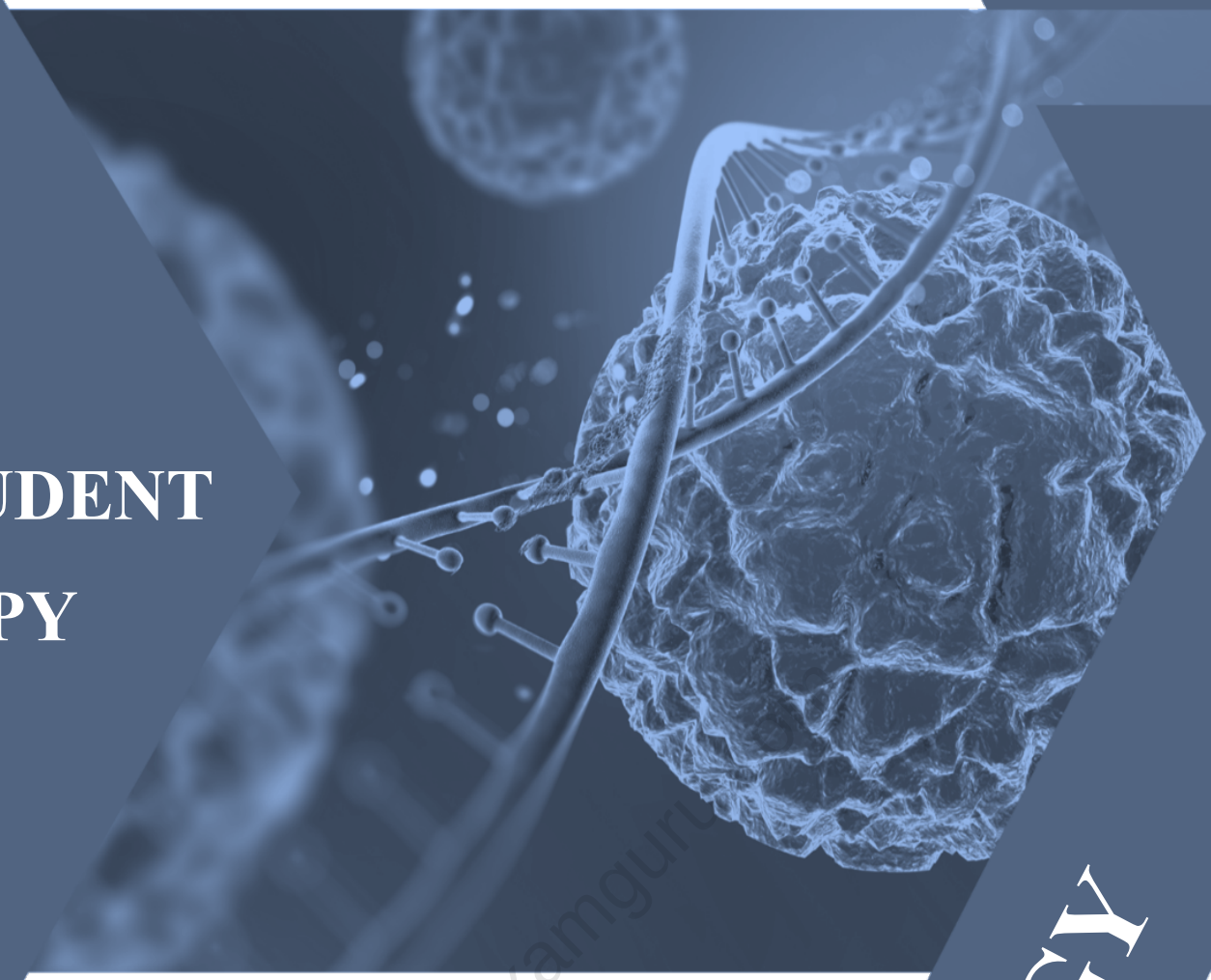

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HEADS-UP
REACH FOR THE STARS

IGCSE BIOLOGY

TOPICAL PRACTICE QUESTIONS

PAPER 4

VOL. 1

2020 EDITION

CHAPTERS 1-7

1 Fig. 6.1 shows three different insects.

Vespula flavopilosa
insect 1

Vespula rufa
insect 2

Callicera rufa
insect 3

Fig. 6.1

(a) Insects 1 and 2 are more closely related to each other than to insect 3.

(i) Explain how the binomial names indicate that insects 1 and 2 are more closely related.

.....

.....

.....

..... [2]

(ii) Explain how the appearance of the three insects suggests that insects 1 and 2 are more closely related.

.....

.....

.....

..... [2]

Vespula flavopilosa gives a painful sting. The insect shown in Fig. 6.2 is very similar in appearance to *Vespula flavopilosa* but does not give a sting.

Chrysotoxum cautum

Fig. 6.2

(b) *Chrysotoxum cautum* is very similar in appearance to *Vespula flavopilosa*. Explain how this is an advantage.

.....

.....

.....

..... [2]

(c) It is thought that *Chrysotoxum cautum* evolved from an insect that did not have any stripes.

Suggest how these insects became striped.

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.....

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..... [5]

[Total: 11]

2 Arachnids, crustaceans, insects and myriapods are all classified as arthropods.

Scorpions, such as *Heterometrus swammerdami* shown in Fig. 1.1, are arachnids.

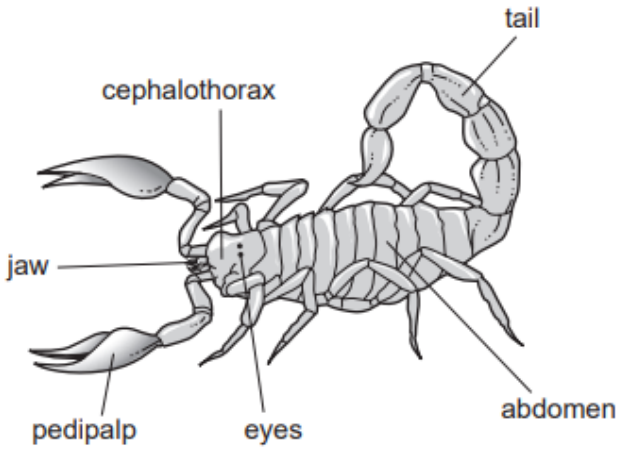

Fig. 1.1

(a) State **three** features, shown by *H. swammerdami* and **visible** in Fig. 1.1, that arachnids share with other arthropods.

1 .....

2 .....

3 ..... [3]

(b) Fig. 1.2 shows seven species of arachnid.

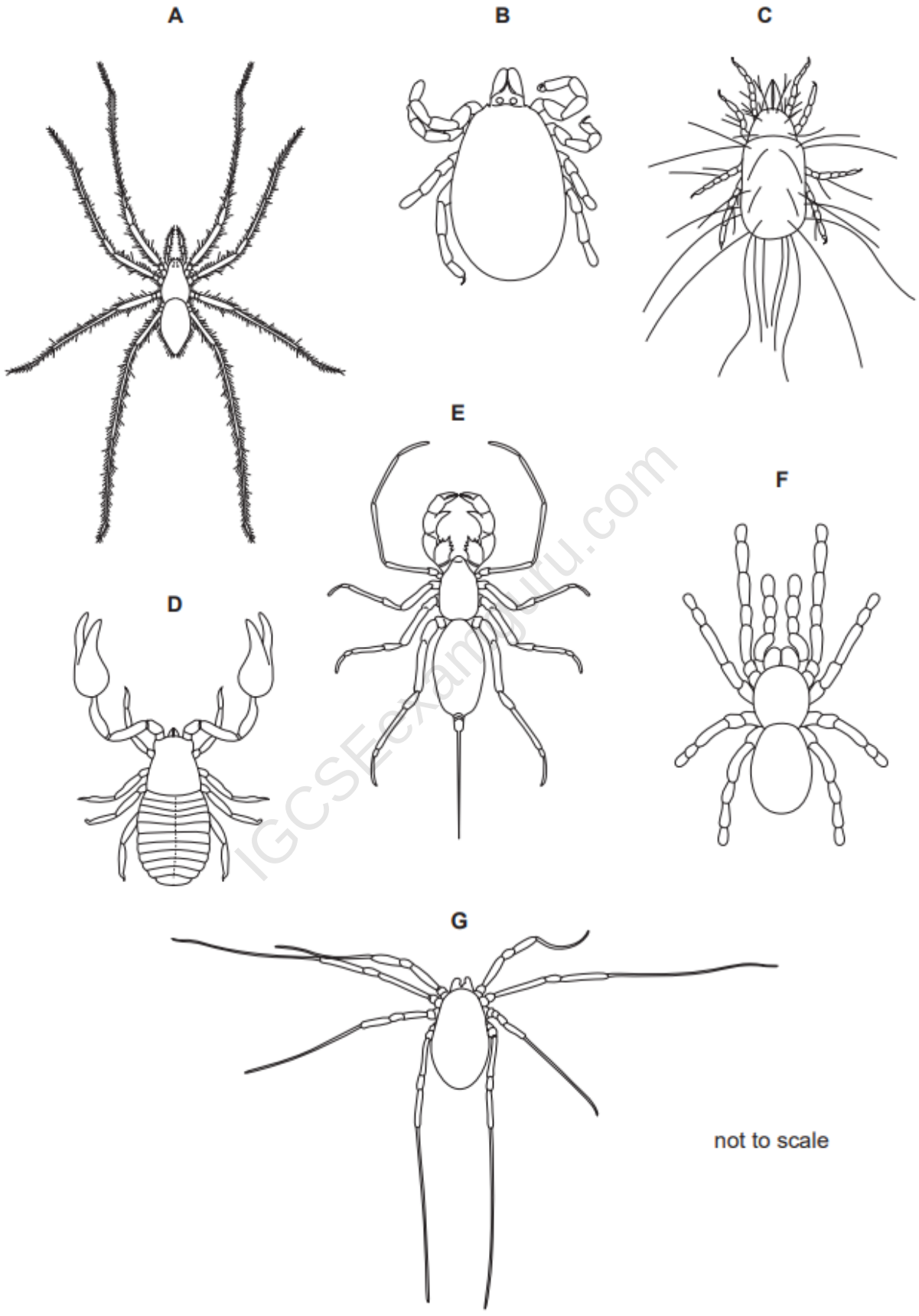

Fig. 1.2

Use the key to identify each species. Write the letter of each species (**A** to **G**) in the correct box beside the key. One has been done for you.

Key

1 (a)	Abdomen with a tail	*Abaliella dicranotarsalis*	**E**
(b)	Abdomen without a tail	go to 2	
2 (a)	Legs much longer than abdomen and cephalothorax	go to 3	
(b)	Legs not much longer than abdomen and cephalothorax	go to 4	
3 (a)	Hairs on the legs	*Tegenaria domestica*	
(b)	No hairs on the legs	*Odielus spinosus*	
4 (a)	Cephalothorax or abdomen segmented	*Chelifer tuberculatus*	
(b)	Cephalothorax and abdomen not segmented	go to 5	
5 (a)	Abdomen and cephalothorax about the same size	*Poecilotheria regalis*	
(b)	Abdomen larger than cephalothorax	go to 6	
6 (a)	Body covered in long hairs	*Tyroglyphus longior*	
(b)	Body not covered in hairs	*Ixodes hexagonus*	

[4]

[Total: 7]

3 **(a)** Fig. 1.1 shows five species of mollusc.

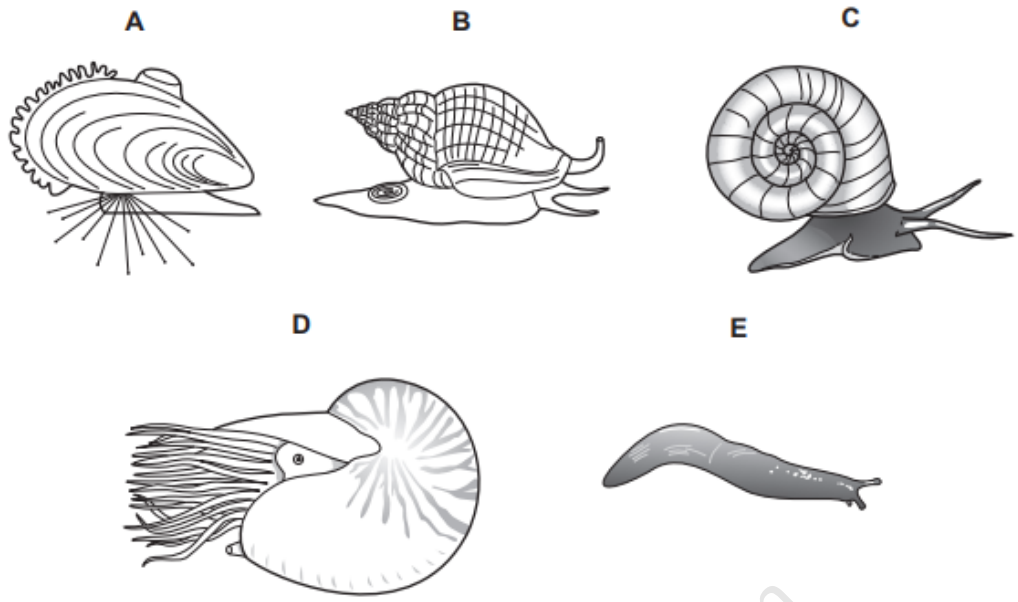

Fig. 1.1

Use the key to identify each species. Write the letter of each species (**A** to **E**) in the correct box beside the key.

