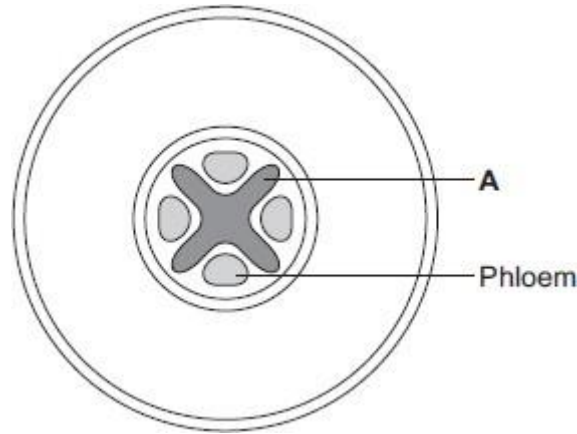


1 The diagram below shows a cross-section of a plant root. The transport tissues are labelled.



(a) (i) What is tissue **A**?

Draw a ring around the correct answer.

cuticle **epidermis** **xylem**

(1)

(ii) Name **two** substances transported by tissue **A**.

1. _____

2. _____

(2)

(b) Phloem is involved in a process called translocation.

(i) What is translocation?

(1)

(ii) Explain why translocation is important to plants.

(2)

(c) Plants must use active transport to move some substances from the soil into root hair cells.

(i) Active transport needs energy.

Which part of the cell releases most of this energy?

Tick (✓) **one** box.

mitochondria

nucleus

ribosome

(1)

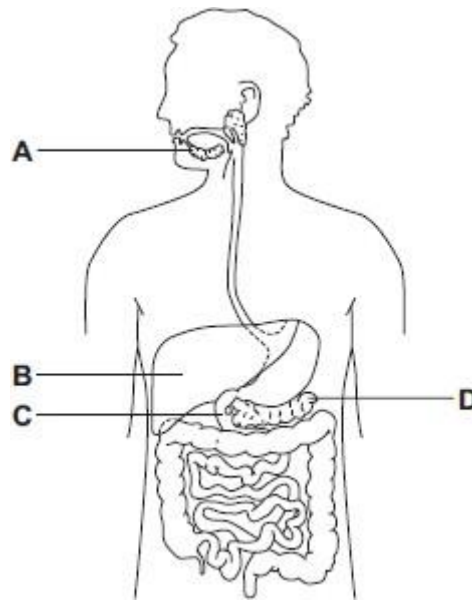
(ii) Explain why active transport is necessary in root hair cells.

(2)

(Total 9 marks)

2

The diagram shows part of the human digestive system.



(a) Name the parts of the digestive system labelled **A**, **B**, **C** and **D**.

A _____

B _____

C _____

D _____

(4)

(b) A student has eaten a steak for dinner. The steak contains protein and fat.

(i) Describe how the **protein** is digested.

(3)

(ii) Explain **two** ways in which bile helps the body to digest **fat**.

(4)

(c) A group of students investigated the action of salivary amylase.
The students:

- collected a sample of salivary amylase
- put a different pH solution and 5 cm³ of a food substance in each of 6 test tubes
- added 1 cm³ of salivary amylase to each of the 6 test tubes
- recorded the amylase activity after 10 minutes.

The results are shown in the table.

pH	7	6	5	4	3	2
Amylase activity in arbitrary units	12	10	3	0	0	0

(i) Name the food substance that amylase breaks down.

(1)

- (ii) Suggest what happens to the breakdown of this substance when food reaches the stomach.

Use information from the table to help you to answer this question.

(3)

(Total 15 marks)

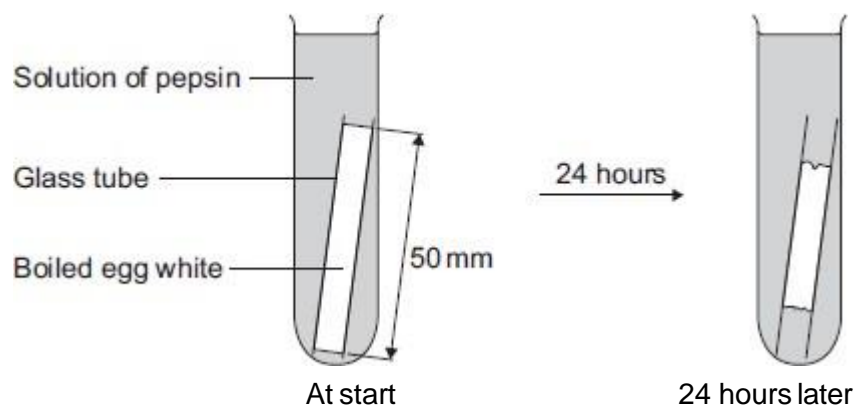
3

Some students investigated the effect of pH on the digestion of boiled egg white by an enzyme called pepsin. Egg white contains protein.

