



# Cambridge IGCSE™

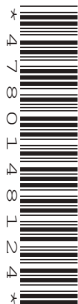
CANDIDATE  
NAME

CENTRE  
NUMBER

--	--	--	--	--

CANDIDATE  
NUMBER

--	--	--	--



## BIOLOGY

0610/42

Paper 4 Theory (Extended)

February/March 2021

1 hour 15 minutes

You must answer on the question paper.

No additional materials are needed.

## INSTRUCTIONS

- Answer **all** questions.
- 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.



- 1 (a) Fig. 1.1 is a diagram showing the position of some organs in the human body.

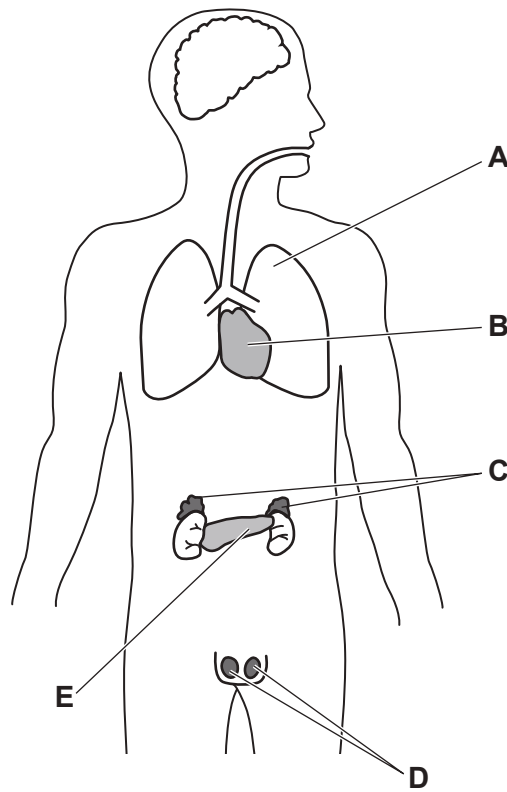


Fig. 1.1

Some of the organs shown in Fig. 1.1 are endocrine glands.

Table 1.1 shows the names of some of the endocrine glands, their identifying letters and the hormones that they produce.

Complete Table 1.1.

Table 1.1

name of endocrine gland	letter in Fig. 1.1	hormone produced
adrenal	C	adrenaline
pancreas	E	insulin
testes	D	testosterone

[3]

(b) Fig. 1.2 shows two graphs representing:

- the relative blood concentrations of two hormones, **A** and **B**, released by the ovaries during the menstrual cycle
- the thickness of the lining of the uterus.