Key

1 (a)	body is completely or partly covered in a shell	go to 2	
(b)	body is not completely covered or partly covered in a shell	*Limax flavus*	
2 (a)	shell is attached to rocks by thin threads	*Mytilus edulis*	
(b)	shell is not attached to rocks by thin threads	go to 3	
3 (a)	shell is a spire that comes to a point	*Buccinum undatum*	
(b)	shell is not a spire that comes to a point	go to 4	
4 (a)	animal has tentacles	*Nautilus pompilius*	
(b)	animal has 2 tentacles	*Planorbis planorbis*	

[3]

(b) State **two** features that are shown by all molluscs.

1 .....

2 .....

[2]

[Total: 5]

4 Fig. 1.1 shows seven different species of amphibian.

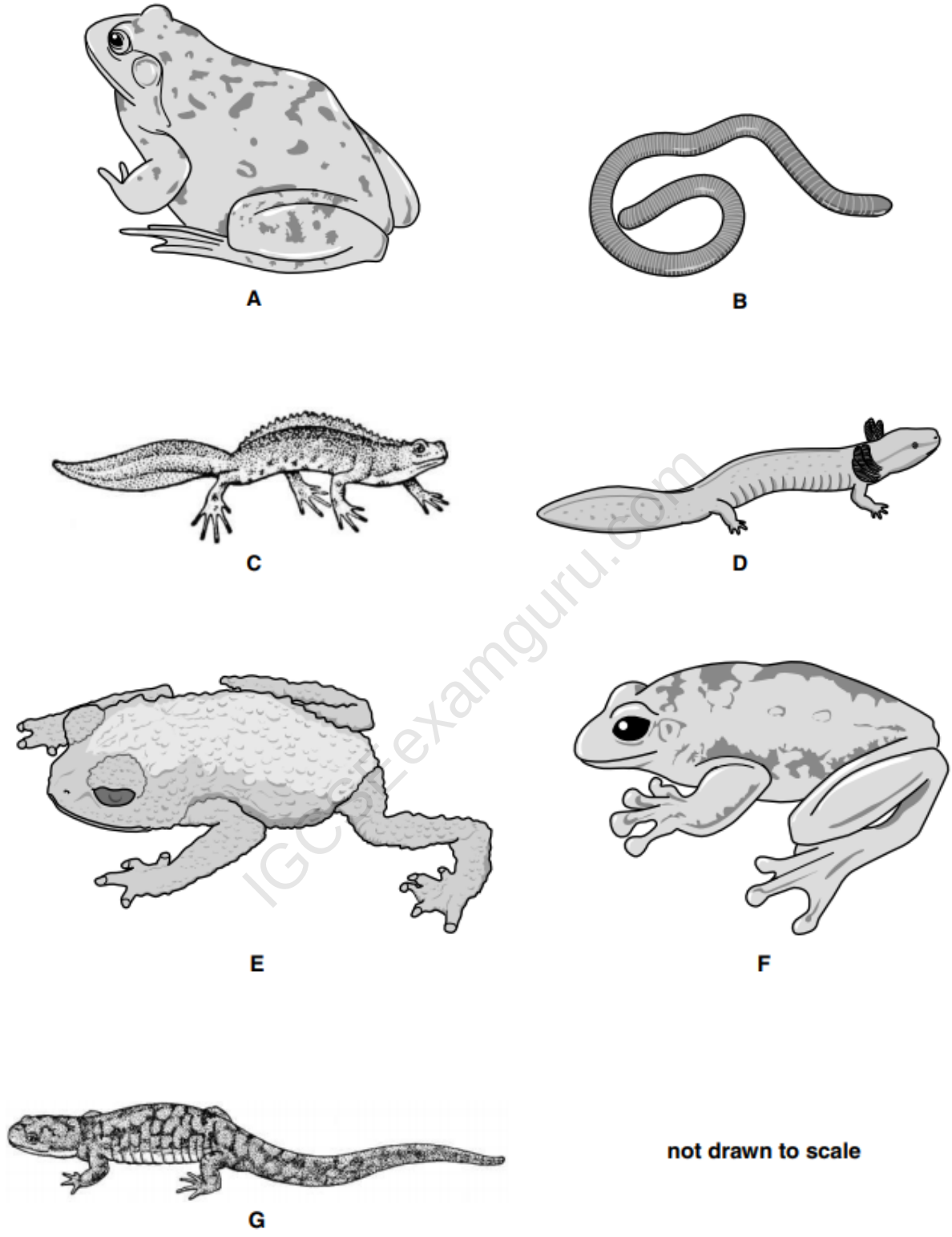

Fig. 1.1

(a) Use the key to identify each species. Write the letter of each species (**A** to **G**) in the correct box beside the key. One has been done for you.

Key

1 (a)	long, narrow body, with or without legs	go to 2	
(b)	body not long and narrow, back legs are larger than the front legs	go to 5	
2 (a)	body without legs	*Gymnopis multiplicata*	**B**
(b)	body with legs which are all of the same size	go to 3	
3 (a)	raised crest along the back of the body	*Triturus cristatus*	
(b)	no crest along the back of the body	go to 4	
4 (a)	gills present	*Necturus maculosus*	
(b)	no gills present	*Ambystoma tigrinum*	
5 (a)	skin is smooth	go to 6	
(b)	skin is not smooth	*Oreophrynella quelchii*	
6 (a)	digits end in swellings	*Polypedates leucomystax*	
(b)	digits do not end in round swellings	*Rana temporaria*	

[3]

(b) Many amphibian species throughout the world are endangered.

Suggest **three** reasons why many amphibian species are endangered.

1 .....

.....

2 .....

.....

3 .....

.....

[3]

[Total: 6]

Chapter 3: Movement In and Out of Cells

1 Some plants can be grown in water using the technique of hydroponics. The roots are in water and supplied with the ions that they need at the concentrations that support maximum growth. Some ions can be absorbed both by diffusion and by active transport.

(a) (i) State **two** features of diffusion that do not apply to active transport.

1 .....

.....

2 .....

.....

[2]

(ii) Explain how roots are adapted to absorb ions.

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.....[2]

A group of students investigated the effect of soaking small onion bulbs in different concentrations of sodium chloride solution. They peeled off the outer papery leaves of the onion bulbs and divided the onions into 6 batches, each with 10 onions.

The onions were surface dried with paper towels and weighed. The mean mass of the onions in each batch was calculated. The onions were then left in sodium chloride solutions for three hours.

After three hours the students surface dried the onions and weighed them again. Their results are given in Table 2.1.

Table 2.1

concentration of sodium chloride solution /g dm^{-3}	mean mass of onions/g		percentage change in mass
	before soaking	after soaking for 3 hours	
0	147	173	+17.7
25	153	165	+7.8
50	176	172	–2.3
100	154	149	–3.2
150	149	142	–4.7
200	183	175	

(b) (i) Calculate the percentage change in mass of the onions that were in the most concentrated solution of sodium chloride. Show your working. Write your answer in Table 2.1.

[2]

(ii) Explain why the students calculated the percentage change in mass of the onions.

.....

.....

.....

.....

.....[2]

(c) The students plotted a graph of the results as shown in Fig. 2.1.

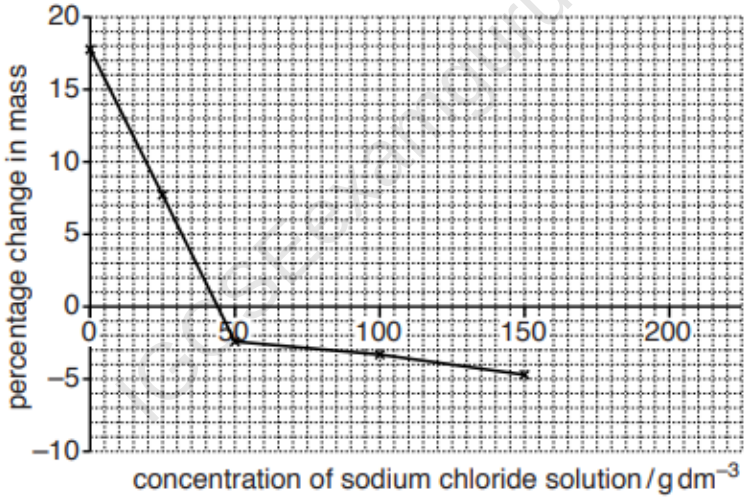

Fig. 2.1

(i) Complete the graph using your answer to **(b)(i)**. [1]

(ii) Use the graph in Fig. 2.1 to estimate the concentration of the sodium chloride solution that has the same water potential as the onions.

.....[2]

(d) Using the term **water potential**, explain why the onions:

gained mass when soaked in dilute solutions of sodium chloride

.....

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.....

lost mass when soaked in concentrated solutions of sodium chloride.

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[4]

[Total: 15]

41/MJ 2017

1 Fat is a necessary component of the human diet.

(a) State **three** ways in which the human body uses fat.

1.....

2.....

3.....

[3]

The arrows in Fig. 1.1 show the pathway of fat in part of the alimentary canal.

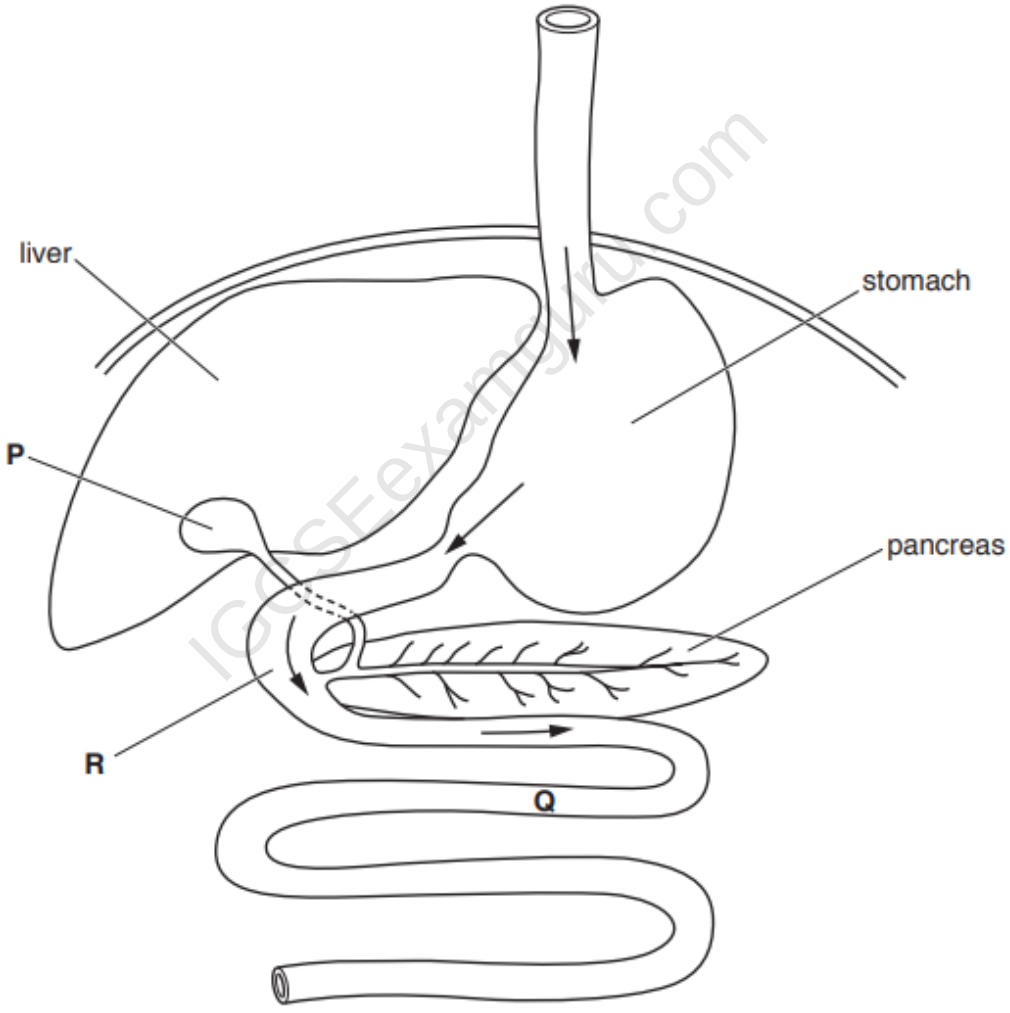

Fig. 1.1

(b) State the name of

(i) the enzyme secreted by the pancreas that digests fat

.....[1]

(ii) the products of chemical digestion of fat

.....[1]

(iii) the liquid that is produced by the liver and stored by organ **P** in Fig. 1.1

.....[1]

(iv) organ **P** in Fig. 1.1.

