞活動中，它是許多代謝作用的即時能量來源，當 ATP 被水解爲 ADP 和磷酸鹽時，會有能量釋出。

ATP may be used in biosynthesis eg. formation of nucleic acids from nucleotides. It may also be used in muscular contraction.

ATP 可用於生化合成，例如在核　酸形成核酸的過程中，它亦可用作肌肉收縮。

23. Explain the role of ADP in respiration

解釋 ADP 在呼吸作用上的功能。

It is the **precursor of ATP**, **used for storing energy** in a readily usable form.

它是 ATP 的前身，用作儲存能量，使能量變成即用的形式。

24. Explain the role of NAD in respiration

解釋 NAD 在呼吸作用上的功能。

It is an immediate hydrogen acceptor, during oxidation of glucose, accepting hydrogen atoms from glycolysis and Krebs cycle. NADH formed will then pass the hydrogen atoms to the electron transport system for oxidative phosphorylation in aerobic respiration.

它是一個即時的氫原子受體，當葡萄糖被氧化時，它接收從糖酵解或克雷伯氏循環所釋出的氫原子，在有氧呼吸中，所形成的 NADH 會將氫原子傳送到電子傳遞系統作氧化磷酸化作用。

25. Explain the role of oxygen in respiration

解釋氧氣在呼吸作用上的功能。

It is the final hydrogen or electron acceptor of the electron transport chain in the oxidation process during aerobic respiration. When electrons are passed down the chain, ATP is formed by oxidative phosphorylation.

它是有氧呼吸的電子傳遞系統的氫原子或電子的最終受體，電子在傳送途中，會有 ATP 形成。

26. Explain the role of mitochondria in cellular respiration.

解釋粒線體在呼吸作用上的功能。

Mitochondria are double membrane rod shaped organelle that its matrix contains enzymes for Krebs cycle while membranes have enzymes for hydrogen transfer system. Glycolysis occurs in the cytoplasm surrounding the mitochondria. Pyruvate formed then enters the mitochondria to be degraded to carbon dioxide and water The membrane system inside the mitochondria greatly increase the surface area for the enzymatic reactions.

粒線體是一個雙膜棒型細胞器，它內含的基質含有克雷伯氏循環所需的酶，而薄膜上有電子傳遞系統所需的酶，糖酵解作用只在包圍著粒線體的細胞質內進行，所形成的丙酮酸鹽會進入粒線體以便被降解爲二氧化碳和水。粒線體內的薄膜系統大大地增加了酶促作用所需的表面積。

27. List some industrial applications of anaerobic respiration.

列出缺氧呼吸在工業上的一些應用。

1. Brewing of beer 釀製啤酒
2. Brewing of wine 釀製紅酒
3. Baking of bread 烤焗麵包
4. Production yoghurt 製造乳酪
5. Production of cheese 製造芝士
6. Production of biofuel 製造生物燃料

28. Compare respiration with photosynthesis.
比較呼吸作用和光合作用。

	Photosynthesis 光合作用	**Respiration 呼吸作用**
Type of reaction **何種反應**	A reduction reaction. 還原反應。	An oxidation reaction. 氧化反應。
Type of metabolism **代謝種類**	Catabolism; breaks down organic food by oxidation to release energy. 分解代謝；藉氧化把有機食物分解，釋出能量。	Anabolism; builds up organic food by reduction to store energy. 合成代謝；藉還原產生有機食物，儲存能量。
Raw materials **原料**	Requires carbon dioxide and water. 需要二氧化碳和水。	Requires oxygen. 需要氧氣。
Products **成品**	Produces oxygen and food. 產生氧氣和食物。	Produces CO_2 and water. 產生二氧化碳和水。
Energy change **能量的轉換**	Energy is stored in high energy compounds. 能量儲存在高能化合物內。	Energy is released from high energy compounds. 能量從高能化合物內釋出。
Occurrence **發生地**	Occurs in green cells only. 只在綠色細胞發生。	Occurs in all cells. 在所有細胞發生。
Light requirement **光的需要**	Requires the presence of light. 需要光。	Independent of light. 不需要光。

Check point 測試站 (43)

1. List the common factors that affect health.
列出所有影響身體健康的因素。

1. Diet
   膳食。
2. Exercise and rest
   運動和休息。
3. Alcohol or drug abuse
   酗酒與吸毒。
4. Infection of pathogens
   病原體的感染。
5. The prevention and control of transmissible diseases
   預防疾病的傳染。
6. A health living habit
   健康的生活習慣。
7. State of mind, being optimistic or pessimistic
   心境，樂觀定悲觀。

2. How is our health affected by a deficiency in food substances?
缺乏食物物質對健康有什麼影響?

Deficiency 缺乏	Disease 疾病
Protein 蛋白質	Kwashiorkor 蛋白缺乏症
Vitamin A 維生素 A	Night blindness 夜盲症
Vitamin C 維生素 C	Scurvy 壞血病
Vitamin D 維生素 D	Rickets 佝僂病
Calcium 鈣	Rickets 佝僂病
Iron 鐵	Anaemia 貧血

3. How is our health affected by an excess of food substances?
進食過量食物物質對健康有什麼影響?

Too much 過多	Disease 疾病
Fat 脂肪	Heart attack and stroke 心臟病或中風 Hypertension 高血壓 Obesity and diabetes 癡肥及糖尿病
Sugar 糖份	Obesity 高血壓 tooth decay and periodontal disease 蛀牙及牙周病
Salts 鹽份	Hypertension 高血壓 Damage to brain and kidney 損壞腦部及腎臟
Energy 熱能	Obesity 高血壓 Heart disease, diabetes and arthritis 心臟病、糖尿病及關節炎

4. What are the benefits of regular exercise?
經常運動有什麼益處？

1.	Strengthen the heart and lungs 增強心肺功能
2.	Reduces the risk of dying from heart disease 減低死於心臟病的機會
3.	Promote muscle growth 促進肌肉生長
4.	Reduces the risk of developing diabetes. 減低患上糖尿病的機會。
5.	Reduces the risk of developing high blood pressure. 減低患上高血壓的機會。
6.	Reduces feelings of depression and anxiety. 減少抑鬱和焦慮的情緒。
7.	Helps control weight. 有助控制體重。

8.	Helps build and maintain healthy bones, muscles, and joints. 有助強健骨骼、肌肉和關節。
9.	Helps older adults become stronger and better able to move about without falling. 令年長者更加健壯，並更能活動自如而不致跌倒。
10.	Promote mental and social well being 促進精神和社交健康

5. In what circumstances that we should not do exercise to safeguard our health?
爲保障健康，什麼的情況不應做運動？

1. When the weather is **hot and humid**, exercise should be avoided. Heat is generated during exercise. When humidity is high, sweat is difficult to evaporate and remove heat from the body. As a result, **heat loss from the body is hampered** and the body will be liable to suffer from **heat stroke** and even death.
   當天氣是又熱又潮濕時，我們不應做運動，濕度高時，汗液難於蒸發，阻礙身體散熱，容易中暑甚或死亡。
2. **At high altitude**, exercise should be avoided. During exercise, more oxygen is required for respiration to provide energy for muscle contraction. However, the **partial pressure of oxygen is low** at high altitude. Oxygen in blood is depleted due to the increased oxygen demand during exercise. As a result, some vital organs, e.g. brain, may not be able to obtain sufficient oxygen.
   在高山應避免做運動，運動需更多氧氣供肌肉收縮之用，但是，高山的氧氣分壓較低，運動因需更多氧氣容易引致身體缺氧，結果，重要的器官如腦部便會供氧不足。
3. On the other hand, exercise should be avoided when **air quality is poor**. Ventilation rate is increased during exercise so as to obtain more oxygen for energy production during respiration. In poor air conditions, more pollutants, e.g. carbon monoxide (CO), sulphur dioxide (SO_2) and nitrogen oxides would be inhaled into the body due to increased ventilation rate. These pollutants are harmful to health.
   此外，空氣污濁的地方亦不宜運動，運動時換氣率增加，會使身體吸入更多污染物如一氧化碳、二氧化硫及氧化氮等，這些污染物會危害身體健康。

6. Why do we need rest after exercise?
爲什麼運動後需要休息？

Continual activity (especially muscular activity) for a sustained period leads to accumulation of toxic wastes (eg. lactic acid) and depletion of food reserve (eg. glycogen). Rest allows cells to undergo a period of inactivity for **removing toxic wastes and replenishing the food reserve** in the cells.

不斷運動（尤其是肌肉運動）一段長時期會引致廢物積聚（如乳酸）及細胞的營養缺失（如糖原），休息可使細胞有一段不活躍期以**移走廢物及補充營養**。

7. How does insufficient sleep affect health?
睡眠不足對健康有什麼影響？

When we sleep, the secretion of growth hormone will be at the peak. The growth hormone can stimulate growth in children. Insufficient sleep affects our alertness, judgment, reaction time and memory.

睡眠時，生長激素的分泌會達致頂峰，這有助兒童的生長，睡眠不足會影響我們的驚覺性、判斷力，反應時間和記憶。

It has been shown that **high blood pressure, diabetes, obesity and depression are related to insufficiency sleep or poor sleep**.

研究發現高血壓、糖尿病、癡肥和抑鬱症均與睡眠不足或不佳有關。

8. Suggest some ways to improve sleep.
建議一些改善睡眠的方法.

1.	Take a break after long hour working. 工作一段時間後應稍作休息。
2.	Avoid heavy meals close to bedtime. 睡前應避免吃得過飽。
3.	Avoid over usage of brain before bedtime. 睡前避免過度用腦。
4.	Develop regular bedtime and waking time. 定時睡覺和定時起床。
5.	Keep your bedroom dark and quiet. 保持睡房昏暗和寧靜。

9. What are the adverse effect of smoking?
吸煙對健康有什麼影響?

Cigarette smoke may inhabit the beating of the cilia in the respiratory tract, more dust particles enter the lungs thereby reducing the surface area of the lung for gaseous exchange.

香煙可抑制呼吸道上的纖毛運動，使更多塵粒進入肺部從而減少可供氣體交換的肺部面積。

成份 **Component**	**對健康的影響** **Effects on health**
Nicotine **尼古丁**	Causes heart disease. Dependence. Retards growth of foetus 引致心臟病，上癮，減慢胎兒生長。
Tar **煙焦油**	**Carcinogenic**, may cause damage to bronchial tubes, mucous membrane and cilia. The smoker has a higher chance of infection by pathogens. **致癌**，可破壞支氣管、黏膜及纖毛，吸煙者有較大機會受病原體感染。
Carbon monoxide **一氧化碳**	Combines with haemoglobin and prevents it from carrying oxygen, leading to decreased physical fitness and retarded growth of foetus. 和血紅素結合阻止它帶氧，引致體能下降及減慢胎兒生長。
Other irritants **其它刺激物**	Chronic **bronchitis** and **emphysema**. 慢性**支氣管炎**和**肺氣腫** Gastric and duodenal **ulcers**. 胃潰瘍及十二指腸**潰瘍** Gingivitis. 齒齦炎 Decreased resistance to diseases. 減低抵抗疾病能力

10. What are the adverse effect of alcohol abuse?
酗酒對健康有什麼影響?

1. Alcohol affects the co-ordination of the body's movement, impairs judgment and slows down our responses. As a result, we are more likely to have accidents.
   酒精影響身體的協調動作，影響判斷及減慢反應，結果容易引致意外。
2. Alcohol has no nutritional value, therefore excessive drinking causes malnutrition. For example, alcoholism can lead to vitamin B1 deficiency, which will lead to damage of the nervous system, leading to numbness, weakness of limbs, hand tremor and mental confusion.
   酒精沒有營養價值，飲酒過量會引致營養不良，長期酗酒會令身體缺乏維生素 B1，損害神經系統，引致例如發抖、癲癇發作、失憶和精神錯亂等的神經系統病徵。
3. It affects our digestive system, causing oesophagitis, chronic gastritis, gastric ulcers and cancers.
   酗酒亦會增加患食道炎、胃炎、胃潰瘍及一些癌症如口腔癌和食道癌的風險。
4. It damages our liver, causing hepatitis, cirrhosis, and even liver cancer. Alcohol raises blood pressure, causes enlargement of heart and eventually heart failure.
   飲酒過量的人患肝炎、肝硬化、肝癌、高血壓及心臟病的機會亦較大。
5. Excessive alcohol drinking in pregnancy will affect the foetus, leading to abnormal development, low birth weight, physical handicaps and mental retardation.
   孕婦飲酒過量會傷及胎兒，引致畸胎、胎兒體重減輕、殘廢及智障。

11. What is drug abuse?
什麼是濫用藥物?

Drug abuse is the taking of drugs without following medical advice, or the use of dangerous drugs for non-treatment purposes.

濫用藥物是指不跟從醫生的指示服用藥物，或服用危險藥物作非醫療用途。

12. What are the effects of drug abuse on health?
濫用藥物對健康有什麼影響?

1.	Heroin causes drowsiness, respiratory depression and nausea. 海洛英引致昏睡、壓抑呼吸和噁心。
2.	Cannabis affects thinking and leads to reduce concentration, poor motor control and slow response. 大麻影響思考力，導致專注力減弱、運動失調及反應遲鈍。
3.	Drugs are addictive. Tolerance to drugs frequently develops so that higher doses are required to satisfy the craving or suppress the withdrawal symptoms. 毒品會令人上癮，因而需要更高劑量及更頻密服用。
4.	Taking more than one drug all at a time can cause death. 同時吸食超過一種毒品足以致命。
5.	As a user becomes drug-dependent, he needs a constant supply of cash, and may resort to serious crimes to support his habit. Some may eventually die of overdose. 當吸毒者開始依賴毒品時，他便需要源源不絕的金錢來滿足其毒癮，藉著犯案以達到目的，以致泥足深陷，難以自拔。吸毒者最後更有可能因爲服食過量毒品而死亡。

13. List the various aspect of personal health and explain how they can prevent spreading of diseases?
列出個人衛生各個範疇及解釋它們如何防止疾病的傳播?

1.	Regular hair washing 經常梳洗	Keep ectoparasites to a low level. 可避免患皮膚病及寄生蟲病。
2.	Daily shower 每天洗澡	Remove sweat, dirt and sebum on the skin, thus eliminate the breeding ground of pathogens. 清除皮膚上的汗水、污垢和皮脂，從而清除病原體的繁殖地。
3.	Teeth brush after meal 餐後刷牙	Use toothpaste that contains fluoride to brush teeth after each meal. 每次進食後都用含有氟化物的牙膏刷牙。
4.	Disinfect or cover wounds 將傷口消毒及覆蓋	Seal entrance to endoparasites. 可減少病原體進入身體。
5.	Do not share towels, shoes and socks 不要共用毛巾及鞋襪	This can prevent the spread of diseases, especially the Athlete's foot. 這可避免感染疾病，尤其是腳癬(香港腳)
6.	Safe sex 安全性行爲	Prevention of sexual disease— prevent or reduce transmission through body fluid. 防止性病－減少透過體液傳染。
7.	Healthy life style 健康的生活方式	Optimistic attitude, persistent exercise, balanced diet etc 保持樂觀、經常運動、均衡膳食等，可增強免疫系統對抗疾病的能力。
8.	Good sanitation 保持環境衛生	Keep environment clean, cover garbage, get rid of stagnant and dirty water help to eliminate breeding ground of parasite, vectors and secondary hosts. 保持環境清潔，蓋好垃圾桶，排除積水等，可清除寄生蟲、傳播媒體及第二寄主的滋生地。

Check point 測試站 (44)

1. What are the causes of infectious diseases?
傳染病的成因是什麼?

Infectious diseases (transmissible diseases) are caused by infection of pathogens. Pathogens include viruses, bacteria, fungi, protists and multicellular parasites. The activities of the pathogens harm the host.
傳染病是由感染病原體引起，病原體包括病毒、細菌，眞菌、原生生物和多細胞寄生蟲。病原體的活動對身體造成破壞。

2. State the different types of pathogens and cite example of the diseases.
說出各種病原體並舉出一些病例。

Pathogens 病原體	Example 病例
1. Viruses **病毒**	Influenza, SARS, AIDS, measles and dengue fever 流行性感冒、非典肺、愛滋病、麻疹和登革熱。
2. Bacteria **細菌**	Cholera 霍亂 Tuberculosis 肺結核
3. Fungi **眞菌**	Athlete's foot 腳癬(香港腳)
4. Protists **原生生物**	Malaria 瘧疾
5. Multicellular parasites **多細胞寄生蟲**	Liver flukes 肝吸蟲病 Tape worm 條蟲病

3. State the different routes of infectious diseases transmission.
說出各種傳染病的傳播途徑。

Routes of transmission: Air, Droplets, Water, Food, Vector, Body fluids, Direct contact
傳播途徑: 空氣、飛沫、水、食物、媒介、體液、直接接觸

4. Explain the following routes of infectious diseases transmission with suitable example, and state the control measures.
用例子解釋下列各種傳染病的傳播途徑，並說出適當的控制措施。

1. Air 空氣
2. Droplets 飛沫
3. Water 水
4. Food 食物
5. Vector 媒介
6. Body fluids 體液
7. Direct contact 直接接觸

	Examples **例子**	**Control measures** **控制措施**
Air **空氣**	Suspended particles in air carrying pathogens or fungal spores may be inhaled. 吸入帶有病原體的懸浮粒子或眞菌孢子。 eg. Measles and tuberculosis. 例子：麻疹和肺結核	Maintain good ventilation. 保持空氣流通。
Droplets **飛沫**	When we cough and sneeze, droplets are expelled from our mouth and nose. These pathogens containing droplets may be inhaled by others. 當我們咳嗽及打噴嚏時，飛沫會從口鼻噴出，這些含病原體的飛沫可能被他人吸入。 eg. Common cold and SARS. 例子：傷風和非典肺	Cover the mouth with tissue paper when coughing or sneezing. If you have a respiratory disease, wear a surgical mask and avoid going to crowded places. 咳嗽及打噴嚏時，用紙巾掩口，如果有呼吸道疾病，應戴口罩及避免到人多的地方。
Water **水**	Water may be contaminated when faeces from an infected person go into the water source. 水源被病人的糞便污染。 eg. cholera and gastroenteritis. 例子：霍亂和腸胃炎。	Supply of clean drinking water. Proper disposal of faeces. Drinking water should be boiled. 清潔的食水供應，妥善處理糞便，將食水徹底煮沸。
Food **食物**	Food may be contaminated when prepared by unwashed hands; crops fertilized with faeces from infected persons; meat, milk and eggs from diseased animals or not proper treated. 食物可能因下列原因受到污染:未洗手處理食物，用病人糞便施肥，肉類、牛奶和蛋來自有病的牲口或不當處理。 eg. Cholera and food poisoning. 例子：霍亂和食物中毒。	Wash hands before handling food. Cook food thoroughly. Keep meat, milk and egg products in refrigerator. 處理食物前洗手，徹底煮熟食物，把肉類、牛奶和蛋類製品儲在雪柜。

Vector 媒介	A vector is an organism that carries pathogens to a new host. Mosquitoes, flies and cockroaches are common vectors. 媒介是把病原體攜帶至新宿主的生物。蚊、蒼蠅和蟑螂是常見的媒介。 eg. Malaria caused by plasmodium is infected by female anopheles mosquito carrying the protozoa when sucking blood of the host. 例如:瘧疾是由瘧疾原蟲引起的，它由帶病原體的雌瘧蚊在吸血時傳播。 Flies carry cholera bacteria from faeces and transfer it to the food they touch. 蒼蠅接觸糞便，把霍亂弧菌傳至其他食物。	Remove the breeding ground of the vectors. Kill the vectors. Prevent contact with vectors. 移除媒介滋生的地方； 把媒介殺死； 避免與媒介接觸。
Body fluids 體液 (blood, semen, vaginal fluid) (血液、精液、陰道分泌物)	Blood or body fluid may enter other's blood stream through wounds, sharing of needles or sex. If these body fluids contain pathogens, diseases may be transmitted. 血液或體液可透過傷口、共用針筒和性行爲進入另一人的血液中，若這些體液帶有病原體，便會傳播疾病。 eg. AIDS and hepatitis B is infected by blood or body fluids during sexual contact. 例如:愛滋病和乙型肝炎便是透過血液或在性交時透過體液傳染。	Wear glove when handling wounds 處理傷口時帶手套。 Cover any wound with a dressing. 用紗布覆蓋傷口。 Do not share injection needles. 不要共用針筒。 One sex partner only. 只有一名性伴侶。 Always use condoms correctly. 經常使用安全套。
Direct contact 直接接觸	Transmission of diseases through touching the skin, wounds or mucous membranes of an infected person or through kiss or sexual behaviour. 疾病傳播是透過接觸患者的皮膚、傷口或黏膜，或經接吻和性接觸而傳播。 eg. Athlete's foot on skin is a fungal disease infected by body contact or clothing contact. 例子:香港腳是由真菌引起的皮膚病，透過身體接觸及衣物傳染。	Reduce physical contact with infected people. 避免與患者有身體接觸。 Maintain good personal hygiene. 保持良好的個人衛生。

5. What are antibiotics?

抗生素是什麼?

They are chemicals **produced by various fungi and bacteria**, which **suppress the growth of other microorganisms** or even kill it, thus reducing the competition for resources. eg. penicillin.

抗生素是**由不同的眞菌及細菌所產生的化學物品**，它**可抑制其他微生物的生長**，甚或殺死它們，減低資源上的競爭，讓自己得以生存，例如青黴素。

6. How do antibiotics kill or inhibit the growth of bacteria?

抗生素如何殺死或抑制細菌的生長?

Antibiotic like penicllin can inhibit the synthesis of bacterial cell wall. Because bacterial cells are **prokaryotic**, the **adverse effects of antibiotics will not happen on the eukaryotic cells** of the host and so antibiotics may be safely used throughout the body. Other antibiotics **may interfere DNA, RNA, protein synthesis and cellular metabolism o**f the microorganisms. They can be used as a drug inside our body to inhibit the bacterial growth.

抗生素如青黴素**能抑制細菌胞壁的合成**，因爲細菌是**原核生物**，青黴素的**不良作用不會發生於宿主的眞核細胞中**，故抗生素可安全使用於人體中，其他的抗生素可**干擾微生物的 DNA、RNA、蛋白合成及代謝作用**，它們皆可用於抑制體內的細菌生長。

7. What are the consequences of indiscriminate use of antibiotics?

濫用抗生素有什麼後果?

1. Development of antibiotic resistance bacteria.
   產生能抵抗抗生素的超級細菌
2. Previously treatable diseases may become untreatable.
   以前可治的病變成不治。
3. Development of new antibiotics needs time and a lot of resources.
   研製新藥需時及大量資源。
4. Antibiotics kill beneficial bacteria in our body as well and this may promote the growth of pathogens.
   抗生素會同時殺死體內的有益細菌，從而促進病原體的生長。

8. How do use antibiotics properly?

說出正確使用抗生素的方法。

(1) Use antibiotics only when they are truly needed.
   有眞正需要時才使用抗生素。
(2) Complete the course of antibiotics as advised by the doctors even though there is an apparent recover from the disease.
   按醫生指示完成整個療程，即就算覺得已復原，也該繼續吃藥，直至吃完所有藥爲止。
(3) Develops new drugs or alternative treatment.
   研發新藥物或其他療法。

9. What are Sulpha drugs?

磺胺類藥物是什麼?

Sulpha drugs can stop bacteria from reproduction and growth. It is an effective drug in the treatment of bacterial infections. This is because its structure is similar to some metabolite in the bacteria. Hence, it competes with the normal metabolite for the active site of bacterial enzymes. As a result, the bacterial enzymatic reaction slows down and growth of bacteria is inhibited.

磺胺類能抑制細菌的生長和繁殖，它是有效的抗菌藥物，因它的結構和細菌的某些代謝物相似，它會和細菌的代謝物爭奪細菌內某些酶的活性部位。結果，細菌的酶促作用減慢，細菌的生長受到抑制。

10. Explain the use of cocktail therapy in treatment of AIDS?

解釋「雞尾酒療法」如何醫治愛滋病。

It involves the taking a number of drugs at the same time that target different points in the reproductive process of HIV. These drugs are effective in suppressing the replication of viral proteins and the synthesis of viral DNA (also prevent the virus to develop drug resistance). It relieves the symptoms and let the patients live longer.

「雞尾酒療法」醫治愛滋病，這是同時使用多種藥物，針對 HIV 繁殖過程中不同的環節。這些藥物能有效地抑制病毒蛋白質和遺傳物質的合成(同時防止病毒發展抗藥性)，減輕症狀，讓病人存活多年。

Check point 測試站 (45)

1. What are non-infectious diseases?

非傳染病是什麼?

Non-infectious diseases are diseases that cannot be transmitted from person to person. Example:

非傳染病不會人傳人。例如:

A. Allergies 過敏
B. Cancer 癌症
C. Cardiovascular diseases 心血管疾病
D. Diabetes mellitus 糖尿病

2. What is a risk factor?

高危因素是什麼?

A risk factor is anything that may increase the risk of developing a disease. There are four types : biological, genetic, environmental and behavioural risk factors.

高危因素是指任何能夠增加患上某疾病的風險的因素，有四類: 生物性、遺傳性、環境性和行爲性高危因素。

3. What is allergy?

過敏是什麼?

A risk factor is anything that may increase the risk of developing a disease. There are four types : biological, genetic, environmental and behavioural risk factors.

高危因素是指任何能夠增加患上某疾病的風險的因素，有四類: 生物性、遺傳性、環境性和行爲性高危因素。

Allergies are related to over-reaction of immune response. It is an antigen-antibody reaction which occurs in certain individuals upon exposure to substances that are harmless to other individuals under similar conditions. eg. asthma.

過敏是身體免疫系統反應過激所引起，這是因接觸某種物質所引起的抗原與抗體的反應，在相同的情況下，某些人會無事，有些人則會因反應過激而受傷，例如哮喘。

4. State the risk factors of allergy?

說出過敏的高危因素?

Family history and esposure to allergens.

家族病史和接觸過敏原。

5. State the proper lifestyle to prevent allergy?

說出避免過敏的合適生活方式?

1. Prevent contact with allergens
   避免接觸引發敏感的物質
2. Drug treatment.
   藥物治療
3. Keep house clean.
   保持家居清潔
4. Early treatment respiratory infection
   及早治理呼吸道感染
5. Regular exercise.
   適量運動

6. What is cancer?

癌症是什麼?

Cancer is caused by uncontrolled and disordered cell division.

癌症由不受控制的細胞分裂引起。

7. State the risk factors of cancer?
說出癌症的高危因素?

1. **Ionizing radiation 電離輻射**

   They cause mutation in the somatic cells or activate genes that are not normally expressed. The control of normal mitotic cell cycles is ruined and the affected cell becomes cancerous.
   它們將細胞內的DNA鏈打斷，引致體細胞發生突變或活化某些本來被抑制的基因，於是控制細胞正常分裂週期被摧毀，受影響的細胞變成癌細胞。

2. **Chemicals (cacinogens) 化學物質（致癌物）**

   They damage DNA molecules.
   它們均會破壞DNA分子。

3. **Viral infection 病毒感染**

   Viruses that cause cancer usually carry oncogenes.
   引起癌症的病毒通常帶有致癌基因。

4. **Hereditary predisposition 遺傳因素**

   Cancer is more common in some families than others, indicating a genetic link.
   某些家族的成員較易患上癌症，相信是與遺傳有關。

5. **Certain lifestyles 某些生活方式**

   Eating over-processed and refined foods which are low in fibre, or foods that are too much fat.
   進食低纖維的過份處理及精製食物、或高脂肪食物。

   Eating too much salted fish during childhood.
   鼻咽癌是童年時進食太多鹹魚。

   Smoking may lead to lung cancer and oral cancer whereas alcoholism can lead to liver cancer.
   吸煙會引致肺癌及口腔癌；酗酒亦會引致肝癌。

8. State the treatment of cancer?
說出醫治癌症的方法?

1. Surgery – physical removal of the cancerous growth, depending on its type, nearby tissues and organs.
   外科手術 － 視乎癌症的種類、鄰近組織和器官，利用外科手術移除癌腫。
2. Radiotherapy – treating the cancer cells with X-rays or other sources of radiation. It involves beaming radiation into the body or placing a small amount of radioactive material directly into the body.
   放射性治療 — 利用X光或其他輻射殺死癌細胞。輻射可從身體外面射入或直接將少量輻射物質置於體內。
3. Chemotherapy – use anti-cancer drugs to destroy cancer cells.
   化療 — 使用抗癌藥物破壞癌細胞。

9. What is cardiovascular diseases?
心血管疾病是什麼?

It occurs when the transportation system is unable to keep up with the demands of the rest of the body. There are many different types of cardiovascular disease: coronary heart disease, hypertension, heart failure and stroke.
若運輸系統的功能未能滿足身體的需要時，便患上了心血管病。心血管病有不同的種類，包括冠心病、高血壓、心衰竭及中風。

10. State the risk factors of cardiovascular diseases?
說出心血管疾病的高危因素?

1. **Age** – risk increases with age, 80% of people who die of coronary heart disease are 65 or older.
   年齡 — 年齡愈大，機會愈大；約八成死於冠心病的病人年齡超過 65 歲。
2. High levels of **cholesterol** in the blood
   血液**膽固醇**水平過高
3. **High blood pressure** – risk increases with increasing blood pressure, which is associated with high salt intake, excessive caffeine or alcohol.
   高血壓 －血壓愈高，心臟負荷愈大。這與進食太多鹽分、咖啡因或酒精有關。
4. **Cigarette smoking** – smokers have twice the risk for heart attack than non-smokers. The nicotine in the cigarette smoke causes constriction of the blood vessels, thus raising the blood pressure.
   吸煙 － 吸煙者出現心臟病發的機會較非吸煙者高達兩倍。香煙中的尼古丁令血管收縮、血壓上升、血液膽固醇水平上升、及心跳增加。
5. **Lack of physical activity** – people who are not physically active have twice the risk for heart disease than those who are active. Aerobic activity helps to strengthen the heart and maintains a healthy blood flow in the vessels.
   缺乏運動 － 缺乏運動的人患上心臟病的機會較經常運動人仕高兩倍。帶氧運動有助加強心臟及維持血管內的正常血液流動。
6. **Obesity** – people who are overweight have a higher risk for cardiovascular disease.
   過度肥胖 － 體重過胖人仕較易患上心血管病。

   7. **Diet** – risk increases with high intake of saturated fat and salt (over-processed foods). Saturated fat will raise blood cholesterol levels; high intake of fat will also cause obesity.
   膳食 － 進食過多的飽和脂肪和鹽分(過分處理的食物)均會增加患病機會。飽和脂肪會提升血液膽固醇水平，進食過多的脂肪亦會導致癡肥。
8. **Stress** – it raises blood pressure because hormones released causes constriction of blood vessels.
   壓力 － 身體釋出的激素引致血管收縮，血壓上升。
9. **Alcohol drinking** – risk increases with high intake of alcohol as it causes high blood pressure.
   喝酒 － 過量喝酒引致血壓上升，增加患病機會。
10. **Diabetes** – an increased risk for people with diabetes.
    糖尿病 － 糖尿病患者有較高的機會患上心血管病。

11. State the treatment of cardiovascular diseases?

說出醫治心血管疾病的方法?

