Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

BIOLOGY

5090/22

Paper 2 Theory

October/November 2022

1 hour 45 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Section A: answer **all** questions.
- Section B: answer **all** questions.
- Section C: answer **either** Question 8 **or** Question 9.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **20** pages. Any blank pages are indicated.

Section A

Answer **all** questions in this section.

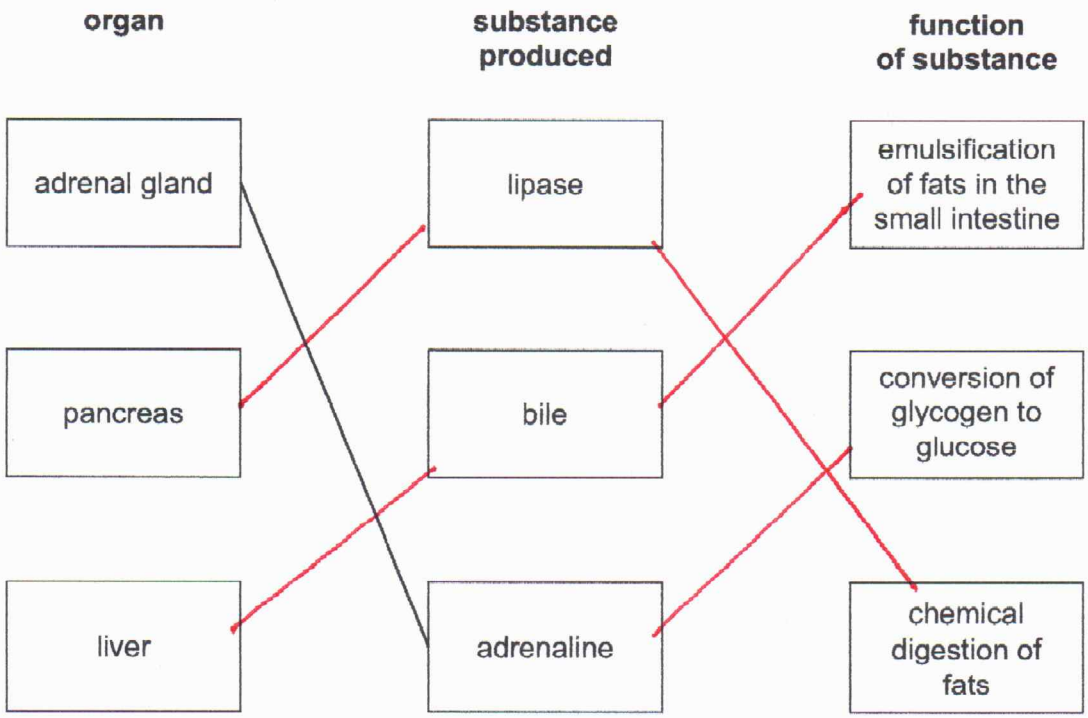
Write your answers in the spaces provided.

1 Organs in the human body produce substances which have specific functions.

Draw lines to link each organ with the substance it produces **and** to link each substance with the description of its function.