.....[1]

(c) Explain what happens to ingested fat at **R** in Fig. 1.1 **before** chemical digestion occurs.

.....

.....

.....

.....

.....[2]

(d) Explain how the products of fat digestion are transported from **Q** to the rest of the body.

.....

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.....

.....

.....

.....

.....[3]

One possible effect of too much fat in the diet is coronary heart disease.

(e) Describe how too much fat in the diet may cause coronary heart disease.

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.....[3]

(f) Describe **and** explain how coronary heart disease can be treated.

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.....[6]

[Total: 21]

2 Many researchers are studying the structure and function of genes.

(a) Define the term *gene*.

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.....

.....[2]

(b) Every living cell is able to make proteins.

The process begins in the nucleus.

Describe how proteins are made in a cell.

.....

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.....[4]

(c) Fig. 2.1 is a diagram of a protein used to move ions across membranes in root hair cells.

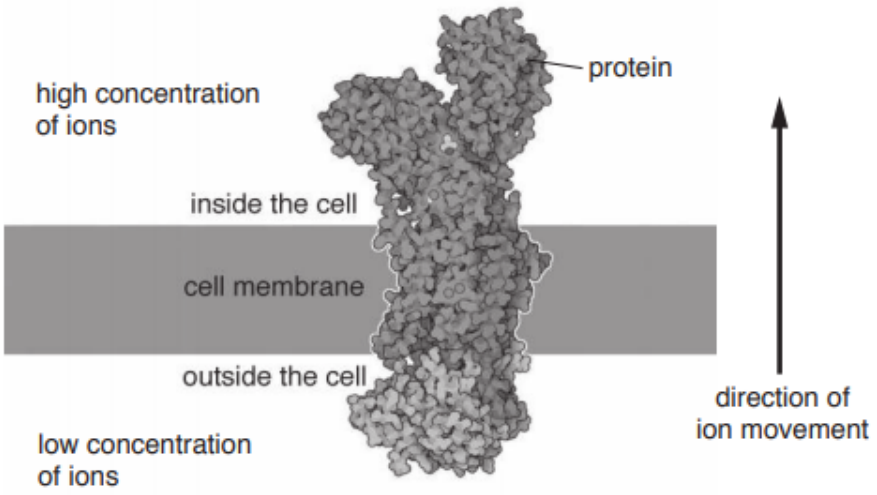

Fig. 2.1

(i) State the name of the process that moves mineral ions into root hair cells through cell membrane proteins.

.....[1]

(ii) Explain how protein molecules move ions across a membrane during this process.

.....

.....

.....

.....

.....

.....

.....[3]

(d) Proteins are also found in the blood.

State the names of **two** proteins found in the blood.

1 .....

2 .....

[2]

[Total: 12]

Chapter 5: Enzymes

1 Enzymes are biological catalysts.

(a) Define the term *catalyst*.

.....

.....

.....

..... [2]

Urease is an enzyme found in bacteria and in the seeds of some species of bean.

The enzyme catalyses the reaction:

urea + water ⟶ carbon dioxide + ammonia

The production of ammonia increases the pH of the area around the bacteria. The formation of ammonia can be used to study the progress of the reaction by testing the pH of the surrounding medium with a pH indicator, such as Universal Indicator solution.

Some students carried out an investigation to find out if there was urease in the seeds of four different species of bean.

- The germinating seeds were ground up in water and filtered to give an extract containing proteins.
- Each extract was added to a urea solution and kept at 30 °C for 30 minutes (tubes **1** to **4**).
- Two more tubes (**5** and **6**) were included in the investigation.
- Samples were taken from the reaction mixture at five-minute intervals and tested with Universal Indicator solution.

The results are shown in Table 4.1.

Table 4.1

test-tube	bean species	urea solution	water	presence of alkaline pH at intervals of 5 minutes						
				0	5	10	15	20	25	30
1	soya	yes	no	×	×	×	×	✓	✓	✓
2	mung	yes	no	×	×	×	×	×	×	×
3	jack	yes	no	×	×	×	✓	✓	✓	✓
4	broad	yes	no	×	×	×	×	×	×	×
5	soya	no	yes	×	×	×	×	×	×	×
6	no beans	yes	yes	×	×	×	×	×	×	×

✓ = alkaline pH × = not alkaline pH

(b) (i) Explain why the test-tubes were kept at 30 °C.

.....

.....

.....

..... [2]

(ii) Explain why test-tubes **5** and **6** were included in the investigation.

.....

.....

.....

.....

..... [2]

(iii) State the conclusions that the students would make from the results of test-tubes **1** to **4**.

.....

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..... [3]

It is thought that some bean seeds produce ammonia as a protection against infection by microorganisms in the soil.

(c) Suggest what would happen to any ammonia that passes into the soil.

.....

.....

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..... [2]

(d) *Helicobacter pylori* is a bacterium that infects the stomach and causes ulcers.

The bacteria secrete urease that helps them to colonise the stomach lining.

(i) Explain why bacteria do not usually grow inside the stomach.

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..... [2]

(ii) Suggest how urease helps the bacteria to colonise the stomach.

.....

.....

.....

..... [2]

(iii) Explain how the immune system protects against infection by bacteria such as *H. pylori*.

.....

.....

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..... [2]

[Total: 17]

2 Enzymes are necessary for many biological processes, such as the digestion of fat.

$$\text{fat} + \text{water} \xrightarrow{\text{lipase}} \text{fatty acids} + \text{glycerol}$$

(a) (i) Explain why enzymes are necessary for biological processes.

.....

.....

.....

.....

.....

.....

..... [3]

(ii) Lipase, protease and amylase are enzymes secreted into the alimentary canal.

Name **one** organ that secretes each enzyme. Choose your answers from this list.

colon gall bladder liver oesophagus

pancreas rectum salivary glands stomach

You can use each organ **only once**.

lipase .....

protease .....

amylase ..... [3]

(b) A group of students investigated the digestion of fat in milk.

- They added an alkaline solution to the milk.
- They divided the milk into four test-tubes.
- They added lipase and bile salts to some of the test-tubes, as shown in Table 5.1. They did this at the same time for each test-tube.
- They kept all test-tubes at 40 °C.
- After 5 minutes, they added Universal Indicator solution to each test-tube.

Table 5.1

test-tube	contents	colour of pH indicator after 5 minutes at 40 °C
A	milk, alkaline solution, lipase and bile salts	orange
B	milk, alkaline solution, bile salts and water	blue
C	milk, alkaline solution, lipase and water	yellow
D	milk, alkaline solution and water	blue

Fig. 5.1 shows the colour of the indicator at different pH values.

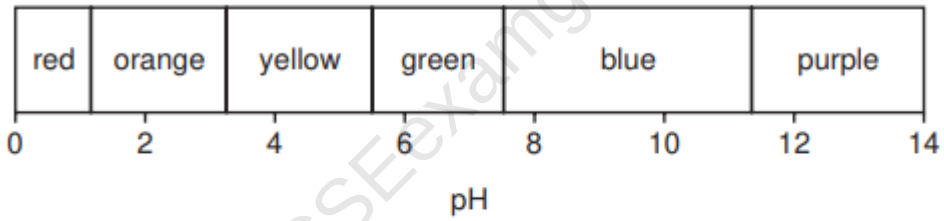

Fig. 5.1

(i) Explain why test-tube **D** was included in the investigation.

.....

.....

.....

..... [2]

(ii) Explain why the colour in test-tube **A** was orange.

.....

.....

.....

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.....

.....

..... [3]

(iii) Explain the results for test-tubes **B** and **C**.

test-tube **B** .....

.....

.....

.....

test-tube **C** .....

.....

..... [4]

[Total: 15]

Chapter 6: Plant Nutrition

1 Fig. 6.1 shows a leaf and a flower of *Helleborus orientalis*.

Fig. 6.1

(a) *H. orientalis* is a dicotyledonous plant.

State three features **visible** in Fig. 6.1 that show it is a dicotyledonous plant.

1. .....

2. .....

3. ..... [3]

Fig. 6.2 is a photograph of a section through a leaf of *H. orientalis*.

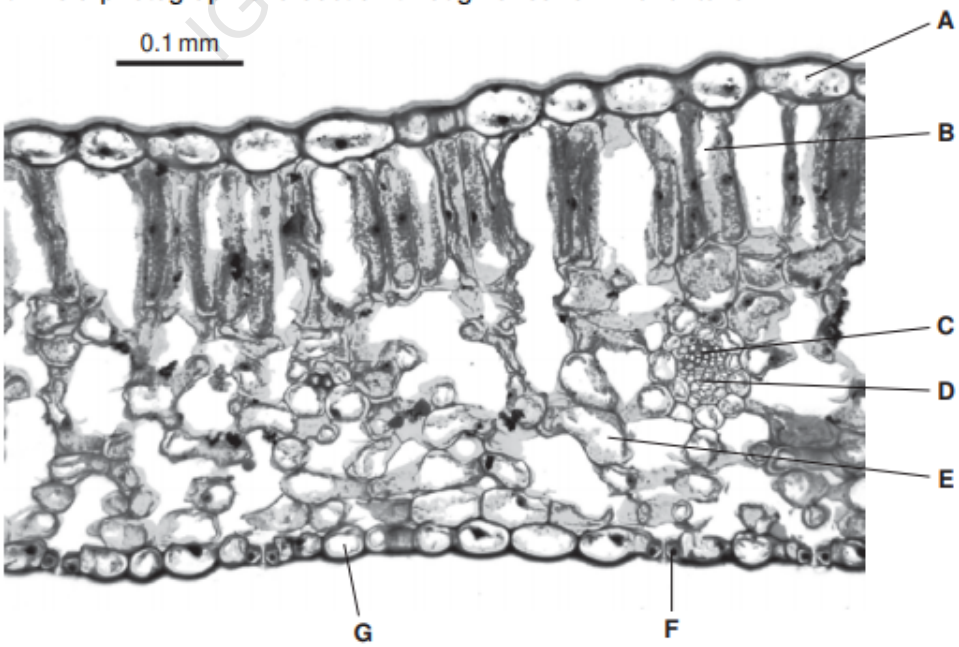


Fig. 6.2

(b) Complete the table, using ticks (✓), to show the cells that carry out photosynthesis.

cell	cells that carry out photosynthesis
A	
B	
C	
D	
E	
F	
G	

[2]

(c) Explain how two features of leaves, **visible** in sections such as that shown in Fig. 6.2, are adaptations for efficient photosynthesis.

1. .....

.....

.....

2. .....

.....

..... [4]

(d) During the period when *H. orientalis* is photosynthesising at a fast rate, substances are transported through the plant in the phloem from sources to sinks.

(i) Name **two** substances that are translocated from a source to a sink.

.....

..... [2]

(ii) For these substances state the source and **two** possible sinks.

source .....

sink 1 .....

sink 2 ..... [2]

[Total: 13]

2 **(a)** Complete the balanced chemical equation for photosynthesis.

light

..... + ... ⟶ ..... + ... [3]

chlorophyll

A student investigated the effect of increasing the concentration of carbon dioxide on the rate of photosynthesis of *Cabomba*, an aquatic plant.

Fig. 4.1 shows the apparatus that the student used.