This includes rest, drug treatment to reduce high blood pressure, valve replacement surgery, fitting an electronic pacemaker to control heart rhythm, heart transplants, balloon angioplasty, and bypass operations to re-route the blood and avoid diseased blood vessels.

休息、降血壓藥、瓣膜替換手術、植入電子起搏器以控制心律、心臟移植、血管擴張手術(通波仔)、心血管分流手術以繞過受影響的血管，均是一些治療心血管病的有效方法。

12. What is diabetes?

糖尿病是什麼?

Diabetes mellitus is a chronic disease in which the pancreas does not produce enough insulin to meet the body's requirement or the body cannot properly react to the insulin. Blood glucose level remains high and exceeds the absorptive capacity of kidney tubule, hence glucose overflows into the urine and passes out of the body.

糖尿病是一種慢性疾病，由於胰臟不能製造足夠的胰島素以滿足身體的需要，或身體未能充分利用胰島素所致。血液中葡萄糖濃度因而上升，超出腎小管重吸收的能力，葡萄糖因而從尿液中流失。

13. State the risk factors of diabetes?

說出糖尿病的高危因素?

Type I: Hereditary factors

I 型 : 遺傳

Type II: Ageing, Unhealthy lifestyles: obesity, insufficient exercise

II 型: 年老,不健康的生活方式: 肥胖、運動不足

14. State the treatment of diabetes?

說出醫治糖尿病的方法?

Type I: Regular injections of insulin

I 型 : 定期注射胰島素

Type II: Low carbohydrate diet and regular exercise, drugs taken orally for lowering blood glucose level

II 型: 低碳水化合物膳食、經常運動、口服抗糖尿病(降血糖)藥物

15. How can we prevent diseases?

我們可怎樣預防疾病?

1. By vaccination and immunizaton program
   透過疫苗接種及免疫接種計劃
2. Adopt a healthy lifestyle.
   採取健康的生活方式
3. Maintain a healthy community
   保持社區健康

16. What is immunization?
免疫接種是什麼?

Weakened (living, treated by heating) or **killed microorganisms** are inoculated to the client to produce immune response. eg. Polio (living), cholera (dead).

接種**減弱**(活生，但經熱處理)了或**已死的微生物**來引發繼發免疫反應，例如小兒麻痺(活生)和霍亂(已死)。

17. Explain how immunization contributes to disease prevention.
解釋免疫接種如何有助預防疾病。

If the majority of people are immunized, infectious diseases will not spread easily in the community. The health and lives of individuals and the community are protected.

若果大部分人都有接受疫苗注射，傳染病便難以在社區散播，而個人和社區的健也同樣受到保障。

18. What is community health?
甚麼是社區健康?

The protection and improvement of health of the whole community.

保障和改善整個社區的健康。

19. What major activities does community health contain?
社區健康應包括那些活動?

1. Screening for infections or diseases
   篩選受感染的人
2. Diseases surveillance
   疾病監察
3. Promotion of health education
   推廣健康教育

20. State some examples of healthy lifestyles.
說出一些健康生活方式的例子。

Do's 應做	**Don'ts 不應做**
Balanced diets 均衡飲食	Do not smoke 不吸煙
Exercise regularly 經常運動	Do not abuse alcohol 不酗酒
Enough sleep and rest 充足睡眠和休息	Do not abuse drugs 不濫用藥物
Good personal hygiene 良好個人衛生	
Regular body check up 定期身體檢查	

Check point 測試站 (46)

1. **Explain non-specific defence mechanism.**
   解釋非專一性防衛基制。
   Non-specific defence mechanisms involve **skin, cilia and mucus, gastric juice, tears and saliva, phagocytes and inflammation**.
   The skin is a very effective barrier to prevent the entry of pathogens. Damaged skin area is rapidly sealed off by blood clot.
   Dusts and germ particles breathed in are trapped by mucus on the nasal surfaces and trachea lining. Then, they are carried by cilia to the pharynx and are swallowed.
   Bacteria in food are killed by gastric juice and digestive enzymes.
   The enzymes in tear and saliva can break down the cell walls of certain bacteria on the conjunctiva and in the mouth cavity.
   When bacteria enter the body, inflammation occurs. Many phagocytes come and ingest the germs.
   非專一性防衛機制包括使用**皮膚、纖毛和黏液、胃液、眼淚和唾液、血液凝固、吞噬作用及炎性反應**等。
   皮膚是有效的屏障，能阻止病原體入侵，受傷的皮膚很快便會用血枷將傷口遮蓋。
   吸入的塵埃及病菌會被呼吸道上的黏液黏住，跟著會被纖毛掃往喉頭，吞進胃內。
   食物中的細菌會被胃酸及消化酶殺死。
   眼淚和唾液溶菌酶能破壞結膜上和口腔內某些細菌的細胞壁。
   當有漏網的細菌進入身體，會有炎性反應發生，許多吞噬細胞會到來將它殺死。

2. **Explain inflammatory response.**
   解釋炎性反應。
   Phagocytosis causes inflammation at the site of infection. The four symptoms of inflammation are **swelling, reddening, warmth and pain**. Swelling is due to the increase in permeability of blood vessels so that more plasma leaks out from the blood vessels. Redness is caused by the dilation of blood vessels so that more blood and thus red blood cells is carried to the inflamed region. Warmth is caused by more blood carrying more heat to the region. The pressure of the surplus tissue fluid on the nerve causes pain.
   The hot and swollen region contains many dead bacteria and phagocytes which are known as pus.
   Inflammation results when histamine is released into the wound as a result of injury or infection. This causes dilation of blood capillaries from which plasma, containing antibodies, diffuse into the infected tissues.
   Lymphocytes (phagocytes) may pass through the capillary walls to the infected area too.
   吞噬細胞會在受感染地區引起發炎，發炎的四個病徵是：腫脹，變紅、發熱和疼痛。腫脹是因血管的透性增加，更多的血漿從血管漏出，滲到受感染地區；變紅是因爲血管擴張使更多血及更多紅血球流到受感染地區；發熱是因爲更多血流到該處會帶來熱能；疼痛是由過多的體液壓迫神經所引起的。
   紅腫的地區有許多的死細菌及死吞噬細胞，所積聚的液體名爲膿。發炎時，受感染地區會釋出組織胺，它會使血管擴張，促使更多帶有抗體的血漿擴散到受感染地區，淋巴球(吞噬細胞)亦會穿過微血管壁到達受感染地區。

3. **Explain the term immunity.**
   解釋名詞免疫力。
   The capacity to recognize the invasion of foreign materials and to activate cells and cell products to remove these foreign materials with great speed and effectiveness.
   辨別入侵的外來物及激發細胞產生產品以快速清除該外來物的能力。

4. **Explain the term antibody.**
   解釋名詞抗體。
   A Y-shaped molecule synthesized by an animal in response to antigen (foreign substances). Antibodies combine with their appropriate antigens and neutralize their action, preventing them form causing harm.
   由動物身體製造以消滅抗原(外來物)的一種 Y 形球蛋白，抗體可和對應的抗原結合，將它溶解，中和它們的毒素，防止它們傷害身體。

5. **Explain the term antigen.**
   解釋名詞抗原。
   any chemical molecule present on the surface of pathogens which will stimulate the production of antibodies.
   任何位於病原體表面的化學分子，可刺激身體產生抗體的異己物質。

6. **Explain the term lymphocytes**
   解釋名詞淋巴球。
   A type of white blood cell, produced by bone marrow which are important in immunity of the body.
   一種由骨髓產生的白血球，它於身體免疫力是非常重要的。

7. **Name the two types of specific defence mechanism.**
   說出兩種專一性防衛機制。
   Humoral immune and cell mediated immune response.
   體液免疫反應和細胞介導免疫反應

8. **Explain humoral (antibody-mediated) immune response.**
   解釋體液免疫反應。
   1. It targets pathogens free in body (extracellular pathogens) eg. bacteria.
      它專門對付細胞外並游離於體液中的病原體，例如細菌。
   2. In response to antigens, the **B-cells** (have antigen receptors on their surfaces, only bind with specific antigen) will differentiate and proliferate to form **a plasma cell clone**.
      抗原會激活 **B 細胞**(B 細胞表面有抗原受體，只與特定抗原結合)，B 細胞會分化爲**漿細胞**，經細胞分裂激增爲一漿細胞克隆。
   3. The plasma cells can produce **antibodies**.
      漿細胞會分泌**抗體**(免疫球蛋白)。

4. The antibodies then attack the antigen. They combine with them, drill holes, clump them together and neutralize toxins produced by microorganisms.
   抗體可和抗原結合，在細胞壁上鑽洞、將它們黏在一起、溶解它們或中和它們的毒素。
5. Antibodies are highly specific for the antigens.
   抗體具專特性，只和對應的抗原結合。
6. They also speed up phagocytosis.
   抗體亦可促進吞噬作用。
7. In addition, **memory B cells** are produced.
   有少量 B 細胞不分化爲漿細胞而變爲**記憶 B 細胞**。

9. Explain the action of antibodies produced by plasma cells.
解釋由漿細胞產生的抗體的作用。

Antibodies are highly specific for the antigens. They combine with them, drill holes, clump them together and neutralize toxins produced by microorganisms. They also speed up phagocytosis.
抗體具專特性，只和對應的抗原結合。抗體可和抗原結合，在細胞壁上鑽洞、將它們黏在一起、溶解它們和中和它們的毒素。抗體亦可促進吞噬作用。

10. Explain cell-mediated immune response.
解釋細胞免疫反應。

1. It targets intracellular pathogens (eg. viruses) and cancer cells.
   它專門對付細胞內的病原體(如病毒)和癌細胞。
2. In response to infection, **T-cells** are stimulated to proliferate and produce **two clones** of T-cells.
   抗原會激活 **T 細胞**，T 細胞受刺激會分化及增殖爲兩組 T 細胞克隆。
3. One is **killer T cell** and the other is **helper T cell**.
   一組是**殺手 T 細胞**，另一組是**輔助 T 細胞**。
4. Killer T cells **kill body cells that have been invaded** by viruses thus preventing the multiplication of the viruses.
   殺手 T 細胞會**殺死被病毒感染了的細胞**，從而阻止了病毒的繁殖。
5. The other, helper T cell, releases **lymphokines** to **activate phagocytes** to carry out phagocytosis.
   另一組輔助 T 細胞會分泌**淋巴激活素**以**激活吞噬細胞**去吞噬病原體。
6. Memory T cells are produced, too.
   還有少量 T 細胞被激活後變爲**記憶 T 細胞**。

11. What are the difference between cell-mediated and antibody-mediated immune responses?
體液免疫反應和細胞介導免疫反應有什麼分別？

	Antibody-mediated 體液免疫反應	**Cell-mediated 細胞介導免疫反應**
Cell recognizing antigen **識別抗原的細胞**	B-cells B 細胞	T-cells T 細胞
Origin of the cell **細胞的來源**	Lymphoid tissue (bone marrow) 淋巴組織（骨髓）	Thymus gland 胸腺
Cells formed from proliferation **增殖時所形成的細胞**	One plasma cell clone 一個漿細胞克隆	Two clone of T-cells 兩個 T 細胞克隆

Functions of the cells **純系細胞的功能**	The plasma cells can produce antibodies. Antibodies then attack the antigen. They combine with them, drill holes, clump them together and neutralize toxins produced by microorganisms. 漿細胞會分泌抗體(免疫球蛋白)，抗體可和抗原結合，鑽孔、將它們黏在一起、溶解它們和中和它們的毒素。	Killer T-cells kill body cells which have been invaded by viruses thus preventing the multiplication of the viruses. 殺手 T 細胞殺死被病毒感染了的細胞，從而阻止了病毒的繁殖。 Helper T-cells release lymphokines to activate macrophages to kill the antigens. 輔助 T 細胞會分泌淋巴激活素以激活吞噬細胞去殺死病原體。

12. Explain the role of memory cells in immune response.
解釋記憶細胞在免疫反應上的功能。

These are lymphocytes produced during the activation of specific defence mechanisms. They **greatly amplify the process of plasma cell formation and antibody secretion** when the antigen invades the body the second time.
它們是專一性防衛機制被激活時所產生的淋巴球，當再次受到感染時，它們可加快漿細胞及抗體的產生，使身體快速康復。

13. What are the difference between specific and non-specific immune responses?
專一性防衛機制和非專一性防衛機制有什麼分別？

	Specific immune responses **特異性防禦機制**	**Non-specific immune responses** **非特異性防禦機制**
Specificity **專特性**	It confers immunity against the effect of particular pathogens, (eg. the disease caused by a particular virus). 它給予對抗某種特定病原體的免疫力	It gives protection against many types of pathogens. They include mechanical barriers, enzymes and phagocytosis. 它可保護身體免受多種病原體的攻擊，包括利用屏障、消化酶和吞噬作用等。
Recognition **識別性**	It involves discrimination between self or non-self molecules 它可分辨自己及異己的分子。	It does not involve discrimination between self or non-self molecules 它不能分辨自己及異己的分子。
Memory **記憶性**	Memory cells are produced so that the second invasion of the same antigen will result in a more rapid, stronger and long-lasting response (secondary response). 有記憶細胞產生，當再次受到感染時，可加快漿細胞及抗體的產生，反應更強烈及更持久(繼發反應)。	Memory is absent. 沒有記憶細胞產生。

14. Distinguish between primary immune respones and secondary immune response.
分辨原發免疫反應及繼發免疫反應
Primary immune response:
原發免疫反應：

It is the response that is evoked when an antigen entered into the body for the first time. A few days after the invasion of the antigens (eg. bacteria), the number of B-cells (and T-cells) greatly increases to combat the antigen. The humoral immune response is being triggered, but it is slow. During this time, the person may develop disease symptoms as the antigen has enough time to cause damage to the body.
它是病原體初次進入身體所引發的免疫反應，抗原(細菌)入侵身體後數天，B 細胞(和 T 細胞)會增加以對抗抗原，體液免疫反應被激發，但此種反應很緩慢，在此段時期，病人會出現患病的症狀，因抗原有時間對身體造成破壞。

Secondary immune response:
繼發免疫反應：

The memory cells produced in the primary immune response will remain in the circulation for a long time. If the antigen invades again, the number of B-cells and antibodies will increase rapidly. The response is faster, stronger and longer lasting, producing greater amounts of B-cells (also T-cells) and antibodies. This is due to the presence of memory cells which can remember the pathogen. This response is called the secondary response.
在原發免疫反應過後會有記憶細胞留存於血流中一段時期，當抗原再次入侵，可加快 B 細胞(和 T 細胞)及抗體的產生，令免疫反應**更快、更強烈及更持久**，製造更多的 B 細胞(和 T 細胞)及抗體，這是**因爲記憶細胞可記住病原體**，此種反應名爲繼發反應。

15. What are the importance of secondary immune response in diseases prevention?
繼發免疫反應有什麼重要性：

Because of the production of memory cells, people can be immunized against certain disease such as polio and measles.
因爲記憶細胞可記住病原體，人類可在某些疾病獲得免疫力，例如小兒麻痺及麻疹。

16. State the functions of immune system.
說出免疫系統的功能：

The functions of the immune system are to recognize, respond to and eliminate foreign substances entering the body or arising in the body.
免疫系統可識別外物、對外物作出反應以致最終將它排除，阻止它們進入身體或在身體內出現。

17. Explain passive immunity.
解釋被動免疫。

It is the **passing of the antibodies into an individual in some way** rather than being produced by the individual himself, eg. antibodies can pass across the placenta from a mother to her foetus, or are passed to the newborn body in the mother's milk.
It may be acquired artificially by injection of antibodies from other individual. eg. in the treatment of tetanus and diphtheria. Passive immunity is temporary.
被動免疫是抗體非由個體自己產生，而是用某種方法輸入體內，例如透過胎盤將抗體從母體傳給胎兒，或透過母乳傳給初生嬰兒。
抗體亦可透過注射而獲得，例如在預防白喉及破傷風時。被動免疫只是短暫性的。

18. Explain active immunity.

解釋主動免疫。

Active immunity occurs when an organism **produces its own antibodies**.
It is the result of an infection. Once the body has started to produce antibodies in response to a disease causing agent, it may continue to do so for a long time (memory effect in secondary immune response). It is why most people suffered from diseases such as mumps and measles once.
It is possible to induce an individual to produce antibodies even without them suffering diseases. To achieve this, the appropriate antigen must be injected in some way. This is the principal of immunization (vaccination).
主動免疫是指個體自己產生抗體。
它是感染後的結果，當身體爲對付某種病原體而開始產生抗體後，它會繼續如此做一段長時間(繼發反應的記憶效應)，這是爲什麼感染腮腺炎及麻疹後便不會再受感染的原因。
根據此理，我們就算沒有患病，亦可誘發抗體的產生，只要注入適當抗原便可，這便是免疫接種(打預防針)的科學原理。

19. Explain passive immunization.

解釋被動免疫注射。

Antibody from infected patients or organisms are inoculated to the client to against the disease agent. eg. tetanus and diphtheria. This will have a fast action.
從受感染的病人或其他生物處抽取抗體，直接注入接種者，例如白喉和破傷風。
這種免疫力收效快。

20. Explain active immunization.

解釋主動免疫注射。

Weakened (living, treated by heating) or killed microorganisms are inoculated to the client to produce immune response. eg. Polio (living), cholera (dead).
接種**減弱**(活生，但經熱處理)了或**已死的微生物**來引發繼發免疫反應，例如小兒麻痺(活生)和霍亂(已死)。

21. Explain the need of a booster dosage in immunization programs?

爲什麼進行防疫注射時，經常要使用加強劑？

The first injection of vaccine brings about a primary immune response which provides low levels of antibodies and memory B-cells only. However the antibody level is not sufficient to protect the person from infection. The booster injection stimulates the proliferation of memory B cells and production of antibodies which stay in the body for a longer period of time. Therefore, further infection is prevented by the artificial acquired immunization.
首次的防疫注射引起原發免疫反應，只能產生小量抗體和記憶 B-細胞，抗體水平太低不足以保護身體免受感染，加強劑的使用可刺激身體產生更多的記憶 B-細胞和抗體，而且效力更持久，故此，可保護身體免受感染。

Check point 測試站 (47)

1. **How does the character of the living organisms controlled by?**
   生物的特徵是由什麼所控制的？
   Each character is controlled by a pair of genes which occur on the corresponding position of a pair of homologous chromosomes.
   每種特徵是由一對位於同源染色體相同位置的基因所控制。

2. **Explain the function of chromosomes and its relation with DNA.**
   解釋染色體的功能及其與 DNA 之關係。
   Chromosomes are made of genetic material found inside the nucleus at each cell. They are made of a chemical called DNA (deoxyribose nucleic acid). DNA has two strands which are twisted together to form a double helix.
   染色體位於每個細胞的細胞核內，內含遺傳物質，它們由去氧核糖核酸(DNA)組成，而 DNA 則由兩條扭在一起的雙螺旋帶組成。

3. **Explain the function of gene and its relation with DNA..**
   解釋基因的功能及其與與 DNA 之關係。
   Genes are the basic units of heredity. They are short lengths of DNA on chromosomes. They determine the inherited characters of an organism.
   基因是遺傳的基本單位，它們是位於染色體上的一小段 DNA(去氧核糖核酸)，能決定生物的遺傳特徵。

4. **State the name of the chains and its arrangement in DNA.**
   說出組成 DNA 的鏈的名稱及它的排列的方法。
   DNA consists of 2 polynucleotide chains (strands) coiled as a double helix.
   DNA 是由兩條多核苷酸鏈構成的雙螺旋。

5. **Describe the structure of nucleotide,**
   描述核苷酸的結構。
   Each nucleotide consists of a 5-C deoxyribose sugar which links to a phosphoric acid and to an organic base.
   每個核苷酸都是由一個五碳的去氧核糖與磷酸及鹼基連接而成。

6. **Name the four kinds of bases in DNA.**
   說出 DNA 的四種鹼基。

Type 類別	**Name 名稱**	
Pyrimidines 嘧啶	thymine 胸腺嘧啶	cytosine 胞嘧啶
Purines 嘌呤	adenine 腺嘌呤	guanine 鳥嘌呤

7. Describe the structure of the polynucleotide chain.
描述多核苷酸的結構。

In each polynucleotide chain, the phosphoric acid and deoxyribose sugar alternate with each other forming a backbone while the pyrimidines and purines project to the side of the chain.
在多核苷酸鏈，核苷酸間的連合是使用磷酸去連接去氧核糖而成一個骨幹，而鹼基則從旁伸出。

8. How do the 2 polynucleotide chains hold together?
兩條多核苷酸鏈如何連接在一起?

The 2 chains are **held together by complementary pairs of bases** (A-T, C-G) bounded by lose hydrogen bonds (2 H bonds in A-T pairs; 3 in C-G pair).
兩鏈之間由鹼基對聯繫，鹼基則靠氫鍵相連，腺嘌呤必定與胸腺嘧啶配對，而胞嘧啶必定與鳥嘌呤配對(腺嘌呤與胸腺嘧啶兩氫鍵，胞嘧啶與鳥嘌呤三氫鍵)。

9. Are the two polynucleotide chains identical?
兩條多核苷酸鏈是否完全相同?

The 2 polynucleotide chains are not identical but are **complementary,** one chain is the reverse of the other and **runs in opposite direction** (anti-parallel).
兩條多核苷酸鏈並非完全一樣而是互補的，其中一條是另一條的相反且走向相反(反向平行)。

10. What are the differences between DNA and RNA?
DNA 和 RNA 有甚麼不同?

DNA	RNA
1. Double helical strand 雙螺旋鏈	Single strand 單鏈
2. Deoxyribose sugar 去氧核糖	Ribose sugar 核糖
3. Thymine 胸腺嘧啶	Uracil 尿嘧啶
4. Occurs only in the nucleus 出現於細胞核	Occurs in the cytoplasm and nucleus 出現於細胞質及細胞核
5. One type of DNA 只有一種 DNA	3 types of RNA: mRNA, tRNA, rRNA 有三種 RNA：mRNA, tRNA, rRNA

11. Describe the process DNA replication.
描述 DNA 複製的過程。

1. The two polynucleotide chains of double helix **unwind and separate** by breaking of hydrogen bonds. Each polynucleotide chain serves as a template for new DNA synthesis.
   維持雙螺旋形狀的氫鍵斷裂，**兩條多核苷酸鏈解離**，每條多核苷酸鏈都作爲合成新 DNA 的模板。
2. Free nucleotides (synthesized in cytoplasm) migrate to the **template** polynucleotide chains (A pairs with T with 2 H-bonds; C pairs with G with 3 H-bonds) in a complementary relationship.
   自由核苷酸（在細胞質製造）會以互補的形式移往多核苷酸**模板**，腺嘌呤與胸腺嘧啶配對，而胞嘧啶與鳥嘌呤配對。
3. The **lined up nucleotides are then joined together** to form a new polynucleotide chain complementary to the template. **DNA polymerase** is required for joining up the nucleotides.
   排成一行的核苷酸進行連接，形成一條與模板互補的新多核苷酸鏈，這過程需要 **DNA 聚合酶**。
4. Two new DNA molecules are formed. They are identical to the parent DNA. The new DNA has **one new polynucleotide and one old polynucleotide**. ie. DNA replication is semi-conservative.兩條相同的 DNA 便形成，它們與親本 DNA 完全一樣，新 DNA **有一條新的多核苷酸鏈和一條舊的多核苷酸鏈**，故此 DNA 的複製是半保留的。

12. Why is the DNA replication called semi-conservative?
爲什麼 DNA 的複製被稱爲半保留複製?
Two new DNA molecules are formed. They are identical to the parent DNA. **The new DNA have one new polynucleotide and one old polynucleotide**. i.e. DNA replication is semi-conservative.
兩條相同的 DNA 便形成，它們與親本 DNA 完全一樣，新 DNA 有一條新的多核苷酸鏈和一條舊的多核苷酸鏈，故此 DNA 的複製是半保留的。

Check point 測試站 (48)

1. State Mendel's first law.
說出孟德爾的第一定律。
Genes exist in pairs and in the formation of gametes, **each gene segregate from the other member of the pair** and passes into a different gametes so that **each gamete has one, and only one, of each kind of gene.**
基因以對的形式存在，當配子形成時，這對基因的**兩個成員會彼此分離**，使**每個配子只能分配到每對基因的其中一員**。

2. State the criteria to select a species for use in genetic experiments.
說出選取一個合適品種作遺傳實驗的條件。

1. It should have a short generation time, so that results can be observed quickly.
   世代時間要短，因爲要快速得到結果。
2. It should reproduce sexually, so that variations can be easily observed.
   能作有性繁殖，以致有可觀察的變異。
3. It should produce large numbers of offspring, so that the results can be statistically analyzed.
   能產生大量後代，使結果可作有效的統計分析。
4. It should be small in size and therefore easy to handle and able to breed in laboratory conditions.
   體積很細小，能於實驗室飼養及容易處理。
5. Contrasting characters can be easily observed.
   對比性狀容易觀察。

3. How to find out the genotype of an organism with an observed dominant phenotype?
怎樣知道具有顯性特徵生物的基因型？

we must cross the organism of an unknown genotype with an organism homozygous for the recessive character. We call this type of cross a test cross.
我們可將這生物與一具有雙隱性特徵的生物進行雜交，我們稱這類雜交爲測交。

4. Why are garden peas suitable for genetics studies?
爲什麼碗豆適合作遺傳研究？

Garden peas are suitable for genetics studies. This is because they have some contrasting and easily recognizable characteristics, eg tall and short stems.
因爲它們有明顯差別的特徵，如高莖和矮莖。

5. How would you assure the stigma of one pea plant only receive the pollens of another pea plant (cross pollination)?
你如何確保一朵豆花的柱頭只能接收另一朵豆花的花粉 (異花傳粉)？

First of all, remove the stamen before the flower is mature. Then, by using a small brush, transfer the pollens from another flower to the stigma of this flower. At last, wrap the flower by a plastic bag to prevent pollination from other flowers.
首先，在花朵成熟前切去花藥，熟後用小毛刷在這朵花的柱頭上刷上另一朵豆花的花粉。最後，用膠袋把這朵花包裹蓋封，以防止再度傳粉。

6. How would you assure self pollination.
你如何確保自花傳粉?

Wrap the flower with a plastic bag before it is mature to assure self pollination.
在花朵成熟前用膠袋把這朵花包裹蓋封，以確保自花傳粉。

7. State Mendel's second law.
說出孟德爾的第二定律。
The distribution of each pair of genes is independent of the distribution of any other pair.
一對等位基因的每個成員都可以與另一對的任何一員自由組合。

8. Explain sex determination in human beings.
解釋如何決定人類的性別。
Every body cell of a human being has 23 pairs of chromosomes of which one pair, known as the sex chromosomes. is very important in the determination of sex. All egg cells carry a X chromosome. When a sperm carries a X chromosome is fertilized with an egg, a zygote with 2 X chromosomes will be formed which will develop to a female. When a sperm carries a Y chromosome is fertilized with an egg, a zygote with one X chromosome and one Y chromosome will be formed which will develop to a male.
每個人體細胞都有 23 對染色體，其中一對名爲性染色體，對性別的決定非常重要。
卵子必定帶有 X 染色體，當一條帶有 X 染色體的精子與卵子結合，便會形成一個含有兩條 X 染色體的合子，這合子會發展成一個女性。 當一條帶有 Y 染色體的精子與卵子結合，便會形成一個含有一條 X 和一條 Y 染色體的合子，這合子會發展成一個男性。

9. Explain the probability of having a boy and a girl is equal.
解釋爲什麼生男生女的機會是相等的。
Since the number of X-bearing sperms and Y-bearing sperms are equal, and the fusion of the gametes is random, therefore the chance of having a boy or girl child is the same (50%)
由於帶有 X 染色體的精子數目與帶有 Y 染色體的精子數目是相等的，同時配子的結合是隨機的，每次誕下男嬰或女嬰的機會率同是 50%。

10. What is meant by multiple alleles?
何謂複等位基因？
The condition in which three or more different forms of a gene (alleles) that produce different phenotypes of a certain character occur at the same loci of a chromosome.
基因出現三個或以上的不同形式的情況，在某一特徵可產生多種不同的表現型，這些等位基因都位於染色體的相同位點。

11. What is meant by sex linkage?
何謂性連遺傳?
Sex linkage is the inheritance of a particular trait associated with the inheritance of sex, which is caused by the location of genes on sex chromosomes (usually X chromosomes).
某種特徵的遺傳和性別有關，這是由於控制該特徵的基因位於性染色體(通常是 X 染色體)而引起的。

12. Explain the cause of colour blindness.

解釋色盲的病因。

Defect occurs on the gene which control the formation of cone cells. There is reduced number of or some defect in one or more of the three types of cone cells. As it is a kind sex-linked inheritance, most patients are male.

病因是控制製造視錐細胞的基因受損，以致其中一種或三種視錐細胞的數目不足或有缺陷。因是 X 染色體性連遺傳，患者以男性居多。

13. What is discontinuous variation?

什麼是不連續變異？

The characters of individuals are very definite and clear cut and usually can be grouped into 2 distinct classes with no intermediates between them.

個體的特徵非常明顯，通常可分爲沒有中間型的兩組。

14. What is continuous variation?

什麼是連續變異？

The characters of individuals are not quite clear cut and cannot be grouped into distinct alternate classes.