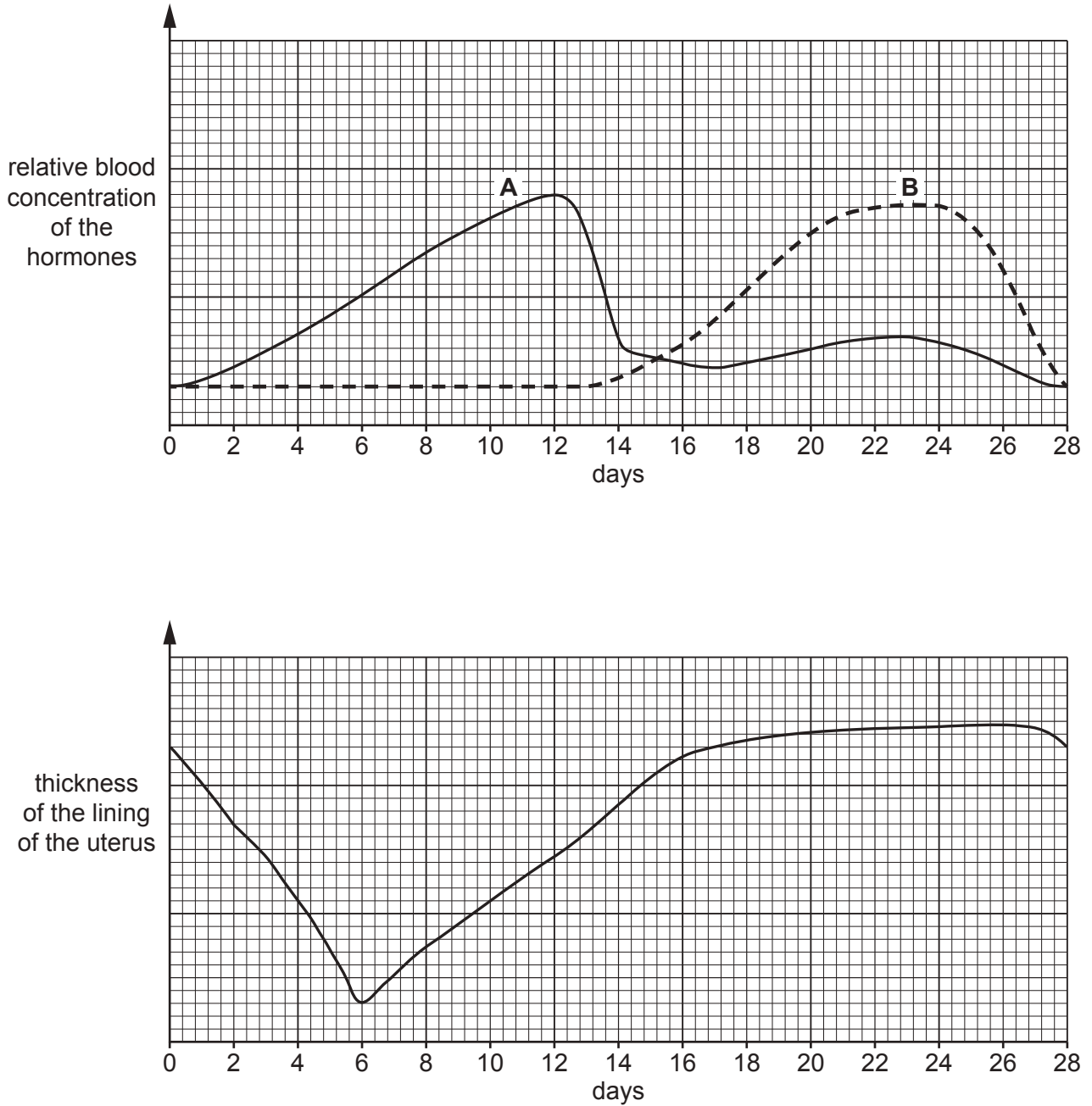


Fig. 1.2

(i) Describe the roles in the menstrual cycle of hormone **A**.

Hormone A is oestrogen. It repairs the uterine lining following menstruation It stimulates the pituitary gland to secrete Leutinising Hormone . It inhibits the secretion of Follicle Stimulating Hormone.

..... [3]

(ii) State the day in Fig. 1.2 when ovulation is most likely to occur.

Day 14 ..... [1]

(iii) State the days in Fig. 1.2 when the lining of the uterus is lost from the body.

Days 0 - 6 ..... [1]

(c) The female contraceptive pill is a chemical method of birth control, which is available in many countries.

(i) Describe the social implications of the increased availability of the female contraceptive pill.

It controls the birth rate. It gives more choice about starting the family. It avoids unwanted pregnancies. It causes an increase in the number of women in education and in work.

.....  
.....  
..... [2]

(ii) The hormones in the female contraceptive pill can enter rivers.

Describe the negative impacts of female contraceptive hormones entering rivers and contaminating drinking water.

Female contraceptive hormones cause feminisation of aquatic organisms. There occurs reduced sperm count in men, leading to reduction in fertility. It also causes reduced sperm count in fish and other aquatic organisms, which leads to reduction in their population.

.....  
.....  
..... [3]

(iii) State **two** barrier methods of contraception.

1 ..... Condom .....

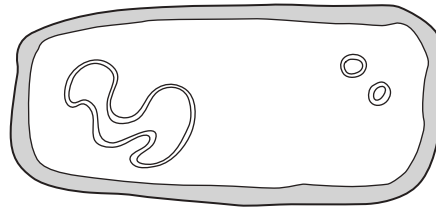
2 ..... Diaphragm .....

[2]

[Total: 15]



- 2 (a) Fig. 2.1 is a diagram of a prokaryotic cell.



not to scale

Fig. 2.1

- (i) State **one** visible feature in Fig. 2.1 that identifies this cell as a prokaryotic cell.

..... Circular chromosome ..... [1]

- (ii) State **one** cell structure that is present in the cells of all organisms.