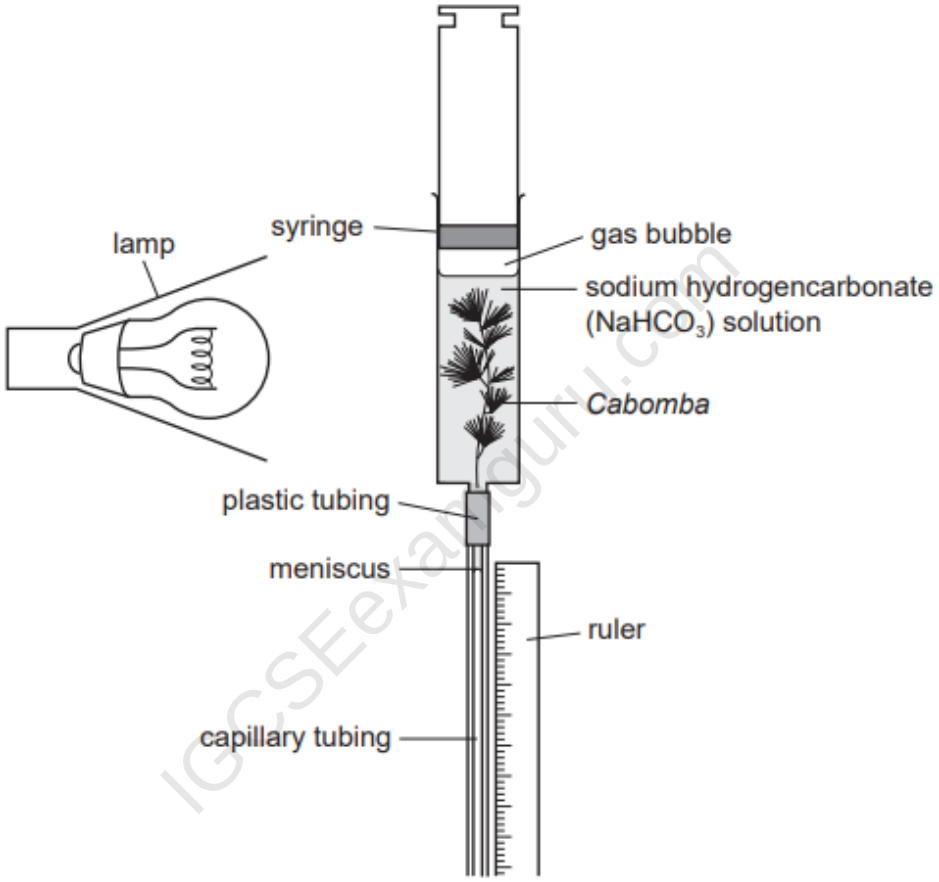


Fig. 4.1

The concentration of carbon dioxide in the water surrounding the plant was changed by adding different concentrations of sodium hydrogencarbonate solution to the water.

The student recorded the time taken for the meniscus to travel 50 mm down the tubing.

The rate of photosynthesis was calculated as:

$$\text{rate of photosynthesis} = \frac{1000}{\mathbf{t}}$$

where **t** = time taken in seconds for the meniscus to travel 50 mm.

The student's results are shown in Table 4.1.

Table 4.1

concentration of sodium hydrogencarbonate solution / mol per dm^3	**t**, time taken for meniscus to travel 50 mm / s	rate of photosynthesis (1000/**t**)
0.00	4998	0.20
0.01	2500	0.40
0.02	1175	0.85
0.05	350	2.86
0.07	201	
0.10	199	5.03

(b) Calculate the rate of photosynthesis for the concentration of sodium hydrogencarbonate solution of 0.07 mol per dm^3.

Write your answer in Table 4.1. [1]

(c) (i) Explain why the lamp must be kept at a fixed distance from the syringe.

.....

.....

.....

..... [2]

(ii) Explain what caused the meniscus to move down the capillary tubing.

.....

.....

.....

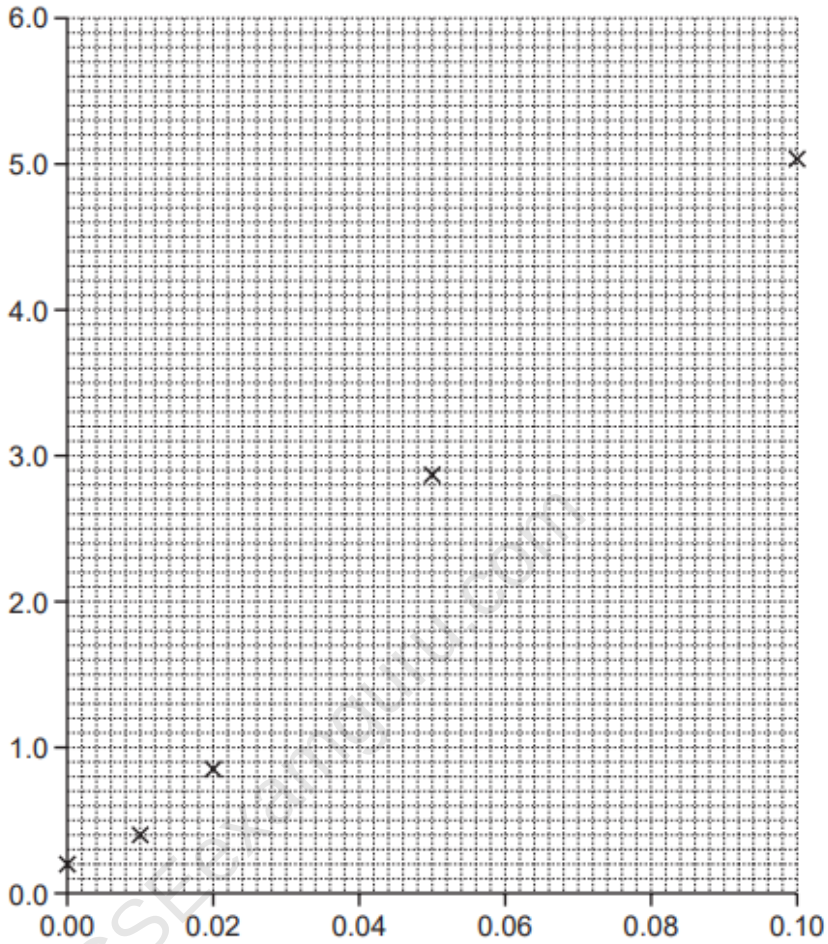
..... [2]

(d) Fig. 4.2 is a partially completed graph of the student's results.

Complete the graph by labelling the axes, adding the missing point and drawing a suitable line.

.....

.....



.....

Fig. 4.2

[3]

(e) Explain, using the term **limiting factors**, the effect of carbon dioxide concentration on the rate of photosynthesis as shown by the student's results.

You will gain credit for using the data in the table and the graph to answer the question.

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.....

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.....

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..... [5]

[Total: 16]

3 Fig. 1.1 is a photomicrograph of a leaf of the tea plant, *Camellia sinensis*.

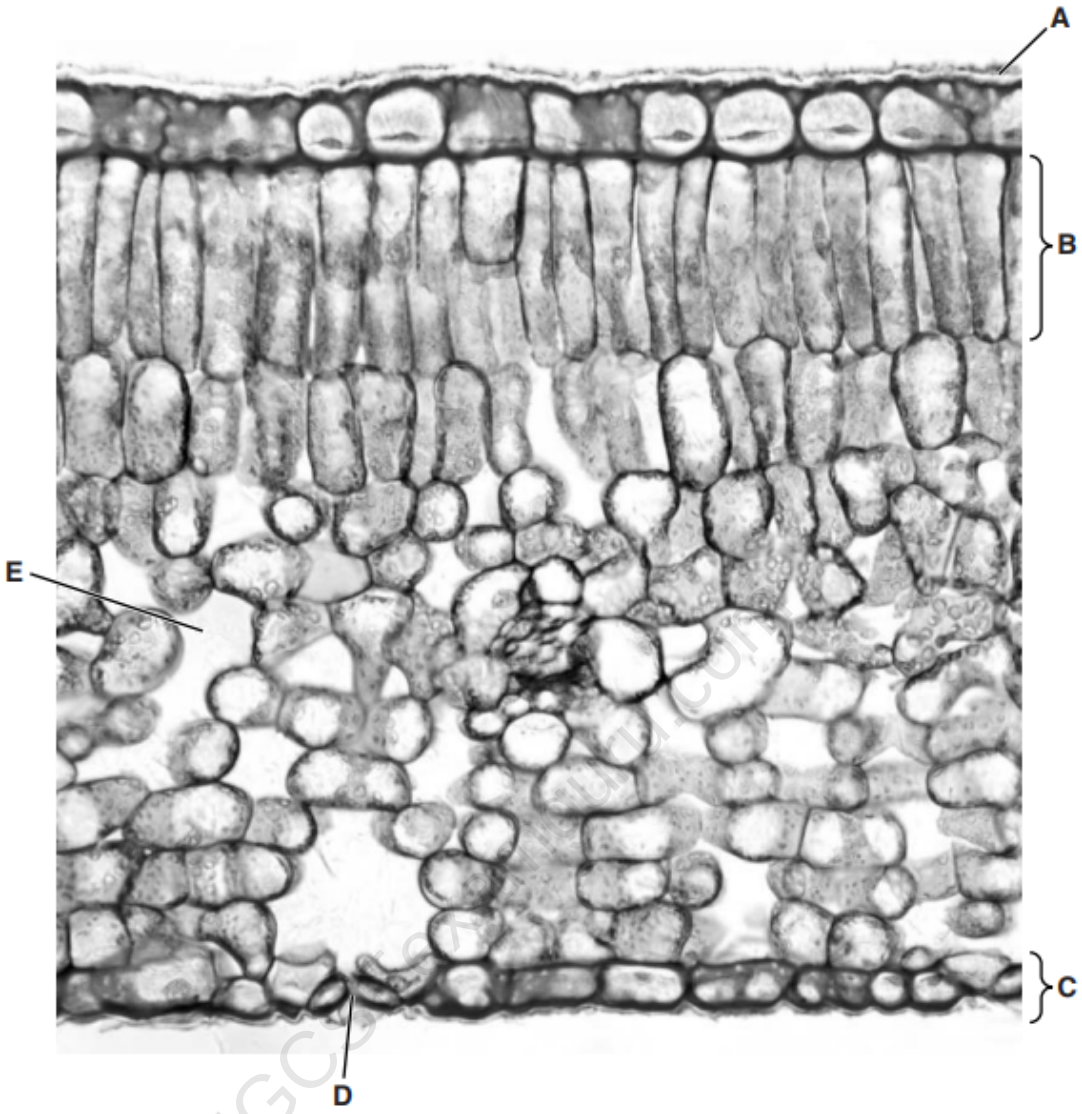

Fig. 1.1

(a) Name **A** to **E**.

A .....

B .....

C .....

D .....

E .....[5]

(b) Fig. 1.2 shows a cell from region **B** of the leaf shown in Fig. 1.1.

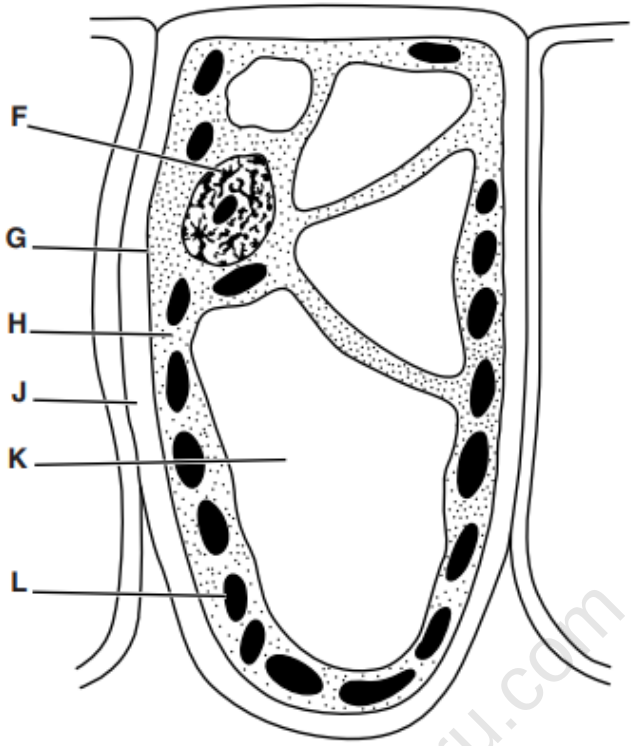

Fig. 1.2

Use the letters from Fig. 1.2 to complete Table 1.1.

Write **one** letter only in each box to identify the function. You may use each letter once, more than once or not at all.

Table 1.1

function	letter from Fig. 1.2
controls movement of substances into and out of the cell	
exerts a pressure to help maintain the shape of the cell	
produces sugars using light as a source of energy	
withstands the internal pressure of the cell	
controls all the activities of the cell	

[5]

(c) The enzyme catalase is found in lettuce leaves.

A student investigated the activity of this enzyme by grinding some lettuce leaves and adding them to a solution of hydrogen peroxide. The volume of oxygen produced was measured until the reaction stopped.

The student's results are shown in Fig. 1.3.