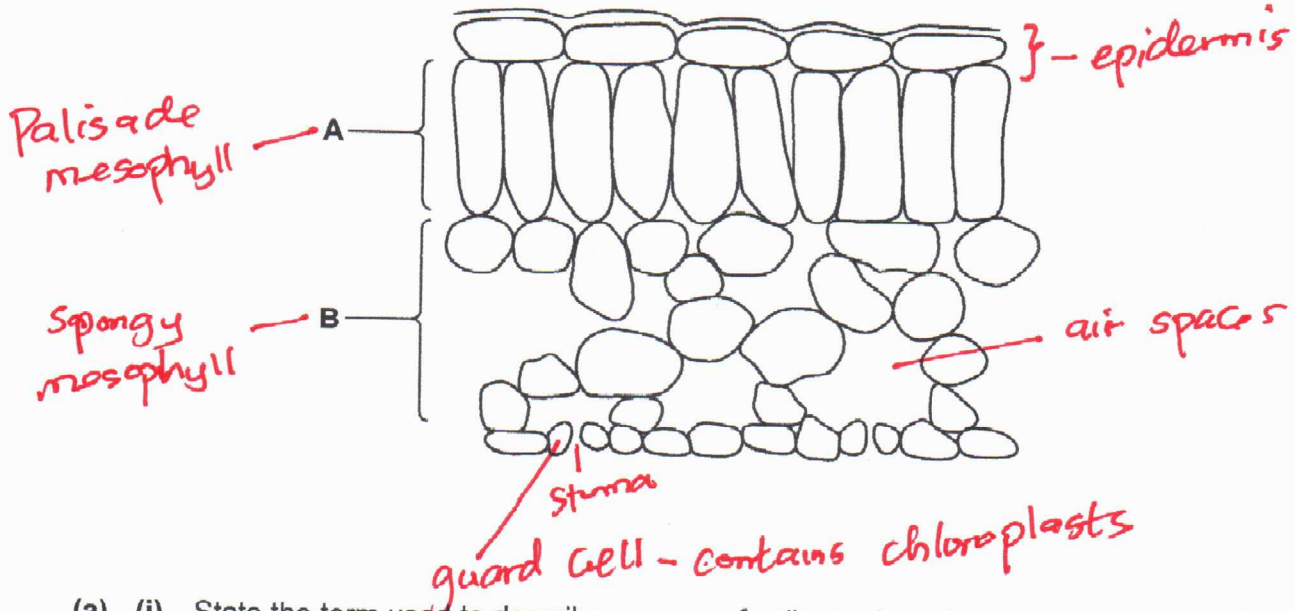
One line has been drawn for you.

Draw **five more** lines.



[5]

2 The diagram shows a cross-section through a leaf when viewed using a light microscope.

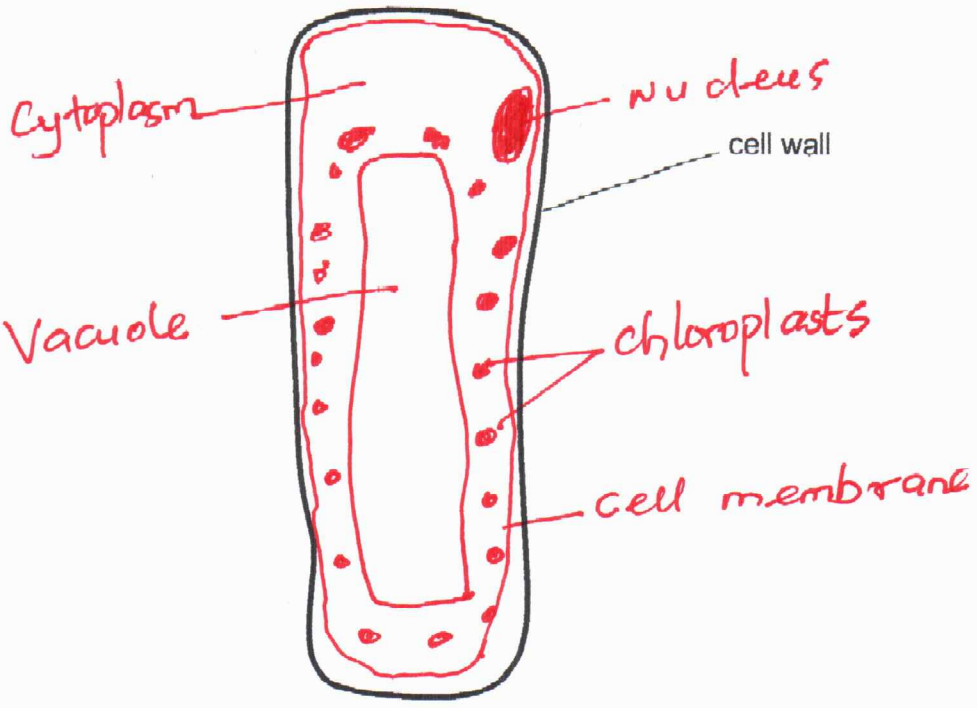


(a) (i) State the term used to describe a group of cells, such as those in part **A** or part **B** of the leaf cross-section.

tissue

[1]

(ii) The diagram shows an enlargement of one cell from part **A** of the leaf cross-section.