The students:

- put a glass tube containing boiled egg white into a test tube
- added a solution containing pepsin at pH 7
- set up six more tubes with solutions of pepsin at different pH values
- left the test tubes for 24 hours at room temperature.

The image below shows one of the test tubes, at the start and at the end of the 24 hours.



- (a) (i) Name the product of protein digestion.

(1)

(ii) What type of enzyme digests protein?

Tick (✓) **one** box.

amylase

lipase

protease

(1)

(b) The egg white in each tube was 50 mm long at the start of the investigation. The table below shows the students' results.

pH	Length in mm of boiled egg white after 24 hours
1	38
2	20
3	34
4	45
5	50
6	50
7	50

(i) At which pH did the pepsin work best?

pH _____

(1)

- (ii) The answer you gave in part **(b)(i)** may not be the exact pH at which pepsin works best.

What could the students do to find a more accurate value for this pH?

(2)

- (iii) There was no change in the length of the egg white from pH 5 to pH 7.

Explain why.

(2)

- (c) Pepsin is made by the stomach.

Name the acid made by the stomach which allows pepsin to work well.

(1)

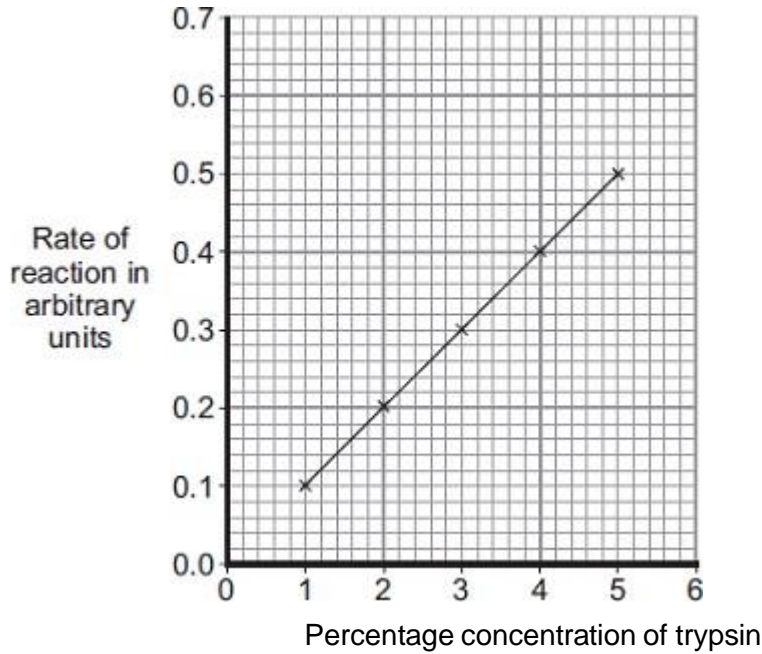
(Total 8 marks)

4 Trypsin is a protease enzyme. Trypsin will digest a protein called gelatine which covers the surface of photographic film.

Some students investigated the time taken to digest the gelatine with trypsin. The students used five different concentrations of trypsin.

The rate of reaction was calculated from the time taken for the gelatine to be digested.

The graph shows the students' results.



(a) (i) Describe the relationship between the concentration of trypsin and the rate of reaction.

(2)

(ii) Use the graph to predict the rate of reaction with 6% trypsin.

_____ arbitrary units

(1)

- (b) In industry, trypsin is used to pre-treat some baby foods.
In their experiment, the students used 1–5% trypsin at 20°C.
The baby food manufacturers make most profit if they use 0.5% trypsin at 35°C.

Suggest why the manufacturers make most profit with these conditions.

(4)

- (c) (i) Describe the effect trypsin would have on the baby food.

(2)

- (ii) Apart from protease enzymes, give **one** other use of a **named** enzyme in industry.