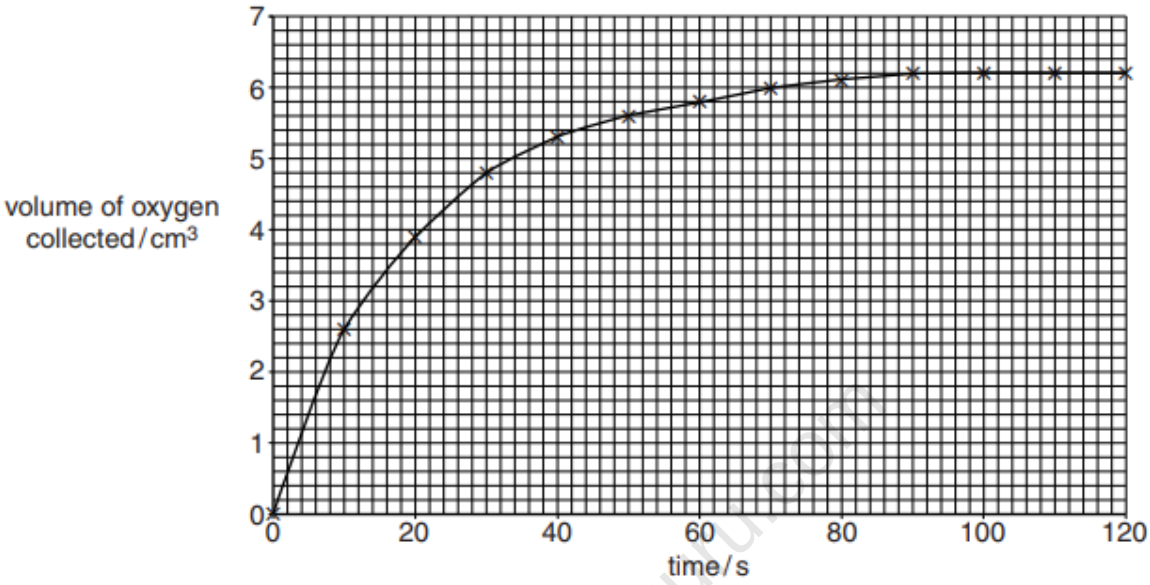

Fig. 1.3

(i) Describe the results shown in Fig. 1.3. You will gain credit if you use the data in your answer.

.....

.....

.....

.....

.....

.....

.....[3]

(ii) Explain the action of enzymes during a reaction.

.....

.....

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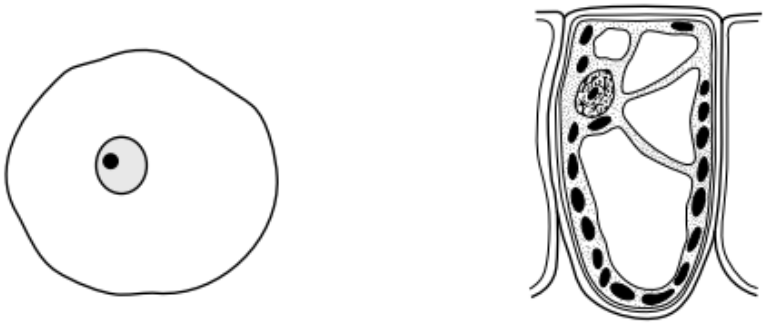
.....

.....

.....[3]

[Total: 16]

4 Fig. 1.1 shows an animal cell and a plant cell as seen with a light microscope.



animal cell plant cell

Fig. 1.1

(a) Table 1.1 shows some structural features of the animal cell and the plant cell in Fig. 1.1.

Complete the table by

- finishing the row for nucleus
- adding **three** structural features, visible in Fig. 1.1, and indicating whether they are present (✓) or absent (✗) in the animal cell and in the plant cell.

Table 1.1

structural feature	animal cell	plant cell
cell wall	✗	✓
nucleus		

[4]

(b) The cells were kept in a dilute salt solution. They were then transferred to distilled water.

Explain what will happen to each of these two cells when they are placed into distilled water.

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.....

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.....[4]

(c) Magnesium is a plant nutrient. Scientists think that magnesium is involved in the transport of sucrose from the leaves to the rest of a plant.

(i) Name the tissue that transports sucrose in plants.

.....[1]

The scientists grew some tomato plants with their roots in a solution that contained all the mineral nutrients that plants require. After a while, the plants were divided into two groups.

- Group **A** continued to receive the solution containing all the nutrients.
- Group **B** received a solution that did not contain any magnesium.

After 12 days, measurements were made on the leaves and the results are shown in Fig. 1.2.

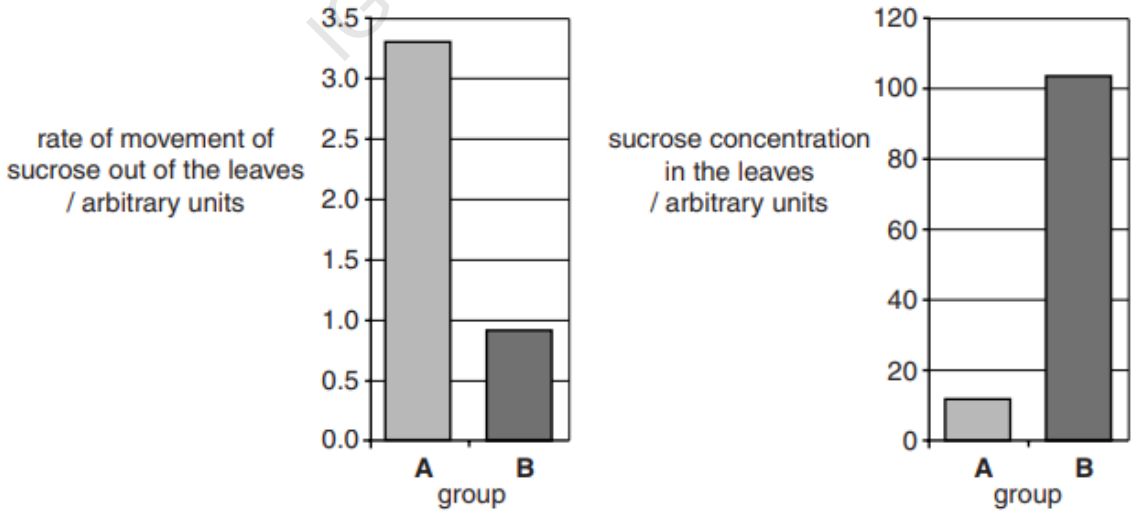

Fig. 1.2

(ii) Describe the effect of magnesium deficiency on the transport of sucrose out of the leaves and the sucrose concentration in the leaves.

transport of sucrose out of the leaves .....

.....

.....

.....

.....

concentration of sucrose in the leaves .....

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.....

.....[4]

(iii) The plants in Group **B** remained in the magnesium-deficient solution for longer than 12 days. At the end of this time they showed symptoms of magnesium deficiency.

Describe and explain the symptoms that the plants would show.

.....

.....

.....

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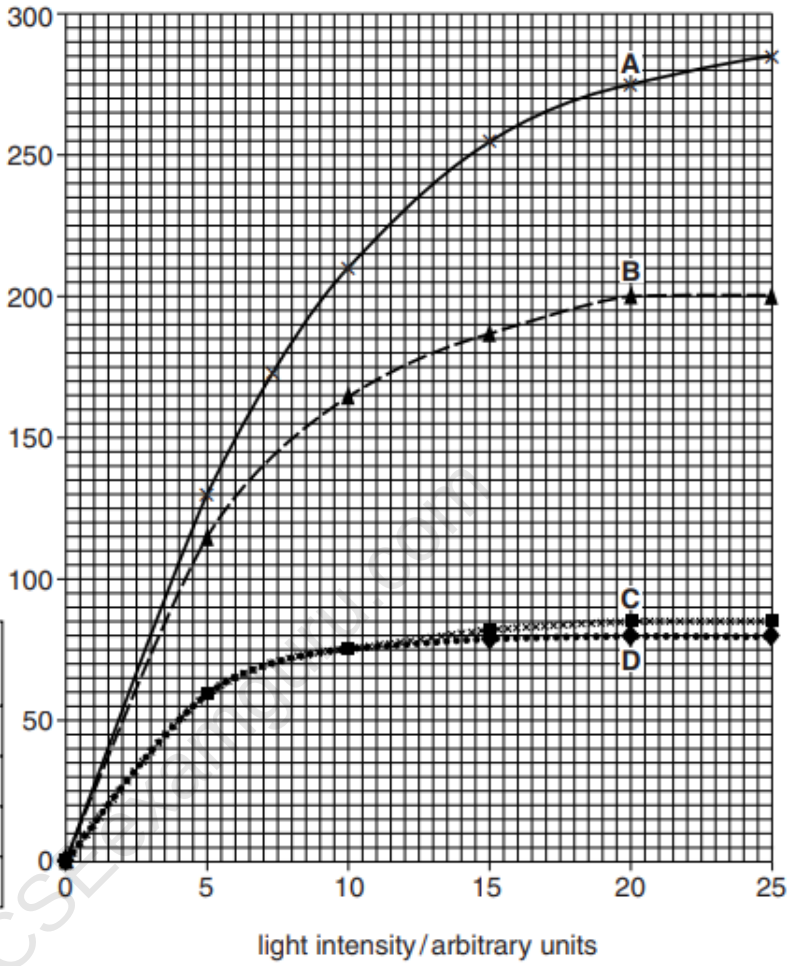
.....[3]

[Total: 16]

5 **(a)** A researcher carried out four experiments, **A** to **D**, to investigate the effect of light intensity on the rate of photosynthesis of cucumber plants. The experiments were carried out at two concentrations of carbon dioxide and at two temperatures.

The results are shown in Fig. 5.1.



Key

	temp / °C	CO_2 / %
A	30	0.13
B	20	0.13
C	30	0.03
D	20	0.03

Fig. 5.1

(i) Use the results in Fig. 5.1 to identify the limiting factor for the rate of photosynthesis at the light intensities given in Table 5.1.

Write your answers in Table 5.1.

Table 5.1

experiment	light intensity / arbitrary units	limiting factor
A	20	
B	20	
C	20	
D	5	light intensity

[3]

(ii) Define the term *limiting factor*.

.....

.....

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.....[2]

Fig. 5.1 shows that providing plants with more carbon dioxide can increase the rate of photosynthesis.

An investigation was carried out in China using crop residues and animal manure mixed together in composting units that were placed into a glasshouse containing crop plants.

Fig. 5.2 shows a composting unit in which decomposition takes place.

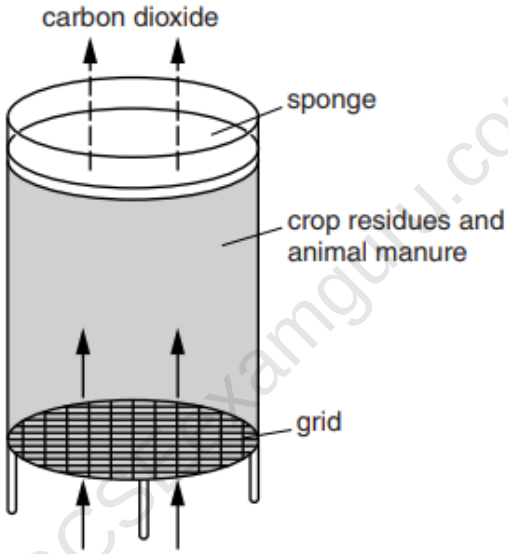

Fig. 5.2

(b) (i) Suggest the reason for using a grid instead of a solid base for the composting unit.

.....

.....

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.....[2]

(ii) The sponge was soaked in sulfuric acid to remove any ammonia gas released by the decomposing material (compost).

Explain how the ammonia was produced.

.....

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.....[2]

(c) Two glasshouses were used in this investigation. One glasshouse contained composting units and the other did not. Each glasshouse contained the same number and type of crop plants.

The concentration of carbon dioxide in both glasshouses was measured at midday.

The results are shown in Fig. 5.3.

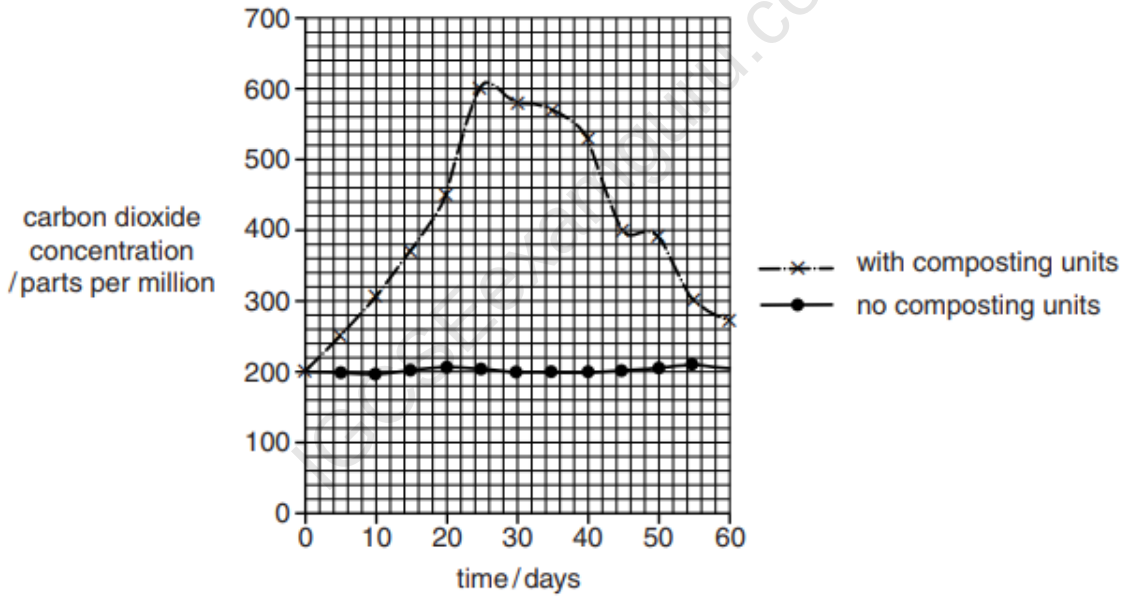

Fig. 5.3

(i) State why a glasshouse without composting units was used in the investigation.