Complete the diagram of the cell by drawing and labelling to show the position of

- **one** chloroplast
- **three** other types of **named** cell component that will be visible.

[4]

(iii) Use a label line on the diagram of the cross-section through a leaf to name and label **one** cell in the lower epidermis that would also contain chloroplasts. [1]

(b) The cell wall of a plant cell can be removed by treating the cell with a digestive enzyme.

Plant cell wall is made of cellulose

(i) Name the substrate for this enzyme.

Cellulose [1]

(ii) Some plant cells from part **B** of the leaf cross-section were treated with this enzyme and then placed in distilled water on a microscope slide for one hour.

The cells were clearly visible using a light microscope at the start of the hour.

The cells were **not** clearly visible using the same light microscope at the end of the hour.

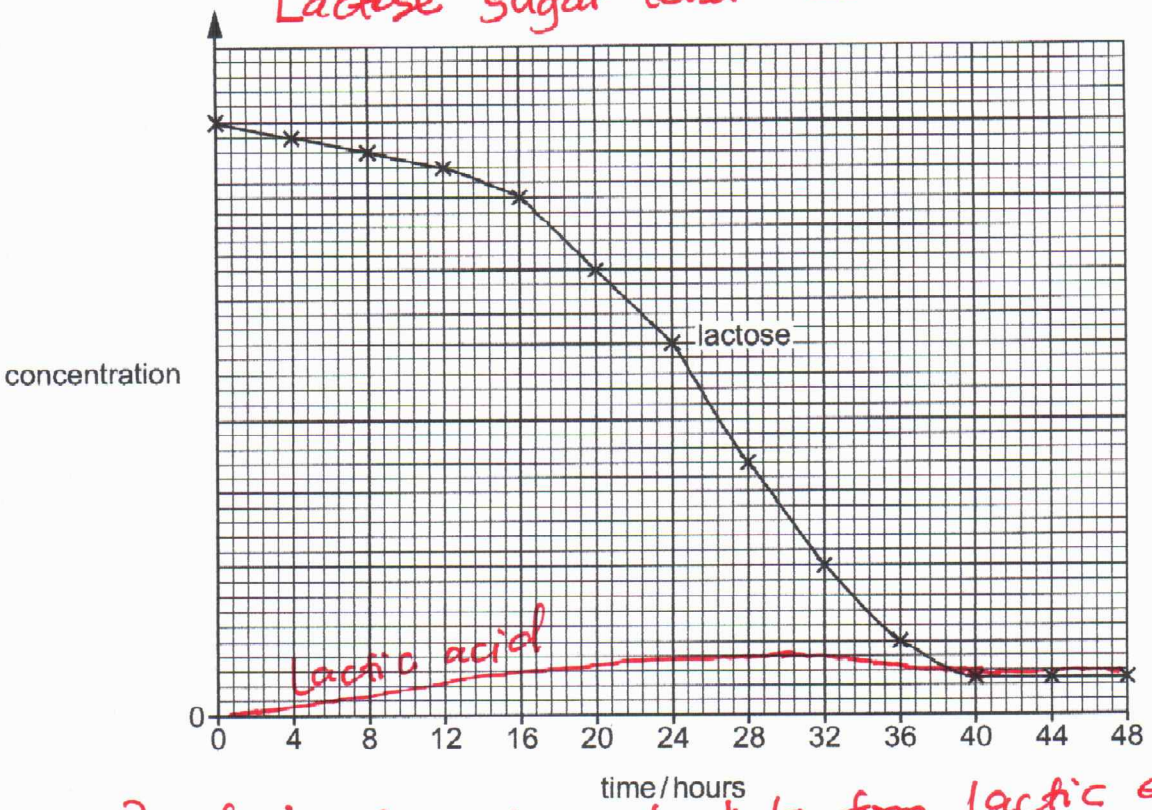
Explain changes to the structure of the cells that took place between these two observations.