..... Ribosomes ..... [1]

- (b) Prokaryotes, Animals and Plants are three of the five kingdoms of organisms.

State the names of the **two other** kingdoms.

1 ..... Fungus .....

2 ..... Protoctist .....

[2]

- (c) Fig. 2.2 shows part of the nitrogen cycle.

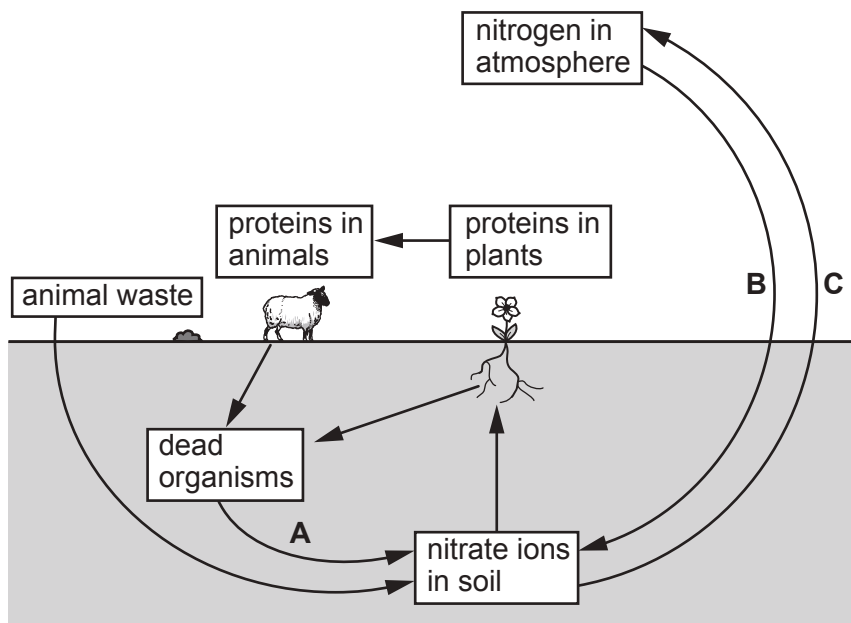


Fig. 2.2



- (i) Describe processes **A**, **B** and **C** in Fig. 2.2.

The process A is decomposition and nitrification. When the animal or plant dies, bacteria and fungi decompose the body. The protein, containing nitrogen, is released as ammonium ions to the soil. Nitrifying bacteria convert ammonium ions to nitrite or nitrate ions

Process B is nitrogen fixation. Nitrogen can be fixed by lightning or with the help of bacteria living in the root nodules of leguminous plants.

Process C is denitrification. Denitrifying bacteria convert nitrates and ammonia in the soil into nitrogen gas, which goes into the atmosphere.

[6]

- (ii) State the name of the process that plants use to absorb nitrate ions.