.....

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.....[2]

(ii) Describe the results shown in Fig. 5.3.

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.....[3]

(d) At the end of the investigation the crop plants were harvested and weighed. Table 5.2 gives the results.

Table 5.2

crop plant	mean fresh mass / g per plant	
	no composting units	composting units
Chinese cabbage	115.7	355.8
celery	44.7	133.9
lettuce	95.5	349.4

Use the information in Fig. 5.3 and in Table 5.2 to summarise the results of the study.

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.....[4]

[Total: 18]

6 A biologist made a slide of some epidermal cells from a scale leaf of an onion bulb.

Fig. 4.1 is a drawing that the biologist made of one of the cells.

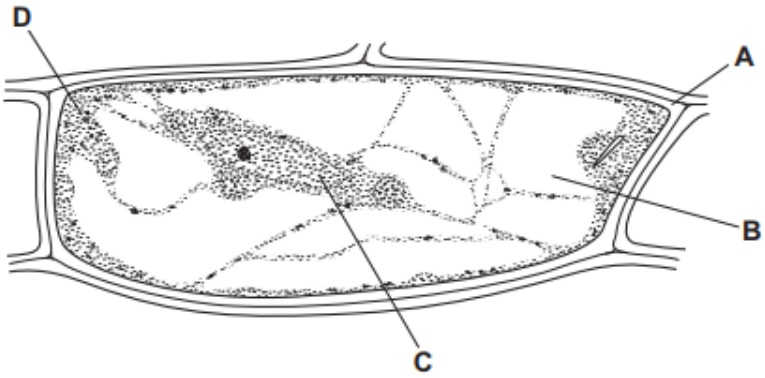

Fig. 4.1

(a) Table 4.1 shows the functions of the structures within a plant cell.

Complete the table by:

naming the part of the cell that carries out each function

using the letters from Fig. 4.1 to identify the part of the cell named.

Table 4.1

function	letter from Fig. 4.1	name
resists the turgor pressure of the cell		
controls the activities of the cell		
site of the chemical reactions of the cell including synthesis of proteins		

[3]

(b) The biologist added a few drops of concentrated salt solution to the cells on the slide and took a photograph of the cells, as shown in Fig. 4.2.

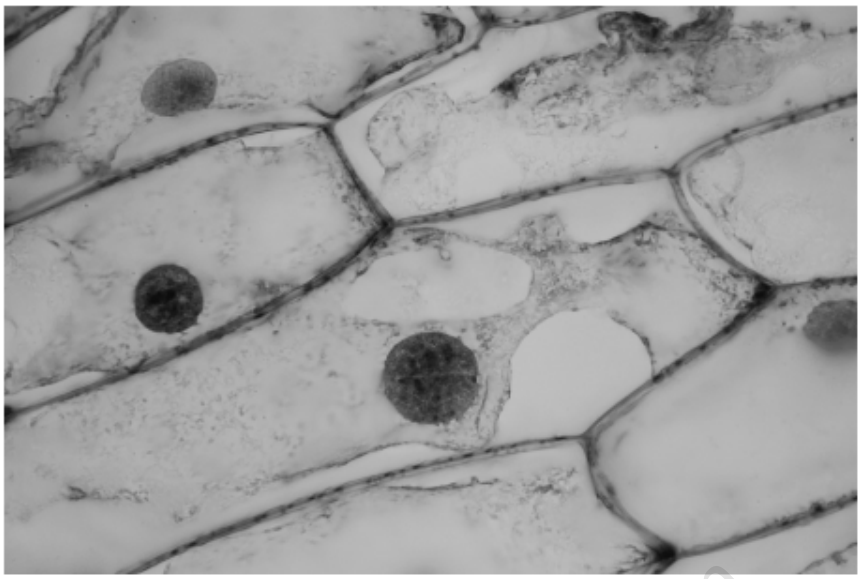

Fig. 4.2

(i) With reference to Fig. 4.2, describe the effect on the plant cells of adding a concentrated salt solution.

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.....[3]

(ii) Use the term **water potential** to explain the effect you have described.

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.....[3]

[Total: 9]

7 **(a)** Write a balanced chemical equation for photosynthesis.

..... → ..... [3]

A student investigated the effect of light intensity on the rate of photosynthesis of algae.

Fig. 2.1 shows the apparatus set up for the investigation.

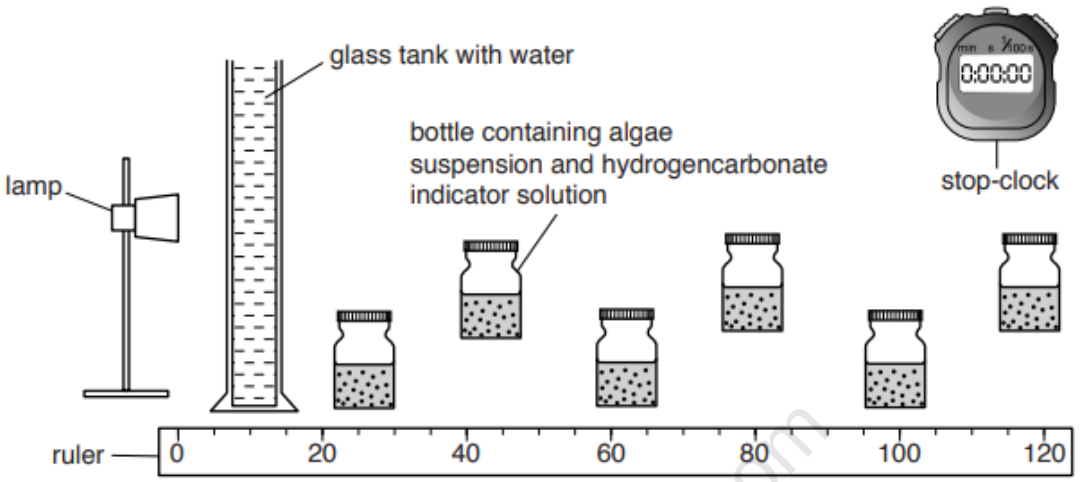

Fig. 2.1

(b) Suggest why a glass tank with water was placed between the lamp and the bottle in the investigation.

.....

.....

..... [1]

(c) The hydrogencarbonate indicator solution changes colour when the pH changes. At pH 8.4 it is red, at pH 7.6 it is yellow and at pH 9 it is purple.

Predict the colour of the hydrogencarbonate indicator solution in the bottle nearest the lamp at the end of the investigation. Explain your answer.

colour prediction .....

explanation .....

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[3]

(d) The student's results are shown in Fig. 2.2.

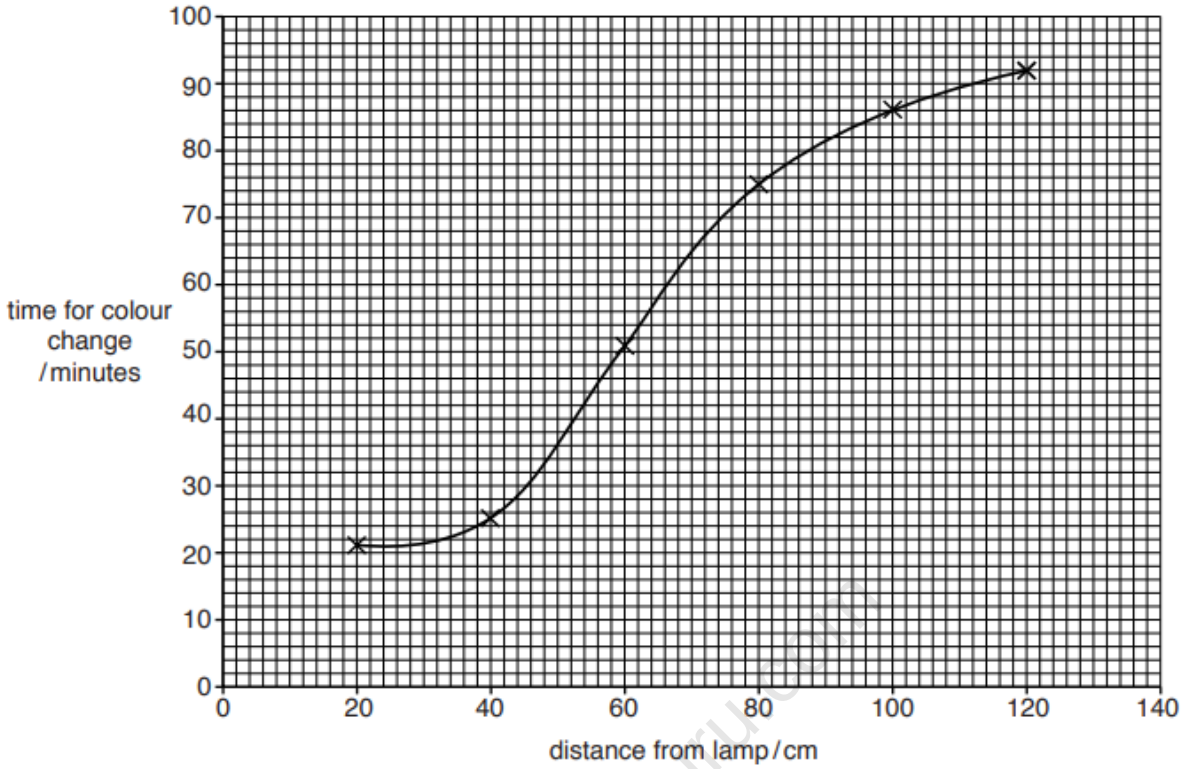

Fig. 2.2

Describe and explain how the rate of photosynthesis is affected by light intensity.

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..... [5]

[Total: 12]

8 Researchers in Michigan investigated the rate of photosynthesis in leaves of big-tooth aspen trees, *Populus grandidentata*, by placing some of the growing leaves inside transparent boxes.

The researchers measured the uptake of carbon dioxide by the leaves over a range of temperatures from 10–40 °C. They carried out their measurements at two different concentrations of carbon dioxide:

H – 325 ppm carbon dioxide which is close to the concentration in the atmosphere;

J – 1935 ppm carbon dioxide which is a very high concentration.

The results are shown in Fig. 3.1.

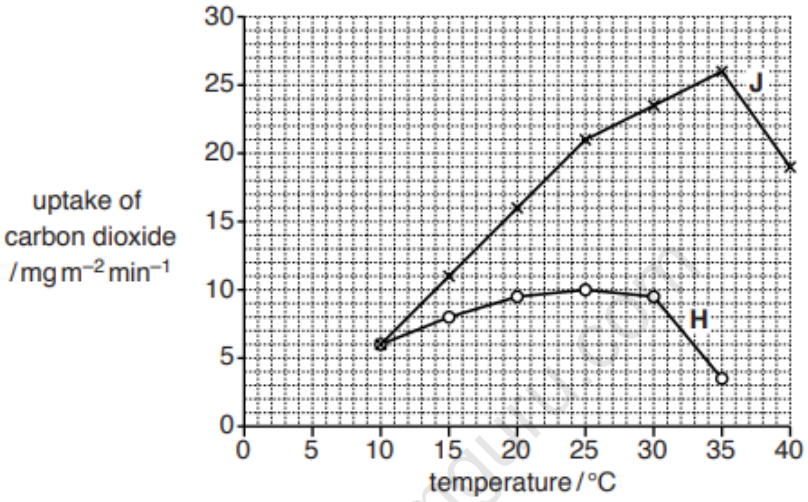

Fig. 3.1

(a) Describe how the results for the aspen leaves in batch **J** differ from the results for the aspen leaves in batch **H**. Use data from Fig. 3.1 in your answer.

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.....[3]

(b) Explain why the rate of photosynthesis in the leaves in batch **J**:

(i) increases with an increase in temperature from 15 °C to 35 °C

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.....[2]

(ii) decreases at temperatures above 35 °C.

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.....[2]

(c) Use the results in Fig. 3.1 to suggest **and** explain the likely effect on plant growth of an increase in carbon dioxide concentration in the atmosphere as a result of the combustion of fossil fuels.