The enzyme cellulase breaks down the cellulose cell wall of plant cells. When placed in distilled water, the plant cells gain water by osmosis. Water moves down potential gradient into the cell. Cell vacuole increases in size and pressure. The cell will burst because the rigid cell wall has been broken down already. Cells are not visible after after one hour because they have burst. [4]

[Total: 11]

3 The graph shows how the concentration of lactose sugar changes during the formation of yoghurt from milk over a period of 48 hours.

Lactose sugar level reduces over time



Bacteria ferment yoghurt to form lactic acid

(a) (i) Name the type of microorganism used in the production of yoghurt.

bacteria ..... [1]

(ii) Name the type of cell division that causes the population of this microorganism to increase over the 48-hour period.

binary fission ..... [1]

(iii) Name the acid produced by this type of microorganism in the formation of yoghurt.

lactate ..... [1]

(iv) Draw a line on the graph to show how the concentration of this acid will change during the 48-hour period. [2]

(b) Lactose intolerance is a medical condition that results from a genetic change. A person with the condition is unable to produce molecules of the correct enzyme to digest lactose sugar.

(i) Name this type of genetic change and explain how it can result in a person being unable to produce molecules of the correct enzyme.

Mutation - change in base sequence in the length of DNA. A set of baces code for lactase enzyme. A change in the sequence of bases results in a protein that will not be complimentary to the substrate.

[3]

(ii) The low concentration of lactose sugar in yoghurt makes it a better food than milk for a person with lactose intolerance.

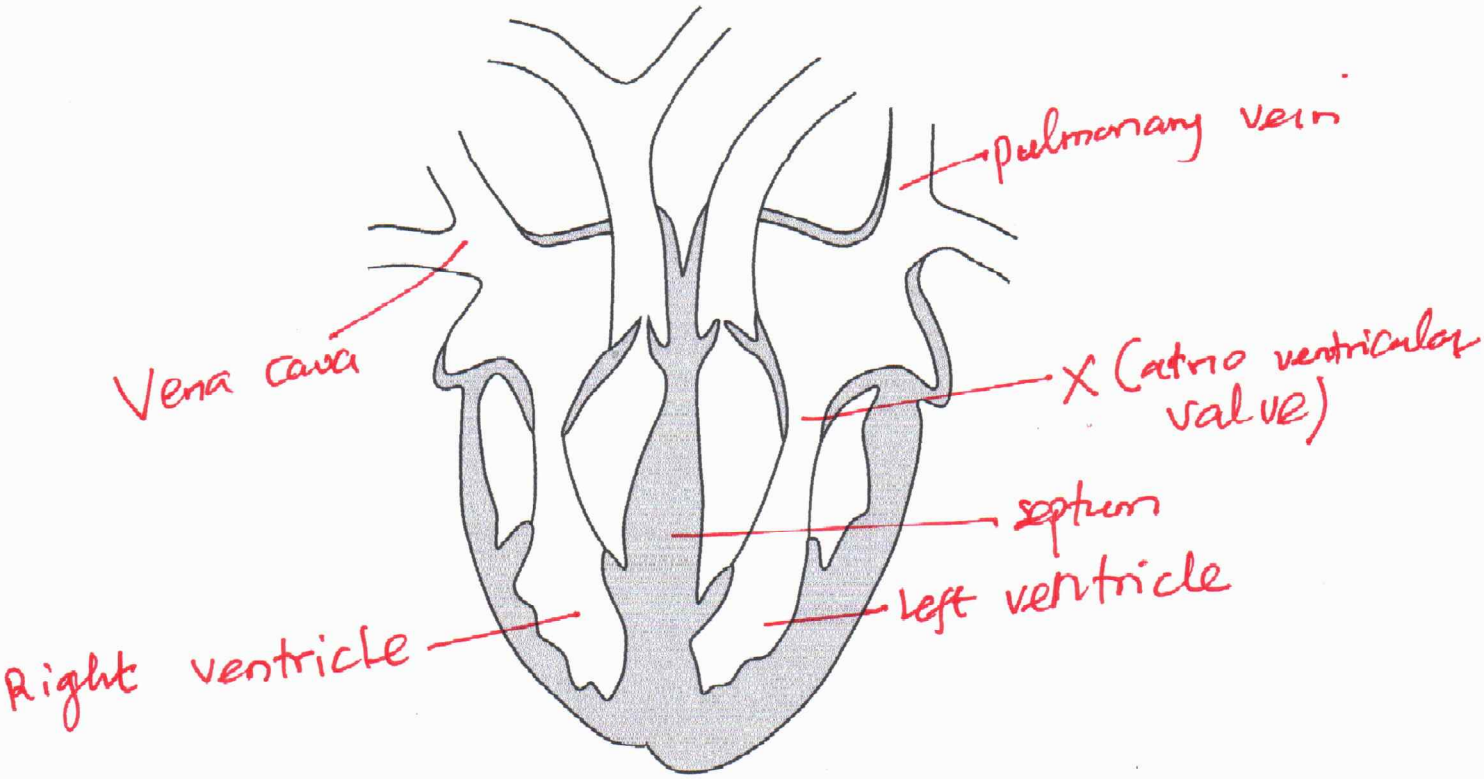
Outline the health benefits to some people with lactose intolerance of continuing to include a dairy product such as yoghurt in the diet.