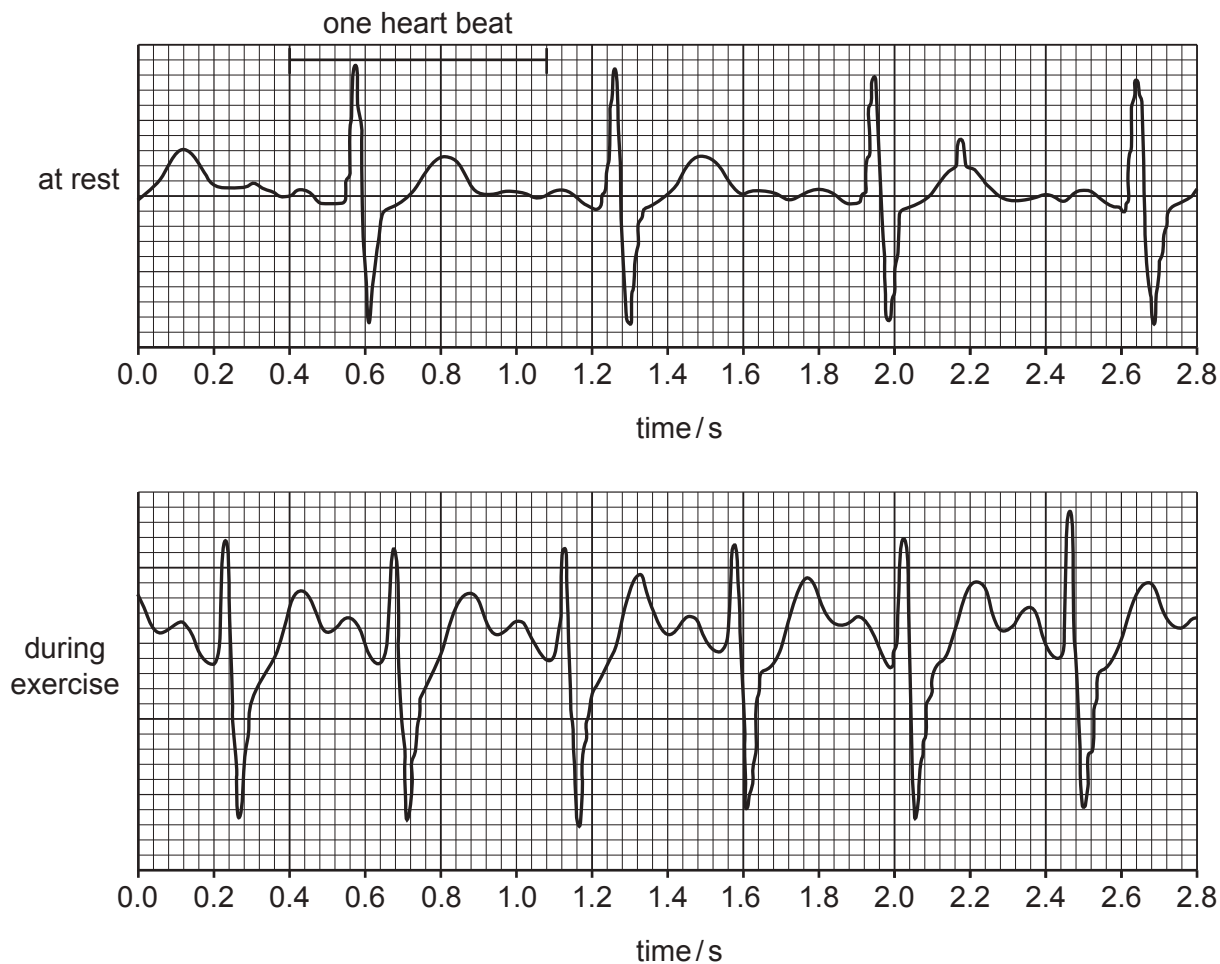
Active transport is the process that plants use to absorb nitrate ions [1]

[Total: 11]

- 3 (a) The activity of the heart can be monitored using different methods.

Fig. 3.1 shows two ECG traces. One trace was recorded when the person was at rest and the second trace was recorded during exercise.

The length of time taken for one heart beat is indicated in Fig. 3.1 on the ECG trace recorded at rest.



**Fig. 3.1**

- (i) Estimate the resting heart rate of the person from their ECG trace in Fig. 3.1.

Space for working.

$$\text{Time in seconds} = 17 \times 0.04 \text{ s} = 0.68 \text{ s}$$

$$\text{Number of beats in one minute} = 60 \div 0.68 = 88 \text{ bpm}$$

.....88..... beats per minute  
[2]

- (ii) Explain why the ECG trace recorded during exercise differs from the ECG trace recorded at rest.

During Exercise, there is an increase in heart beat. So, there is an faster blood flow to muscles, to provide more oxygen and glucose, and to remove the excess carbon di oxide.

Exercising muscles require more energy for muscle contraction .There is an increase in respiration.

..... [4]

- (iii) Suggest **one other** way of monitoring the activity of the heart.

Counting the pulse rate is the other way of monitoring the activity of the heart

..... [1]

- (b) If exercise is very intense an oxygen debt is formed.

- (i) Complete the sentence.

An oxygen debt results in a build-up of .....lactic acid..... in the muscles..... during vigorous exercise.

[2]

- (ii) Outline how the body removes an oxygen debt.

The body removes an oxygen debt by increasing the breathing rate and heart rate. The heart continues to beat faster to ensure that extra oxygen is being delivered to the muscle cells. The excess lactic acid is broken down in the liver , and is removed by aerobic respiration.

..... [4]

4 (a) A leaf can be described as an organ.

Define the term *organ*.