個體的特徵不容易分類，特徵從一極端逐漸轉變爲另一極端。

15. What are the causes of genetic variation?

遺傳變異的成因是什麼？

Heredity 遺傳:

1. Independent assortment of chromosomes at meiosis → many different combination of gametes.
   染色體在減數分裂時的獨立分配→配子都各自擁有一套不同的等位基因。
2. Random fertilization of gametes.
   配子的隨機受精作用。
3. Mutation: sudden and inheritable change of the gene.
   突變：基因發生突然和永久性的遺傳變化。

Environment 環境:

If one of the identical twins is brought up in a well-nourished environment while the other in a poorly-nourished environment, the former will be heavier than his twin.

若單卵雙生的其中一個個體在營養充足的環境下長大，而另一個則在營養較差的環境下長大，結果前者會較胖。

16. What is mutation?

何謂突變?

Sudden and inheritable change of the gene.

基因發生突然和永久性的遺傳變化。

Check point 測試站 (49)

1. **In what form does DNA carry genetic information.**
   DNA 以什麼形式攜帶遺傳資訊?
   It carries genetic information in the form of **specific nucleotide base sequence**.
   它以特定的鹼基順序儲存遺傳資訊。

2. **How is code word represented?**
   遺傳密碼以甚麼形式表達?
   Each code word is represented by **3 successive nucleotide bases** which specifying a particular amino acid.
   每個遺傳密碼都是由三個連續不斷的鹼基所組成，此三個鹼基形成一個三聯體密碼，名爲密碼子，每個密碼子都爲一個氨基酸編碼。

3. **How does the sequence of cord words affect the protein structure?**
   遺傳密碼的次序如何影響蛋白質的結構?
   The sequence of code words **determines the sequence of amino acids** incorporated into a polypeptide chain or protein.
   遺傳密碼透過決定多肽鏈的氨基酸順序來決定蛋白質的種類。

4. **How does DNA determine an organism's characteristics?**
   DNA 如何決定一個生物的性狀?
   Phenotype of organisms depends on types of protein present. e.g. enzymes. **By determining which enzymes are produced**, the DNA can determine an organism's characteristics.
   個體的表現型受決於何種蛋白質(例如酶)的存在。
   大部分的生化合成都需酶(蛋白質)的參與，故決定酶的產生便可決定一個生物的特徵.

5. **Explain the necessity of a triplet code in coding for amino acids.**
   爲什麼需要爲氨基酸編碼時需要用三聯體密碼?
   There are just twenty amino acids in proteins, and each must have its own cord of base on the DNA. A triplet code of bases produces sixty-four codes, more than enough to satisfy the requirements of twenty amino acids. This is called the triplet code.
   蛋白質由 20 種氨基酸組成，每種氨基酸都應在 DNA 有它的遺傳密碼，三聯體密碼(用三個鹼基爲氨基酸編碼)可產生 64 (4^3) 種遺傳密碼，足夠爲 20 種氨基酸編碼而且有餘，故此遺傳密碼爲三聯體密碼。

6. **Explain why some codes must be degenerate.**
   解釋爲什麼有些遺傳密碼需作簡併。
   As there is 64 triplet codes for 20 amino acids, some codes must be degenerate.
   i.e. more than one codon specify one amino acid.
   因爲有 64 個密碼子爲 20 個氨基酸編碼，有些密碼需作簡併，即是多於一個密碼子爲一個氨基酸編碼。

7. **What is meant by genetic code is commaless?**
   遺傳密碼是沒有逗號的是什麼意思?
   No nucleotide base to separate the codons
   即是沒有鹼基分隔開密碼子。

8. **State the name of the code that do not code for any amino acid and give its function**
   有些密碼子並不爲任何氨基酸編碼，請說出它們名稱和功能。
   Some codes do not code for any amino acid, they are called nonsense code.
   These codes are signals for the termination of polypeptide chain.有些密碼子並不爲任何氨基酸編碼，它們被稱爲無意義密碼子，它們是終止多肽合成的訊號。

9. **Distinguish between codon and anticodon.**
   分辨密碼子與反密碼子。
   Codon is a three bases sequence (triplet) on the mRNA and specifies for one amino acid.
   Anticodon is also a triplet but on tRNA. The sequence on codon is complementary to the corresponding anticodon.
   密碼子是位於 mRNA 的三聯體密碼，它爲一個氨基酸編碼。
   反密碼子亦是三聯體密碼，但位於 tRNA，密碼子的順序和對應的反密碼子順序成互補。

<u>Check point 測試站 (50)</u>

10. **Why is the DNA replication called semi-conservative?**
    爲什麼 DNA 的複製被稱爲半保留複製?
    Two new DNA molecules are formed. They are identical to the parent DNA. **The new DNA have one new polynucleotide and one old polynucleotide**. i.e. DNA replication is semi-conservative.
    兩條相同的 DNA 便形成，它們與親本 DNA 完全一樣，新 DNA 有一條新的多核苷酸鏈和一條舊的多核苷酸鏈，故此 DNA 的複製是半保留的。

11. **Explain the term transcription.**
    解釋名詞轉錄。
    It is the process by which the genetic message is transcribed into the form of RNA (mRNA).
    這是將遺傳資訊轉錄在 RNA (mRNA) 的過程。

12. Describe the process transcription.

描述轉錄的過程。

The **double helix of DNA molecule unwind**.

The appropriate part of the DNA (gene) **serves as template** for formation of mRNA.

Pairing of nucleotides occur, adenine to uracil, cytosine to guanine.

When all complementary RNA nucleotides have paired with the free DNA bases **with the aid of the enzyme RNA polymerase,** they become **joined together to form a strand of mRNA.** The mRNA leaves the nucleus through nuclear pores. In the cytoplasm it is attached to the ribosome.

某段 DNA 雙螺旋(順反子)鬆開。

暴露出來的鹼基(合適的基因)作爲合成 mRNA 的模板。

鹼基配對發生，腺嘌呤與尿嘧啶配對，胞嘧啶與鳥嘌呤配對。

RNA 聚合酶沿著 DNA 移動，每次加一個互補 RNA 核苷酸到 DNA 新鬆開的部分，RNA 核苷酸連接在一起形成一條信使 RNA。

mRNA 分子太大，難以擴散通過核膜，故需穿過核孔離開，繼而附在細胞質的核糖體。

13. Explain the term translation.

解釋名詞轉譯。

It is the process by which **genetic message is decoded on the ribosome** where **mRNA is used as a template directing the specific amino acid sequence** during protein synthesis.

轉譯是將載於 DNA 的遺傳資訊解碼，利用 mRNA 作模板指揮氨基酸排成特定的順序以合成蛋白質。

14. Describe the process translation.

描述轉譯的過程。

During translation, a group of **ribosomes becomes attached to the mRNA** to form polysome. The **complementary anticodon of a tRNA-amino acid complex is attracted to the first codon on the mRNA.** The second codon likewise attracts its complementary anticodon. **The ribosome act as binding site for the amino acids. Once they have combined by forming peptide bonds, the ribosome will move along the mRNA to hold the next codon-anticodon complex together** until the third amino acid is linked with the second. In this way **a polypeptide chain is assembled by the addition of one amino acid at a time.** The free tRNA is released back into the cytoplasm to pick up other amino acid. This up take of amino acid requires energy from ATP.

轉譯時，一群核糖體與 mRNA 結合成一種稱爲多核糖體的結構。

tRNA－氨基酸複合體的互補反密碼子被吸引到 mRNA 的第一個密碼子上。

同樣第二個密碼子吸引它的互補反密碼子到來。

核糖體作爲氨基酸的接合點，幫助兩個氨基酸形成肽鍵，它們一旦結合，核糖體便沿 mRNA 移動，幫助下一個密碼子－反密碼子複合體，直至第三個氨基酸與第二個氨基酸結合起來。

這樣每次增加一個氨基酸，便可裝配一條多肽鏈。

15. Describe how the information carried on DNA is used in protein synthesis
解釋載於 DNA 的資訊如何用於蛋白質的製造。

DNA carries genetic information **in the form of specific nucleotide base sequence**.
Then the description of the process transcription + translation. See question 12 and 14.
DNA 以特別的鹼基順序來攜帶遺傳資訊，跟著是寫轉錄及轉譯的過程，參考題目 12 及 14。

16. Describe the structure of tRNA.
描述 tRNA 的結構。

It is a single stranded polynucleotide chain twisted to form a helix by formation of H-bonds between complementary N-bases transcribed from DNA.
它是一條從 DNA 轉錄而來的多核苷酸單鏈，它自我扭結成一個螺旋，其形狀由鏈內的鹼基以氫鍵互相連結來維持。

17. Distinguish between the function of mRNA and tRNA.
分辨 mRNA 和 tRNA 的功能。

The function of **mRNA is to copy the message from DNA** and carries it from the nucleus into the cytoplasm where it **directs the assembly of a protein**
The function of **tRNA is to deliver its corresponding amino acid to the mRNA** where amino acids are assembled to form the protein
mRNA 將 DNA 的遺傳資訊抄錄下來，然後將此資訊從細胞核帶到細胞質，用這些資訊指揮氨基酸排成特定的順序以合成蛋白質。
每個 tRNA 都編配了一個特定的氨基酸，在蛋白質合成時，tRNA 將氨基酸運送到對應的 mRNA。

18. State the two types of chromosome aberration.
說出染色體突變的兩大種類。

Change in number of chromosome per cell.
染色體數目上的改變。
Changes in gross structure of a chromosomes.
染色體結構上的改變。

19. There are two types of changes in number of chromosome, name it.
說出兩種關於染色體數目改變的突變

Changes involve the entire set of chromosomes. (polyploidy)
整套染色體數目上的改變(多倍體)
Changes involve the addition or loss of one chromosome
增加或減少一條染色體

20. Explain trisomic and name one disease resulted from it.

以一種病例解釋三體性。

An individual having one extra chromosome. Eg. Mongolism /Down's syndrome

個體增加一條染色體，例如唐氏綜合症(蒙古癡呆症)。

21. Explain the cause of trisomic.

解釋三體性的成因。

Non-disjunction.

不分離現象。

22. Explain the term non-disjunction.

解釋不分離現象。

The failure of homologous chromosomes to separate at anaphase I of meiosis.

i.e. Some gametes get 2 copies of a chromosome, other get none.

同源染色體不能在減數分裂的後期 I 分離，有些配子有兩套染色體，有些一套也沒有。

23. How to identify trisomic (Down's syndrome)?

如何辨識三體性(唐氏綜合症)?

Identified in karyotype (nuclear division)

By inspecting the appearance of the chromosome at metaphase, including comparative size, shape and morphology of different chromosome.

唐氏綜合症可於核形圖(細胞分裂時)辨識，在細胞分裂的中期時觀察染色體的外觀，包括比較不同染色體的大小和形狀。

24. Name the 4 types of changes in gross structure of the chromosomes.

說出染色體結構上的四種改變。

Deletion, Duplication, Translocation, Inversion.

缺失、重複、移位及倒位。

25. Describe the mutation that is at DNA level.

描述在 DNA 層面上的轉變(基因突變)。

Mutation takes place in gene. (gene mutation)

Result of a **change in the nucleotide sequence of the DNA molecule.**

It involves changes in the sequence of nucleotide and the order of amino acids in polypeptide is altered. The molecular shape of proteins is therefore affected and this results in changes of the phenotype of an organism.

此種突變在基因內發生，是由 DNA 分子內的核苷酸改變順序所引起，此種突變可以是鹼基的重複、插入、缺失、倒位及替代。

核苷酸的順序改變(突變)→多肽的氨基酸順序改變→蛋白質的分子形狀改變→表現型改變

26. Give one example of gene mutation and its cause.

說出基因突變的一個例子及其成因。

Sickle cell anaemia

Caused by replacement of a nucleotide of one of the genes that controls the production of normal haemoglobin.

例子：鐮狀細胞性貧血

由控制生產血紅蛋白的基因的一個核苷酸被取代所做成。

27. Explain why disadvantageous genes are able to pass from generation without being eliminated by natural selection.

解釋爲什麼壞基因能代代相傳和不會那麼容易被天擇淘汰？

Sickle shaped red blood cells are destroyed more rapidly (short life span) and cause anaemia. However, disadvantage genes may have beneficial effects. Gene for sickle cell anaemia is bad but it makes the carriers more resistant to malaria. Plasmodium, cannot easily invade sickle cells. Further more, most disadvantageous genes are recessive. They make no phenotypic differences for natural selection. They have to be double recessive for expression

鐮刀狀紅血球很短命，導致貧血，但不利的基因，在某些情況下，可能有利，鐮狀細胞性貧血的基因雖然很壞，但它可對抗瘧疾，因爲瘧疾原蟲不能輕易侵入鐮狀細胞。再者，大部分的壞基因都是隱性的，在雜合的情況下，與正常表現型無異，必須在純合的情況下才能顯現，故壞基因不會那麼容易被天擇淘汰。

28. State the causes of mutation.

說出突變的成因。

1. **Spontaneous mutation** : Mutation occurs in nature without any known cause. Such mutation occurs at a very low rate.
   自然突變：此種突變自然發生，原因不明，發生率很低。
2. **Induced mutation** : Induced artificially by mutagens.
   誘發突變：可用誘變劑來誘發。

29. Give some examples of mutagens.

說出一些誘變劑的例子。

(a) Ionizing radiation: X-rays, protons, neutrons, α, β, γ rays.
電離輻射：例如 X-射線、質子、中子、α、β、γ 等射線。

(b) Chemical mutagens: nitrous acid, base analogues, formaldehyde, mustard gas.
化學誘變劑：例如硝酸、類鹼基、甲醛和芥子氣。

30. Explain why ionizing radiation can cause mutation.

用例子解釋爲什麼電離輻射可引致突變。

These radiations **produce ions by colliding with atoms and releasing electron from stable molecules.** Thus **making the organic base less stable, may be replaced by other improper bases,** causing mutation. The greater the dosage, the greater the mutation rate.

此等輻射撞擊穩定分子內的原子，產生離子和放出電子，故可令鹼基不穩定，使它可被其他不當的鹼基取代，從而引致突變。劑量越大，突變率越大。

31. Explain the role of mutation in evolution and speciation.
解釋突變在物種形成的功能：
Mutation results in variations which confer different survival values to organisms which are then subject to natural selection. The most significant kinds of mutation are most likely those **adding new genes or chromosomes. They promote evolutionary change and may result in the formation of new species.**
突變引致變異，使生物有不同的適應能力以供天擇，最有用的突變是那種能添加新基因或新染色體的突變，它促進演化及新物種的形成。

Check point 測試站 (51)

1. Explain the term genetic engineering.
解釋名詞遺傳工程。
In genetic engineering, one gene or most commonly, a set of genes is taken out of the DNA of one organism and inserted into the DNA of another organism. It produces genetic products what human need. It modifies or creates new species.
遺傳工程是將一個或一組基因從某生物的 DNA 抽取出來，將它重新插入另一種生物的 DNA 中，它產生人類所需的產品，改變或創造新品種。

2. Outline the recombinant DNA technology (transgenic technology).
概述 DNA 重組技術(轉基因技術)。
1. Obtaining DNA fragments of degsired gene.
   獲取目標基因片段
   Obtain DNA fragments from blood, saliva, semen and bones, etc.
   從血液、唾液、精液和骨塊等樣本獲取 DNA 片段。
   Cutting out the DNA of the desired gene.
   剪出目標基因的 DNA
2. The desired gene is cut into small sections by using restriction enzymes (restriction endonucleases). These enzymes are used to cut DNA between specific base sequences which the enzyme recognizes.
   用限制酶(限制性內切酶)將目標基因切成小段，此等酶可辨別特定的鹼基順序，然後在指定的部位將 DNA 切成小段。
3. Inserting the gene into a vector.
   把目標基因插入載體。
   The plasmids in bacteria are often used as vectors. The plasmid is also cut open by restriction enzymes first. The recombination of genes is carried out with the aid of the enzyme DNA ligase.

細菌質粒時常用作載體，質粒亦是先用內切酶切開，目標基因和質粒的連接需要 DNA 連接酶的協助。

4. Insertion of the vector into a host cell.
   將載體導入寄主細胞。
   The vector (recombinant plasmid) carrying the desired gene is inserted into a host cell which allows the vector DNA to replicate. The host cell can be a bacterium, a yeast cell or a mammalian cell. They treat the foreign DNA as its own.
   帶有目標基因的載體(重組質粒)會植入寄主細胞，寄主細胞可以是細菌、酵母菌、甚或哺乳動物的細胞，它們會將目標基因視爲自己的基因。

3. What is remombinant DNA
重組 DNA 是什麼?
It is the DNA that results from the combination of DNA fragments from two different cells or organisms.
重組 DNA 是指來自不同細胞或個體的 DNA 進行重組後所形成的新 DNA。

4. Expain the meaning of clone.
解釋名詞複製(克隆)。
A clone is a group of genetically identical individuals (or cells) derived from the asexual reproduction of a common ancestral cell. We can obtain a clone of cells by cell culture.
純系(克隆)是一組遺傳上完全一樣的生物(或細胞)，它是從同一祖先細胞無性繁殖而來，我們可透過細胞培養獲取一個純系(克隆)。

5. Explain the use of electrophoresis in genetic engineering.
解釋如何應用電泳法於遺傳工程上。
Electrophoresis can be used to separate the DNA or RNA fragments from one another according to their sizes. As DNA or RNA molecules contain many phosphate groups, they are highly negatively charged. These fragments are attracted to the anode. They pass through a gel at a rate that is inversely proportional to their size. Thus this method can be used to separate different DNA or RNA into bands.
電泳可按 DNA 及 RNA 片段的大小來把它們分開，因爲 DNA 及 RNA 含有許多磷組，故帶有許多負電荷，這些片段會被吸引到正極，移動途中會經過一層凝膠，而速度與它們的體積成反比，用此法可將不同的 DNA 及 RNA 片段分離，在凝膠上形成不同的紋帶。

6. What is DNA fingerprinting?
甚麼是 DNA 指紋分析?
It is a techniques involved the use of DNA analyses to identify individuals.
那是一種利用 DNA 分析來鑑定身份的技術。

7. What is the principle of electrophoresis?
試述電泳法的原理。

It makes use of an electric field to attract DNA fragments to the positive terminal. DNA fragments move at speeds that depend on their size.
利用電場，把 DNA 片段吸引到正極，DNA 片段的移動速率取決於它們的大小。

8. State the applications of genetic fingerprinting.
說出一些遺傳指紋法的應用。

To provide evidence to the court in forensic science.
在法證科學上作爲呈堂證供。
To identify victims in disasters.
鑑定災難中死者的身份。
To establish family relationships in parentage tests.
在親子鑑證中確定親屬關係。

9. What is human genome project?
什麼是人類基因組計劃？

The Human Genome Project (HGP) is an international collaborative research effort, which aims to identify and locate all human genes, and to determine the complete nucleotide sequence of human DNA.
人類基因組計劃是一項國際性合作的研究計劃，旨在辨識和判定所有人類基因在染色體上的位置，及尋找人類 DNA 的核苷酸排列順序。

10. State the goals of human genome project.
說出人類基因組計劃的目的。

1. Identify all the approximately 30,000 genes in human DNA.
   主要目標是辨識人類 DNA 內所有的基因(約 30,000 個)。
2. Determine the sequences of the 3 billion base pairs that make up human DNA.
   找出組成人類 DNA 的三十億對鹼基順序。
3. Store this information in databases.
   利用數據庫儲藏資料。
4. Help researchers pinpoint specific genes on our chromosomes. This could help curing genetic diseases like haemophilia. The knowledge will provide new strategies to diagnose, treat, and possibly prevent human diseases.
   精確地找出某些基因在染色體上的位置，從而協助醫治血友病等遺傳疾病，爲診斷、治療和預防人類疾病提供新的策略。
5. Address the ethical, legal, and social issues (ELSI) that may arise from the project.
   研究人類基因組計劃所帶來的道德倫理、法律及社會議題

11. What are the contributions of the data obtained from the HGP?
人類基因組計劃的數據有什麼用?

1. Better understanding of genetics.
   加深人類對遺傳學的理解。
2. Improved diagnose and treatment of diseases.
   改善疾病的診斷和治療方法。
3. Better understanding of evolution.
   加深人類對進化的理解。

12. What are the limitations of the HGP data?
人類基因組計劃的數據有什麼局限?

The genetic data obtained may still not be enough to understand all biological processes.
所得的數據仍未足以理解所有生物過程。
They have raised ethical, legal and social issues.
這些數據引起道德、倫理、法律和社會議題。

Check point 測試站 (52)

1. What is the origin of life?
說出生命的起源。
It is belived that life is evolved from inorganic matters like ammonia, methane, water vapour and hydrogen. In ancient atmosphere, there was frequent lightning and strong ultraviolet radiation. These supply energy for the reactions among the above inorganic matters to form simple organic molecules like amino acids and organic acids. The organic molecules then joined to form the first organism.
科學家相信生命是從無機物如氨、甲烷、水蒸氣和氫氣等衍生而來。在遠古的大氣常有閃電及強烈的紫外光，它們提供能量讓以上無機物發生化學反應，產生如氨基酸及其他有機酸等簡單有機物質。這些有機物結合成原始的生物。

2. Explain Darwin's theory of evolution.
解釋達爾文之進化論。

1. **Existence of variation 存在變異 :**
   Different individuals of a species show considerable variation, such that some individuals are better adapted to the environment than others.
   物種內的個體多少有些差異，這些差異使某些生物比其他的同類更適應環境。
2. **Struggle for existence 掙扎求存 :**
   Organisms generally produce more offspring than the environment can support. This leads to overcrowding, resulting in keen competition between individuals.
   生物通常生產多於環境所能承受的後代，這會引致過度擠迫，個體間出現惡性競爭。
3. **Natural selection 物競天擇 :**
   The environment exerts a weeding-out effect, so that the poorly adapted organisms perish before they reach sexual maturity.
   環境的汰弱淘強效應使不能適應的生物未達生育年齡便消失。

4. **Survival of the fittest 適者生存：**
Individuals with favourable variations will stand a better chance of survival. As a result well adapted individuals reach reproductive age and hand on their favourable characteristics to their offspring whereas less well adapted individuals fail to do so.
有優良變異的生物較易生存，結果較能適應環境的生物可達到生育年齡，將優良的性狀傳給下一代，而不良的個體會被淘汰。

3. **Give evidence of evolution from fossil records.**
提出支持進化論的化石紀錄證據。
It is found that the **top layers of rock strata show complex fossils in the order** of mammals, birds, reptiles, amphibians and fishes as we go downwards, while the lower (older) layers show fossils belonging to invertebrates. This shows that simple organisms gradually evolved to complex organism. The fossil records sometimes show **extinct forms intermediate between two presently living types.** For example, Archaeopteryx was an extinct bird that had teeth and a long tail (character of reptiles) and also had feathers (character of birds). This proved that the birds had evolved from the reptiles.
從石層的表面往下發掘，所找到的化石顯示出一個由上而下的次序：哺乳類、鳥類、爬行類、兩棲類、魚類。底層(年老)的化石多是無脊椎動物，這顯示出複雜的生物從簡單的生物進化而來。化石有時可找到現存生物的中間型，例如我們找到一塊名爲**始祖鳥**的化石，始祖鳥是一種已絶種的鳥類，牠有牙齒及長尾(爬行類的特徵)，又有羽毛(鳥類的特徵)，這可證明鳥類是從爬行類進化而來。

4. **What are the limitations of using fossil record as evidence for evolution?**
化石紀錄作爲進化的證據有什麼局限性?
There are missing links in the fossil record.
化石紀錄存在缺少的環節。
Soft-bodied orgaisms cannot be fossilized.
由軟組織構成的生物未能石化。
Some fossils are located in inaccessible areas.
有些化石藏於難以接觸的地區。

5. **Give evidence of evolution from comparative anatomy.**
提出支持進化論的比較解剖學證據。
If different animals have started with the same ancestor, subsequent generations should show slight modification of the basic anatomical plan. They **should have homologous structures.**
Having homologous structures (the presence of pentadactyl limb) **in nowadays organisms** showing adaptations to different environmental conditions and mode of life **suggests the existence of divergent evolution.**
若不同的動物都是從同一祖先而來，牠們的身體結構應該極爲相似，因爲牠們的身體結構都只會從祖先的基本結構作少許的修改，牠們應有**同源結構**。
存有能適應不同環境及生活方式的同源結構(五趾型肢)是趨異演化的證據。

6. Give evidence of evolution from genetic similarities.
提出支持進化論的遺傳物質的相似性證據。
The more similar the base sequence of DNA, the closer the evolutionary relationship of the organisms. eg. 98% base sequence of human is the same as that of chimpanzees, but only 80% of rabbits. Human therefore have a closer evolutionary relationship with chimpanzees than rabbit.
兩種生物的鹼基序列越相似，它們的進化關係越密切。例如:人類的鹼基序列跟黑猩猩有 98% 相同，但跟兔子則只有 80%，因此人類與黑猩猩的進化關係較與兔子密切。

Check point 測試站 (53)

1. Explain the mechanism of evolution.
解釋進化的機制。
Evolution is due to the **combined effect of variation and natural selection.**
進化是由變異及天擇的混合效應所造成。

1. There is always variation among individuals in a population.
   種群內的個體常存變異。
2. Some favourable variations make an individual more likely to survive and reproduce than other individuals.
   有利的變異可增加個體的生存及繁殖下一代的機會。
3. The environment exerts a weeding-out effect, so that the poorly adapted organisms perish before they reach sexual maturity.
   環境的汰弱淘強效應使不能適應的生物未達生育年齡便消失。
4. Those variant traits that enhance survival will be found in an increasing succeeding generation.
   那些有利生存的特徵會在下一代越來越多。
5. Over many generations, the action of natural selection leads to the evolution of new species.
   經過許多世代後，自然選擇的作用導致物種進化。

2. Explain the role of variation in evolution
解釋變異在進化上的功能。
Genetic variation ensures that all populations contain a range of phenotypes. Only some phenotypes of each generation will be well enough adapted to survive in the immediate environment. These phenotypes will breed and pass on their genes to the next generation. Less well adapted phenotypes will not be able to survive the competition for food and space, they will not breed and their genes will be lost when they die. However, if there is a change in the environment there is a chance that some of the adaptations which were ill-fitted to the first environment will be advantageous in the new environment, and now these phenotypes will survive to breed and pass on their genes. The existence of variation increases the chances of a species surviving environmental change.
遺傳變異使每個種群內都存有一個範圍的表現型，只有某些後代的表現型足夠良好以生存於即時的環境中，這些表現型可互相交配，將它們的基因傳給下一代。
較劣的表現型在食物及居所的競爭中失敗，不能生存亦不能交配，它們的基因隨著它們的死亡而消失。但是若環境有所改變，某些先前是不良的基因可在新環境中變得有利，這些表現

型現可生存及繁殖，將它的基因傳給下一代，故存有變異有利一個品種在轉變中的環境生存。

3. Explain the cause of variation.
解釋變異的成因。

(1) Due to sexual reproduction:

During sexual reproduction there can be innumerable combinations of genes from the two parents, resulting in a large number of variations among the offsprings. When genes are linked, crossing over can lead to new combinations of the genes, giving new varieties in the offsprings.

因爲有性繁殖:

在有性繁殖，後代從每個父母各取一套染色體，因爲染色體的獨立分配，從父母處獲得的基因可以有無數的組合，引致後代出現大量的變異。當基因是連鎖時，互換可產生新的基因組合，做成不同種類的後代。

(2) Due to mutation

因爲突變:

4. What is meant by natural selection?
天擇是什麼意思?

It means that **those organisms that are best adapted to their environment are most successful in reproducing offsprings.**

它是進化的主要動力，意味著最能適應環境的生物是最能產生後代的。

5. Explain the process speciation.
解釋物種形成的過程。

Speciation is **a process of forming new species from one or more species.** It occurs as a result of **barriers leading to reproductive isolation between members of the population.** This would **stop gene flow between populations.** Then, their **gene pools can change independently through natural selection.**

物種形成是從現有品種形成新品種的過程，這是因某些屏障而做成的種群間生殖隔離，這會阻止基因在種群間交流，基因庫便可透過天擇而獨立轉變。

6. Explain the isolation mechanism in speciation.
解釋物種形成時的隔離機制。

Isolation mechanisms can be defined as any factors that decrease the amount of interbreeding between groups of organisms. If they are isolated, they will evolve independently so that after some time, they will diverge from each other so much that they can no longer breed with each other.