Dairy products provide calcium ions for the developement of strong bones and teeth. Strong bones prevent rickets. Dairy products are also respired to produce energy for growth

[2]

[Total: 10]

4 The diagram shows the internal structure of the human heart and associated blood vessels.



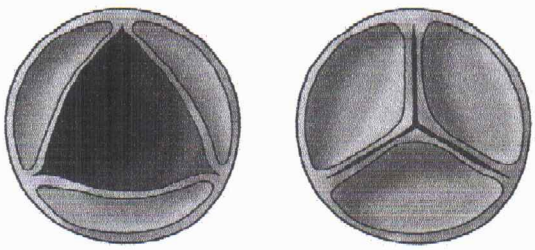
(a) Name **two** blood vessels shown in the diagram that carry oxygenated blood.

1 ..... aorta .....

2 ..... pulmonary vein .....

[2]

(b) Blood flows through a valve when the left ventricle of the heart contracts. Diagram 1 shows this valve in the open and closed positions.

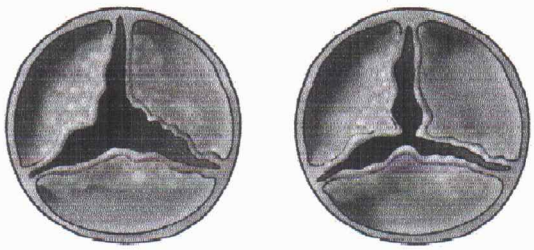


valve open valve closed

Diagram 1

(i) Label, using the letter **X** on the diagram of the heart, the location of this valve. [1]

A small number of people develop a medical condition that causes changes to this valve. Diagram 2 shows the same heart valve in the open and closed positions in a person with this condition.



valve open valve closed

Diagram 2

(ii) Explain how this medical condition will affect the flow of blood when the left ventricle contracts and relaxes.

The value does not close or open fully. When the ventricles contract, pressure is generated but the value opens partialy. This allows loss blood to pass to the atrium.
When ventricles relax, less blood will flow through the value. Therefore there will be backflow of blood back to the ventricle.

[4]

(iii) Describe and explain the effect of this condition on the ability of the person to exercise.