Organ is a structure made up of a group of tissues, working together to perform a specific function.

.....

.....

..... [1]

(b) Fig. 4.1 is a photomicrograph of a cross section of part of a leaf.

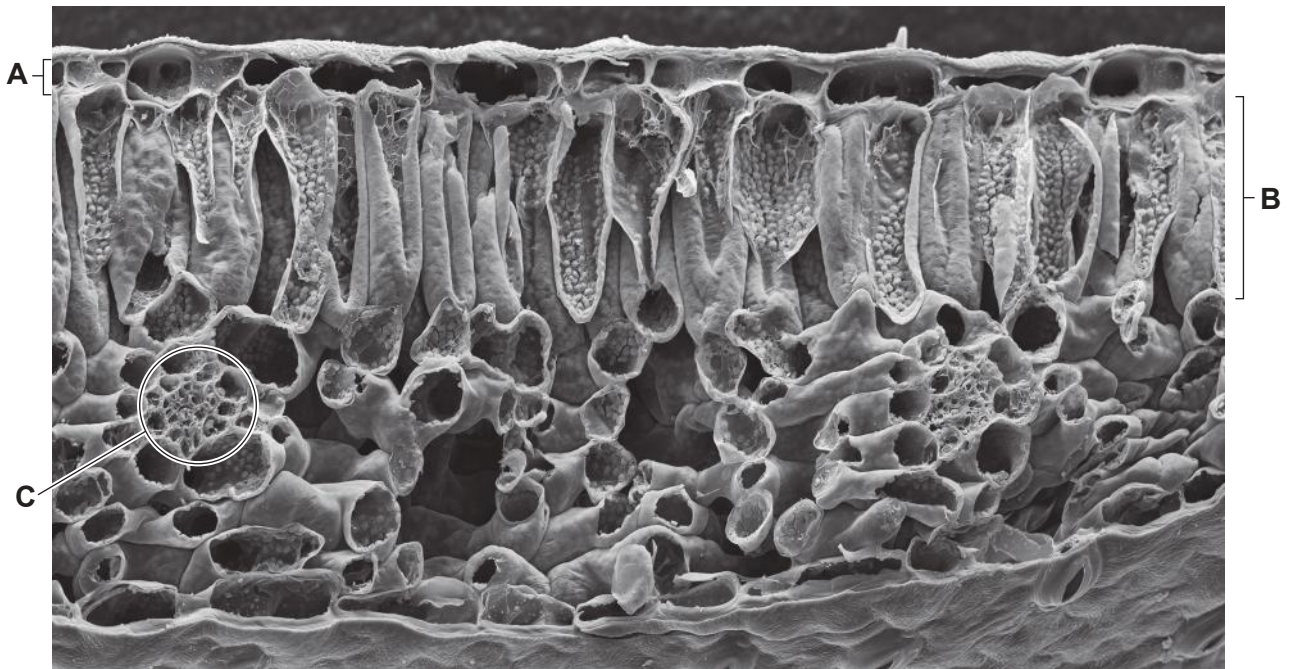


Fig. 4.1

(i) Identify the tissue labelled **A** in Fig. 4.1.

..... Upper epidermis ..... [1]

(ii) Identify the structure labelled **C** in Fig. 4.1.

..... Vascular bundle ..... [1]

(iii) Describe how the tissue labelled **B** is adapted to maximise photosynthesis.

B is the palisade mesophyll layer. The cells are tightly packed. They contain many chloroplasts. The cells are positioned at the top of the leaf, to get maximum sunlight. Large vacuole ensures chloroplasts are at the edge of cells.

[3]

(c) (i) State **two** substances that are transported only in the phloem.

Sucrose and amino acids [1]

(ii) Explain why some parts of a plant can act as both a source and a sink.

They act as a source when it is photosynthesizing. They act as a sink when it is respiring.

[2]

(d) The effect of carbon dioxide concentration on the rate of oxygen production in an aquatic plant was measured.

- A lamp was used to keep the light intensity constant.
- The oxygen gas released by the plant was collected in a gas syringe.
- The plant was placed in water that was kept constant at 20 °C.

Fig. 4.2 shows the results.

(i) The rate of oxygen production was assumed to be the same as the rate of photosynthesis.

Suggest why the rate of oxygen production was **not** the same as the rate of photosynthesis.