隔離機制可定義爲任何可減少群體間交配的因素，若群體受到隔離，它們會獨自進化，過了某些時間後，群體間的歧異變得很大，以致它們不能再交配。

7. Give examples of isolation mechanisms.
說出隔離機制的各個例子。

1. **Geographical isolation:** eg. mountain ranges, rivers and oceans.
   地理隔離：例如山脈、河流和海洋等。這些屏障阻止同一品種的種群會面。
2. **Reproductive isolation**: Occasionally a mutation arises which makes the individual possessing it incapable of breeding with the companion.
   生殖隔離：有時會有突變發生阻止帶有突變者和同類交配。
3. **Behavioral isolation**: Two species are prevented from interbreeding because they have different behaviour.
   行爲隔離：兩個品種因有不同的行爲而被制止交配。

8. Describe how evolutionary theory is supported by selective breeding.
解釋如何以動植物育種來顯示進化。

Man selected the animal or plant with qualities he desired to breed. This **acts as the natural selection** stated in evolutionary theory. As a result, **genotype with desired phenotypes can survive while those not cannot**. After a period of time, the gene pool of the species change
人類作爲農作物的選擇者，他會選擇他喜好的動植物品種來培植，這行爲與進化論所提及的天擇相類似，結果能給出人類喜愛的表現型的基因可生存而不能的則淘汰，過了一段時間後，該品種的基因庫會改變。

Check point 測試站 (54)

1. Name the three parts of the kidney.
說出腎臟的三個主要部分。

1. Cortex - outer region
   皮部 - 外層
2 Medulla - darker inner region
   髓部 - 深色的內層
3. Pelvis - whitish central region
   腎盂 - 白色的中央部份

2. What is the name of the smallest unit that made up kidney?
組成腎臟的基本結構是什麼?

nephron
腎元

3. What structure does nephron start with?
腎元從什麼結構開始?

Each nephron starts with the cup-shaped Bowman's capsule.
杯形的鮑氏囊作開始。

4. **Name the tubes that Bowman's capsule connected to?**
   說出鮑氏囊所連接之管的名稱。
   tubule 腎小管

5. **Describe and explain the feature of tubule.**
   描述和解釋腎小管的特徵。
   The tubule is highly coiled to increase surface area and time for more reabsorption.
   腎小管高度旋繞以增加再吸收作用的表面積和時間。

6. **What vessel enters Bowman's capsule and what is its appearance inside Bowman's capsule?**
   什麼管伸進鮑氏囊，它在囊內的外貌如何?
   A tiny artery (afferent arteriole) enters the Bowman's capsule, inside, it divides into a dense network of capillaries, the glomerulus.
   一小動脈(入腎小動脈)伸進鮑氏囊，在囊裏分枝名爲腎小球的微血管網絡。

7. **What change occurs on the capillaries when it leaves the glomerulus?**
   當微血管離開鮑氏囊後有什麼轉變?
   The capillaries from glomerulus join up again to form efferent arteriole.
   微血管再次會聚在一起形成出腎小動脈。

8. **What will be the fate of the efferent arteriole?**
   出腎小動脈的命運如何?
   The efferent arteriole breaks up into capillaries which envelop the tubule and join up to a tiny vein.
   出腎小動脈分枝爲包圍著腎小管的微血管網絡，這些微血管最後會合爲一小靜脈。

9. **Draw a flow chart to show the ducts leading from Bowman's capsule to bladder.**
   繪一流程圖以顯示從鮑氏囊至膀胱的管道。
   Bowman's capsule→tubule→collecting duct→pelvis→ureter→bladder
   鮑氏囊→腎小管(近曲小管→遠曲小管)→集尿管→腎盂→輸尿管→膀胱。

10. **Draw a flow chart to show the blood vessels leading from afferent arteriole to renal vein.**
    繪一流程圖以顯示從入腎小動脈至腎靜脈的血管。
    Afferent arteriole→glomerulus→efferent arteriole→capillaries surround the tubule→vein→renal vein
    入腎小動脈→腎小球(微血管網絡) →出腎小動脈→圍繞腎小管的微血管網絡→小靜脈→腎靜脈

11. **What is meant by ultrafiltration?**
    超濾作用是什麼意思?
    Filtration under pressure, Bowman's capsule acts like a filter, 20% of plasma is force from the capillaries into the capsular space.
    在壓力下的過濾作用。鮑氏囊類似一個過濾器，20%的血漿被迫從微血管進入囊中，形成腎小球濾液。

12. How to attain high blood pressure at glomerulus?
腎小球如何達到高血壓?
Afferent arteriole has a larger diameter than efferent arteriole
入腎小動脈的腔比出腎小動脈的腔爲闊。

13. What is the featureof nephron to aid ultrafiltration?
腎元在結構上有甚麼特點，能夠協助超濾作用?
Efferent arteriole is smaller than afferent arteriole lead to high blood pressure, plasma is forced to pass through the capillary wall and capsular wall.
The wall of Bowman's capsule and capillary is thin which allow material to pass through them easily.
出腎小動脈較入腎小動脈狹窄，在腎小球中形成高流體靜壓，會逼使血漿通過腎小球的微血管壁和鮑氏囊壁，進入鮑氏囊。
微血管及鮑氏囊的壁很薄(只得一層細胞的厚度)及具選透性，細小的分子很容易便可通過。

14. Is there any blood cells in glomerular filtrate, why?
腎小球過濾液內有沒有血球，爲什麼?
No blood cells and proteins because they are too large to pass through.
不含紅血球和血蛋白，因他們太大不能穿過微血管壁。

15. What happens to the filtrate when it passes down the tubule?
當過濾液經過腎小管時有什麼事情發生?
When the filtrate passes down the tubule, useful substances (water, glucose, amino acids, salts) are reabsorbed into the blood capillaries.
有用的物質(水、葡萄糖、氨基酸、鹽等)會被吸進微血管。

16. What substances will not be reabsorbed?
什麼物質不會被重吸收?
Urea.
尿素。

17. How can the useful substances be absorbed completely when it is in low concentration?
有用的物質在低濃度下如何被重吸收?
Reabsorption of useful substances occurs by active transport against the concentration gradient.
有用物質的重吸收依賴主動運輸來對抗濃度坡度。

18. Can glucose be found in urine, why?
可否在尿液中找到葡萄糖，爲什麼?
Normally, no glucose is found in urine due to reabsorption by active transport.
通常尿中不含葡萄糖，因爲主動運輸的再吸收作用將它吸去。

19. Explain why there is a higher concentration of salt and urea in urine when compared with filtrate.
和過濾液作一比較，解釋爲什麼尿液中含較高濃度的尿素和鹽分。
As the fluid passes along the tubule, large amount of water is reabsorbed but urea is not reabsorbed, thus leading to a relatively higher concentration of salt and urea in the collecting duct.
當過濾液通過腎小管時，大部份的水份會被再吸收，但尿素不會被吸收，引致集尿管有較高濃度的鹽和尿素。

20. Compare the component of glomerular filtrate with that of plasma.
試比較腎小球濾液和血漿的成分。
The component of glomerular filtrate is quite similar to that the plasma, both contain water, amino acids, glucose, urea and minerals, except that the former do not have proteins.
腎小球濾液的成分與血漿相似，兩者都有水、氨基酸、葡萄糖、尿素和礦物質，
只是前者沒有蛋白質。

21. Explain one situation which leads to the excretion of glucosein the urine of a <u>healthy</u> person.
在什麼情況下，一個健康的人會經尿液排泄葡萄糖? 試舉出一項情況，並加以解釋。
After a person eats too much sugary food, the digested sugar will be absorbed into the blood.
When the blood glucose level is so high that it exceeds the absorptive capacityof kidney tubule, glucose is excreted with urine.
當進食過量的含糖食物後，消化了的糖會被吸收入血液。當血漿內的葡萄糖濃度太高，以致超過腎小管的再吸收能力，葡萄糖便隨尿液排出。

22. State and explain the concentration of urine when we drink al lot of water.
說出和解釋尿的濃度當我們飲了很多水時。
When we drink a lot of water : water content in the body is increased, a smaller proportion of water is being reabsorbed, therefore a lot of diluted urine.
身體內的水份增加，較少比例的水被再吸收，於是產生大量稀釋的尿。

23. State and explain the concentration of urine when our body is short of water.
說出和解釋尿的濃度當我們身體缺水時。
Kidney reabsorbs most of the water, small amount of dull yellow concentrated urine.
腎臟再吸收大部份的水，只有少量暗黃和濃度高的尿。

24. Why is the concentration of urea in pelvis higher than in glomerulus?
爲什麼腎盂內的尿素濃度高於腎小球的?
It is because the water in the filtrate is reabsorbed.
因爲過濾液內的水份被吸收掉。

25. Why is the amountof glucose in blood entering the kidney higher than leaving?
爲什麼入腎的血的葡萄糖濃度高於離腎的血?

It is because in the kidney some glucose is used to provide energy by oxidation.
因爲在腎內有些葡萄糖用作提供能量。

26. State all the functions of kidney.
說出腎臟的所有功能。

1. Osmoregulation
   滲透調節 :
2. Removal of excess salt
   排除過多的鹽。
3. Excretion : to remove urea.
   排泄廢物 : 排除尿素。

27. Distinguish between excretion and egestion.
分辨排泄作用和排遺作用。

Excretion : the removal of metabolic wastes from the body.
排泄作用 : 排除由身體產生的代謝廢物。
Egestion : removal of indigested or unabsorbed food substances.
排遺作用 : 排除不能消化或不被吸收的食物。

28. Give examples of excretory products.
舉出排泄物的例子。

They are carbon dioxide, water, urea and bile pigment.
它們是二氧化碳、水、尿素和膽色素。

29. For the excretory products of the above question (carbon dioxide, water, urea and bile pigment), state where it is formed, and by which process it is formed.
就上題所述的排泄物 (二氧化碳、水、尿素和膽色素)，分別指出它在何處及產生時所涉及的過程。

Carbon dioxide is formed in body cells by cellular respiration. Urea is formed in liver by deamination. Bile pigment is formed in liver when old red blood cell is broken down.
二氧化碳和水在細胞的呼吸作用時產生；尿素在肝臟的脫胺基作用時產生；
膽色素在肝臟紅血球被拆毀時產生。

30. After eating a lot of beans, how would it affect the urea concentration in urine, explain.
食用大量的豆，會如何影響排泄出來的尿素分量? 請解釋。

The urea concentration in urine will increase. Beans contain a lot of proteins, after digestion it will be converted to amino acids. The excess amino acids will be deaminated in liver and part of it becomes urea. This will excrete out with urine and make the urea concentration increase.

排泄出來的尿素分量上升。這是由於豆含有大量蛋白質，當蛋白質经過胃和小腸後，會被消化成氨基酸，其中過多而沒有被吸收的氨基酸會被肝臟分解而成尿素，令排泄出的尿素量上升。

31. Explain how does the brain carry out osmoregulation.

解釋腦部如何進行滲透調節。

In the hypothalamus of the brain, there are groups of osmoreceptor cells which are sensitive to the osmotic pressure of blood. When the osmotic pressure of blood increases (eg. when the body is dehydrated), the osmoreceptorswill send impulses to the posterior lobe of the pituitary which will then secrete a hormone called antidiuretic hormone (ADH) into the blood stream.

Through the blood, ADH reaches the collecting duct and increases the permeability of it. More water will be reabsorbed from the collecting duct to the loop of Henle so that the water can be reabsorbed once more at the distal convoluted tubule. By this method, more water is retained by the body. When the osmotic pressure of blood decreases (eg. when a large amount of water is drunk), less ADH will be released from the pituitary so that more water will be excreted from the body.

在腦部的下丘腦有數堆滲透感受細胞，他們對血的滲透壓非常敏感。

當血的滲透壓上升(例如身體脫水)，滲透感受細胞會向垂體後葉發出神經脈衝，促使它分泌抗利尿激素進血液中。

隨著血液，抗利尿激素到達腎臟的集尿管，增加它對水的透性，使更多的水從集尿管被重吸收進亨利氏套，水便可在遠曲小管再次被重吸收，如此，身體可保留更多水分。

當血的滲透壓下降(喝了很多水)，垂體後葉會釋出較少的抗利尿激素進血液中，使較多的水分被排出體外。

32. Explain the maintenance of plasma sodium (salt) level.

解釋如何維持血中鈉離子(鹽)的水平。

The maintenance of plasma salt level is **controlled by the hormone aldosterone** secreted from adrenal cortex. It **alters the salt reabsorption in the distal convoluted tubule**. It **stimulates the active uptake of Na^+ from the filtrate into the capillaries.**

血中鈉離子(鹽)的水平受由腎臟皮質分泌的醛固酮所控制，它能改變在遠曲小管鹽分的重吸收程度，它刺激鈉離子的主動運輸，將鈉離子從濾液吸進微血管中。

33. What will be the change in blood pressure in severe sweating?

大量出汗對血壓有什麼的影響？

Severe sweating leads to **loss of water and salt from the body.** Loss of water leads to **decrease in plasma volume** and thus **decrease in arterial blood pressure**.

大量出汗引致身體水和鹽的缺失，缺少水分使血漿體積減少，引致血壓下降。

34. What events will occur at kidney when the blood pressure decrease?
血壓下降會引起腎臟什麼的反應。

Firstly, **adrenal cortex produces more aldosterone** to **increase reabsorption at kidney tubules.** Secondly, **glomerular filtration rate would decrease** to decrease the excretion of water and sodium.
首先，腎臟皮質會產生更多的醛固酮以增加鈉離子在腎小管的重吸收。
其次，腎小球的過濾速度會減慢以減少水分和鹽分的排泄。

35. What happen to the hypothalamic osmoreceptor when there is a loss of water?
水分的缺失會對下丘腦的滲透感受器有什麼的影響，下丘腦會作出什麼的反應?

Loss of water leads to increase in plasma osmolarity and thus **stimulate hypothalamic osmoreceptors to secret antidiuretic hormone (ADH).** ADH leads to an i**ncrease in permeability to water of collecting duct** so that more water is reabsorbed into plasma.
水分的缺失會增加血漿的滲透壓，刺激下丘腦的滲透感受器。
滲透感受器會向垂體後葉發出神經脈衝，垂體後葉會增加抗利尿激素的分泌，此激素會增加水分的重吸收。結果腎臟會進一步保留水分，這可保償水分和鹽分從汗液中的散失。

36. Explain the biological principle of kidney machine.
解釋洗腎機的生物學原理。

A kidney machine carries out dialysis, a process in which the patient's blood flows on one side of a thin membrane while a solution, called the dialysate, flows in the opposite direction on the other side. This is a kind of counter-current flow. It ensures the most efficient exchange of material across the membrane. As the membrane is permeable to small molecules such as urea, this waste product will diffuse from the plasma where it is relatively highly concentrated to the dialysate where its concentration is lower.

To prevent the loss of useful substances like glucose and salts, the dialysate's composition is the same as that of normal blood. This means that any substance which is in excess, e.g. salts, will also diffuse out until they are in equilibrium with the dialysate. Large molecules such as blood proteins are too large to pass through the membrane and there is therefore no risk of them being lost to the dialysate. A patient's blood needs to pass through the kidney machine many times to ensure the complete removal of all wastes. Thus, it is necessary for dialysis to take place for up to ten hours every few days.

洗腎機利用透析作用，其過程是把病人的血液在膜的一邊流動，而透析液則在另一邊以相反方向流動，這種逆流流動能保證穿過薄膜的物質能進行有效的交換。由於薄膜是可以讓諸如尿素等小分子透過，這些廢料將從較高濃度的血液流向較低濃度的透析液。
爲了阻止血液中像葡萄糖和鹽等有用物質的失去，透析液的成分與正常血液的成分相同。這就意味著任何過剩物質，也一樣會被擴散出去，直到與透析液取得平衡。像血蛋白等大分子由於太大而不能穿過薄膜，所以不存在失去的危險。病人的血液需要通過洗腎機器數次，以保證所有的廢物都被排除，因此每隔幾天使要進行長達 10 小時的洗腎。

Check point 測試站 (55)

1. Explain the rise in metabolic rate of homoeothermic animal in cold temperature.
解釋爲什麼恒溫動物在寒冷天氣代謝率會上升?

The metabolic rate of the homoeothermic animal rises in colder temperature so as to produce more heat to compensate the increased heat loss. This maintains a constant body temperature.
在低溫下恒溫動物的代謝率會上升來產生更多的熱能來補償損失的，這可維持固定的體溫。

2. What are the responses of the skin to a sudden hot condition?
皮膚對突然轉熱有什麼反應？

1. Vasodilation
   血管擴張
2. Increased sweating
   增加出汗
3. The hairs lie flat on the skin
   毛髮平伏

3. What are the responses of the skin to a sudden cold condition?
皮膚對突然轉冷有什麼反應？

1. Vasoconstriction
   血管收縮
2. Decreased sweating
   減少出汗
3. The hairs are raised
   毛髮豎立

4. Name some ways of producing more heat in the body during cold condition.
說出一些寒冷時身體產生熱能的方法。

1. In a cold condition, the body has a higher metabolic rate.
   身體提高代謝率。
2. In a sudden cold condition, shivering can produce heat.
   突然轉冷時、顫抖可產生熱量。

5. What are the responses of the body to prolonged hot condition?
身體對長期炎熱有什麼反應？

(1) The subcutaneous fat becomes thinner
   皮下脂肪變薄。
(2) The metabolic rate becomes slower.
   代謝率減慢。

6. What are the responses of the body to prolonged cold condition?
身體對長期寒冷有什麼反應？

(1) The subcutaneous fat becomes thicker.
皮下脂肪變厚。

(2) The metabolic rate becomes faster.
代謝率加快。

7. Explain why heat loss from a person's body is mainly through sweating when air temperature is higher than the body temperature.
解釋爲什麼當氣溫高於體溫時，人的體熱主要是藉著排汗來消散?

When the air temperature is higher than the body temperature, our body cannot depend on losing heat by condution, convection and radiation. Sweating becomes the main way to lose heat. The evaporation of sweat can carry body heat away.
由於空氣溫度比體温高，所以身體不能依靠傳導、對流和輻射等方法去散熱，流汗於是便成爲散熱的主要途徑。汗水的蒸發能把身體上的熱能帶走。

8. Explain the sweating rate during vigorous exercise.
解釋劇烈運動時的汗液產生率。

During vigorous exercise, the sweating rate is higher than that of at rest. It is because our body will produce a lot of heat during exercise. This increases the body temperature. Thus our body increase sweating rate to get rid of this extra heat.
進行劇烈運動時，產生汗液的速率比休息時產生汗液的高。這是因爲運動時身體產生大量熱能，令體温上升，於是身體便要加快產生汗液來降温。

9. Explain the rate of urine production during vigorous exercise.
解釋劇烈運動時的尿液產生率。

During vigorous exercise, our body will lose a lot of water through sweating. The water potential of the blood drops. The nephron will reabsorb a greater proportion of water from the glomerular filtrate; therefore decrease the rate of urine production.
進行劇烈運動時，身體因排汗而流失大量水分，血液的水潛能因而下降，腎臟會從腎小球濾液重吸收較大比例的水分，令尿液減少。

10. Explain why the face becomes red when doing vigorous exercise.
解釋劇烈運動時臉部爲什麼會轉紅。

During vigorous exercise, our body produces a lot of heat. The arterioles of the skin expand so that more blood together with heat will flow to the skin surface. Heat lose to the surrounding and thus our face turns red.
運動時，人體產生大量熱能，所以皮膚的小動脈擴張，令較多的血液流往皮膚，熱能也隨之而散失，故臉色變紅。

11. What is the importance of reddening of the face during vigorous exercise?
劇烈運動時臉部轉紅有什麼重要性?

The arterioles expand will promote heat lose from the body. It keeps the body temperature constant. Thus enzymes can function at the optimum temperature.
皮膚的小動脈擴張促進身體散熱，令體温維持在恆定的水平，酶也可在最佳温度下發揮作用。

12. What kind of weather will have a high risk of heatstroke?
何種天氣最易使人中暑?

High air temperatue with high humidity and low wind speed.
高温加上高濕度及低風速。

13. Explain the effect of high air temperature and high humidity on man.
解釋高溫與高濕度對人的影響。

If the air temperature and the relative humidity is very high, the life of a person will be endangered. The evaporation of water from the sweat become very slow and heat could not be lost from the body. As a result, the body temperature increased leading to the increase in the rate of metabolism. The increased in metabolic rate caused the increase of the body temperature further until it became so high that disturbed the normal functioning(denature the enzymes) of the body and endangered the life of the person.
當高溫與高濕時，人的生命會受到威脅，汗液的蒸發變得非常緩慢，熱能不能從身體散失，結果體溫上升引致代謝率上升，代謝率上升促使體溫進一步上升，直至體溫高至破壞身體的正常運作(體內的酶變性)，威脅人的生命。

14. Explain the role of hypothalamus in temperature regulation.
解釋下丘腦在温度調節的功能。

In the hypothalamus are two **thermoregulatory centres**, the heat loss centre and the heat gain centre.
下丘腦有兩個**溫度調節中心**，散熱中心和增熱中心。
The hypothalamus can detect the body temperature through two ways:
下丘腦可透過以下兩個方法探測熱能。

1. Increased in skin temperature due to high **external temperature** is detected by **skin thermoreceptors**. The information will be carried by nerve fibers to the thermoregulatory centres.
   外界溫度增加會令皮膚溫度升高，這由**皮下的溫度感受器探知**，訊息經由神經傳送至温度調節中心。
2. Increased in **core temperature** (blood temperature) due to exercise is detected by **thermoreceptors in the hypothalamus**.
   因運動所引致的**體內溫度**（血液溫度）升高由**下丘腦的溫度感受器**探知。

After receiving the information, the hypothalamus will make the corrective mechanism.
收到訊息後，下丘腦會發出修正指令。

Check point 測試站 (56)

1. **Which organ controls breathing.**
   呼吸是受甚麼器官所控制的？
   Breathing is controlled by **respiratory centre** on the **medulla** of the brain.
   延腦的呼吸中樞(中心)控制呼吸。

2. **From where does respiratory centre receive the needed information?**
   呼吸中樞從何處獲所需的資料?
   1. Chemoreceptors in the respiratory centre: detect changes in the carbon dioxide content and oxygen content in blood.
      呼吸中樞內的化學感受器:探測血液內的二氧化碳和氧含量變化。
   2. Chemoreceptors in the aortic and carotid bodies: detect changes in the carbon dioxide content and oxygen content in blood. The aortic bodies are some parts of the aorta wall. The carotid bodies are some parts of the carotid arteries which supply blood to the neck.
      主動脈體和頸動脈體內的化學感受器:探測血液內的二氧化碳和氧含量變化。主動脈體位於大動脈壁上，頸動脈體位於頸動脈壁上，頸動脈負責將血泵往頸部。
   3. Stretch receptors in the lungs: they are stimulated (and send out impulses) when lungs inflate.
      肺內的牽張感受器:肺擴張時，會受刺激，發出神經脈衝。

3. **How does respiratory centre initiate inhalation and exhalation ?**
   呼吸中樞如何引發吸氣和呼氣?
   The respiratory centre sends nerve impulses to the **intercostal muscles** and **diaphragm muscles** to trigger inhalation. When no impulse sent to the respiratory muscles, exhalation occurs.
   呼吸中樞會發出神經脈衝至肋間肌和橫膈膜肌肉，引發吸氣，當呼吸中樞停止發出神經脈衝，呼氣發生。

4. **How does respiratory centre control the basic rhythm of breathing ?**
   呼吸中樞如何控制呼吸的基本節奏?
   The feedback mechanisms between the respiratory centre and the stretch receptors in the lungs control the basic rhythm of breathing.
   呼吸中樞根據來自肺內的牽張感受器的訊號來維持呼吸的基本節奏。

5. **Which factor in blood affects breathing rate?**
   血液中的什麼因素影響呼吸率?
   Both rate and depth of breathing is affected by the carbon dioxide concentration in blood.
   呼吸的速率和深度皆受血中的二氧化碳濃度所影響。
   The respiratory centre does not respond directly to change in carbon dioxide content in blood, rather, it responds to change in pH of blood.
   呼吸中樞並非直接受血中二氧化碳濃度所影響，正確來說是血的酸鹼度。

6. **What is the effect of change in CO_2 and oxygen concentration on rate of breathing?**
   改變血液的二氧化碳濃度和氧氣濃度對呼吸率有甚麼的影響?
   Increase in carbon dioxide concentration will lead to a decrease in pH of blood. This will lead to increase in rate and depth of breathing.
   增加血液的二氧化碳濃度使血液的 pH 下降，這會引致呼吸的速率和深度增加。
   Decrease in oxygen concentration will lead to a less obvious increase in rate and depth of breathing.
   降低氧氣濃度亦會引致呼吸的速率和深度增加，但效果不及二氧化碳增加時明顯。

7. **Explain in detail the mechanism of increase of respiratory rate by increasing the concentration of CO_2.**
   詳細解釋增加二氧化碳的濃度如何導致呼吸率的增加？
   Increase in CO2 and decrease in oxygen are detected by chemoreceptors – the aortic and carotid bodies in the walls of major arteries. These chemoreceptors are sensitive to minute changes in pH. When pH decreases, nerve impulses from these chemoreceptors are sent to the respiratory center.
   二氧化碳的增加和氧氣的減少由化學感受器所探測，它們是位於主要動脈血管壁的主動脈體及頸動脈體，此等化學感應器對血中微小的 pH 轉變非常敏感，當 pH 降低時，化學感受器會發出脈衝，傳送到呼吸中樞。
   After processing, the respiratory centre sends more nerve impulses to the respiratory muscles to cause them to contract faster and stronger. This increases both the rate and depth of breathing. More carbon dioxide is removed from blood at a higher rate.
   處理訊息後，呼吸中樞會發出更多神經脈衝至呼吸肌肉，令它們收縮得更快及更有力，這會令呼吸的速率和深度增加，從而更快地排走血中的二氧化碳。

8. **What mechanism makes the heart beat?**
   甚麼機制令心臟跳動?
   Heart beat is myogenic: i.e. the muscle has an inherent capacity for beating.
   哺乳類的心跳是肌原性的，即是肌肉有自我收縮的本能

9. **Which node initiates the contraction of the heart?**
   甚麼結引發心臟的跳動?
   The contraction is initiated at a point, the sinoatrial node (SA node), at the right auricle near the entrance of the superior vena cava.
   心搏最初的刺激起源於一群在組織上相異的心肌細胞稱爲竇房結，它位於右心房(心耳)壁接近上腔大靜脈進入心房的部位。

10. **How does the SA node initiate the beating of the auricles?**
    竇房結如何引發心房的收縮?
    As the sinoatrial node initiates the beating, it is also known as a pace maker. It **sends out rhythmical waves of electrical excitation to both auricles**, stimulating them to beat regularly.
    竇房結決定心搏的基本速率，因此稱爲起搏點，它送出節奏性的電脈衝(興奮波)給兩個心房，刺激它們大約在同一時間收縮。

11. How does the wave of excitation from SA node initiate the contraction of ventricles?
從竇房結而來的興奮波如何引發心室的收縮？

The wave of excitation **from SA node** then reaches **a similar group of cells known as the atrioventricular node** (AV node) 0.1 second later which lies between the two auricles. **To allow blood to be forced upwards into the arteries,** the ventricles need to contract from the apex upwards. To achieve this, **new waveof excitation from the AV node is conducted along Purkinje fibres** which lead along the septum to the apex of the ventricles from where they radiate upwards. **The wave of excitation travels along these fibres** and causes muscle contraction starting at the apex.

興奮波稍後(0.1 秒)到達一群相似的細胞稱爲房室結，房室結位於兩個心房之間。
爲了把血液向上推，使它進入動脈，心室必須從底下的尖端向上收縮，要完成這個過程，來自房室結的新興奮波必須沿著組成希氏束的柏金氏纖維傳導，這些纖維沿著心室間膈膜通向心室尖端，從這裡向上輻射散開，興奮波沿著這些纖維傳送，只在尖端才被釋放，引起肌肉收縮，心室受刺激後，便同一時間從尖端向上收縮，整個過程稱爲心搏週期。

12. What is meant by cardiac output?
甚麼是心輸出量?

Cardiac output = stroke volume (70 ml) x heart rate (72) = 5040 ml (5L/min)
心輸出量 = 心搏量 (70 ml) x 心搏率 (72) = 5040 毫升(每分鐘 5 升)

13. Give the name and location of the nervous system that control the heart rate?
說出控制心搏率的神經系統名稱和位置。

It is **autonomic nervous system within the medulla oblongata of the brain.** There are **two centers in the medulla** which control the heart rate : The cardio-acceleratory center and the cardio-inhibitory center .

心輸出量的變化是由自主神系統所控制的，在腦部的延腦中心有兩個中樞－心加速中樞和心抑制中樞。

14. Explain the control of heart rate by cardio-acceleratory center.
解釋心加速中樞如何控制心搏率。

The cardio-acceleratory center is **linked by the sympathetic nerve to the SA node.** Impulses from the sympathetic nerve result in the **secretion of small quantities of noradrenaline from the nerve endings at the SA node** onto the cardiac muscle. **Noradrenaline is powerful in speeding up cardiac contractions** and increases both the stroke volume and heart rate.