The condition restricts blood flow to the muscles. The person get tired because there is less oxygenated blood delivered to the muscles. Less oxygen makes the baby to respire anaerobicaly. This process produce lactic acid in muscles and small amount of energy. [3]

(c) It is possible for the valve to be replaced by surgery. The human valve is removed from the patient and can be replaced with a valve containing tissue from another species. This tissue is treated with a chemical to prevent rejection by the human body.

Suggest how the cells of the tissue are modified by the chemical treatment and explain how this will prevent rejection by the human body.

The antigens on the cells from other species are removed and blocked. This makes them not to cause an immune response. The cells could also be coated with human antigens to prevent recognition by lymphocytes and phagocytes. This will reduce immune response. So there will be less antibodies and less phagocytosis.

..... [4]

[Total: 14]

5 A group of scientists investigated the total mass of carbon dioxide released when animals and plants are farmed and then used as food for humans.

(a) The total mass of carbon dioxide released for each food in the study included the mass released

- during production of the food by farming
- after the food left the farm and before it was eaten.

Suggest and explain how human activity may result in the release of carbon dioxide **after** food has left the farm on which it was produced.

Combustion of biofuels produce carbon dioxide and water vapour. During processing of food, carbon dioxide gas is produced. e.g roasting. Waste food produce carbon dioxide during decomposition by fungi or bacteria. Refrigeration of food also produce carbon dioxide. [3]

(b) Some of the results of the investigation are shown in the table.

food produced	mass of CO_2 released per kg of food produced / kg
lamb	39.2 ✓
salmon	11.9
chicken	6.9
rice	2.7
beans	2.0 ✓
tomatoes	1.1

(i) A farmer decides to change production from lamb to beans.

Calculate the percentage change in carbon dioxide released per kg of food produced.

Space for working.

$\left(\frac{39.2-2}{39.2}\right) \times 100 = 95.4\ \%$

95.4 % [3]

(ii) An increasing number of people in some countries choose to eat a diet consisting **only** of plants.

Use the results in the table and your scientific knowledge to explain how this choice of diet may benefit the environment.

- It produces less carbon dioxide to the atmosphere. Carbon dioxide is a greenhouse gas that cause global warming. A decrease in carbon dioxide reduces effects of climate change.
- It will also reduce levels of land cultivateon and also increase biodiversity in an area. It will decrease methane production from animals. [4]