All the oxygen released from the plant is not measured. Some of the oxygen is used in ...  
respiration. Some of it is dissolved in water. So, the rate of photosynthesis appear lower  
than the actual rate.

[2]

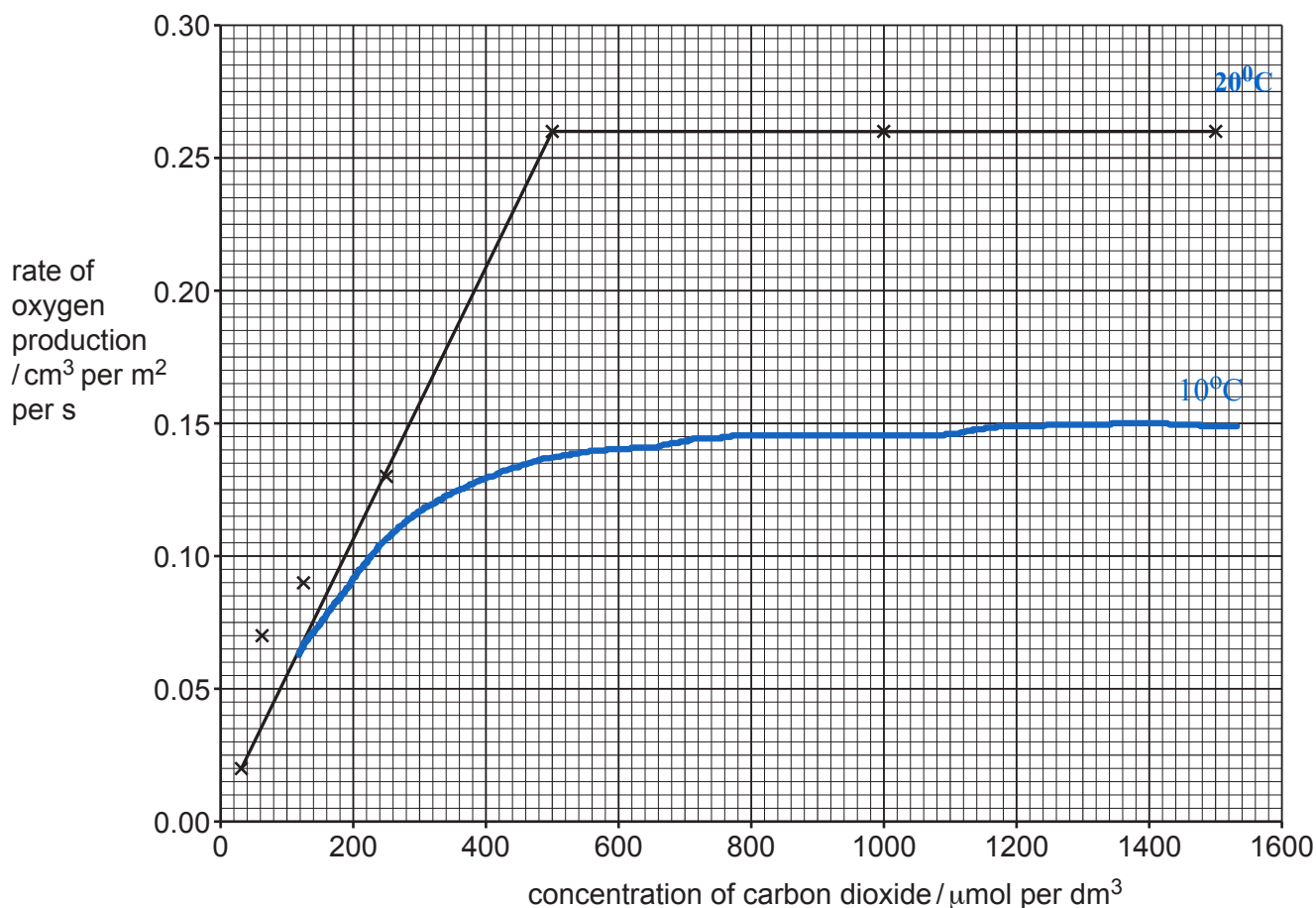


Fig. 4.2

(ii) Explain the results shown in Fig. 4.2.