心加速中樞通過交感神經系統與竇房結連接，收到刺激時，這些神經末梢會在心臟肌肉放出去甲腎上腺素，去甲腎上腺素能增加心搏率及增大心搏量，使心輸出量增加。

15. Explain the control of heart rate by cardio-inhibitory center.
解釋心抑制中樞如何控制心搏率。
The cardio-inhibitory center is linked by parasympathetic fibers within the vagus nerve, to the SA node and AV node. Impulses arriving at the parasympathetic nerve endings result in the release of small quantities of acetylcholine onto the cardiac muscle, inhibit activity of the pacemaker, thus reducing heart rate, stroke volume and hence the cardiac output.
心抑制中樞通過副交感神經(又稱迷走神經)與竇房結及房室結連接，刺激神經末梢釋出乙酰膽鹼，抑制起搏點的活動，降低心搏率及心搏量從而降低心輸出量。

16. What is the stimulus to affect the activities of the cardio-centers?
何種刺激會影響心加速中樞和心抑制中樞的運作。
The activities of these two centers is affected by the pH of the blood which in turn depends upon its carbon dioxide concentration.
由那個中樞刺激心臟是視情況而定，例如血液的 pH 值，而這又取決於血液中的二氧化碳濃度。

17. **State the detector and explain the physiological responses occur when the level of carbon dioxide in the blood rises.**
請說出血液中的二氧化碳濃度升高時的探測器名稱和對應的生理反應。
When carbon dioxide concentration of the blood increases as a result of vigorous exercise, **receptors in the carotid and aortic body detect this change** and **send nervous messages to the cardio-acceleratory center. Impulse is then generated in the motor neuron to the heart and intercostal muscles and diaphragm** which increases the heart beat and ventilation rate, thereby **increasing the rate at which carbon dioxide is delivered to the lungs for removal.**
劇烈運動會使血液中的二氧化碳濃度升高，血液的 pH 因而降低，主動脈體和頸動脈體的化學感受器探測到這一變化，會向心加速中樞發出神經脈衝，加速中樞使心搏加速，從而加快了向肺部輸送二氧化碳。

18. Describe the hormonal control of the heart rate.
試述心搏率的激素控制。
During exercise and excitement, the sympathetic nerve will send impulses to the adrenal gland to increase the secretion of adrenaline, and thyroid gland to to increase the secretion of thyroxine. These hormones, especially adrenalin, are powerful in increasing cardiac output to prepare the body for action in emergencies.
運動和緊張時，交感神經會發出神經脈衝往腎上腺，令它分泌腎上腺素，又令甲狀腺分泌甲狀腺素，這些激素，尤其是腎上腺素，可增加心輸出量，使身體作好準備，應付緊急事故。

19. What happens to the heart rate when sympathetic nerve is stimulated?
當副交感神經受刺激時，心搏率有甚麼變化?
The heart rate increases.
心搏率會減慢。

20. What happens to the heart rate when the parasympathetic nerve is stimulated?
當交感神經受刺激時，心搏率有甚麼變化?
The heart rate decreases.
心搏率會增加。

21. What can be deduced about the nature of innervations to the heart?
心搏率的神經控制是何性質?
The heart receives two nerves of opposing effects.
心搏率是受到兩條不同效應的神經所控制。

Check point 測試站 (57)

1. **Name the sex hormones that are produced by the pituitary gland.**
說出由腦下垂體所分泌的性激素。
Follicle stimulating hormone (FSH) and luteinizing hormone (LH).
促卵泡激素(FSH)及促黃體激素(LH)。

2. **Name the sex hormones that are produced by the ovaries.**
說出由卵巢所分泌的性激素。
Oestrogen and progesterone
雌激素和孕酮

3. **Give the functions of FSH.**
說出促卵泡激素的功能。
FSH stimulates the development of immature follicles in the ovary.
促卵泡激素刺激卵巢內的卵泡發育。
It promotes the secretion of oestrogen form the developing follicles.
它刺激發育中的卵泡分泌雌激素。

4. **Give the functions of oestrogen.**
說出雌激素的功能。
It causes repair of the uterus lining following menstruation.
引起月經後子宮內膜修補。
It stimulates the pituitary to produce luteinizing hormone (LH). (and also FSH*)
刺激垂體生成促黃體激素(及促卵泡激素)。

5. **Give the functions of luteinizing hormone.**
說出促黃體激素的功能。
It causes ovulation.
促使排卵發生。
It stimulates the ovary to produce progesterone from the corpus luteum.
刺激卵巢的黃體生成孕酮。

6. **Give the functions of progesterone.**
   說出孕酮的功能。
   Progesterone, produced by corpus luteum (yellow body), causes the uterus lining to be maintained in readiness for the embryo.
   由黃體所分泌，使子宮內膜維持厚度，準備胚泡的植入。
   High levels of progesterone and oestrogen together inhibit the secretion of FSH and LH from the pituitary.
   高水平的雌激素和孕酮一起運作，抑制垂體分泌促卵泡激素和促黃體激素。

7. **State the sequence of the production of the sex hormones.**
   說出性激素生成的次序。
   The hormones are produced in the following sequence : FSH, oestrogen, LH, progesterone.
   激素按下列次序生成：FSH、雌激素、LH、孕酮。
   Progesterone (together with oestrogen) at the end of the sequence inhibits the production of FSH.
   排在末尾的孕酮(和雌激素一起)抑制 FSH 生成。
   In turn, the production of the other hormones stops, including progesterone itself.
   繼而令其他激素也停止生成，其中包括孕酮本身。
   The absence of progesterone now means that the inhibition of FSH ceases and so FSH production starts again.
   沒有了孕酮意味著抑制 FSH 的生成也停止，促卵泡激素(FSH)的生成便重新開始。
   In turn, all the other hormones are produced. This produces a cycle of event – the menstrual cycle.
   而所有其他激素也可以由此生成，這些激素的交替啓動和關閉產生了一個週期—月經週期。

8. **Which hormone inhibits the production of FSH?**
   那種激素抑制 FSH 的生成？
   Progesterone (together with oestrogen)
   孕酮 (和雌激素一起)。

9. **Explain the action of contraceptive pill.**
   解釋避孕丸的避孕原理。
   It contains both synthetic oestrogen and progesterone and when taken daily it maintains high levels of these hormones in the blood. This inhibits the production of the gonadotrophic hormones from the pituitary, and the absence of FSH and LH prevents follicle development and ovulation.
   避孕丸含有合成的雌激素和孕酮，如果每天服用，可令這些激素在血液中保持高水平，這能抑制垂體產生促性腺素，缺乏促卵泡激素及促黃體激素可防止卵泡發育及排卵。

10. What is the importance of hormonal control of the menstrual cycle?
月經週期的激素控制有什麼重要性?

1. **Ensure one ovum is discharged at a time.**
   確保每次只排出一個卵子。
   The other follicle will undergo development only if the ovulated ovum is not fertilized. This would result in better survival of the foetus, and avoid expenditure or a large amount of energy in developing unnecessary ova.
   其他卵泡只會在已排出的卵子沒有受精時方會發育，這令胎兒有更佳的生存機會，及防止大量不需要的卵子同時發育，虛耗大量營養。
2. **Give time for the growth of ovum.**
   給時間卵子生長。
   Ovum needs time to accumulate nutrients for growth and mature.
   卵子需要時間積聚營養作生長及成熟。
3. **Prepare for implantation.**
   爲胚胎植入作好準備。
   It gives time for the hormones to exert its effect so that the uterine lining is thickened for the implantation of embryo.
   給予激素時間發揮其效應，令子宮內膜增厚，以便胚胎植入。
4. **Prepare for the next possible pregnancy.**
   爲下一次懷孕作好準備。
   Let menstruation occurs and sex hormones secrete again to start the next cycle and hence next possible pregnancy.
   讓月經發生及性激素的再分泌以產生另一次週期，爲下一次懷孕作用準備。

11. Explain the treatment of infertility by hormones.
解釋如何利用激素治療不育?

1. Treatment of failure of mature ova production by FSH: It stimulates follicle development
   用促卵泡激素治療不能產生成熟的卵子: 激素刺激卵泡發育
2. Treatment of no ovulation by LH: It stimulates ovulation
   用促黃體激素治療不能排卵: 激素刺激排卵
3. Treatment of failure of implantation by synthetic oestrogen and progesterone: It stimulates the thickening of the uterine lining for the implantation of the embryo
   用合成雌激素和孕酮治療著床難以發生: 激素刺激子宮內膜加厚，讓胚泡植入

Check point 測試站 (58)

1. **What will be the impact of human population explosion on the environment？**
   人口膨脹對環境有什麼影響？
   As the world population keeps on increasing, more land is needed to feed and house people and for various economic activities. As a result many natural habitats are destroyed, the balance of nature is disturbed. Many organisms are endangered and some are near extinction. Natural resources such as coal, natural gas and oil are good fuels. They are sources of plastics and other useful product. However, they will be exhausted if they are continuously extracted from the Earth. In addition, the development of technology after the industrial revolution in the 18^{th} and 19^{th} centuries has also caused many types of pollution. The environmental problems caused by human become more and more severe as the population increases.
   全球人口的持續上升，使人類需要更多的土地來生產糧食、建造房屋和進行各項經濟活動，爲了滿足這些需要，人類破壞了許多天然生態環境，擾亂大自然的平衡，使部份生物瀕危，甚至滅絕。另一方面，人類不斷從地層中發掘天然資源，如煤和石油作爲燃料及作爲塑膠和各類製品的原料，使資源逐漸耗盡。另外，在十八和十九世紀期間，工業迅速發展，引致各類污染問題，影響生態環境，而人口的不斷增加，亦令污染問題日趨嚴重。

2. **Why is population control necessary?**
   爲什麼需要控制人口?
   The rapid growth in human population will incease the exhaustion of natural esources and environmental degradation. Population control can help ensure a contiuous supply of natural resources for our current needs and for the future generations.
   人口急速增長會導致天然資源耗盡和環境退化，爲了確保我們和後代有充足的資源供應，我們必須控制人口增長。

3. **Suggest some practical method in population control.**
   建議一些控制人口的具體方法。
   Birth control is the most effective mean in reducing human population.
   生育控制是最有效的維持人口水平的方法。
   Family planning is essential in educating people the advantages of a small family so that they are willing to carry out birth control. In case of an unplanned pregnancy, legalized abortion is also an effective birth control mean.
   家庭計劃對控制人口方面非常重要，它可教育人們小家庭的優點，令他們願意進行生育控制，即是節育。在那些沒有計劃而引致的懷孕個案，合法墮胎是一個有效控制人口增長的方法。

4. With examples, explain what are non-renewable resources.
用例子解釋何謂不可再生資源。
They cannot be replaced as they are used. There is a fixed quantity of the resources on the Earth and in time they will be depleted.
它們被用後便不可再生，它們在地球上的數量是有限的，在一段時間後便會用完。例如:

(a) fossil fuel: eg. coal, petroleum and natural gas.
化石源料：例如煤、石油和天然氣。
(b) minera
礦物質。

5. With examples, explain what are renewable resources?
用例子解釋何謂可再生資源。
They **can be replaced. They are things which grow.** They are not produced in limitless quantities and their supply is ultimately exhausted if the rate at which they are removed exceeds that at which they have been produced. eg. agriculture, fishery, forestry and wildlife.
它們用後可再生，它們是能生長的物質，例如樹木和魚類。
但它們也不是無限量地生產的，亦會有機會耗盡，當它們所被移除的速率高於它們生產的速率時，它們便會耗盡。例如: 農業、魚業、森林業和野生生物

6. What are the consequences of uncontrolled usage of resources?
過度使用資源有什麼的結果？
(1) Environmental degradation:
降低環境的質素：
(a) Landscape destruction:
景觀受到破壞：
Over exploitation in forestry and the unrestricted hunting of wildlife has destroyed the scenery of the nature.
林業的過度開採和野生生物的不受限制捕獵會破壞自然生態的美麗景色。
(b) Soil erosion:
土壤侵蝕：
Over exploitation in forestry and over grazing by animals remove the protective natural plant cover, thus enhance the action of wind and subsequently promote soil erosion.
林業的過度開採和過度的放牧，會把土地上重要的植被移走，這樣當有強風來臨的時候，會把表面的土壤吹走，加速土壤侵蝕。

(2) Exhaustion of non-renewable resources:
耗盡不可再生資源：
(a) Exhaustion of fossil fuel : It is estimated that the supply could only last for 150 years.
耗盡化石燃料，估計化石燃料會在一百五十年後用盡。
(b) **Over exploitation of renewable resources :**
耗盡礦物質，若果不限制開採，某些重要的金屬將會在數十年內開採完。

(3) Over exploitation of renewable resources :

過度開採可再生資源：

(a) Over exploitation in fisheries :

漁業的過度開採：

It results in a decline in the regeneration of fisheries yields.

因過度捕魚使魚類沒有足夠的時間繁殖，引致魚類的產量下降。

(b) Over exploitation in forestry

林業的過度開採：

It results in a decline in the regeneration of forestry yields.

林業的過度開採，會使樹林沒足夠的時間及機會再生，引致林業產量的下降。

(c) Malpractices in agriculture:

農業的不當運作:

Destruction of natural habitats

破壞天然生境。

Soil erosion

土壤侵蝕

Chemical (toxic) pollution.

化學(毒性)污染。

Chemical fertilizers has adverse effect

化肥有害處:

Chemical used in rearing livestock has adverse effect

牲畜濫藥有害處:

7. Explain the difficulties arise at recycling of metals.

解釋金屬在循還再用所遇到的困難。

In theory these metals can be recycled, but in practice this is often difficult or impossible for various reasons:

理論上這等金屬可以循還再用，但實際上是很難實行的。

1. The metal may be oxidized or converted into a form **unsuitable for recycling.**
   該等金屬可能經氧化或轉化成一種不適合循還再用的形式。
2. The quantities of the metal within a material may be so small that it is **not worthwhile recovering it.** e.g. The thin layer of tin on most metal cans.
   在器具中的某種金屬的含量可能太低，故不值得將它抽提出來，例如在某些金屬罐面上的一層薄薄的錫質。
3. The metal is **often combined with many other materials**, which make it difficult to separate.
   某些金屬可能和另外的一些物質結合在一起，令它難以分離。

8. **Explain the effect of over exploitation in fisheries.**
   解釋過度開採漁業的影響。
   Results in a decline in the regeneration of fisheries yields.
   Extinction of certain species and disturbance of the ecosystem.
   因過度捕魚使魚類沒有足夠的時間繁殖，引致魚類的產量下降。
   這會引起某些品種的滅絕和擾亂生態的平衡。

9. **Explain the effect of over exploitation in forestry.**
   解釋過度開採林業的影響。
   Results in a decline in the regeneration of forestry yields.
   Extinction of certain species, and a disturbance of the ecosystem, resulting in a
   Decrease in other fauna, landscape destruction and soil erosion.
   林業的過度開採，會使樹林沒足夠的時間及機會再生，引致林業產量的下降。
   這會引起某些品種的滅絕和擾亂生態的平衡，結果引致植物種類的下降，景觀受到破壞和土壤侵蝕。

10. **What are the undesirable effects of the chemical control of pests and weeds?**
    使用化學藥品控制害蟲和雜草有什麼不良後果？
    The continued use of one pesticides to control specific pest often leads to the **selection of a resistant strain**. It is better to alternate the use of recommended pesticides rather than use the same one every time.
    長時期使用同一種殺蟲藥以控制某種害蟲會**使害蟲產生抗藥性**，故此輪流使用不同的農藥效果會較年年都使用同一種的農藥爲佳。
    Some pesticides are very poisonous. **When leaked out accidentally from the field may cause great harm to human being**. They have to use with great care.
    某些殺蟲藥的毒性非常高，當意外地**漏出田野時，會對人類構成極大的傷害**，故此，我們必須小心使用農藥。
    The insecticides **may kill non-target species**. Many pesticides are non-selective (not specific) eg. DDT. Besides the pest, it also kills other organisms like invertebrates, fish, etc. This upset the natural control of population size in the ecosystem.
    農藥**可殺死非目標生物**，大多數的殺蟲藥都不是選擇性的殺蟲藥(沒有專特性)，例如 DDT，除了殺死要殺滅的害蟲外，它亦會殺死其它的生物，例如無脊椎動物、魚類等。這樣會擾亂自然界的生態平衡，干擾了生態系統中各種群的大小。
    They may have **long poisoning effect**. Some pesticides are long lasting, i.e. they are non-biodegradable. eg. DDT is fairly persistent and can accumulate in the fatty tissue as well as along the food chains. DDT reaches a high concentration at upper trophic level and may kill the animals which contain it. Even though the concentration is not sufficient to kill, it may cause harm. The birds may be infertile and the egg shells are so thin that they break during incubation.

許多農藥**毒性深遠**，某些農藥能持久不變，即是它們不會輕易被微生物降解，例如 DDT 頗隱定，能在生物的脂肪組織積聚，它沿食物鏈累積，在高的食性層次上，會達到很高的濃度，那時便會殺死含有它的生物，就算它的濃度不足以殺死該生物，亦會構成傷害，如雀鳥會喪失生育能力，因爲蛋殼會變得很薄，在孵化時蛋殼會很容易破裂。

They may **harm the aquatic organisms**. Fungicides usually contain mercury and copper. These heavy metals are poisonous. They may pollute the rivers and coast when they are washed away by rainfalls or leaked into the underground water course.

農藥會**傷害水中生物**，許多殺眞菌劑都含有水銀和銅，此等重金屬非常毒，它們會污染河流，沖進海口時會污染海岸，或在下水道流出時污染海洋。

11. What are the adverse effects of excessive use of chemical fertilizers?
過量使用化肥有什麼不良後果？

The excessive use of chemical fertilizers will pollute the environment by causing；
過量使用化肥會因以下原因污染環境:

Soil erosion 土壤侵蝕：

The excessive use of chemical fertilizers will decrease the soil fertility render the land unsuitable for agriculture. It is because the intensive use of chemical fertilizers implies that organic fertilizers are being replaced. The soil becomes lack of humus or organic matter, and thus the water retaining ability is greatly reduced. When the farmer abandons the land, the top soil cannot be protected by vegetation and may be washed away easily by rainfall leading to soil erosion.

過量使用化肥會減低土壤的肥力，使它不再適合耕種，因爲大量使用化肥意味著有機肥料將被取代，土壤會缺乏腐殖質及有機物，保水能力大爲下降，當農民廢棄農田時，沒有植被保護表土，表土會被雨水沖走，引致土壤侵蝕。

Pollution 污染：

When too much fertilizers are applied to the farmland, it will not be all absorbed by the crops. Some leached into the nearby rivers and lakes. These fertilizers act as the nutrients for the algae. The massive growth of algae will upset the ecological balance and pollute the water course. It finally choked up the rivers, a condition called eutrophication. The algae used up the oxygen in the water at night. This causes aquatic organisms die of suffocation.

當太多化肥施於農地時，農作物並不會完全吸收所有化肥，有些便會流進(淋溶)附近的河流及湖泊，這些肥料會作爲藻類的營養，促進它們的生長，藻類的大量繁殖會干擾生態平衡，污染水道，引致河道淤塞，這情況便稱爲富營養作用。藻類晚間消耗水中氧氣來進行呼吸作用，水中生物因缺氧而窒息死亡。

Other effects 其他影響:

The manufacture of chemical fertilizers would release harmful gaseous into the atmosphere leading to air pollution and global warming. In addition, the leakage of fertilizers into the underground water may contaminate the drinking water.

生產化肥會釋出有毒氣體，引致空氣污染及全球暖化。此外，化肥可滲入地下水，引致食水污染。

12. What are detrimental effect of land clearance on the ecosystem?
闢地會對生態系統做成什麼的傷害？

1. **Depletion of lot of plant and animal species**.
   很多動植物品種會消失。
   The removal of natural habitat will lead to the extinction of many species.
   自然生態環境的移除會引致很多品種絕種。
2. **Loss of a lot of valuable medicine**.
   損失許多有用的藥物。
   Many important Chinese **herbal medicines** are come from forest flora.
   許多有用的中**草藥**都是來自森林植物的。
3. **Reduce the removal of carbon dioxide and the renewal of oxygen**.
   減少二氧化碳的排除和新鮮氧氣的供應。
   Vegetations are important in producing oxygen and removal of carbon dioxide. There may be green house effect as a result of increasing atmospheric carbon dioxide level.
   植物在產生氧氣的和排除二氧化碳方面很重要，二氧化碳水平的的上升最終會引起溫室效應。
4. **Destroy the beauty of landscape**.
   破壞美麗的景觀。
5. **Soil erosion**.
   土壤侵蝕。
   Land clearance may lead to soil erosion as peoples abandon the land later.
   It is because plant has the function of holding the soil particles, protecting the soil from washing away by heavy rains and adding organic matter to the soil.
   闢地會引致土壤侵蝕，當人們廢棄闢地而來的農田時，因爲沒有植物抓緊泥土的顆粒，保護表土免受雨水的沖刷，亦不再增加土壤中的有機物，這會引起土壤侵蝕。

13. What are the impact of land reclamation on marine organisms?
填海會對海洋生物造成什麼衝擊？

1. **Destroy the habitats of marine organisms**.
   破壞海洋生物的自然生境。
   There will be a loss of marine habitats along the original shore line due to reclamation.There will be a loss of breeding ground or feeding ground of many species.
   因爲沿海岸線的海洋生境會大量消失，許多品種的魚類都會失去它們的捕食和交配地區。
2. **Marine organisms are directly killed by burying the animals** as a result of dumping of soil at the reclaimed sites.
   填海時把泥土直接投進海中亦**會把大量的動物埋藏**，使到許多海洋生物被殺死。
3. **Increase in suspended solids in seawater.**
   增加海水中的懸浮粒子。
   This reduces light penetration in the water column thus affecting photosynthetic activity of phytoplankton.
   這會減低射進海水中的光強度，影響浮游植物的光合作用。
   The zooplankton would also be affected as they feed on phytoplankton.
   浮游動物也會受到影響，因爲它們靠捕食浮游植物維生。

In turn the food for the predator community such as fish will decrease and the entire food web will be affected.

因爲浮游動物減少會減少獵食者如魚類的食物，最終整個食物鏈都會受到影響。

The soil particles may clog the fish gills.

在水中懸浮的泥土顆粒亦會阻塞魚的鰓部。

The feeding of filter feeders is seriously affected.

許多濾食性獵食者，例如蠔等，都會受到嚴重的影響。

4. Increase in nutrient level in seawater.

   增加海水中的營養水平。

   Nutrients from the sediment are released into the seawater **causing eutrophication** (red tide).

   填海時的泥土會釋出營養，**引致海水的富營養作用**（紅潮）。

5. **Increase in toxin level in seawater**

   增加海水中的毒素水平。

   The soil may contain heavy metals and organic pollutants which poison the sea organisms when dissolved into seawater

   泥土中可能含有重金屬及有機污染物，會污染海水，毒害海洋生物。

6. Change in shore line may **affect the flow pattern and flow rate of water**.

   There will be an increased wave action in harbour due to excessive reclamation.

   海岸線的改變可能**影響水流的速度和水流的模式**，在海港中的過度填海會使到海浪增加。

Check point 測試站 (59)

14. Describe the effect of dust and smoke particles on the global temperature.

塵粒和煙霧顆粒對地球的溫度有什麼影響?

Dust and smoke particles reduces the visibility, lower the temperature of the Earth. (ice-box effect)

塵粒和煙霧顆粒會減低空氣的能見度，減少陽光進入地球，降低地球的溫度(冰箱效應)。

15. Describe the effect of air pollution on vegetation.

空氣污染對植物有什麼影響？

The presence of dust and smoke particles reduce the available light energy for photosynthesis.

Damages to vegetation: sulphur dioxide, nitrogen dioxide can cause the collapse of leaf tissues.

空氣污染物例如二氧化硫、二氧化氮等會引致樹葉組織萎縮，尤其是海綿組織。

塵粒及煙霧顆粒亦會減少給光合作用進行的光能。

16. Describe the effect of air pollution on causing human diseases.

空氣污染對人類健康有什麼影響？

Causing human diseases: as lung irritants that cause respiratory diseases.

Asbestos dusts: lung cancer. Tetramethyl lead: damage the nervous system.

Carbon monoxide: reduces the oxygen carrying capacity of blood.

空氣污染會引起人類疾病：

塵粒和煙霧顆粒亦會刺激肺部，引致呼吸道疾病，例如支氣管炎和哮喘。

從工廠排放出來的石棉及汽車煞制時磨擦出來的石棉會引起支氣管病和肺癌。

從汽車廢氣排放出來的含鉛化合物可在骨中積聚，破壞神經系統。
一氧化碳會減低血液的帶氧能力。

17. Describe the effect of air pollution on deterioration of materials.
空氣污染對物質的侵蝕有什麼影響？

The acid rain formed by dissolving nitrogen dioxide and sulphur dioxide in the atmosphere may deteriorate the concrete buildings and rocks.
The acid rain also increases the acidity of soil. In some industrial areas, the soil may be so acidic that the plants cannot grow.
大氣中的二氧化氮和二氧化硫會溶解於雨水中，變成酸雨，它們會腐蝕混凝土建築物和石塊。
酸雨亦會增加土壤的酸性，在某些工業區，泥土可能變得很酸，再也不適合植物的生長。

18. Describe the effect of increased concentration of CO_2 on the global temperature.
二氧化碳濃度上升對地球的溫度有什麼影響?

Carbon dioxide in the atmosphere traps the sun's heat like a green house and cause an increase in Earth's temperature (green house effect).
大氣中的二氧化碳可像溫室般把陽光的熱能困鎖著，令地球溫度的上升(溫室效應)。

19. Explain green house effect.
解釋溫室效應。

Carbon dioxide in the atmosphere traps the sun's heat like a green house and cause an increase in Earth's temperature (green house effect). The rise in temperature that green house effect produces will cause the gradual melting of the polar ice caps and consequent rise in sea level. This would in turn cause flooding of low-lying land.
太陽的光波能穿越大氣層令地球表面的物質受熱，但是物件所放出的熱能是較長的電磁波，被二氧化碳所阻擋，不能回到太空外，結果，二氣化碳把熱能困於大氣層內，就像溫室中的玻璃把熱能困在溫室內的道理一樣。溫室效應會引致地球的溫度上升，使兩極的冰塊溶化，令水平面上升，這樣會引致低窪地帶被海水淹蓋。

20. Explain the beneficial function of the ozone layer.
解釋臭氧層的益處。

Between 15 and 40 kilometres above the earth is a layer if ozone. A large amount of the potentially harmful ultra-violet radiation is absorbed and so prevented from reaching the earth's surface. Living things are protected from radiation that otherwise would destroy them by changing the structure of their nucleic acids, causing sun burnt and skin cancer.
地球上方十五至四十公里處有一臭氧層，由紫外光輻射射擊氧氣所造成，具危險性的紫外光輻射會被吸收而不能到達地球表面，生物可免受紫外光輻射的傷害，因爲紫外光能改變核酸的結構，引致皮膚灼傷及皮膚癌。

21. With an example, explain the effect of air pollutants on ozone layer.
用例子解釋空氣污染對臭氧層的影響。

Pollutants such as the chlorofluorocarbons (CFC) can affect the ozone layer. They enter into the stratosphere irreversibly react with ozone molecules. The ozone molecules are broken to oxygen gas. This beneficial ozone layer is being damaged by atmospheric pollution to the point where a hole in it had appeared over the Antarctic and possibly the Arctic too.

許多污染物都可破壞臭氧層，其中最出名的是氯氟碳化物(CFC)。CFC 用於冰箱作爲冷凍劑，它惰性特別強，不容易降解，能保持不變地進入同溫層，使臭氧分解爲氧氣，這層有益的臭氧層正被空氣污染所破壞，在南極的臭氧層已穿了一個洞，可能北極也有。

22. Explain the two origins of sewage and how do they create a biochemical oxygen demand.
解釋污水的兩個來源及它們如何造成生化需氧量。

Sewage has two main origins: from industry and from the home. Domestic effluents is 95-99% water, the remainder being organic matter. Organic material is harmless, but it acts as a food source for many saprophytic organism, especially bacteria. Aerobic saprophytes decompose the organic material - a process called putrefaction - and in so doing use up oxygen. This creates a biochemical oxygen demand (BOD).

水質污染是排放家庭廢水(包括：糞便、洗潔精、殺蟲劑等)和工業廢水(包括：染料、洗潔精和金屬鹽)等入河流和海洋而引起的。

家庭廢水(污水)有 95-99%是水，其餘爲有機物。有機物本身無害，但它是很多腐生生物，尤其是細菌的食物來源。在有氧的情況下，需氧腐生生物會將有機物分解，稱爲腐敗作用，此過程需要氧氣，產生生化需氧量，簡稱 **BOD** 一詞。

23. Explain the effect of untreated sewage on aerobic species.
解釋排放未經處理污水入水道對需氧生物的影響。

Where sewage is deposited untreated into relatively small volumes of water, i.e. rivers and lakes rather than the oceans, the **BOD may be great enough to remove entirely the dissolved oxygen**. This **causes the death of all aerobic species,** including fish, **leaving only anaerobic ones.** In addition to the death of aerobic species, these conditions can **result in the build up of ammonia and hydrogen sulphide from anaerobic decomposition of sewage**. The chemicals are toxic and result in an almost lifeless river.

若污水未經處理就排放到相對較小的水體時，即河川和湖泊而非海洋時，BOD(生化需氧量)可大至足以完全耗盡所有氧氣，從而導致所有需氧生物包括魚類的死亡，只剩餘一些厭氧品種。在沿河川多個不同地點都有污水排入的情況下，可能在大部份河長的河水都有缺氧狀態，這樣的條件除了令需氧物種死亡外，還導致污水缺氧降解所產生的氨和硫化氫積聚，這些化學物質有毒，可使河川幾乎變成沒有生命的死河。

24. What is eutrophication?

何謂富營養作用？

When an excess of nutrients is introduced into a freshwater habitat (rivers), it causes a dramatic growth in certain kinds of algae. When the nutrients have been used up, the algae die, and the bacterial decomposers which feed on the dead algae use up the oxygen in the water giving rise to an biochemical oxygen demand. This may be result in oxygen depletion and death of most living organisms in the rivers.

當過量營養排放進淡水生境，例如河流時，便會產生富營養作用，引致某些藻類急劇的增加。稍往下游，當營養用盡時，藻類會死亡，細菌開始把藻類分解，分解藻類時需要使用水中的氧氣，這樣會引起生化需氧量，需氧生物(魚類等)因缺氧而全部死亡。

25. Explain the cause of red tide.

解釋紅潮的成因。

Red tide is **a type of eutrophication caused by red algae bloom**. Usually the algae level in an aquatic area is **limited by the nutrient level available**. During summer time, the **sea water is warm**. The temperature is **favourable for the growth and multiplication of algae.** If the nutrient level is suddenly increased due to the **influx of nutrients produced by pollution**, **eutrophication occurs.**

紅潮是由一種紅色藻類大量繁殖所引起的富營養作用，通常海中的藻類水平是受到營養水平所限制的，當夏天來臨的時候，海水變得溫暖，溫度變得適合藻類的生長和繁殖，遇上流進海口的污水而令營養水平急速上升，便會發生富營養作用，引致紅潮。

26. Explain the effects of red tide.

簡述紅潮的影響。

* Due to a sudden increase in the algae population during eutrophication, the dissolved oxygen available to fish or other aquatic organisms decreased due to the increased uptake by the respiration of algae.
  因爲富營養作用而引致藻類大量繁殖，藻類在晚間會把水中的氧氣用掉，使到魚類及其他海洋生物沒有氧氣呼吸。
* The shortage of dissolved oxygen may lead to the death of such aquatic organism.
  在缺氧情況下會引致該等水生生物大量死亡。
* Moreover, some types of micro-organisms causing a red tide may be toxic to fish or other organisms.
  此外，某些引起紅潮的微生物會分泌毒素毒害魚類及其他海洋生物。
* Some types of red tide may cause direct harmful effects to a person's health.
  某些紅潮可以對人類的健康構成直接的傷害。
* When the nutrients are exhausted, the algae will die . The decomposition of the dead bodies of the algae causes further decreases in dissolved oxygen.
  當營養耗盡，藻類開始死亡，細菌在分解死亡的藻類時，需要使用氧氣，引致溶氧量進一步減少。

27. What is the main cause of oil pollution?

由石油所引起的海水污染的成因是什麼？

Spilling of oil during oil tanker accidents mainly causes oil pollution. In addition, there is deliberate discharge of waste oil from ocean-going vessels, accidental spillage in harbors when oil is transferred from ship to shore.

大部分由石油引起的海水污染的原因是非法在海面清潔油船的油罐，非法傾倒廢油，或是油船發生意外時洩漏原油。

28. Describe the effect of oil pollution on water birds.

說出油污對海鳥的影響。

Oil spills is **very damaging to water-birds.** The **oil coats their feathers**. The birds, while trying to clean themselves by preening, **can ingest the oil and be poisoned;** or the oil may deposit on their plumage and **destroy their natural heat insulation**. Bird will become chilled and die. Heavily oiled bird can **lose their buoyancy and drown**.