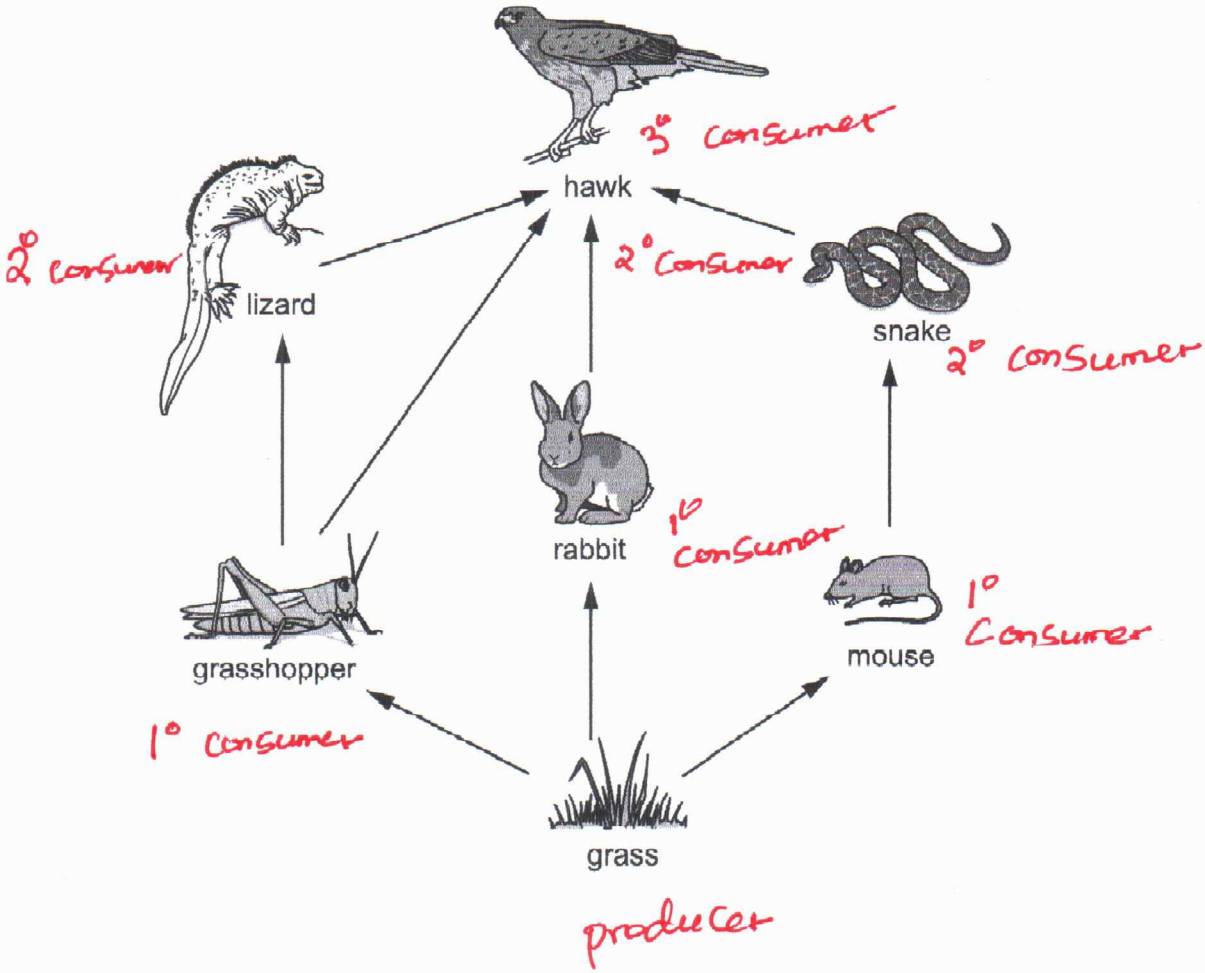
[Total: 10]

Section B

Answer **both** questions in this section.

Write your answers in the spaces provided.

6 The diagram shows a food web in an area of grassland.



(a) Organisms in a food web can be classified into different trophic levels based on their feeding relationships.

Explain the feeding relationships of **named** organisms at different trophic levels in this food web.

The grass are the producers in the food web. They make food by photosynthesis. Producers make carbohydrate (glucose) using carbon dioxide, water and light energy. Herbivores are primary consumers. The rats and grasshopers feed on grass. So they are herbivores. Snakes, lizards and hawks are carnivores. They are secondary consumers because they feed on other animals. The hawk is both a secondary and tertiary consumer. It is at the top of a food chain. It is a predator of snakes, lizards and rabbit. [5]

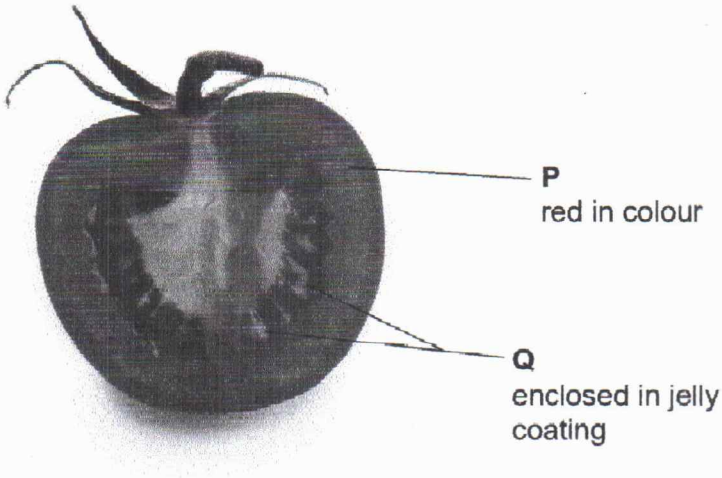
(b) Describe how energy flows into and through a food web. Explain how this will determine the biomass of organisms at different trophic levels.