Carbon dioxide is required for photosynthesis. Initially, carbon dioxide is limiting the rate of photosynthesis. After 500  $\mu\text{mol per dm}^3$  of carbon dioxide concentration, it is not a limiting factor

..... [3]

.....

.....

.....

.....

(e) The investigation was repeated with the same type of aquatic plant at 10 °C.

Draw a line on Fig. 4.2 to predict the results at 10 °C. [2]

[Total: 16]

## 5 (a) Measles is a transmissible disease.

The percentage of the population that were vaccinated against measles in a country was determined.

The number of confirmed cases of measles in the country was also recorded.

Fig. 5.1 shows the data that were collected between 1975 and 2010.

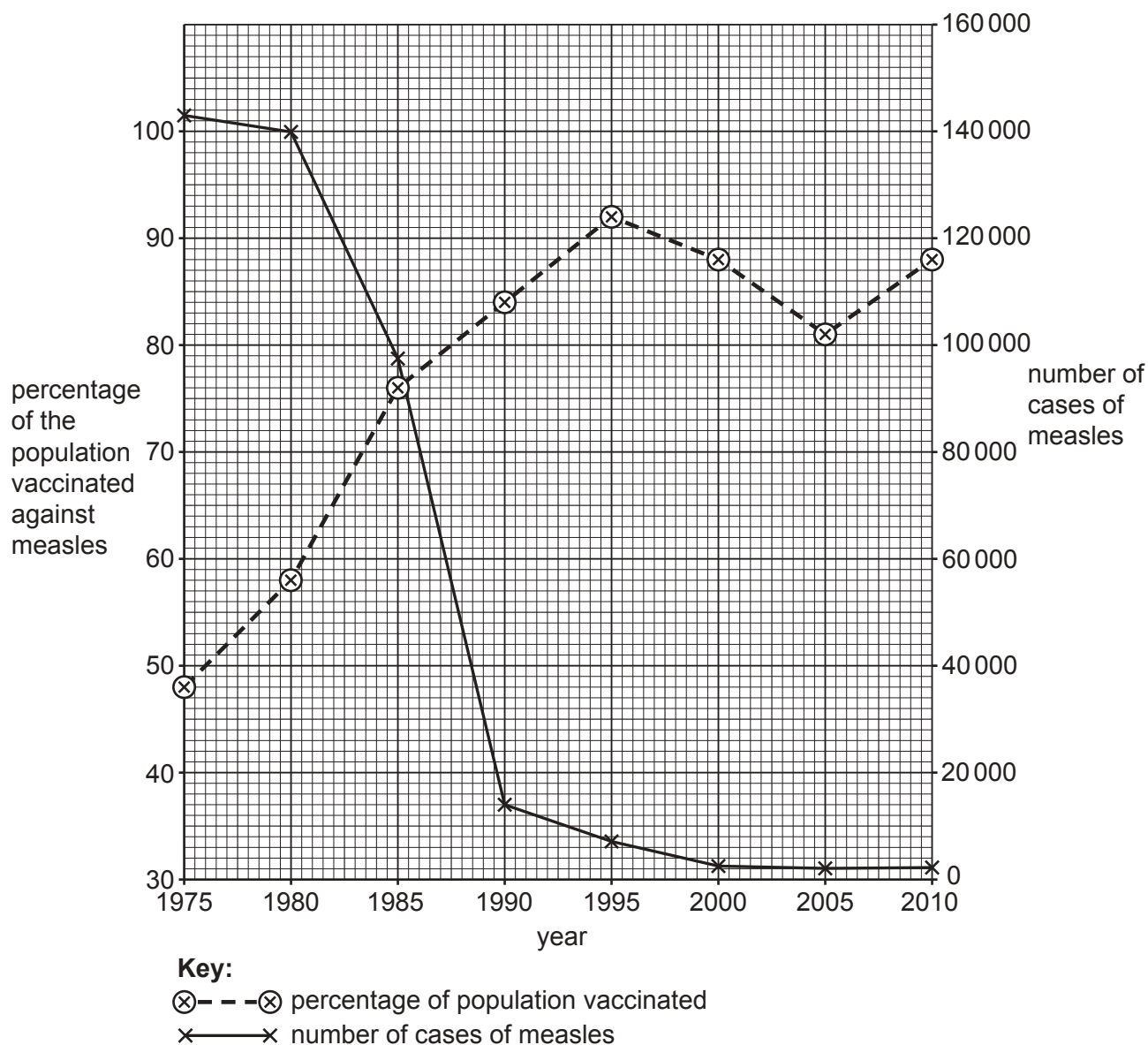


Fig 5.1

- (i) Calculate the percentage change in the number of cases of measles between 1980 and 1990.