油污會傷害海鳥。這些海鳥在嘗試用嘴清潔留於羽毛上的油污時，會吃進石油，因而中毒。海鳥還會因羽毛沾油不能飛翔而特別危險。油污還會降低保溫的能力，造成低溫致死。被嚴重油污沾污的海鳥會喪失浮力，因而會遇溺。

29. Describe the effect of oil on sea plant.

說出油污對海中植物的影響。

The oil coats seaweed, preventing photosynthesis.

油污包著海藻，阻礙光合作用

30. Describe the effect of oil on shellfish.

說出油污對貝殼類的影響。

The oil covers the gills of shellfish, interfering with feeding and respiration.

油污遮蓋貝殼類的鰓，干擾攝食和呼吸。

31. Explain why the top consumers are more affected by insecticides (eg.DDT) than lower consumers.

爲什麼高級消費者較低級消費者更易受農藥(DDT)所影響？

1. DDT is sprayed on the field to kill the pests. The crops absorb DDT at low concentration.
   DDT(滴滴涕)施於農田以殺死害蟲，穀物吸收了低濃度的 DDT。
2. DDT is non-biodegradable. It cannot be excreted or broken down in the tissues.
   DDT 很難降解，亦不會排出體外或被身體分解。
3. One pest feeds on many crops and one carnivorous bird feeds on many pests, DDT will accumulate in the body and concentrate along the food chain.
   一隻害虫可吃許多穀物，而捕食牠的雀鳥可吃許多的害虫，故 DDT 會在身體內積聚，且沿食物鏈不斷提升。
4. Finally the top consumers (birds) will have the highest concentration of DDT in their tissues. They become poisoned and some may be killed. Even the concentration is not sufficient to kill, it may cause harm.

最終頂級消費者(鳥類)會有最高的 DDT 濃度，牠們會中毒，有些會死亡，就算 DDT 濃度未高至致命，亦會對動物構成傷害。

Check point 測試站 (60)

1. **State the 3Rs principle and its importance in pollution control.**
   說出在控制污染所採用的 3R 原則及其重要性。
   Reduce, Reuse and Recycle the resources.
   減少使用、再三使用及循環再造。
   Importance: minimize pollution and run out of resources
   重要性: 減少污染及資源耗盡

2. **State the 3 key pollution control strategies in Hong Kong.**
   說出香港控制污染的三大策略。
   (1) To reduce municipal solid waste
   減少都市固體廢物
   (2) To reduce air pollution
   減少空氣污染
   (3) To solve sewage problem
   解決污水問題

3. **State the 4 main topics in reduction of municipal solid waste.**
   說出減少都市固體廢物的四大綱領。
   1. Source separation of solid waste
   固體廢物源頭分類
   2. Recovery and recycling programs
   回收及循環再造計劃
   3. Reduction on plastic bags
   減少使用膠袋
   4. Development of EcoPark
   發展環保園

4. **Explain what the government has done in the reduction of air pollution.**
   解釋政府在減少空氣污染方面所作的努力。
   - The use of leaded petrol had been banned in 1999.
   自 1999 年起禁用含鉛汽油。
   - Adopting higher fuel sulphur content and vehicle emission standards.
   採用嚴格的汽油含硫及廢氣排放標準。
   - Promoting the use of liquefied petroleum gas, a cleaner fuel, in public light buses and taxis.
   鼓勵小巴和的士採用更潔靜的液態石油氣燃料。

- Requiring the installation of catalytic converters in all diesel vehicles to remove nitrogenous compounds, carbon monoxide and incomplete burnt hydrocarbons in exhaust fumes.
  要求柴油車輛安裝催化轉化器以減少氮氧化物、一氧化碳和未燃燒的碳氫化合物排放。
- Reducing exhaust fumes by switching off engines while waiting.
  推行「停車熄匙」措施以減少汽車的廢氣排放。

5. State and explain some air pollution control methods.
說出並解釋一些控制空氣污染的方法。

1. Remove the toxic components (especially petroleum derivatives and sulphur) from the fuel and refuse before burning.
   在燃料中及廢氣中移除有害物質(特別是汽油衍生物及硫磺)。
2. After burning, the pollutants in the smoke can be removed by means of filtering, electrostatic precipitation, or dissolving them by certain solvents. The incinerators in Hong Kong are all fitted with one of these devices. Using catalytic converters in car exhaust systems.
   在燃燒後的污染物可用過濾設施來移除，例如使用靜電過濾器，或把它溶解於某些溶劑中，香港的焚化爐都配有此等除污設施，在汽車的排氣系統安裝催化轉化器。
3. Increase the use of alternative energy sources such as
   solar energy, hydro-electricity, wind energy, tidal power
   and geothermal power, etc.
   增加使用其他能源，例如太陽能、水力發電、風能、潮汐能及地熱能。
4. Smoke control by legislation :
   立法控制污染：
   (1) Factory owners are fined if they allow too much smoke to be emitted out.
   工廠若排出過多的廢氣，東主會受到檢控。
   (2) Exhaust fumes from motor vehicles are checked by police and their owners will be fined if the amount of smoke exceeds the standard value.
   警察會檢查汽車所排放出來的污染物，超標者會被檢控。
5. Plant green vegetation everywhere so that carbon dioxide can be recycled.
   在各處種植植物以吸收空氣中的二氧化碳，使它可循環再用。

6. Explain what the government has done in solving sewage problem.
解釋政府在解決污水問題所作的努力。

1. User pays sewage charge:
用者自付排污費:

The consumer has to pay a sewage charge on the volume of water supplied. The charge not only covers part of the cost of sewage treatment works, but also encourages us save water and reduces sewage discharge.
使用者須爲所使用的水付出排污費，此費不單可補助部分污水處理費用，還可教育用戶節約用水，減少污水的排放。

2. The Harbour Area Treatment Scheme :
淨化海港計劃

It is an overall sewage collection and treatment scheme for areas on both sides of Victoria Harbour.
它是環繞維港兩岸區域所進行的污水收集及處理綜合工程。

It involves the construction of long deep underground tunnels to carry sewage from both Hong Kong and Kowloon side to a sewage treatment plant at Stonecutters Island for chemical treatment and disinfection.
它涉及建造一個很長的深層隧道系統，將來自港島及九龍的污水，輸往昂船洲的污水處理廠作化學處理和消毒。

7. State and explain some water pollution control methods.
說出並解釋一些控制水質污染的方法。

(a) Effluents from the factories should be controlled. Toxic substances should be prevented from entering water.
必須控制從工廠排放出來的污水，阻止有毒物質進入下水道。

(b) Domestic sewage should be treated by sewage treatment plant before discharging into river or sea.
家居污水在排放前必須經過污水處理，才能排放到河道或海中。

(c) Agricultural effluent is treated by integrated farming system. Solid wastes are collected and converted to compost.
農業污水可用綜合農業系統來處理，收集到的固體廢物可用作堆肥。

(d) **Biodegradable** pesticides or biological control methods are used to kill the pests instead of DDT which requires a very long time to degrade.
改用可生物降解的殺蟲藥或生物控制法來殺死害蟲，而棄用 DDT，因爲 DDT 需要一段很長的時間才能降解。

(e) After an oil spill, chemicals and microbes can be used to break down the oil to reduce the adverse effects of oil pollution.
發生油污後，可用化學物品和微生物來將油污分解，減少它對海洋生物的不良影響。
Peoples are educated through mass medium or campaigns like the ‘clean Hong Kong campaign’ to keep the water clean by not littering.
透過大眾傳播媒介或舉行像「清潔香港運動」等運動來教導人們不要在水中丟棄垃圾。

(f) Industrial wastes are collected and treated in the chemical Treatment Plant at Tsing Yi. Heavy penalty is put by the government on the discharge of it.
收集工業污水然後進行污水處理，例如在青衣的化學處理廠，未經處理的污水若排放進水道中，將會受到政府的重罰。

8. Explain the problems in recycling.
解釋循環再造所遇到的困難:

1. High costs involved in collection and separation of waste materials.
收集和將廢料分類的成本很高。
2. The public awareness of the importance of environmental protection is still relatively low.
公眾的環保意識仍然很薄弱。

3. Small house sizes in Hong Kong restrict waste separation and storage.
   香港的屋宇細小亦限制了垃圾的分類及儲藏。
4. The low prices and lack of market demands of some recovered materials (eg. plastics and glass)
   回收的物料價值很低(例如塑膠及玻璃)及缺乏市場亦限制了循環再用的發展。

9. Describe the modern methods of sewage treatment.
簡述現代處理污水的方法。

1. Primary treatment 初級污水處理：

Sewage is passed through a series of screens to remove large objects, such as boxes and rags, then through a finer screen to remove grit. The sewage then passes into sedimentation tanks. The sludge is taken off for anaerobic digestion. The supernatant liquid, or effluent , passes onto the next stage for secondary treatment.
污水先經過一連串的粗篩以去除大塊物件，如碎石、木頭、木箱等，以免阻塞處理廠的管道和設備，跟著經過幼篩以隔除碎屑。污水跟著流入有圓錐形底部的大池中(沉澱池)，有機物質，瘀泥和沙會沉降到池底，沉降下來的物質稱爲污泥，會定期自池底移到污泥消化池進行缺氧呼吸消化，已除去大部分固體廢物的污水稱爲廢水，由沉澱池頂部排走，流入另一個污水池(曝氣消化池)，進入下一階段─次級污水處理。

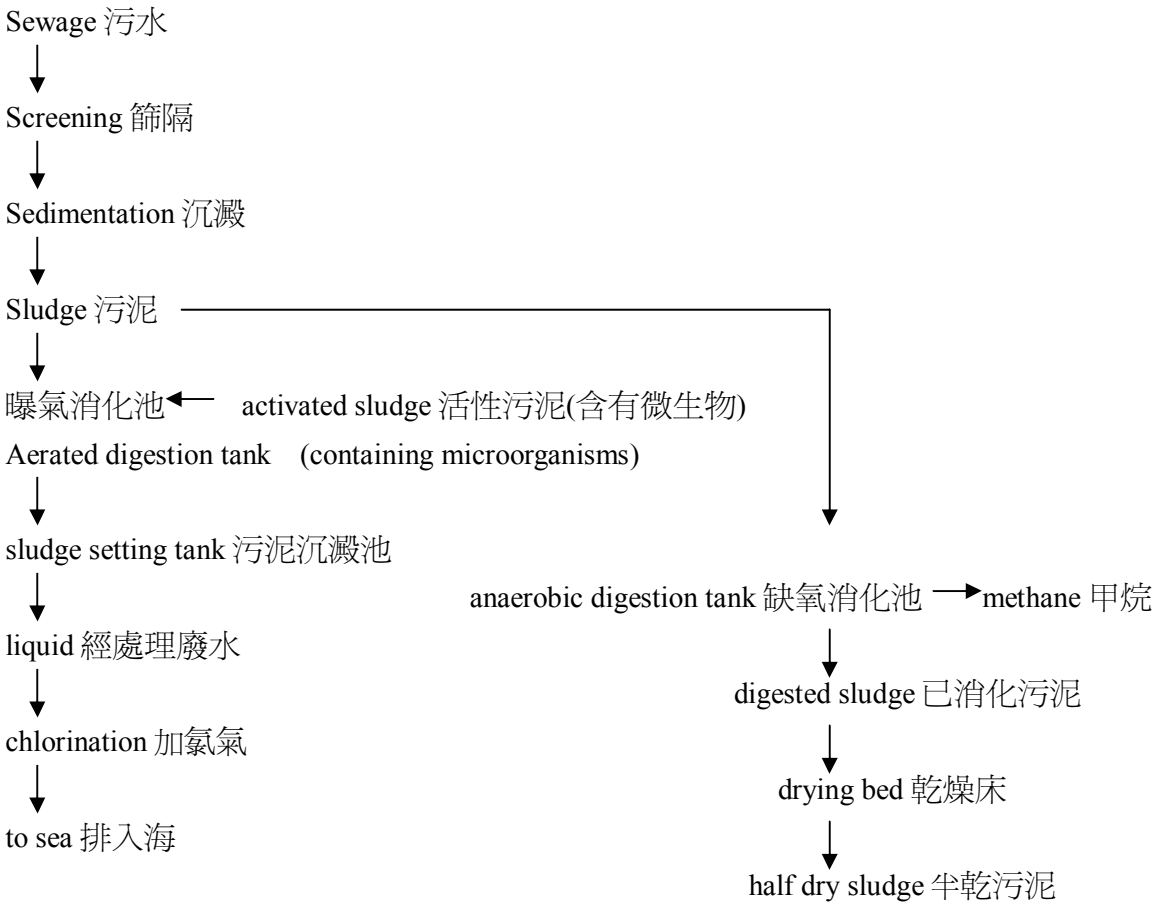
2. Secondary treatment 次級污水處理：

Aerobic microorganisms are used to break down most of the organic matter in the effluent. The organic matter in the sewage is used as a nutrient medium for the growth of a great variety of aerobic microorganisms in large tanks. Oxygen levels are kept at a very high level by constantly aerating the sewage, either by bubbling air through or by rapidly rotating paddles.
此法應用活性污泥法，污水中的有機物會作爲微生物的食物，幫助居於大水池中一系列的有氧呼吸微生物生長，水中的氧氣濃度維持在高水平，這可透過在水中加氣來達到，常用的方法是在水中打氣或快速攪動螺旋葉片。處理終結時，大部分的水中有機物都會被除去，留下的污泥含有大量的微生物，這些微生物一部分會循環再用，作爲下一次污水處理的種子，餘下的便會移走，進行無氧呼吸的污泥消化。

3. 污泥的缺氧分解：

Sludge is transferred to a large air tight tank (anaerobic digestion tank). Methane (biogas) is the only thing produced in anaerobic conditions. Temperature must exceed 15^{o}C. The methane produced is used to heat up the digester. Sometimes it is used to generate electricity which can be used to power the sewage plant. Digested sludge is then dried. Often it is used as landfill in reclamation. It may be applied to farm land as a soil conditioner. It improves the water-retaining capacity of the soil and supplies certain mineral salts, such as phosphates and nitrates.
污泥會被移進密封的大池(缺氧消化池)，分解成簡單的化合物，釋出甲烷(沼氣)，溫度須長期維持於 15 ℃ 以上。所釋出的甲烷可將消化池加熱，或用作發電，以供應整個污水處理廠的電力。消化過的污泥排入大池(乾燥床)，再經過空氣乾燥以減低水分，生成的半固體物質可用作填海。這些污泥是良好的土壤改善劑，它可增加土壤的保水力和肥力，例如磷及硝酸鹽。

10. Draw a flow diagram of treating sewage in a city sewage treatment plant.
繪出污水處理廠處理污水的流程圖



11. Give two reasons for treating sewage,
說出兩個處理污水的理由。
Firstly, sewage can contain pathogens which cause disease. Secondly, by treating sewage, pollution of the environment can be avoided.
進行污水處理有兩個原因，首先，污水含有引起疾病的病原體，再者，經過處理後，環境的污染便可大爲降低。

12. Explain the need for conservation.
解釋保育的需要。
Conservation is the wise management of our environment so as to maintain a balance between harvest and renewal so that there will be a continual yielding of natural resources.
保育是良好地運用天然資源以使它們不會受損，在收獲與重生間取得平衡，使資源可源源不絕的供應。

13. Explain the importance of maintaining biodiversity.

解釋維持生物多樣性的重要性。

1. Every species helps scientists understand how life has evolved and how it will continue to evolve.
   每個品種均可幫助科學家瞭解生物的起源及它如何進化。
2. The organisms in an ecosystem are interdependent. Each species forms important parts of food chains and plays a specific role in the ecosystem.
   生態系內的生物是互相依賴的，每個品種於食物鏈內都有其特別功能。
3. Biodiversity is our heritage, just like art and cultural achievements. We have the responsibility of keeping it.
   生物的多樣性像藝術和文化般，是我們的遺產，我們有責任保存它。
4. Almost all food crops are **domesticated** from wild tropical plants. Plant breeders and farmers rely on their genetic diversity to improve crop yield, develop new crops and pests and diseases resistant crops.
   差不多所有穀物都是從野生植物馴養而來，馴養者及農夫依賴野外植物的相異基因
5. Wild plants supply us oils, dyes, fibre, paper and other useful products.
   野生植物爲我們提供油類、染料、纖維、紙張和各種有用物質。
6. Wild plants supply us **herbal medicines**.
   野生植物爲我們提供草藥。
7. Wild plants and animals are a source of beauty, wonder, joy and recreational pleasure for us. Wildlife tourism enables people to visit natural environments for relaxation. It also helps to educate people about the importance of conservation. Wildlife tourism is a kind of business, it provide jobs and income for many people.
   野生動植物爲我們提供美景、歷奇及娛樂，生態旅遊可使人們從緊張的生活鬆弛下來，又可教導人們環保的重要性，同時它亦是一盤生意，爲許多人提供職業及收入。

14. What are the causes that lead to endangered species?

什麼原因造成物種瀕危?

1. Commercial exploitation or over harvesting of a species either legal or illegally:
   因商業理由而進行的合法或非法過度開採或獵殺:
   This causes population drop to a very low level. eg. the hunting of tiger for their bodies as food and medicine, the killing of elephants for their ivory, the killing of turtles for their shells.
   這使種群數目下降至非常低的水平，例如捕殺老虎作食物或醫藥、捕殺大象以取象牙、捕殺烏龜以取龜殼。
2. Indiscriminate hunting or collection:
   胡亂的獵殺及收集:
   It decreases many wildlife populations, eg. hunting for sport results in disappearing of leopards.
   使許多野生種群數目下降，例如爲娛樂而獵殺使獵豹面臨絕種。
3. Destruction of natural habitats:
   自然生境被破壞:
   Land cleared for urban development, construction of highway and recreation purpose. eg. golf course at Sha Lo Tung will destroy Hong Kong's best dragonfly habitat.

闢地作市區發展、建築高速公路或娛樂用途，例如在沙螺洞建高爾夫球場便會破壞香港最好的蜻蜓繁殖場。

Acid rain has destroyed the forest.
酸雨破壞了森林。

Industrial wastes and agricultural wastes have polluted the streams and rivers.
工業廢料及農業廢料污染了溪澗及河流。

4. Predation by abandoned animals:
   被遺棄了的動物所捕食:
   The introduced cows and sheep may **over graze** the plants on island.
   引進的牛羊被遺棄後可過度牧食島上的植物。

15. State some ways for the general public to protect the endangered species.
說出一些普羅大眾可保護瀕危物種的方法。

1. **Do not buy** items such as ivory products, leopard furs or tiger skins.
   不要購買用瀕危物種造成的用品，如象牙製品、豹皮大衣或老虎皮等。
2. **Do not eat** endangered animals
   不要吃瀕危物種。
3. **Do not keep** endangered animals as pets.
   不要飼養瀕危物種作寵物。
4. **Do not engage** in hunting for sport.
   不要爲娛樂而捕獵瀕危物種。
5. **Do not pick** or collect specimens of plants when out for walk in countryside.
   在野外旅行時，不要採摘植物作標本。
6. **Have an awareness** of how man's activities endanger plants and animals.
   對人類的活動會影響瀕危物種的生存要有警覺性。
7. **Support signature** campaigns to rescue endangered species.
   支持爲拯救瀕危物種而舉行的簽名運動。

16. Explain how the related authorities can protect the endangered species.
解釋有關機構如何可保護瀕危物種。

1. The government protects the endangered species by **legislation**. The following practices are prohibited:
   政府透過**立法**保護瀕危物種，禁止:
   - Hunting or disturbance of wild animals or their nests.
     捕獵野生動物或騷擾其巢穴。
   - Feeding wild animals.
     餵飼野生動物。
   - Damaging plants in any forest.
     破壞樹林中的植物。
   - Sale and possession of protected wild plant and animal species.
     售賣及管有受保護的野生生物。

2. **Breeding programs** are set up by research centres, like
   科研機構設立**育種計劃**，如:
   - Artificial insemination (captive breeding) in the breeding of panda.
     繁殖熊貓時的人工授精(人工育種)。
   - Captive breeding in the conservation of Romer's tree frog.
     拯救盧文氏樹蛙的人工育種。
   - Endangered plant species (eg. orchid) are reproduced by artificial propagation.
     瀕危植物(如蘭花)可用人工繁殖方式育種。

3. **Gene banks** are set up by research centres:
   科研機構設立**基因庫**:
   Seeds, sperm, ova, tissues, blood products and DNA of endangered species are stored in liquid nitrogen vessels to keep viability. They may be used for the later breeding.
   把瀕危物種的種子、精子、卵子、組織、血液成分和 DNA 等，於液態氮中冷藏以保持其生命力，以用於稍後的人工育種。

4. Through **education programs** run by government or conservation groups, the public are told the importance of conservation
   可透過政府或環保團體所舉行的**教育活動**來提高公衆的環保意識。

17. Explain the government's work in the conservation of habitats.
解釋政府在生境保育所做的工作。

(1) Country parks 效野公園

They are set up by the government for nature conservation, countryside recreation, education and scientific studies. The conservation measures are :
這些公園由政府設立，用作自然保育、鄉效娛樂、教育和科研，保育措施如下:

- tree planting and vegetation management.
  植樹和植被管理。
- preventing of hill fire.
  防止山火。
- setting up of bird-nest boxes for bird breeding.
  設置巢箱供雀鳥繁殖。
- building of educational facilities, such as visitor centres and natural trails.
  提供教育設施，如遊客中心和自然教育徑。

(2) Natural reserves 自然護理區

There are two nature reserves in Tai Po Kau and Mai Po. The one in Tai Po is the natural habitats of many species of butterflies and birds. Visitors are welcome there. While in Mai Po are fish ponds, gei wai, reed bed and migratory birds. Permission is needed for public visit.
香港有兩個自然護理區，分別位於大埔滘及米埔，大埔的是許多蝴蝶和雀鳥的棲息地，歡迎遊客參觀，米埔的有許多魚塘、基圍、蘆葦床和候鳥，公眾須申請才可參觀。

(3) Marine reserve 海岸保護區

There is a marine reserve in Cape D'Aguilar. It is a rocky shore rich with coral that all coastal activities are prohibited. It is for conservation and scientific study only.
鶴咀有一個海岸保護區，那是擁有豐富珊瑚礁的岩岸，嚴禁一切捕魚和水上活動，只供保育和科研。

(4) Marine parks 海岸公園

There are four marine parks. Recreational activities are allowed (like swimming and diving) but collection of specimen is prohibited.
香港有四個海岸公園，遊客可在公園內作消閒活動(如游泳及潛水)，但是禁止採集標本。

(5) Sites of special scientific interest (SSSI)具特殊科學價值地區

Areas with special animals and plants like Mai Po Marshes, Hoi Ha Wan and the Cape D'Aguilar are planned to be SSSI. No development will be allowed there except for conservation.
具有特殊動植物品種的地區(如米埔濕地、海下灣和鶴咀)被劃定爲具特殊科學價值地區，那裏預留作保育區，不可發展。

(6) Ramsar site 拉姆薩爾濕地

It arose from an international convention in 1971. All participating countries must at least designate one Ramsar site (wetland) within their country for conservation. The one in Hong Kong is the Mai Po Inner Deep Bay.
由 1971 年的國際會議所倡議建立，締約國須在本國內最少劃出一個拉姆薩爾濕地，進行保育，香港的位於米埔內后海灣。

(7) Wetland Park 濕地公園

It is a piece of re-constructed wetland at Mai Po which house many water birds and wildlife. It opens for the public and serves the purpose of displaying the biodiversity of Hong Kong's wetland.
這是一片位於米埔的經重建濕地，它是許多水鳥及野生生物的居所，開放予公眾作爲旅遊景點及展示香港濕地生態系的多樣性。

18. Explain ecological restoration of damaged land with the use of afforestation as an example.
用植林作例子解釋受破壞土地的生態重建。

Ecological restoration is to restore the damaged habitats close to their natural state.
生態重建是將受損的生境回復至接近原貌。

Afforestation 植林

The cutting of trees for fuel wood and burning down trees for farm land in the past have made the hillsides barren. Afforestation aims to reduce soil erosion has been practiced for hundred years. Fast growing trees like Taiwan Acacia and paper-bark tree are commonly planted in the program. The forest provides food and shelter for local animals. The woodland area has increased from 4% in 1940 to 17% now.

過去鄉民砍伐樹木作燃料及燒毀林地作農地，令到很多山頭變成禿地，此百年間，政府不斷植林以減少土壤侵蝕，通常會種植快速生長的樹木，如台灣相思及白千層，樹林能爲原生動物提供食物和居所，自 1940 年至今，林地的面積已由 4%升至 17%。

19. Explain the importance of afforestation.

解釋植林的重要性。

1. Control of soil erosion
   控制土壤侵蝕。
2. Maintain the fertility of the soil
   維持土壤的肥力。
3. Provide food, cover and shelter for wild life
   爲野生動物提供食物、遮蓋和居所。
4. Removal of carbon dioxide and renewal of oxygen
   增加氧氣，移除二氧化碳。
5. Provide natural resources for rural inhabitants:
   給鄉民提供天然資源。
   - They may get food and fruit.
     提供食物及水果。
   - Their cattle may have grass to eat.
     爲牛隻提供糧草。
   - They can get fire wood for cooking.
     提供木柴作燃料。
   - They can get herbal medicine for treatment of illness.
     提供草藥治病。
6. Town inhabitants may obtain recreation through the following ways :
   市區居民亦可透過以下途徑獲取娛樂:
   - Countryside provides places for picnic and camp sites.
     鄉郊提供旅行及露營的地方。
   - It provides a sense of enjoyment and contentment for people who want to appreciate nature.
     給喜好鄉郊生活的人提供欣賞自然界的機會及滿足感。
   - It provides natural trails for educational purpose.
     提供作教育用的自然教育徑。

20. What is meant by sustainable development?

可持續發展是什麼意思?

Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

可持續發展是指既能滿足我們現今的需要，而又不損害子孫後代，能滿足他們的需要的發展模式。

21. What is the importance of sustainable development?

可持續發展有什麼的重要性?

It is based on conservation and the sustainable use of natural resources, making use of efficient economic development to achieve the goal of creating a society with improving quality of life.

它從自然資源的保育及可持續利用出發，有效地利用經濟發展，以達致建立一個不斷改善生活質素的社會爲目標。

Sustainable development offers a number of potential benefits. These include:

採用可持續發展可獲得以下的潛在利益：

1. Reduced wastage (eg. through energy savings);
   減少浪費(例如通過節約能源)；
2. Improved health and reduced economic burden on health care;
   改善健康狀況，減少保健的經濟負擔；
3. More efficient land use and improved amenity from outdoor areas;
   更有效地使用土地與改善戶外地方的康樂設施；
4. Greater community ownership of quality of life issues.
   對改善生活質素問題上有更強的社區歸屬感；
5. Greater competitive advantage as Hong Kong's regional and international image as a clean, safe and sophisticated world city is enhanced.
   加強香港在區域及國際間作爲一個清潔、安全及先進的世界級城市的形象，從而加強香港的競爭優勢。

22. How are fisheries managed in a sustainable way in Hong Kong?

香港的漁業應如何管理以符合可持續發展?

1. **Implementing fishing moratorium**
   設立休魚期
   Fishing is forbidden each year from June to August in South China Sea. This gives time for fish to grow and reproduce.
   每年的六至八月禁止在南中國海域捕魚，這讓魚類有機會生長和繁殖。

2. **Prohibiting destructive fishing methods**
   禁止破壞性捕魚方法
   The use of explosive, cyanide, electricity and bottom trawling are prohibited by law.
   立法禁止使用魚砲、氰化物、電擊和底拖網等方法捕魚。

3. **Running of the artificial reef project**
   施行人工魚礁計劃
   Put boulders, construction wastes in appropriate sites to build artificial fish reef so as to provide habitats for marine organisms.
   在適當的地點以大石塊，或建築廢料等建造人工魚礁，吸引各種魚類聚居和繁殖。

4. **Giving advice on aquaculture**
   爲漁業提供意見
   Develop fish farming (farming of fish, shrimps and shellfish) rather than sea fishing. It

reduces the burden on wild fisheries.

發展養魚業(養殖魚、蝦、蠔)而非單靠捕魚業來獲取魚類，這可減低野生魚類的負擔。

23. How are forestry managed in a sustainable way in Hong Kong?

香港的林業應如何管理以符合可持續發展?

1. Forests are protected by law

   林木受法例保護

   Control deforestation for agricultural, industrial and urbanization purpose.

   管制伐林以作農業、工業及市區發展。

2. Afforestation programs

   植林計劃

   Reforest areas where fires have occurred.

   山火發生後立即進行植林。

3. Prevention of fire

   防止山火

   Create fire lines for prevention of fire.

   設立隔火路以阻止山火蔓延。

   During the fire season from October to April, AFCD fire crews are on duty to detect and fight hill fires within country parks.

   每年十月至翌年四月的山火高峰期，漁農自然護署的滅火隊會在效野公園內巡視，監視並撲滅山火。

4. Forest certification system

   林木認證系統

   This system assures the timber is obtained from well-managed and conserved forests to avoid destruction of the wild forest.

   此系統可確保木材是來自管理妥善及環保的森林，以避免破壞野外的森林。

24. How are agriculture managed in a sustainable way in Hong Kong?

香港的農業應如何管理以符合可持續發展?

Organic farming is the key of environment protection as well as sustainable agricultural development. It uses organic fertilizers and organic pest control method in crop rotation.

有機耕種是保育環境及推動農業繼續發展的重點，它是於輪作上應用有機肥料及有機害蟲防治法。

1. **Organic fertilizers**

   有機肥料

   Compost is the most common form of organic fertilizer. It is made up of animal manure and waste plant material recycled from farm. Under aerobic condition, the bacteria will decompose the organic matter into compost.