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.....[5]

[Total: 12]

9 Fig. 4.1 is an electron micrograph of part of the lower surface of a leaf. Three stomata are visible.

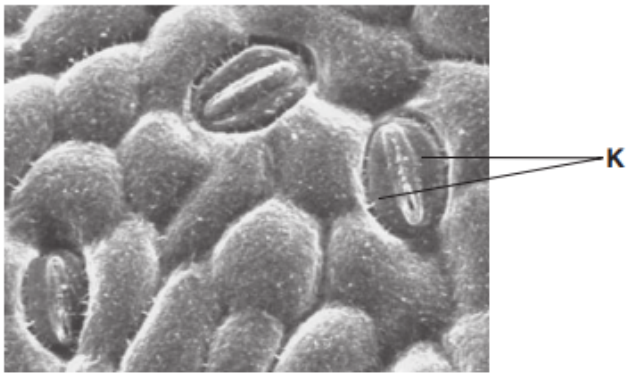

Fig. 4.1

(a) Name the cells labelled **K**.

.....[1]

(b) Stomata allow the movement of gases into and out of the leaf. During the daytime oxygen passes out and carbon dioxide passes in.

(i) Explain why oxygen passes out of the leaf during the daytime.

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.....[3]

(ii) Describe the path taken by a carbon dioxide molecule **after** it has passed through the stomata during the daytime until it becomes part of a glucose molecule.

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.....

.....[3]

(c) Plants that live in different types of habitat have leaves that show adaptations for survival.

Table 4.1 shows some features of the leaves of three species of plant from different types of habitat.

Table 4.1

species	habitat	orientation of the leaves	individual leaf area / cm^2	mean stomatal density / number of stomata per mm^2	
				upper epidermis	lower epidermis
annual meadow grass, *Poa annua*	grassland	vertical	1 – 10	125	135
white water lily, *Nymphaea alba*	the surface of ponds and lakes	horizontal	more than 1000	460	none
common myrtle, *Myrtus communis*	dry scrubland	horizontal	2 – 4	none	508

(i) State how the stomatal density of annual meadow grass differs from the stomatal densities of the other two species in Table 4.1.

.....

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.....

.....

.....[2]

(ii) Suggest explanations for the distribution and density of stomata in white water lily and common myrtle as shown in Table 4.1.

white water lily .....

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common myrtle .....

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[5]

[Total: 14]

1 **(a)** Fig. 1.1 is a diagram of the human digestive system.

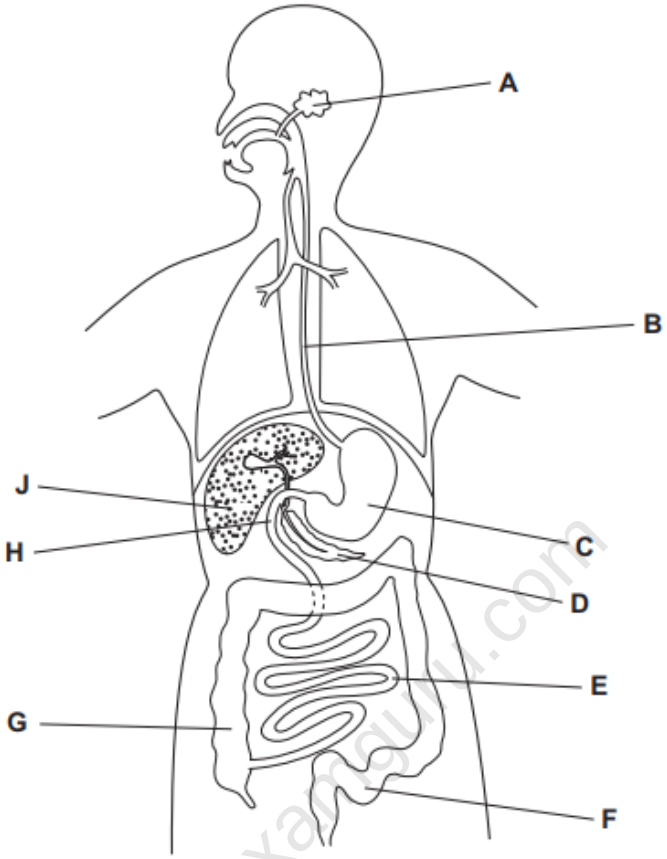

Fig. 1.1

Use the letters from Fig. 1.1 to complete Table 1.1 to give the part of the human digestive system that is identified by each function.

Write one letter only in each box. You may use the same letter more than once. There are some letters that you will not use. The first one has been done for you.

Table 1.1

function	letter
peristalsis	**B**
protein digestion	
insulin production	
deamination	
partially digested food is mixed with bile	
most water is reabsorbed	

[5]

The human diet provides nutrients for the synthesis of biological molecules that make up cells, cell products and tissues.

(b) (i) Complete Table 1.2 to show the nutrients that are absorbed from food to synthesise the large molecules listed.

Table 1.2

large molecules	nutrients absorbed
protein	
glycogen	
fat	

[3]

(ii) Mineral ions are required in the human diet in small quantities.

State the mineral ion required for each process:

making bone .....

making haemoglobin. ..... [2]

(iii) State another type of nutrient required in the human diet in small quantities.

..... [1]

(c) One role of nutrients is to provide materials for the repair of damaged tissues. Fig. 1.2 shows the events that happen after a cut to the skin.

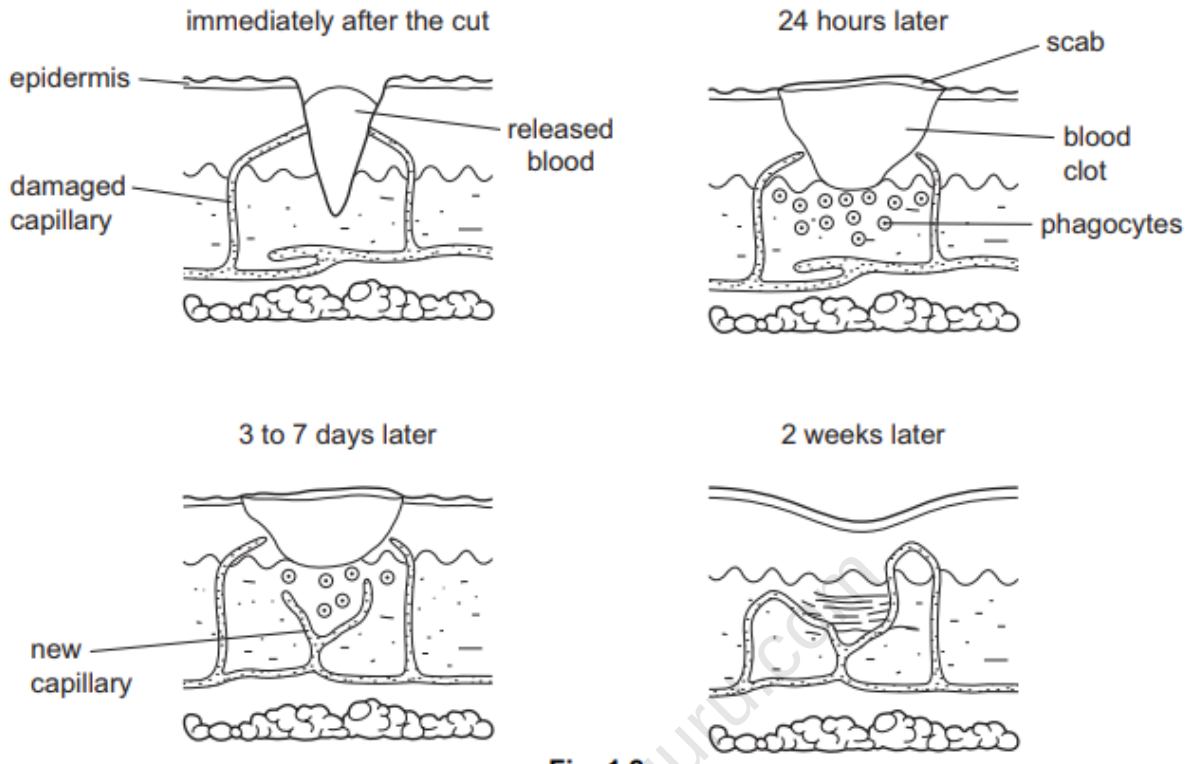

Fig. 1.2

Use the information in Fig. 1.2 to describe what happens to seal the wound in the skin and repair the skin tissue.

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..... [5]

[Total: 16]

2 Fig. 1.1 **A** shows a cell from the lining of the alimentary canal.

Fig. 1.1 **B** shows a cell from the lining of a kidney tubule.

Both cells absorb substances into the blood.

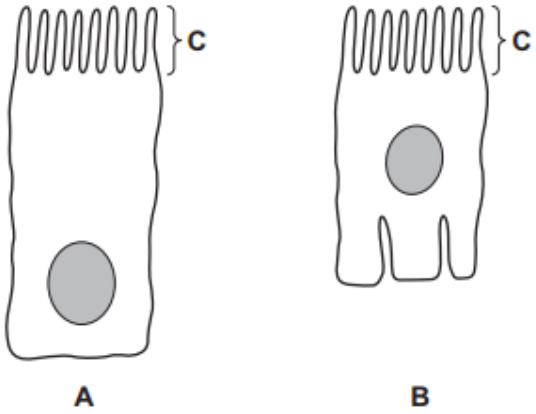

Fig. 1.1

(a) Name the structures labelled **C** on the cells in Fig. 1.1.

.....[1]

(b) List three substances that are absorbed by **both** cells shown in Fig. 1.1.

1 .....

2 .....

3 .....[3]

(c) Explain how **both** cells shown in Fig. 1.1 are adapted for absorption of substances into the blood.

.....

.....

.....

.....

.....[2]

(d) Name the part of the alimentary canal that is lined by the cells shown in Fig. 1.1 **A**.

.....[1]

[Total: 7]

3 The alimentary canal is adapted for chemical and mechanical digestion.

(a) Explain how chemical digestion differs from mechanical digestion.

.....

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..... [3]

Fig. 5.1 is a diagram of the human alimentary canal.

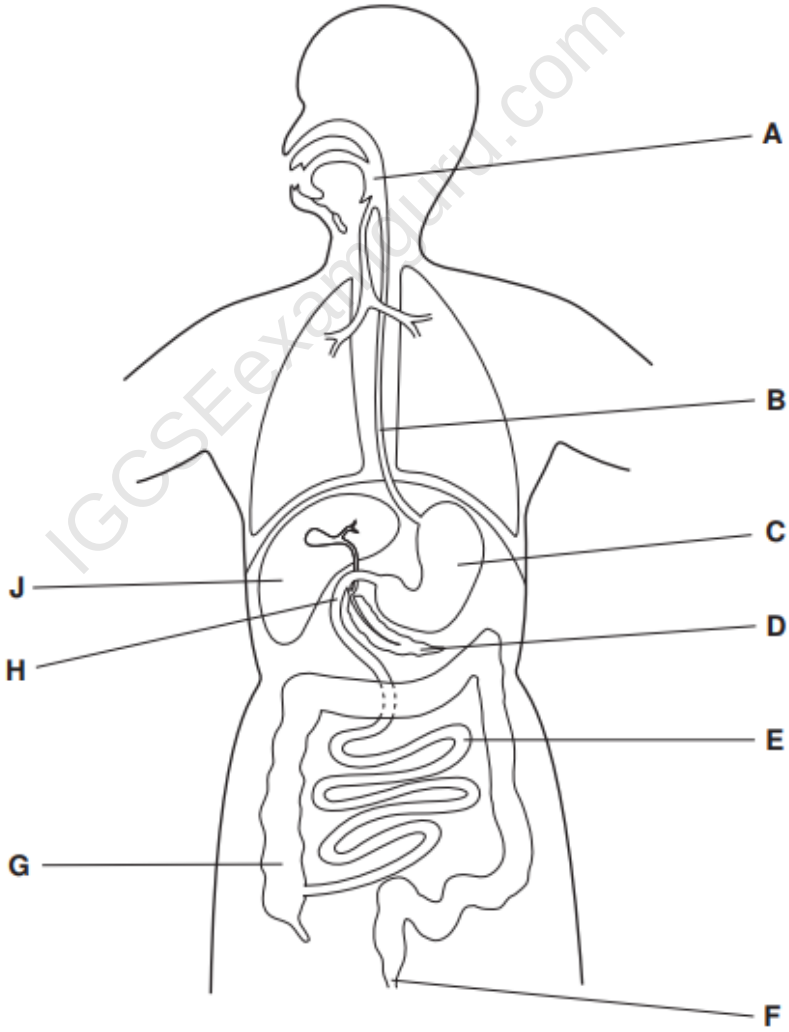

Fig. 5.1

(b) Table 5.1 shows four functions of the alimentary canal.

Complete the table by:

- naming the part of the system that carries out each of the functions;
- using the letters from Fig. 5.1 to identify the part of the system named.

One row has been completed for you.

Table 5.1

function	name of part	letter from Fig. 5.1
produces bile	liver	**J**
most soluble food is absorbed into the blood		
indigestible food is egested		
hydrochloric acid is produced		
protease, lipase and amylase are produced		

[4]

(c) Some people develop gallstones, made of cholesterol, that accumulate in the gall bladder and the bile duct. Gallstones block the flow of bile.