Space for working.

Number of cases of measles in 1980 = 140 000  
 Number of cases of measles in 1990 = 14 000  
 $140\,000 - 14\,000 / 140\,000 \times 100 = 90\%$

..... 90 %  
 [2]



- (ii) Describe the data shown in Fig. 5.1.

There occurs a decrease in number of cases of measles as the percentage of the population vaccinated against measles increases. The percentage of the population vaccinated increases until 1995 and then fluctuates. The number of measles cases decrease, and then remain constant. There is a rapid change before 1995 in percentage vaccinated and the number of cases. The number of cases remains the same from, 2000 - 2005, while percentage vaccinated fluctuates.

[4]

- (iii) Explain how vaccination protects people against a transmissible disease such as measles.

Vaccines are attenuated pathogens injected into the body of an individual. Antigens are present on these pathogens. They trigger an immune response and the lymphocytes produce antibodies. When the body is exposed to the same pathogen, memory cells are produced. Antibodies destroy the pathogen, providing long term immunity.

[5]

- (b) The human body has several defences against pathogens.

- (i) State **two** of the body's chemical barriers to pathogens.

1 Mucus

2 Secretion of hydrochloric acid in the stomach

[2]

(ii) Describe the process of blood clotting.

Platelets are involved in blood clotting. In the blood plasma, soluble fibrinogen is .....  
converted into insoluble fibrin. They form a mesh across the wound, which traps red blood  
cells, forming a blood clot.....

.....  
.....  
.....  
..... [3]

[Total: 16]

6 (a) Fig. 6.1 shows a food web.

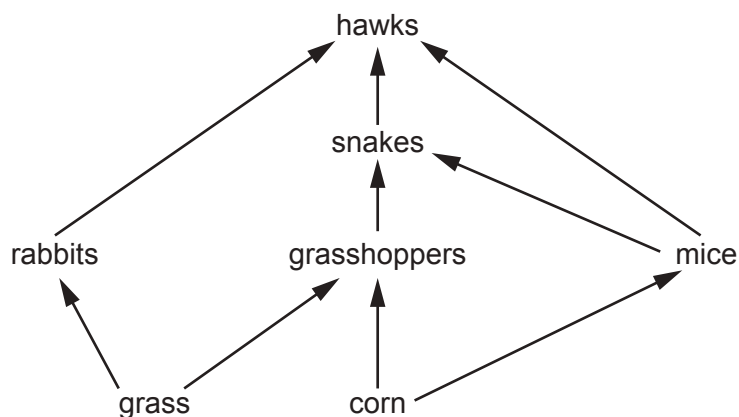


Fig. 6.1

(i) State the number of trophic levels in the food web in Fig. 6.1.

4 ..... [1]

(ii) State the name of **one** organism that feeds at both the third and fourth trophic levels from Fig. 6.1.

Hawks ..... [1]

(iii) State the name of the type of energy that is transferred between trophic levels.

Chemical energy is transferred between trophic levels ..... [1]

(b) The total biomass of the snakes is much less than the total biomass of the mice in the food web shown in Fig. 6.1.

Explain why the total biomass of the snakes is less than the total biomass of the mice.

Use the term **energy** in your answer.

Most of the energy is lost between the trophic levels. Snakes occupy a higher trophic level than mice. There is not enough energy to sustain larger biomass of snakes at higher trophic levels

..... [3]

- (c) Food shortages that result in famine can be caused by many factors.

Describe how drought can contribute to famine.

Drought is a lack of water. The seeds and plants can't germinate. Plants need water for photosynthesis. With out water, they wilt. Drought causes the destruction of crops, which leads to desertification. There will be less food and water for livestock.

.....  
.....  
.....  
.....  
..... [3]

[Total: 9]

---

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at [www.cambridgeinternational.org](http://www.cambridgeinternational.org) after the live examination series.

Cambridge Assessment International Education is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which itself is a department of the University of Cambridge.