   堆肥是常用的有機肥料，它由農場的動物糞便及植物廢料組成，在有氧情況下，利用細菌將有機物分解成肥料。

Organic fertilizers contain a lot of nutrients required by plants and it helps to hold soil particles together (improve aeration and water retaining ability). The use of compost not only provides nutrients to crops but also reduces pollution problems by recycling the waste material.
有機肥料除了富含植物所營養外，亦可將土壤顆粒黏結在一起，增加通風及保水力，使用堆肥不單可爲農作物提供營養，還可透過廢物的循環再造減低污染。

2. **Organic pest control**
   有機害蟲防治法
   Organic pesticides such as matrine and derris root extract are used to control pest. They will be decomposed naturally and will not accumulate in body tissues.
   有機殺蟲劑是指用諸如苦參鹼和魚籐水等植物提取物殺滅害蟲，殺蟲劑會於陽光下分解，故不會在生物組織積聚。

   Biological control is the other way of pest control. The pest is either killed by using its predator (ladybird is used to control cottony cushion scale) or by bacterial and worm infections.
   生物防治是另一種害蟲防治法，一是利用天敵殺滅害蟲(如用瓢蟲防治吹棉蚧殼蟲)，或是利用細菌或小蟲感染害蟲，把害蟲殺死。

3. **Crop rotation**
   輪作
   Particular nutrients will be depleted quickly if a single type of plant is grown on a field for a long time. Crop rotation can prevent this by growing of different types of plants in different seasons, or different years. The advantages are as follow:
   若長期於同一農地上種植同一種植物，某些營養素會很快用完，輪作是在不同季度或年度種植不同的農作物，這可減少營養的耗盡。輪作的好處如下:

   - Soil can remain fertile for a longer of time.
     農田能長時間保持肥沃。
   - It interrupts the host-specific pest life cycle and reduces the pest population.
     它干擾某些具宿主專特性的害蟲的生命週期，減少害蟲的數目。
   - Growing of leguminous plants in crop rotation can increase soil fertility as nitrogen fixing bacteria live in the root nodules of these plants.
     於輪作中種植豆科植物可增加土壤肥力，因爲固氮細菌居於此等植物的根瘤中。

Check point 測試站 (61)

1. **What is a microorganisms?**
   微生物是什麼?

   Microorganisms are very small organisms that can only be seen under the microscope including protista, algae (unicellular/microscopic), bacteria, cyanobacteria (blue green bacteria), fungi and viruses.

   微生物是非常細小的生物，用顯微鏡才可看見，它們包括原生生物、一些藻類(單細胞/微小的)、細菌、藍綠細菌(藍綠藻)、真菌和病毒。

2. **What is the structure of a virus?**
   病毒有什麼的結構?

   A virus consists of nucleic acids (either DNA or RNA) surrounded by a protein coat. It has no nucleus, cytoplasm, cell organelles, cell wall or cell membrane.

   病毒含有核酸(只有一種，非 DNA 即 RNA)，外層包有蛋白質外殼，沒有細胞核、細胞質、細胞器、細胞壁及細胞膜。

3. **How do viruses multiply?**
   病毒如何繁殖?

   Viruses can only multiply inside living host cells. The major stages of multiplication are as follows:
   病毒只能在寄主細胞內繁殖，主要的步驟如下:

   1. **Attachment 依附:**
      It adheres to the bacterium by its tail.
      它用尾部依附於細菌表面。

   2. **Penetration 注入:**
      The tail sheath contracts. The cell wall of the bacterium is punctured and the DNA strand of the phage is injected into the bacterium. The protein coat remains outside and takes no further part in the reproductive process.
      尾鞘收縮，細菌的細胞壁被刺穿，噬菌體的 DNA 注入細菌體內，蛋白外殼仍然留於細菌體外，它在隨後的生殖作用中再沒有功能。

   3. **Biosynthesis and replication 生化合成與複製:**
      Phage DNA codes for production of phage enzymes using protein synthesizing machinery of host. Phage inactivates and breaks down host DNA and phage DNA takes over cell machinery. Phage DNA replicates itself. ie. make new viral proteins and new viral nucleic acids.
      病毒 DNA 的密碼指令寄主的代謝系統製造病毒酵素，這些酵素可鈍化和破壞寄主的 DNA，在此，病毒的 DNA 可完全取代細菌的代謝系統，此後噬菌體進行自我複製，即是製造新病毒蛋白質外殼和核酸。

4. **Assembly 組裝:**
   After about 20 minutes, new phage particles are generated by assembly of protein coats around phage DNA. 100 to 300 complete phages are formed.
   二十分鐘後，蛋白殼和新製成的病毒 DNA 結合，成爲新的病毒粒子，每次大約可製造一百到三百個病毒粒子。

5. **Release 釋出:**
   Lysozyme made by phage DNA causes cell lysis releasing phages to infect other bacterial hosts if available, or if not, each can remain dormant indefinitely.
   稍後病毒 DNA 會指令製造溶菌酶，將細菌壁溶解，釋出新的病毒粒子去感染其他的細菌，如沒有適合的寄主時，它可以保持無限期休眠狀態。

4. State the growth requirement of microorganisms.
列出微生物的生長要求。

(1) Water 水分
(2) Nutrition 營養
(3) Temperature 溫度
(4) Oxygen 氧氣
(5) Salinity 鹽度
(6) pH 酸鹼度
(7) Osmotic pressure 滲透壓
(8) Organic growth factors 有機生長因子

5. How do microorganisms grow?
微生物如何增長?

Most microorganisms divide into two identical individuals by binary fission when they reach a suitable size. The process repeatd regularly and the population of microorganisms increases exponentially in favourable conditions.
當微生物達到一定體積，大部分以二分法繁殖，一分爲二，此過程會週期性地重覆，在有利的環境下，微生物會以對數式急劇增長。

6. State the different stages of growth in microorganisms.
列出微生物的不同生長期名稱。

1. Lag phase 遲滯期
2. Log phase 對數期
3. Stationary phase 靜止期
4. Death phase 死亡期

7. Explain lag phase.

解釋遲滯期。

Growth is slow at first, while the microbes acclimate to the food and nutrients in their new habitat. They are immature and not yet able to divide.

生長起初很慢，因爲微生物都在適應新的食物和環境中，他們是不成熟的，仍未能分裂。

8. Explain log phase.

解釋對數期

It is the favourable condition for growth, the organisms multiply at a rapid rate. Most individuals are reproductive mature and there are plenty of food. Number doubles every few minutes.

種群在沒有限制因素的情況下，以不斷加快的速率增長，因大多數個體已達性成熟，而且食物充足，數目於數分鐘內便可加倍。

9. Explain stationary phase.

解釋靜止期

The population density reaches maximum and becomes constant. Overcrowding and competition occur. Nutrient starts to decrease and toxic wastes accumulate.

種群的密度達至極限而變得穩定，發生過度擠迫和競爭，營養開始減少，有害廢物逐漸積聚。

10. Explain death phase.

解釋死亡期

Toxic waste products build up, food is depleted and the microbes begin to die. Death rate exceeds birth rate, resulting in a decrease in number of individuals.

積聚太多的有毒廢物，營養耗盡，微生物開始死亡，死亡率高於出生率，引致個體數目的下降。

11. Describe the procedures in viable count.

簡述活數的步驟。

(1) Make the appropriate ten-fold serial dilutions

作適當的十倍系列稀釋。

(2) Inoculation of the bacteria onto the algar plate.

將細菌接種於瓊脂碟上。

(3) Incubation

溫培。

(4) Counting the cells

數算細胞

(5) Calculation

計算

12. Describe the procedures in optical density count.

簡述光學密度數的步驟。

A spectrophotometer is used to measure the percentage of light transmission through a liquid microbial culture, which is inversely proportional to the population of microorganisms. The larger the percentage of light transmission, the smaller is the microbial population. The population can be work out by reference to the O.D. population table.

利用光譜分析儀量度出穿透過微生物培養液光線的百分比，這與微生物的數量成反比，越多光透過，越少微生物，參照光學密度對微生物數量表，便可找出微生物的數量。

13. Describe the procedures in direct count.

簡述直接數的步驟。

The samples are observed under a microscope. By using a cell counter, the number of bacterial cells from a given volume of sample is counted, dead cells are also counted too. By using the known volume trapped in the grid, the density of the microorganism can be worked out.

將細菌樣本置於顯微鏡下觀察，利用細胞數算器，一定容量培養液內的細菌會被數算，包括死細胞。利用已知的網格容量，計算出微生物的密度。

14. Describe the procedures in biomass count.

簡述生物量數的步驟。

It involves extracting the microorganisms from the liquid culture and weighting it directly. The microorganisms are obtained by getting the residues after centrifugation. The residues are then dried by heating at 100^{o}C for 10 hours. The dried residue is weighted and can represent the population of the microorganisms.

此法採取從培養液中分離微生物然後替他量重，微生物可用離心機抽取，獲得的殘餘物在 100℃ 高溫下烘乾 10 小時，然後秤量乾燥的殘餘物，這可推算出細菌的數量。

15. Explain the importance of aseptic techniques..

解釋消毒技巧的重要性。

Aseptic techniques are the precautionary measures taken to prevent contamination of pure cultures and sterile laboratory equipment. We must treat all organisms as potential pathogens for sake of safety. Many of the organisms can be opportunistic in their abilities to cause infection.

消毒技巧是防止純種培養液及實驗儀器受到污染的預防措施，我們必須將所有微生物當作病原體處理以策安全，許多微生物都可作伺機性感染。

16. What are aseptic techniques?

何謂消毒技巧?

Aseptic techniques are the procedures used to exclude unwanted microorganisms in order to avoid contamination. It involves sterilizing equipment and culture media before and after use for safe disposal.

消毒技巧是防止微生物意外外泄，引致污染的必要步驟，它包括在實驗前或後消毒儀器及培養基，確保安全。

17. Describe the method of making solid medium.
簡述固體培養基的製作法。

1. Boil agar powder / pieces with nutrient solution.
   瓊脂片加水和營養素一起煮沸成溶液。
2. The resulting mixture is poured into sterilized petri dishes. Add cover.
   將所得的溶液倒進已消毒的平淺碟內，加上蓋子。
3. The petri dishes with agar solution are sterilized by heating under pressure in an autoclave.
   將盛有瓊脂液的平淺碟放進高壓消毒柜，以高溫加壓消毒。
4. After sterilization, let the liquid agar solidifies at room temperature. A petri dish containing solidified nutrient agar is called an agar plate. It is ready to culture bacteria.
   消毒後，讓瓊脂液在室溫下冷卻成固體，載有固體營養瓊脂的平淺碟現在可稱爲瓊脂碟，它已可以用來培植細菌。

18. Describe the method of making liquid medium.
簡述液體培養基的製作法。

1. Dissolve the necessary nutrient in distilled water.
   將所需營養素加進蒸餾水中。
2. The resulting mixture (nutrient broth) is poured into sterilized test tubes.
   將所得的溶液（營養液體培養基）倒進已消毒的試管內。
3. The test tubes with nutrient broth are sterilized by heating under pressure in an autoclave.
   將盛有培養液的試管放進高壓消毒柜，以高溫加壓消毒。
4. After sterilization, the mouth of test tube is covered with a plug of cotton. It is ready to culture bacteria.
   消毒後，在試管口加上棉花塞，它已可以用來培植細菌。

19. Describe the streak plate method in inoculating the culture medium.
簡述接種細菌時的平板劃線法。

1. The inoculating loop is first sterilized by heating it to red hot.
   接種環首先加熱至通紅以消毒。
2. The loop is allowed to cool down for 10 seconds.
   讓接種環冷卻十秒。
3. The loop is dipped into a broth containing the bacteria.
   將接種環浸入含有細菌的營養液體培養基內。
4. The loop is stroked across the surface of agar in a series of continuous S shaped movements.
   把接種環在瓊脂表面劃線，劃出多條連續的之字形線條。
5. The loop is sterilized again by heating, stroked across the surface again after cool down on unstroked area.
   將接種環再次加熱，冷卻後在瓊脂表面未劃線區繼續劃線。

20. Why should the growing microorganisms be incubated?
爲什麼培植中的微生物需要溫培?

An incubator can control the temperature as well as the concentration of oxygen and carbon dioxide inside its chamber. This can promote microbial growth.
溫培箱可控制溫度、氧濃度及二氧化碳濃度，這可加快微生物的生長。

21. Compare the advantages and disadvantages of different counting methods.
比較不同量度方法的優劣。

Counting method 量度方法	Advantages 優點	Disadvantages 缺點
Viable count 活數	Can distinguish viable and dead. 可分辨生與死。	No instant result and laborious. 不可即時知道及較麻煩。 Some microorganisms cannot be cultured. 有些微生物不能培養。
Optical density count 光學密度數	Convenient and has instant result. 方便及可即時知道結果。	Not applicable to low population. 不適用於低含菌量。
Direct count 直接數	Instant result and simple instrument. 可即時知道結果及儀器簡單。	Cannot distinguish viable and dead, and very often bacteria are too small to be detected. 不可分辨生與死，許多時細菌過小難於觀察。
Biomass count 生物量數	Easy way to obtain data. 操作容易。	Not accurate for low population. Cannot distinguish viable and dead, 於低含菌量時不準確，不可分辨生與死。

Check point 測試站 (62)

1. State all the beneficial aspects of microorganisms.
列出微生物對人類的各種好處。

1. Food production 食物製造
2. Food processing 食物加工
3. Vaccines 製造疫苗
4. Antibiotics 製造抗生素
5. Industrial enzymes 製造工業用酶
6. Sewage treatment 污水處理
7. Biogas production 生產沼氣
8. Pollution indicating organism 作爲污染指示生物

2. Explain the use of microorganisms in producing food.
解釋在食物製造上如何應用微生物。

Unicellular microorganisms are grown and used as single-cell proteins for livestock and human consumption. Mycoprotein produced by fungi as a meat substitute is an example.
單細胞微生物可製成單細胞蛋白被牲口或人類直接食用，例子:利用眞菌蛋白作爲肉類代替品。

3. How are microorganism used in producing health food?
解釋如何應用微生物於生產健康食品。

Microorganisms rich in certain nutrients can be used as health food. Eg. Spirulina is used to produce powder capsules as a dietary supplement. It is added to normal food products, such as milk.
富含某類營養素的微生物可用作健康食品，如螺旋藻可製成粉狀膠囊作爲食物補充劑，或加進日常食品中，如奶類。

4. Compare the advantages and disadvantages of using single-cell protein?
比較使用單細胞蛋白的優劣。

Advantages **優點**	**Disadvantages** **缺點**
High production rate due to high growth rate. 高生產率，因有高生長率。	Single-cell proteins are colourless and tasteless. 單細胞蛋白無色無味。
They can be easily genetically modified for varying the amino acid composition. 很容易基因改造以改變氨基酸成份。	Product safety and quality have to be concerned. 產品安全及質素需小心控制。
High protein content. 高蛋白質含量。	Some bacterial and fungal protein have amino acids different from animal proteins. 有些細菌及眞菌的氨基酸與動物的不同。
Cheap or waste materials are used to grow microbes, may help in the removal of pollutants. 可用廢物培植，既便宜又可減少污染物。	The consequences to humans after long term consumption are still not quite clear. 人類長期食用後的後果還未十分清楚。
Land requirements is low. 土地需求低。	The required equipment and production process are expensive. 儀器及製作程序非常昂貴。
No religious and ethical issues. 沒有宗教和道德上的顧慮。	As it is come from microbes, may not be accepted by some of the customers. 因爲是由微生物而來，未必人人能接受。

5. Explain the use of microorganisms in food processing.
解釋在食物加工上如何應用微生物。

1. Alcoholic fermentation by yeast.
   利用酵母菌釀酒。
2. Baking of bread. The carbon dioxide released by yeast is used to raise the dough so that the bread becomes porous and soft.
   製造麵包，麵團發酵時酵母所釋出的二氧化碳在烤焗時會膨脹令麵包變得鬆軟。
3. Production of butter and cheese (by some species of Penicillium).
   製造牛油和乳酪(利用青黴菌)。

4. Production of yoghurt (by bacteria).
   製造酸乳酪(利用細菌)。
5. Production of vinegar (by fungi).
   製造醋類（利用眞菌）。

6. Explain the use of microorganisms in vaccines production.
解釋在製造疫苗上如何應用微生物。

Some diseases are caused by pathogenic microorganisms. Whole microorganisms, their components (eg. antigens) or products (eg. toxins) are used to produce vaccines to induce immunity against diseases.
有些疾病是由致病性微生物引起，整個微生物或部分身體(如抗原)或產品(如毒素)皆可作爲疫苗刺激接種者產生免疫反應。

Whole agent vaccine:
全菌疫苗:
Vaccines containing whole microorganisms which are either weakened or killed.
疫苗含有整個微生物，那是已死或減弱了的微生物。

Subunit vaccine:
次元疫苗:
Vaccines containing components of a pathogen rather than the whole organism (eg. outer surface protein)
疫苗含有部分微生物而非全體，如外殼的表面蛋白。

7. Explain the use of microorganisms in producing antibiotics.
解釋如何應用微生物製造抗生素。

Antibiotics are substances produced by microorganisms that inhibit or kill other microorganisms. They can be used to treat infections inside the body of both humans and animals. eg. penicillin.
抗生素可殺死其他的微生物或阻止它們的生長，它們可用作醫治人類及動物的傳染病，例如青黴素。

In its mass production, the fungus grows in large fermenter. The growing fungus secretes the antibiotic into the culture medium. The culture medium is filtered to obtain the liquid filtrate. Antibiotics in the filtrate can then be extracted and purified.
於大量生產時，有關的真菌會在大型發酵器內生長，生長中的真菌會釋出抗生素於培養液內，培養液會被過濾以獲取濾液，其內的抗生素會被抽提出來及加以提純。

8. Explain the use of microorganisms in industrial enzymes production.
解釋在工業用酶製造上如何應用微生物。

Microorganisms are widely used to produce enzymes which are used in many industries.
微生物廣泛應用於生產工業用酶。

1. Biological washing powder:
   生物活性洗衣粉:
   Microorganisms are usd to produce various enzymes, such as amylase, lipase and protease to break down stains on clothes.

微生物用來生產不同的酶，如澱粉酶、脂肪酶和蛋白酶，這些酶可去除衣服上的污蹟。

2. Fruit juice extraction:
   果汁的提取:
   Enzymes ae used to increase the volume of juice produced and the speed of extraction.
   Pectinase is used to digest pectin in cell walls and helps release more juice than can be achieved by squeezing. Pectinase can also make the juice clearer and sweeter.
   利用適當的酶可增加果汁提取的體積及加快提取速度，果膠酶可分解水果的細胞壁，將果膠移除，用於果汁抽取時，比直接搾取獲得更多的果汁，果膠酶亦可令果汁更清及更甜。

9. Explain the use of microorganisms in sewage treatment.
解釋在污水處理上如何應用微生物。

In secondary treatment, aerobic microorganisms present in the sewage or added from the previously digested sludge break down the organic wastes into harmless inorganic compounds in aerobic condition.
在次級污水處理，需氧微生物在有氧的情況下，將有機物分解爲無害的無機物。
The sludge is digested by anaerobic microorganisms in the digester to produce methane gas.
餘下的污泥會送往缺氧消化池，於缺氧情況下，被微生物分解爲甲烷。

10. Explain the use of microorganisms in biogas production.
解釋在生產沼氣上如何應用微生物。

Biogas consists mainly of methane which is an excellent fuel. It burns cleanly and is produced from the fermentation of organic wastes in a digester.
沼氣主要成分是甲烷，它是一種極佳的燃料，燃燒後很清潔，由有機廢物在缺氧消化池發酵而生。
In the digester, the organic wastes are broken down by different types of anaerobic microorganisms, including methogens, into methane.
在消化池，不同的缺氧微生物，尤其是甲烷菌，會將有機廢物分解爲甲烷。

11. How can microorganisms be used as pollution indicating organism?
微生物如何可應用於作爲污染指示生物?

E. coli is a kind of bacteria that is frequently used as a biological indicator of water pollution (both marine and fresh water). The number of it increases with the degree of pollution caused by organic matters (like human and animal faeces). Since faeces are a potential vector for spreading intestinal pathogens, detection of it in water sources suggests the water has a high risk of causing intestinal diseases. The water source is not safe for human consumption or leisure activities.
大腸桿菌 E. coli 常用作水質污染的指標（海水及淡水皆適用），它的數量隨著由有機物(如人類及動物糞便)引起的污染程度增加而增加，因爲糞便是傳播腸道疾病的媒體，若在水體中出現將表示有高度傳播腸道疾病風險，那水源不適合人類飲用或作消閑活動。

12. What is recombinant DNA technology?
何謂重組 DNA 技術?

A fragment of DNA (containing the target gene) from one organism combines with the DNA of a different organism. The resulting DNA contains a new combination of genes from two different organisms. This new DNA is called recombinant DNA.

一生物的 DNA(含有目標基因)與另一不同生物的 DNA 結合，形成的 DNA 含有新的遺傳組合，此新 DNA 名爲重組 DNA。

13. What are genetically modified organisms?
什麼是基因改造生物?

Organisms produced by recombinant DNA technology are called transgenic or genetically modified organisms, of which the majority are microorganisms.

由重組 DNA 技術產生的生物名爲轉基因生物或稱基因改造生物，其中大部分都是微生物。

14. Explain the use of genetically modified microorganisms.
解釋基因改造微生物的應用。

GM microorganisms have great contributions to medical, industrial and agricultural areas. They are the living factories for producing drugs, hormones, enzymes and vaccines.

基因改造微生物廣泛應用於醫療、工業和農業上，它們是生產藥物、激素、酶和疫苗的活工廠。

Example (1):

Insulin is produced by GM bacteria.

胰島素是由基因改造細菌所製造。

Example (2):

Hepatitis B vaccine is produced by GM yeasts (a gene codes for protein coat in hepatitis B virus is introduced into the yeast cell).

乙型肝炎疫苗是由基因改造酵母所製造(將製造乙肝病毒蛋白外殼的基因導入酵母細胞)

Example (3):

The enzymes required by the synthesis of fructose are produced by GM bacteria.

用於生產果糖的酶是由基因改造細菌所製造。

15. State the potential hazards of the applications of genetically modified microorganisms.
說出使用基因改造微生物的潛在風險。

1. It may enhance the development of super pathogens.
   可能製造出「超級病原體」。
2. It may upset the ecological balance when GM microorganisms accidentally released into the nature.
   當意外地釋放至自然環境中，可能會干擾生態平衡。
3. It may be used as biological weapon by terrorist.
   可能被恐怖分子用作生物武器。

Check point 測試站 (63)

1. **How do viruses cause diseases?**
   病毒如何致病?
   All viruses are parasites. They use the host machinery in reproduction and upset the physiological balance of the infected cell. They kill the host cell when new viral particles leave and burst the cells and so resulting in disease.
   所有病毒都是寄生者，它們利用寄主細胞的器材繁殖，擾亂寄主細胞的生理平衡，當新病毒粒子離開細胞時，會令細胞破裂，因而殺死細胞，因而致病。

2. **How do bacteria cause diseases?**
   細菌如何致病?
   Bacteria multiply among body cells and cause various types of tissue damage. They may produce enzymes to digest host tissues. Some release toxins into the tissue fluid which is then circulated throughout body by bloodstream, Bacterial toxins often cause fevers, muscle spasms, vomiting, diarrhea, heart damage and respiratory failure.
   細菌在細胞間繁殖對組織做成破壞，它們會產生酶消化寄主組織，有些會在組織釋放毒素隨血流走遍全身，毒素會引致高熱，肌肉痙攣，嘔吐，腹瀉、心臟受損和不能呼吸。

3. **How do protists cause diseases?**
   原生生物如何致病?
   Protists include microscopic algae and protozoan. They cause disease by producing toxins or by releasing enzymes that disturb the normal functioning of the host cells. Some invade the host cell and cause massive death of it (eg. malaria).
   原生生物包括微小的藻類及原生動物，它們可分泌毒素或釋出酶，干擾細胞的正常運作，因而致病，有些會入侵細胞(如瘧疾)，引致細胞大量死亡。

4. **How do fungi cause diseases?**
   真菌如何致病?
   Fungi grow on or just below the surface of the bodies of the patients. They cause diseases by secreting enzymes to break down the host tissues and absorb the digested nutrients.
   真菌居於患者身體表面或表皮之下，它們會釋放酶以消化寄主組織，將溶解了的養份吸收。

5. **What are food-borne diseases?**
   什麼是食物傳染病?
   Food-borne diseases are caused by eating food contaminated with pathogens.
   食物傳染病由進食受病原體污染的食物而引起。
   There are two types: food-borne infections and food poisoning caused by microbial toxins.
   有兩種: 食物傳染和由微生物毒素引致的食物中毒。

6. Explain food-borne infection with a suitable example.
用例子解釋食物傳染。

Salmonellosis is a food-borne infection caused by bacteria of the genus Salmonella.
沙門氏菌病是一種由沙門氏菌引起的食物傳染病。
The bacteria live in the intestine of infected humans and livestock such as chickens and ducks. Therefore, food contaminated by faeces may contain Salmonella bacteria. The symptoms include diarrhea, abdominal pain, vomiting and a slight fever.
此菌居於人類及牲畜(如雞和鴨)的腸道中，故此吃了受糞便污染的食物，大有機會感染沙門氏菌，症狀包括:發燒、腹瀉和腹部抽筋。

7. Explain food poisoning caused by microbial toxins with a suitable example.
用例子解釋由微生物毒素引致的食物中毒。

Bacterial toxins 細菌毒素:
Botulism is a type of food poisoning caused by a bacterium called Clostridium. The bacterial toxin is very toxic. Patients may have double vision and drooping eyelids, slurred speech, dry mouth, difficulty swallowing and weak muscles. Severe case is fatal.
肉毒中毒(臘腸毒菌病)是一種由肉毒桿菌引起的食物中毒，此毒素非常之毒，患者會視力模糊、眼瞼下垂、言語不清、口乾、吞嚥困難和肌肉無力。嚴重時可致命。

8. What is microbial deterioration?
什麼是微生物引起的生物致劣?

1. Deterioration of food 使食物腐爛：
   Many are saprophytes. They cause food decay and food poisoning.
   許多微生物是腐生者，它們引起食物的腐爛和食物中毒。
2. Deterioration of man's belongings 腐爛人類的財物：
   Wood, wool, fur, paper, leather goods may be decayed by saprophytic micro-organisms.
   腐生微生物會腐爛木材、羊毛、皮草、紙張和皮革等。

9. What happens to the foodstuff in food spoilage?
食物腐爛時食物本質有何轉變?

Most spoilage involves the breakdown of proteins, fats and carbohydrates.
大部分的食物腐爛都有蛋白質、脂肪和碳水化合物的分解。
Proteins are hydrolyzed to amino acids, amines, ammonia and hydrogen sulphide.
蛋白質被水解爲氨基酸、胺、氨及硫化氫。
Fats are hydrolyzed to fatty acids and glycerol, while carbohydrates are fermented into acids, alcohols and gases.
脂肪被水解爲脂肪酸和甘油而碳水化合物發酵爲各種的酸、酒精及氣體。

10. What are the favourable conditions for food spoilage?
食物在何情況下最易腐爛?
Food spoilage is more likely when the food is rich in nutrients, oxygen and water are present and temperature and pH conditions are suitable.
食物腐爛在以下情況最易發生：營養豐富的食物、氧氣和水分充足、溫度及酸鹼度適中。

11. State some methods used to preserve food.
說出常用保存食物的方法。
Deep freezing, Refrigeration, Vacuum packing, Heating, Curing, Pasteurization, Bottling and canning, Osmotic dehydration, Picking, Drying,
冰凍法、冷藏法、真空處理法、高溫消毒法、煙燻法、巴斯德消毒法、瓶藏及罐藏法、醃製法、滲透脫水法、脫水法

Check point 測試站 (64)

1. What is biotechnology?
什麼是生物工程?
Biotechnology involves the use of organisms, biological systems or processes in producing goods or providing services.
生物工程是指利用生物、生物系統或生物過程製造產物或提供服務的各種技術。舉例如下:

2. Give some examples of traditional biotechnology.
請爲傳統生物工程舉一些例子。
1. Produce crops and animals with desirable characteristics by selecting the best varieties of organisms to breed. This is called selective breeding.
   選用最優良的品種進行交配以孕育出具有理想特徵的農作物和牲畜，這名爲選擇育種。
2. Use microorganisms to produce bread, cheese, soya sauce, wine and beer.
   利用微生物以製造麵包、乳酪、醬油、紅酒和啤酒等。

3. What is modern biotechnology. Give some examples.
什麼是現代生物工程，試舉一些例子。
Modern biotechnology involves the manipulation of DNA, cells, tissues or biological processes for mass production of goods and services. It includes genetic engineering and cloning.
現代生物工程是指操控 DNA、細胞、組織或生物過程以大量生產產物或提供服務。它包括遺傳工程和克隆(複製)兩大項目。

4. What is genetic engineering.

遺傳工程是什麼?

In genetic engineering, one gene or most commonly, a set of genes is taken out of the DNA of one organism and inserted into the DNA of another organism. It produces genetic products what human need. It modifies or creates new species.

遺傳工程是將一個或一組基因從某生物的 DNA 抽取出來，將它重新插入另一種生物的 DNA 中，它產生人類所需的產品，改變或創造新品種。

4. What is meant by cloning?

克隆是什麼意思?

A clone is a group of genetically identical individuals (or cells) derived from the asexual reproduction of a common ancestral cell. We can obtain a clone of cells by cell culture.

純系(克隆)是一組遺傳上完全一樣的生物(或細胞)，它是從同一祖先細胞無性繁殖而來，我們可透過細胞培養獲取一個純系(克隆)。

5. What are the functions of restriction enzymes, DNA polymerase, DNA ligase, DNA probes and vectors in genetic engineering?

限制酶、DNA 聚合酶、DNA 連接酶、DNA 探針和載體在遺傳工程方面有什麼用途?

Tool 工具	Function 功能
restriction enzyme 限制酶	To cut double stranded DNA at specific sites. 在特定位置切開雙鏈 DNA.
DNA polymerase DNA 聚合酶	To catalyse the synthesis of a new DNA strand against a template. 以單鏈 DNA 作爲模板，催化新 DNA 鏈的合成
DNA ligase DNA 連接酶	To catalyse the joining of complementary DNA fragments. 催化兩段互補 DNA 片段連接起來
DNA probes DNA 探針	To detect a gene of interest in a DNA sample. 探測 DNA 樣本是否含有目標基因
vectors 載體	To act as a carrier to transfer a gene of interest into a host. 負責攜帶目標基因，把目標基轉移到宿主

6. Why are plasmids suitable for use as vectors in recombinant DNA technology?

爲什麼質粒適合用作重組 DNA 技術的載體?