Explain how gallstones can affect the digestion of fat.

.....

.....

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.....

.....

..... [3]

(d) Cholesterol can also accumulate in the walls of the coronary arteries.

Explain the effects that this might have.

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.....

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..... [3]

[Total: 13]

4 **(a)** **(i)** Explain the term *balanced diet*.

.....

.....

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.....

.....

..... [3]

(ii) State **three** factors that influence a person's nutritional needs.

1 .....

2 .....

3 ..... [3]

(b) Glucose is absorbed in the small intestine and transported in the blood. The kidneys filter the blood and reabsorb the glucose.

If the blood contains more than 180 mg of glucose per 100 cm^3, the kidney cannot reabsorb it all and some is present in the urine. This figure is called the **renal threshold**.

A doctor suspects that a patient has diabetes because a urine test is positive for glucose.

The patient takes a glucose tolerance test by drinking a solution of glucose. The doctor records the patient's blood glucose concentration at 30 minute intervals for five and a half hours.

The results are plotted on Fig. 2.1.

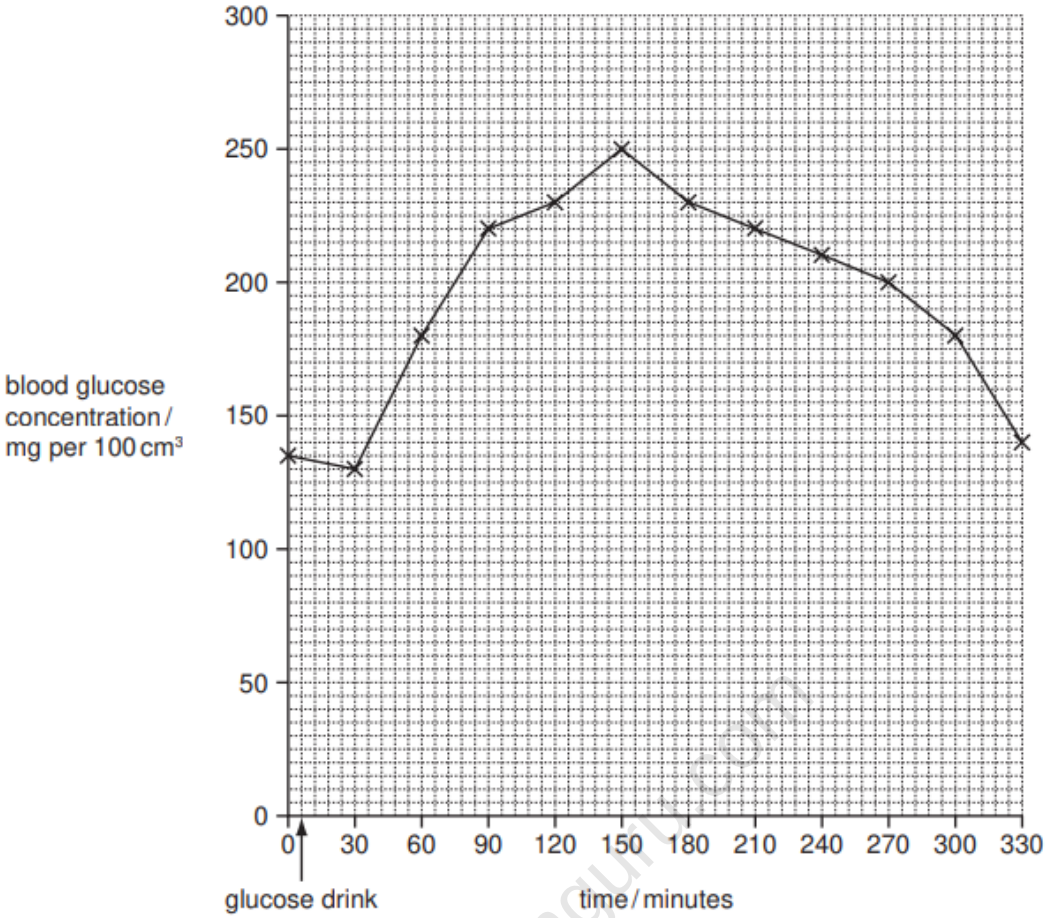

Fig. 2.1

(i) Draw a horizontal line on Fig. 2.1 to show the **renal threshold**. [1]

(ii) State the time period when the kidney will produce urine containing glucose.

..... [1]

(iii) Sketch on Fig. 2.1 the blood glucose concentrations that the doctor might expect if he repeated this test on someone who does **not** have diabetes. [1]

(c) People who do not have diabetes maintain their blood glucose concentration below 180 mg per 100 cm^3.

Explain how the body does this.

.....

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..... [3]

[Total: 12]

5 **(a)** Describe how food is moved along the small intestine.

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.....

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..... [2]

(b) The small intestine is lined by many villi.

Fig. 5.1 shows a longitudinal section of a villus.

Fig. 5.2 shows a cross-section of the same villus at **V** – **W**.

The diagrams are not drawn to the same scale.

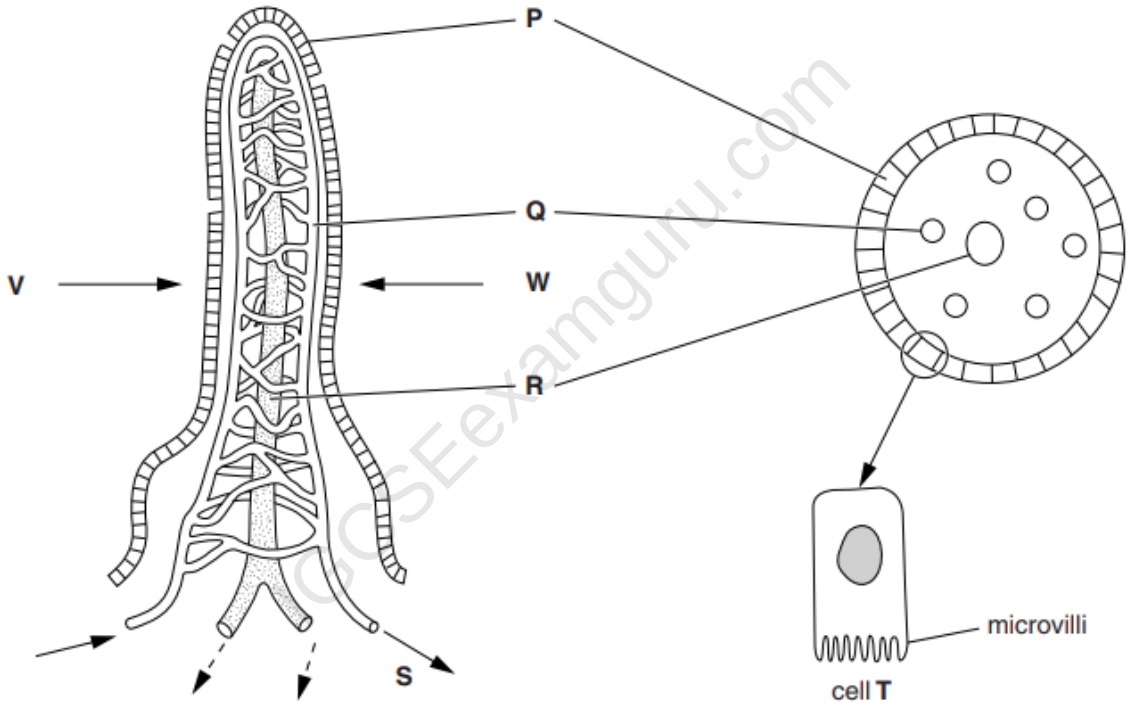

Fig. 5.1 **Fig. 5.2**

(i) Name structures **P**, **Q**, and **R**.

P .....

Q .....

R ..... [3]

(ii) The blood that flows from **S** enters a vein.

Name the vein that transports blood away from the small intestine.

..... [1]

(iii) Cell **T** is an example of the cells that form the surface of the villi.

Explain why there are many microvilli on cell **T**.

.....

.....

.....

.....

..... [2]

(iv) Some of the cells on the surface of the villi secrete mucus for protection.

Suggest what the villi need to be protected against.

.....

.....

.....

..... [2]

[Total: 10]

6 Fig. 3.1 shows part of the thoracic and abdominal cavities of a human.

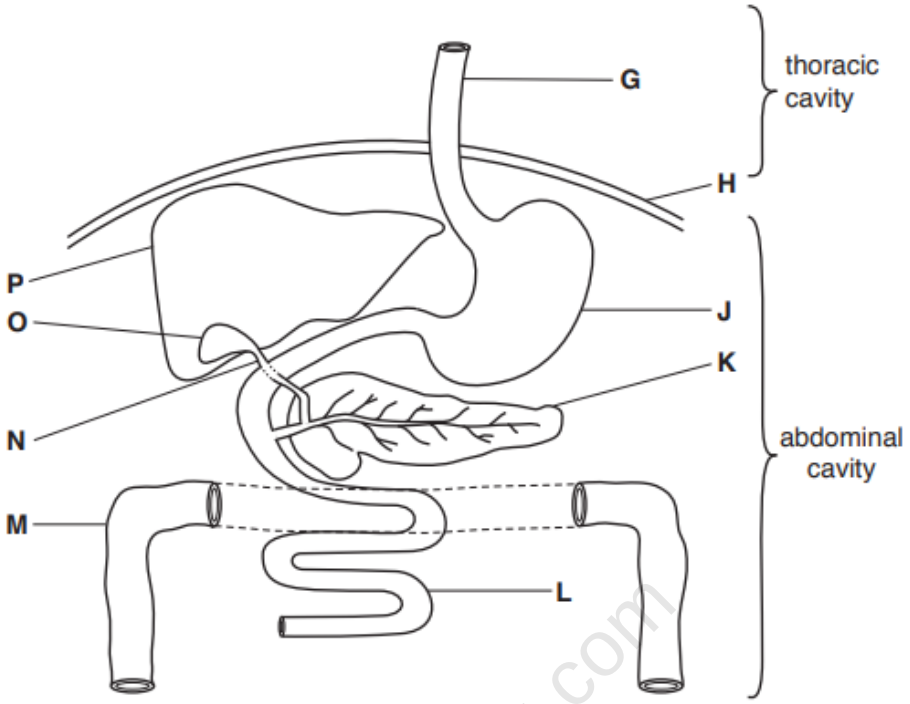

Fig. 3.1

(a) (i) Name the structures labelled **G**, **H** and **M**.

G .....

H .....

M .....

[3]

(ii) Table 3.1 shows five functions of organs in the abdominal cavity.

Complete the table by:

- naming the organ that carries out each function
- using the letters from Fig. 3.1 to identify the organ named.

One row has been completed for you.

Table 3.1

function	name	letter from Fig. 3.1
conversion of glucose to glycogen		
secretion of insulin and glucagon	pancreas	**K**
absorption of products of digestion		
storage of bile		
chemical digestion of protein in an acidic pH		

[4]

(b) Fat is particularly difficult to digest as it is not water soluble and forms spherical globules in the alimentary canal.

Fig. 3.2 is a diagram showing what happens to fat globules when mixed with bile.

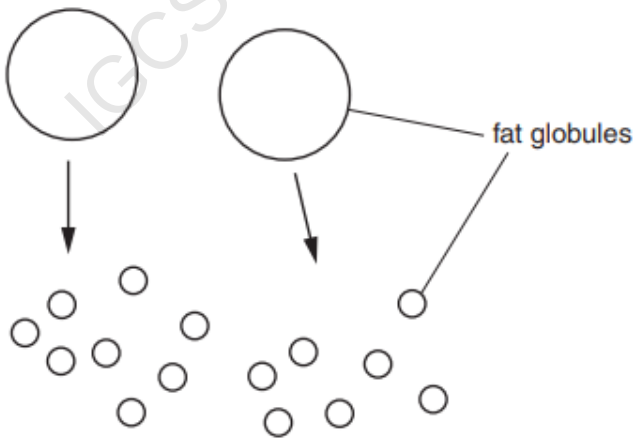

Fig. 3.2

(i) Name the process shown in Fig. 3.2.

.....[1]

(ii) Explain the advantage of the process shown in Fig. 3.2.

.....

.....

.....

.....

.....[2]

(c) Insulin and glucagon are hormones secreted by the pancreas to control the concentration of glucose in the blood.

(i) Complete Table 3.2 to show how the uptake of glucose by cells and the concentration of glucose in the blood respond when the two hormones are secreted.

Use the words *increases*, *decreases* and *stays the same* to complete the table.

Table 3.2

hormone	uptake of glucose by cells	concentration of glucose in the blood
insulin		
glucagon		

[2]

(ii) State another hormone that influences the concentration of glucose in the blood.

.....[1]

(d) Explain why the control of the concentration of glucose in the blood is an example of negative feedback.

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.....[3]

[Total: 16]