Plants use solar energy to make glucose using water and carbon dioxide. This process is called photosynthesis. Photosynthesis convert light energy into chemical energy. Energy from the sun flows into producers and then to consumers. Energy flow is non cyclical because energy never flows back to the sun. Energy is lost as it is transfered from one trophic level to the next one. Heat energy is lost during respiration. Therefore, less energy will be passed onto the next trophic level. This leads to decrease in biomas up the trophic levels [5]

[Total: 10]

7 The photograph shows a fruit of the tomato plant.

The fruit has been cut in half to show the structures labelled **P** and **Q**.



(a) Before fertilisation, structures **P** and **Q** in the fruit were structures in a flower of the tomato plant.

Complete the table to name the structures in a flower that have developed into structures **P** and **Q**.

structure in fruit	structure in flower
P	ovary
Q	ovule

[2]

(b) (i) Suggest, with reference to the adaptations shown in the photograph, how the structures labelled **Q** are dispersed by animals.

Red bright colour in tomato attract animals. The animals ingest the fruit but does not digest its seeds. The seeds have a jelly coat to protect it from digestion by enzymes of the animals. The animals are mobile as they move from place to place. So, the animals will remove seeds in faeces, far away from the mother plant. [4]

(ii) Outline advantages to the tomato plant species of **Q** being dispersed far from the parent plant.

Seed dispersal allows the tomato species to colonise new habitats. This reduces overcrowding of tomatoes in one place. It also reduce competition for water, nutrients and space. Dispersal increases chances of survival. It reduces risk of disease and pests wiping out tomatoes. It prevents extinction of the plant. [4]

[Total: 10]

[Turn over

Section C

Answer **either** Question 8 **or** Question 9.

Write your answers in the spaces provided.

8 **(a)** Describe and explain the gas exchange that takes place between the leaf of a plant and the air in the atmosphere during a 24-hour period.

During the day, plants take in CO_2 from atmosphere and water to make glucose. oxygen gas is given out during this process. At night, plants respire glucose to get energy. So they take in oxygen gas and use it in aerobic respiration. Respiration takes place more when the plant is in darkness. Carbon dioxide gas is given out during respiration. - Stomata are open during the day and close at night. So more water vapour is lost during the day. A compensation point is reached when rate of respiration and photosynthesis are equal

[5]

(b) Outline the movement of water through a leaf during the process of transpiration.

Water moves from the soil through the xylem vessels. Water moves from xylem into the mesophyll of the leaf. Water spreads throughout the leaf by osmosis and diffusion. Osmosis is the movement of water down its water potential gradient. Water evaporates from the outer layer of the spongy mesophyll cells into the air spaces. Water vapour exits the leaf via the stomatal openings.

[5]

[Total: 10]

9 (a) Explain the advantages and disadvantages of the use of insecticides in agriculture.

Insecticides kill harmfull insecticides which destroy crops. This Leads to increased yields. High yields give profits to farmers. The insecticides reduce spread of diseases carried by insecticides. However, insecticides harms non-pest insects. This reduces pollination as pollinators are also targeted. Death of insects reduce biodiversity and also disrups food chains. Insecticides pollute habitats for other organisms in aquatic systems. Insecticides may also concentrates up the food chain (bioaccumulation). [5]

(b) Describe the methods used to control the insect vector of malaria **other** than the use of insecticides. Explain the effect of each control method on the vector.

Malaria is caused by female anopheles mosquitos. The mosquito can be controled by draining water in swamps to reduce breeding grounds. So the mosquito stops laying eggs. Oil may be added to swamps to kill eggs of mosquitoes. Mosquito repellants may be used to prevent bites from mosquitoes. The males could be irradiated to produce gametes. This leads to production of infertile eggs that dont develope to larvae. [5]

[Total: 10]