1. They are non-essential genes of the bacteria, but beneficial to the survival of them.
   它是非必要的基因，但攜有對細菌生存有利的基因。
2. They are small rings that the genes can be located by mapping easily.
   它是小環，基因的位置容易確定。
3. They take up foreign DNA readily.
   它能接收來自其他生物的 DNA。
4. They can be transferred easily between bacteria.
   它可以在細菌間轉移。
5. They can replicate independently of the bacterial chromosome and exist in multiple copies.
   它可以獨立於細菌的染色體，自我複製，可以出現多個相同的質粒。

7. Briefly describe the basic principle of recombinant DNA technology.
簡述重組 DNA 技術的基本原理。

1. Obtaining DNA fragments of desired gene.
   獲取目標基因片段
   Obtain DNA fragments from blood, saliva, semen and bones, etc.
   從血液、唾液、精液和骨塊等樣本獲取 DNA 片段。
2. Cutting out the DNA of the desired gene.
   剪出目標基因的 DNA
   The desired gene is cut into small sections by using restriction enzymes.
   用限制酶將目標基因切成小段。
3. Inserting the gene into a vector.
   把目標基因插入載體。
   The plasmids in bacteria are often used as vectors. The plasmid is also cut open by restriction enzymes first. The recombination of genes is carried out with the aid of the enzyme DNA ligase.
   細菌質粒時常用作載體，質粒亦是先用內切酶切開，目標基因和質粒的連接需要 DNA 連接酶的協助。
4. Insertion of the vector into a host cell.
   將載體導入寄主細胞。
   The vector (recombinant plasmid) carrying the desired gene is inserted into a host cell which allows the vector DNA to replicate. The host cell can be a bacterium, a yeast cell or a mammalian cell. They treat the foreign DNA as its own.
   帶有目標基因的載體(重組質粒)會植入寄主細胞，寄主細胞可以是細菌、酵母菌、甚或哺乳動物的細胞，它們會將目標基因視爲自己的基因。

8. What are the applications of recombinant DNA technology?
重組 DNA 技術有那些應用?

It can be used in producing useful products (eg. human insulin and growth hormone) and genetically modified organisms (GMOs).
可用於生產有用的產物(例如:人類胰島素和生長激素)及製造基因改造生物。

9. How to select the transformed bacteria?
如何篩選轉化了的細菌?

To select the transformed bacteria, plasmids carrying a marker such as an antibiotic resistance gene are used as vectors. eg. The recombinant plasmid carries both DNA encoding human insulin and antibiotic resistance gene. When the bacteria carry this recombinant plasmids are exposed to an antibiotic, only the transformed bacteria will survive.
爲了篩選成功轉化的細菌，帶有對抗生素有抗藥性基因的質粒會作爲載體，例如:同時載有人類胰島素基因及抗藥性基因的重組質粒，當帶有此重組質粒的細菌於含有抗生素的培養基上培植時，只有成功轉化的細菌能生存下來。

10. How to carry the recombinant plasmid into the plant cell?
如何將重組質粒導入植物中?

Method 1: Use bacterium mediated transformation technology to carry the recombinant plasmid into the plant cell (a biological method). eg. BT corn.

方法 1: 利用細菌介導轉化技術，將重組質粒導入植物中(生物性方法)，例如抗蟲玉米。

Method 2: The target genes are fired into plant cells by using a gene gun (a physical method). Before using, the tungsten beads are coated with DNA which contains the target gene. Then tungsten beads are fired into the target plant cells.

方法 2: 利用基因槍把目標基因發射到植物細胞內(物理方法)，在使用前，把帶有目標基因的 DNA 塗在鎢珠表面，然後用基因槍把鎢珠發射到目標植物細胞內。

11. How to carry the recombinant plasmid into the animal cell?
如何將重組質粒導入動物中?

Method 1: Microinjection－a physical method.

方法 1: 微注射－物理方法。

By using a super fine micropipette, inject the exogenous DNA directly into the fertilized ovum.

利用超幼細的玻璃微量吸移管，把帶有目標
基因的外源 DNA 注射到受精卵內。

Method 2: By using a retrovirus－a biological method.

方法 2: 利用逆轉錄病毒－生物方法。

A retrovirus (eg. tumor virus) is an RNA virus that is duplicated in a host cell using the reverse transcriptase enzyme to produce DNA from its RNA genome. The DNA is then incorporated into the host's genome. The pathogenic gene of the virus will be removed first before using.

逆轉錄病毒(例如腫瘤病毒)是一種 RNA 病毒，它可感染寄主細胞，利用逆轉錄酶將它的 RNA 轉製成 DNA，然後病毒 DNA 會結合到寄主的 DNA 中，寄主細胞複製時也會將病毒 DNA 複製。使用時會先將病毒的致病基因移除。

Check point 測試站 (65)

12. With an example, briefly describe the process of plant cloning.
用例子簡單描述植物複製的過程。

1. Remove the somatic cells (meristematic tissues) from a tomato plant.
   在番茄植物取一些體細胞(從分生組織)。
2. Place the cells into a sterile medium containing all necessary nutrients for growth and plant hormones for differentiation and development.
   將細胞置於含有所有營養素及植物激素的消毒培養基中。
3. Under suitable conditions, the cells divide and develop into a group of undifferentiated cells called callus.
   在適合的環境下，細胞會進行分裂發育成一團未分化的細胞群，名爲胼胝體。
4. Cut the callus into pieces. Transfer a piece to a solid medium for the development of plantlets.
   將胼胝體分成許多小塊，移植其中一塊到固體培養基中長久培植，讓它長成一株小植物。
5. The mature cloned plant is regenerated.
   複製出一株成熟的植物。

13. Explain the cloning process of the cloned sheep Dolly.
簡單解釋複製羊多莉的複製過程。

1. An unfertilized egg was collected from a sheep (A).
   從一隻羊(A)取出未受精卵。
2. The nucleus of the unfertilized egg was removed.
   該未受精卵的細胞核被去掉。
3. A cell was taken from the mammary gland of the donor sheep (B).
   從一個捐贈羊(B)的身體取出一個乳腺細胞。
4. The nucleus from mammary gland cell wastransferred into the enucleated egg cell.
   該乳腺細胞的細胞核被移入去核的未受精卵。
5. The fused cell was incubated in a culture medium for six days to develop into an embryo (C).
   這結合了的細胞會放進培養液中培植六天，讓他發育成一個胚胎(C)。
6. The embryo which has the genes of the donor animal (B) was implanted into the uterus of another sheep (D) (the surrogate mother).
   這與捐贈羊(B)有相同基因的胚胎被植入另一隻代母羊(D)的子宮中。
7. A baby sheep named Dolly whose has genes identical to the donor (B) was born.
   最後誕生一個基因與原捐贈羊(B)完全相同的新生命－複製羊多莉。

14. State some applications of plant cloning.

說出植物複製的一些應用。

To grow plants that are endangered, or economic importance which is hard to grow by traditional method. (eg. orchids) 生產瀕危植物(如蘭花)，或難以用傳統方法種植的高經濟價值植物。
To produce disease-free plants by growing them in a sterile medium. 在無菌的環境下，種植出沒有感染疾病的植物。
To rescue plants with diseases by culturing their unaffected tissues. 從患病的植物切取健康組織，培養成植株，拯救患病的植物。
To produce GM plants from cells inserted with a desirable gene. 將理想基導入細胞，培養成基因改造植物。
Those plants and animal stocks with high yield, better taste and high nutritional value qualities can be produced without afraid the losing of the desirable characters through sexual reproduction. 那些優良的動植物品種如高產量、味道美及高營養價值等，可透過複製大量而得，再不用擔心在有性繁殖中會失去此等優良特徵。

15. State some applications of animal cloning.

說出動物複製的一些應用。

To produce good quality farm animals or endangered animals. 繁殖高品質農場牲畜或瀕危動物。
To produce genetically identical animals for use in drug tests or research. 生產遺傳成分相同的動物作藥物測試。
To provide stem cells for medical treatment. 生產幹細胞作醫療用途。
To mass produce GM animals for manufacturing of drugs and chemicals. 大量生產基因改造動物以獲取藥物或化學品。
Those plants and animal stocks with high yield, better taste and high nutritional value qualities can be produced without afraid the losing of the desirable characters through sexual reproduction. 那些優良的動植物品種如高產量、味道美及高營養價值等，可透過複製大量而得，再不用擔心在有性繁殖中會失去此等優良特徵。

16. Explain the process of polymerase chain reaction.

解釋聚合酶連鎖反應的過程。

1. Samples are heated to 96°C for several minutes to denature (separate into single strands) the target DNA.
   雙鏈的 DNA 在 96℃ 加熱數分鐘後(變性)成爲單鏈的 DNA。
2. The temperature is lowered to 55 °C for several minutes allowing the left and right primers to anneal (attach themselves to the single DNA strands) to their complementary sequences on either side of the target sequence.
   跟著溫度下降至 55 ℃ 數分鐘，讓左右兩個引子連接於各單鏈的一端。
3. The temperature is raised to at 72 °C for several minutes allowing DNA polymerase to attach at each priming site and extends (synthesize) a new DNA strand.
   溫度提升至 72 ℃ 數分鐘，讓 DNA 聚合酶附著於每個引子上，依箭頭的方向進行延長合成複製。
4. At the end of cycle one, two DNA molecules are formed.
   在週期(一)的結尾，形成兩份雙鏈的 DNA

5. The temperature is raised to 96°C again, denaturing the target DNA as in cycle one. The cycle is repeated for many times.
   溫度再次提升至 96℃，如週期(一)般將目標 DNA 變性，如此的週期一再重覆就會使得原來特定的 DNA 得以連鎖複製。

17. State some examples of the applications of PCR.
舉出一些聚合酶連鎖反應的應用例子。

1. Detection of hereditary diseases from early embryo.
   從早期胚胎細胞檢查有沒有遺傳病。
2. Preparation of genetic fingerprints from crime scene.
   從犯罪現場製作遺傳指紋。
3. Diagnosis of infectious diseases (eg. SARS).
   診斷傳染病(例如非典肺)。
4. Cloning of genes.
   基因複製。
5. Paternity testing.
   親子鑒定。
6. Amplify DNA from the remains of historical figures or extinct species for studies.
   擴增歷史人物或絕種生物殘骸的 DNA，進行研究。
7. In human genome project, amplify the interested genes for investigation.
   進行人類基因組計劃時，把需要研究的基因擴增。

18. Explain the basic principle of DNA fingerprinting.
解釋 DNA 指紋分析的基本原理。

1. Only 5% of human DNA codes for functional proteins. The remaining DNA has no function and is called **non-coding DNA**.
   只有約 5%的人類 DNA 用於蛋白質編號，餘下的作用未明，稱爲**非編碼 DNA**。
2. Among the non-coding DNA, there are highly variable regions called **variable number tandem repeats (VNTRs)**. **Each VNTR consists of repetitive base sequence of 9-80 base pairs**.
   在非編碼 DNA 中有些可變區域，該等區域於各同源染色體都可以是不同的，它們名爲**可變數目銜接重複(VNTRs)，每個 VNTR 由 9-80 個鹼基對重複多次重成**。
3. DNA fingerprinting is based on the detection of differences in VNTRs between individuals.
   DNA 指紋分析的原理就是找出各個體間 VNTR 的差別。

19. How does gel electrophoresis help in DNA fingerprinting?
凝膠電泳如何協助 DNA 指紋分析?

Electrophoresis is a technique used to separate molecules of different electrical charge or molecular weights. It can be used to separate DNA or RNA fragments from one another according to their sizes.
電泳是一種用來分離帶有不同電荷或不同分子量的分子的方法。它可根據 DNA 或 RNA 碎片體積的大小，把它們分開。

20. State some applications of DNA fingerprinting.
說出 DNA 指紋分析的一些應用。

1. **Forensic science 法證科學:**
   It helps to find out the truth of the crime.
   它幫助鑑定犯罪事實。
2. **Parentage tests 親子鑑證:**
3. **Other applications 其他應用:**
   - Identify victims in disasters.
     鑑定災難中死者的身份。
   - Confirming the pedigree of animals.
     確定動物譜系。
   - Detecting some inherited diseases.
     檢定某些遺傳疾病。
   - Monitoring bone marrow transplants
     監察骨髓移植。
   - Evolution studies.
     進化的研究。
   - Distinguish between natural food and GM food.
     鑑定食物是天然而基因改造。

Check point 測試站 (66)

1. Cite some example of pharmaceutical products made by biotechnology.
說出一些用生物工程製造的醫療製品。
Human insulin, human growth hormones, vaccines and monoclonal antibodies.
人胰島素、人生長激素、疫苗和單克隆抗體。

2. With an example, explain the process of production of subunit vaccine (antigenic protein).
用例子解釋生產次元疫苗(抗原性蛋白)的過程。
1. The gene for producing the surface protein of the hepatitis B virus is inserted into a plasmid.
   把乙肝病毒表面蛋白基因和質粒結合。
2. The recombinant plasmid is then introduced into a yeast cell.
   將重組質粒導入酵母菌。
3. The viral gene direct the production of viral suface protein in the GM yeast cells.
   病毒基因指導基因改造酵母製造病毒蛋白。
4. The protein is collected and purified for injection.
   收集蛋白質提純後用作疫苗注射。

3. What are monoclonal antibodies?
單克隆抗體是什麼?
They are antibodies produced by the cell clones derived from a single parent B cell.
它們是由單一 B 細胞衍生出來的細胞克隆所產生的抗體。

4. State some applications of monoclonal antibodies.

說出單克隆抗體的一些應用。

1. For diagnosis of disease

診斷疾病

Some monoclonal antibodies can recognize the surface proteins of cancer cells.

有些單克隆抗體可辨認癌細胞的表面蛋白。

2. For isolating and purifying important biological molecules

生物分子的分離及提純

Monoclonal antibodies are coated on the surface of beads. When solution containing the wanted molecules pass through, the molecules bind to the antibody and is retained. These molecules can be collected later by special washing procedures.

將單克隆抗體鋪於珠子表面，當含有我們想要的目標分子溶液通過時，目標分子會和抗體結合，得以保留，稍後採用特別的沖洗程序便可獲得高純度的分子。

3. For use of sensitive test

作爲高敏感度的測試工具

eg. Home pregnancy tests. During pregnancy, HCG is present in urine. HCG can bind to the monoclonal antibody and cause a colour change.

例如家中驗孕，懷孕時，尿液含有人絨毛膜促性腺激素(HCG)，HCG 會和單克隆抗體結合，產生顏色上的轉變。

4. Treatment of cancers

醫治癌症

Monoclonal antibodies are used in the treatment of some forms of cancer such as breast cancer and lung cancer. Some antibodies are linked with toxic drug or a radioactive substance. The antibodies recognize and attach to a cancer cell, then release the drugs to kill the cell (targeted therapy) .

單克隆抗體可用來醫治乳癌和肺癌等癌症，有些抗體會加上毒藥或放射性物質，抗體會追蹤及附在癌細胞，釋出毒藥將癌細胞殺死（靶子療法）。

5. What are the basis of gene therapy?

基因治療是什麼原理?

To treat a disease by supplementing the defective gene with a normal gene.

利用正常基因補助缺陷基因以治療疾病

6. Distinguish between germ line and somatic gene therapy.

分辨種系基因治療與體細胞基因治療。

germ line gene therapy 種系基因治療	somatic gene therapy 體細胞基因治療
It affects gametes or zygotes 影響配子或合子	It affects somatic cells. 影響體細胞
Genetic correction is inheritable 基因矯正是可遺傳的	Genetic correction is not inheritable 基因矯正是不可遺傳的

7. State the potential benefits of gene therapy.

說出基因治療的好處。

1. Treatment of genetic diseases caused by the loss of a functional protein.
   醫治由缺少正常蛋白質所引起的遺傳病。
2. Treatment of cancers and infectious diseases. The new gene or gene product may inhibit the activity of cancer cells or pathogens.
   醫治癌症和傳染病，新的基因或其產品或能抑制癌細胞及病原體的活動。
3. A preventive measure against diseases. eg. A gene codes for an enzyme may protect heart tissues from damage when the oxygen level falls.
   可預防疾病，例如某基因可爲一特別的酶編碼，該酶能保護心臟於缺氧時受傷。
4. Germ line gene therapy may correct a disease before it happens. It may help the removal of all defective genes in human.
   種系基因治療可預防疾病的出現，它或能有助消除人類的所有缺陷基因。

8. State the potential hazards of gene therapy.

說出基因治療的潛在危機。

1. Viral vectors may regain its disease causing ability during operation.
   病毒載體在過程中可能會重獲致病能力。
2. Viral vectors may cause severe immune reactions. eg. A young man died a few days after gene therapy in 1999 because he is allergic to the vector.
   病毒載體可引起嚴重的免疫反應，例子: 在 1999 年，一青年於基因治療數天後死亡，因爲它對病毒載體反應過敏。
3. The insertion of new genes may affect the expression of existing genes. eg. some patients die of blood cancer after gene therapy. The point of insertion may be the locus of a gene involved in cell division.
   新基因的插入可能影響原有基因的表達，例子:有些病人基因治療後死於血癌，原來新基因正好插正控制細胞分裂的基因。
4. The new genes may be wrongly transported into non-target cells. This results in other health problems.
   載體可將新基因誤載至非目標細胞，引致其他的健康問題。
5. Treatments may have to be repeated as the treated cells die and are replaced.
   治療可能要反覆進行，因爲經改造細胞死亡後會被替換。

9. Explain the nature of stem cells.

解釋幹細胞的本質。

Stem cells are the body's "master" cells. They can renew themselves indefinitely and differentiate into any types of specialized cells, such as muscles, nerves, organs, bone, blood and so on.

幹細胞是身體的「主宰」細胞，它們可自行無限更生和分化爲任何種類的特化細胞，例如肌肉、神經、骨骼和血液等。

10. Suggest some uses of stem cells in future treatment.

將來幹細胞可醫治什麼疾病?

1. It **provides advance treatment** for patients with a range of diseases such as:
   幹細胞移植**提供先進的療法**(移植上不會被排斥)以醫治一系列的疾病，如**：**
   (a) To cure **Parkinson's disease** by transplanting stem cells into the patient's brain.
   移植幹細胞入病人腦部以醫治**柏金遜病**。
   (b) To cure heart disease by transplanting stem cells into the diseased heart.
   移植幹細胞入病人心臟以醫治心臟病。
   (c) To cure leukemia by producing new bone marrow for the patients who are suffering from leukemia.
   移植幹細胞入病人體內製造新骨髓以醫治白血病。
   (d) To cure diabetes mellitus by transplanting stem cells into the diseased pancreas.
   移植幹細胞入病人胰臟以醫治糖尿病。
2. This technology (developing) may be used to generate tissues and organs for transplantation so that the need for organ donation could be significantly reduced.
   這技術(研究中)可用來生產組織及器官作移植用途，將來需要捐贈的器官可大爲減少。
   (a) To cure heart diseases by cloning a new heart to replace the diseased one.
   複製一個健康的心臟來取代患病的心臟以醫治心臟病。
   (b) To cure hepatits by cloning a new healthy liver to replace the diseased one.
   複製一個健康的肝臟來取代發生病變的肝臟以醫治肝衰竭。

11. What are transgenic organisms?

什麼是轉基因生物?

They are organisms whose genetic material has been altered through genetic engineering.
它們是遺傳物質經遺傳工程改造的生物。

12. What are the differences between genetic modification and traditional breeding?

基因改造與傳統育種有什麼不同？

Genetic modification **基因改造**	**Traditional breeding** **傳統育種**
1. Isolation and transfer of well-defined genes. High accuracy of transfer. 將特定的基因分離及轉移，準確。	Crossing of thousands of genes at one time. Low accuracy of transfer. 每次都雜交數以千計的基因，不準確。
2. Introduction of desired genes across the species barrier 將所需的基因在品種間轉移。	Gene transfer usually within-species. 基因只在品種內轉移。
3. Faster and less costly 快速價廉。	More time consuming in the process of observation and natural selection to achieve the desired characteristics. 需花時間於觀察及選種以獲所需的特徵。
4. Desired change can be achieved in one generation 只需一代便可得到所需的特徵。	Cannot be achieved in one generation. 不能於一代內達到。

13. With an example, explain the beneficial aspect of GM plant.
用例子解釋轉基植物的好處。

Crop 植物	GM trait 基因改造特徵	Advantages 好處
Soybean 大豆	Herbicide tolerance 可抵抗除草劑	Weeds can be killed simply by spraying a herbicide instead of cutting. 直接噴灑除草劑便可殺草，不需人手割除。
Corn 粟米	Insect resistance 可抵抗害蟲	Plants can produce toxin which kill caterpillars but safe to human. 植物可產生毒素殺死毛蟲但對人無害。
Tomato 番茄	Delay softening of tissue 減慢組織軟化	Fruits with longer shelf life and better quality. 蔬果可有較長的存放期和品質較佳。
Rice and wheat 稻米和小麥	cold, drought and salty tolerance 可抵抗寒冷、乾旱和高鹽度	Crops can grow in winter, dy climates and saline lands. 穀物可在冬季、乾旱環境和鹽土生長。

14. With an example, explain the beneficial aspect of GM animal.
用例子解釋轉基動物的好處。

Animal 動物	GM trait 基因改造特徵	Advantages 好處
Salmon 三文魚	Fast growing 快速生長	It decreases overfishing of wild salmon. 減低野生三文魚的過度捕撈。
Pig 豬	More lean meat and less fat 多瘦肉，少脂肪	Food is more delicious and healthy. 食物更美味健康。
Goats 山羊	Produce lactose-free milk 無乳糖奶	It is suitable for people who cannot tolerate lactose. 適合有乳糖不耐症的人飲用。
Sheep 綿羊	Produce more wool with better quality 更多佳品羊毛	It increase wool production and improves quality. 提高羊毛的產量及品質。

Check point 測試站 (67)

1. **List some issues of GM Food which are related to the below aspects.**
   列舉一些與以下範圍有關的基因改造食物議題。
   (a) Safety issues
   安全議題
   (b) Ethical issues
   道德倫理議題
   (c) Social and economic issues
   社會和經濟議題
   (d) Environmental issues
   環境議題

Safety issues **安全議題**	➢ GM food may cause **allergics** in some people. 基因改造食物對某些人會引起**過敏反應**。 ➢ Antibiotic resistance genes are often used in screening of GM organisms. If these genes are transferred to pathogens accidentally, **super bacteria** may be produced which is difficult to kill. 抗生素抗性基因常用來篩選經改造生物，若這些基因意外轉移到病原體，可能產生難以殺死的**超級細菌**。
Ethical issues **道德倫理議題**	➢ The production of GMOs act like **the role of God** which will not be accepted by most people. 製造基因改造生物**尤如上帝**所爲，這不爲大多數人接受。 ➢ Some people may worry about eating a food containing a gene from something they would not eat for **religious reasons**. 一些人會憂慮會吃進的食物含有**不被宗教接受**的基因。
Social and economic issues **社會和經濟議題**	➢ Developed countries have more money to invest on the production of GM foods. The GM foods are more competitive in market and may **affect the living of farmers in developing countries**. 發達國家有更多錢投資於生產基因改造生物上，基因改造食物因在市場上有更大競爭性，會**影響發展中國家的農夫的生計**。
Environmental issues **環境議題**	➢ There may be **unintended modification of similar species** in the neighbouring fields due to cross pollination. 對環境有潛在的危機：通過異花傳粉會**出現難以預計的基因轉移**、對其他相近生物做成計算不到的傷害。 ➢ If herbicide resistance genes are transferred to weeds, **super weeds** may be produced which is difficult to control. 若抗殺草劑基因意外轉移到野草上，可能產生難以控制的**超級野草**。 ➢ It will **disturb the balance of ecosystems**. **擾亂生態平衡**，破壞自然生物的價值。

2. List some issues of cloning which are related to the below aspects.
列舉一些與以下範圍有關的克隆議題。

(a) Ethical issues
道德倫理議題

(b) Social and economic issues
社會和經濟議題

(c) Environmental issues
環境議題

Ethical issues **道德倫理議題**	For human cloning: 在人類複製: ➢ People produced from cloning may be regarded as **unnatural or sub-human**. 複製人會**受到歧視**，視作**遺反自然或是次等人**。 ➢ It is **difficult to set up relationship** between the clone and the nucleus donor and his family. 複製人與胞核捐贈者及其家人的**關係難以界定**。 ➢ What will be the **identity** of the clone? Should he have his own identiey or share the identity of the nucleus donor? 複製人的**身份**是什麼?他應有自己的身份嗎?還是與胞核捐贈者共用身份? ➢ This promotes the **'uniparent'** trend in human society and is against the culturally and naturally developed 'biparent society'. 這會在人類社會**做成單親趨勢**，違反自然上及倫理上的雙親文化。 ➢ Rich peoples may use the technology to **produce servant**s to serve their needs. 有錢人可利用此科技**製造僕人**服侍自己。 ➢ Rich peoples may **clone themself for organ transplant**. 有錢人可**複製自己作器官移植**。
Social and economic issues **社會和經濟議題**	➢ Animal cloning requires expensive equipment. This **increases cost and hence price for food** produced by this method. 動物複製需昂貴的儀器，這**增加產品的成本**，可能轉嫁到消費者身上。
Environmental issues **環境議題**	➢ Endangered animals are suffering from loss of habitats. Even the cloning is successful, the cloned one still have **no place to live**. Should we put our money on habitat conservation, rather than cloning? 瀕危動物苦於無處棲身，就算複製成功，還是**無地容身**，我們是否應該將資源投放於保護生境上? ➢ It may **limit the gene pool** as only a minority of the genes in the species is cloned. 這會**限制了基因庫的大小**，因爲只有該品種少量的基因會被複製。

3. List some issues of human genome project which are related to the below aspects.
列舉一些與以下範圍有關的人類基因組計劃議題。

(a) Legal issues
法律議題

(b) Ethical issues
道德倫理議題

(c) Social and economic issues
社會和經濟議題

Legal issues **法律議題**	➢ **Who owns and controls** genetic information? **誰該擁有和控制**遺傳資料? ➢ **Who should have access to personal genetic information**, and how will it be used—insurers, employers, courts, schools, adoption agencies, and the military, among others? **誰有權取得個人的遺傳資料**，保險公司、僱主、法院、學校、收養機構、軍隊，抑或其他人仕? 這些資料又該如何使用? ➢ Suppose a gene related to violence is found, can the possession of it **be an excuse** to prove someone innocent in court? 若一個基因和暴力有關，在法庭上，擁有者可否作爲無罪的**申辯理由**。
Ethical issues **道德倫理議題**	➢ If there is no cure for a certain genetic disease, what is the benefit of diagnosing the disease? Would such a diagnosis **cause anxiety** to the patient? 若某遺傳病是絕症，一早知道患有此病有何用? 斷症後病人多會**感到沮喪**。 ➢ **How would one feel**, if he is genetically different from the norm? 若某人發現自己的基因異於常人，他會**有什麼感受**?
Social and economic issues **社會和經濟議題**	➢ Life style can also affect the expression of some genetic diseases. It may be **better to promote healthy life styles** rather than merely focusing on the cause of the diseases. 生活方式也可影響遺傳病的發病，或許我們應用多些資源**推廣健康的生活方式**，而非只是聚焦於該病的成因上。 ➢ The analysis of DNA of an individual results in the classification of people carrying genetic diseases as handicaps if their genetic information is disclosed. These people will be **discriminated** and their opportunities of getting a job, buying insurance or admission to certain groups are lowered. DNA 的分析會揭露個人的遺傳病，若資料被公開，帶有遺傳病的人將被看作殘疾人士，勢必**受到歧視**。因被歧視，他們在找工作上，購買保險上，加入某些團體上會受到留難。

4. List some issues of gene therapy which are related to the below aspects.
列舉一些與以下範圍有關的基因治療議題。

(a) Safety issues
安全議題

(b) Ethical issues
道德倫理議題

(c) Social and economic issues
社會和經濟議題

Safety issues **安全議題**	➢ Viral vectors may cause **severe immune reactions** as some patients are allergic to the vector 病毒載體可引起**嚴重的免疫反應**，有些病人會對病毒載體反應過敏。 ➢ Viral vectors may **regain its disease causing ability** during operation. 病毒載體在過程中可能會**重獲致病能力**。
Ethical issues **道德倫理議題**	➢ It is hard to decide **when gene therapy should be used**. Should it only apply to no cure diseases? 難於決定**何時需使用基因治療**，是否應只用於無其他療法的疾病? ➢ Where is the line between medical treatment and **enhancement**? 該如何劃定醫學治療和**人體強化**的界線? ➢ Germ line gene therapy will **affect offsprings**. Are we acting as God in changing the genetic constituent of future generations? Would there be any **hidden hazards**? 種系基因治療可**影響後代**,我們是否正扮演上帝的角式去改變未來世代的遺傳成份，這**會否遭天譴**?
Social and economic issues **社會和經濟議題**	➢ Only the rich people can afford the expensive gene therapy. Would it further **widen the gap between the rich and the poor**? 只有有錢人可負擔昂貴的基因治療，這會**加深貧富間的矛盾**? ➢ Is it right to invest **a large sum of money** in gene therapy to take care of just **a few patients**? 基因治療需投放**大量資金**，只有**少數病人可受惠**，值得嗎?

5. List some issues of stem cell therapy which are related to the below aspects.
列舉一些與以下範圍有關的幹細胞治療議題。

(a) Ethical issues
道德倫理議題

(b) Legal issues
法律議題

(c) Social
社會議題

Ethical issues **道德倫理議題**	➢ To obtain embryonic stem cells, human embryos are destroyed. Is it a case of **murder**? 爲了獲取胚胎幹細胞，需摧毀人類的胚胎，這是否**謀殺**?
Legal issues **法律議題**	➢ How can we ensure the stem cells are used in treatment of diseasse only? To some scientists, it would be an great **temptation to clone human being**. 如何確保幹細胞只用於醫療上? 對於某些科學家而言，這是**製造複製人的一大誘惑**。
Social issues **社會議題**	➢ The cloned embryo is destroyed to harvest embryonic stem cells. Would this practice make the public **become used to the destruction of human life**? 複製的胚胎會被摧毀以收集胚胎幹細胞，此種行爲會否令大衆**產生可隨意奪取他人生命的錯覺**。

The End