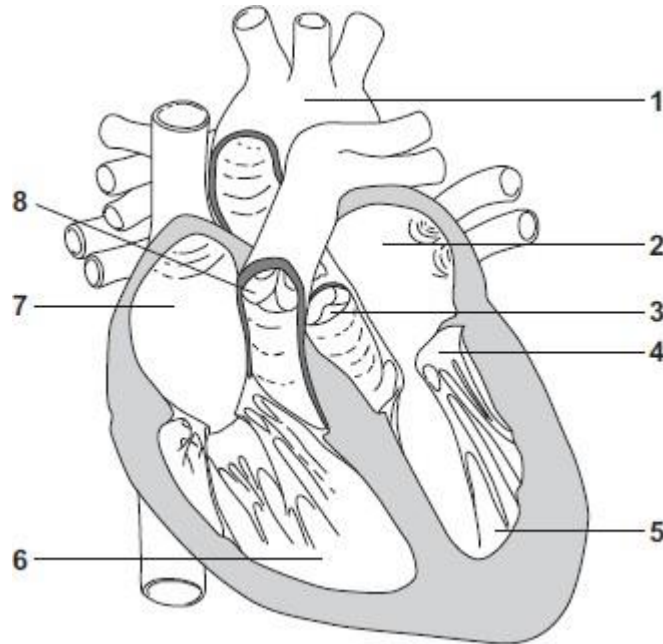
(2)

(Total 11 marks)

5

The diagram in **Figure 1** shows a section through the human heart, seen from the front.

Figure 1



(a) Draw a ring around the correct answer to complete each sentence.

(i) The wall of the heart is made mostly of

- epithelial
- glandular
- muscular

tissue.

(1)

(ii) The resting heart rate is controlled by the pacemaker.

The pacemaker is located at position

- 1.
- 6.
- 7.

(1)

(iii) If a person's heart rate is irregular, the person may be fitted with an artificial pacemaker.

The artificial pacemaker is

- an electrical device.
- a pump.
- a valve.

(1)

(b) (i) Write a number, **2, 5, 6** or **7**, in **each** of the three boxes to answer this question.

Which chamber of the heart:

pumps oxygenated blood to the head and body

receives deoxygenated blood from the head and body

receives oxygenated blood from the lungs?

(3)

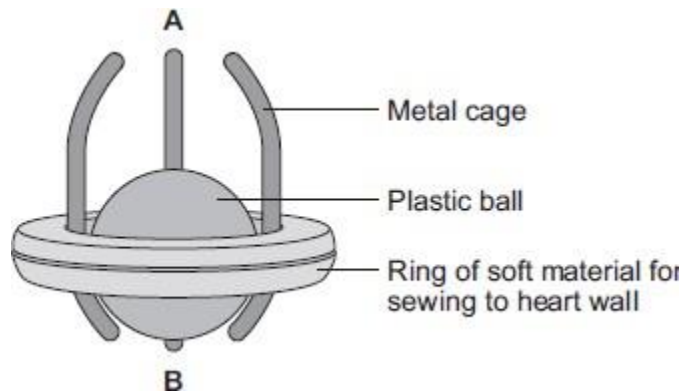
(ii) Give the number, **3, 4** or **8**, of the valve that closes when the blood pressure in the aorta is greater than the blood pressure in the left ventricle.

Write the correct answer in the box.

(1)

(c) The diagram in **Figure 2** shows one type of artificial heart valve. The plastic ball is in the closed position.

Figure 2



This type of artificial valve could be used to replace a faulty valve in the heart.

(i) What is the function of valves in the heart?

(1)

(ii) The artificial valve could be used to replace valve **4** shown in **Figure 1**.

The artificial valve opens to let blood through when the ball is moved towards **A**.

Which end of the valve, **A** or **B**, should point towards chamber **5**?

Explain your answer.

(3)

(d) (i) The artificial heart valve may cause blood clots to form on its surface.

Describe what happens during blood clotting.

(2)

(ii) Read the information in the passage.

Replacing a damaged heart valve can dramatically improve the blood circulation and the supply of oxygen to the body's tissues. The operation to replace a heart valve is a long one during which the patient's blood goes through a bypass machine. Sometimes the artificial valve can fail to work. If the surface of the valve becomes rough, small blood clots can form on its surface then break away and be carried around the body by the blood.

Mark schemes

- 1**
- (a) (i) xylem 1
- (ii) water 1
- minerals / ions / named example(s)
ignore nutrients 1
- (b) (i) movement of (dissolved) sugar
*allow additional substances, eg amino acids / correct named sugar
(allow sucrose / glucose)
allow nutrients / substances / food molecules if sufficiently qualified
ignore food alone* 1
- (ii) sugars are made in the leaves 1
- so they need to be moved to other parts of the plant for respiration / growth / storage 1
- (c) (i) mitochondria 1
- (ii) for movement of minerals / ions
Do not accept 'water' 1
- against their concentration gradient 1
- [9]**
- 2**
- (a) **A** – saliva(ry) gland 1
- B** – liver 1
- C** – duodenum
ignore small intestine 1
- D** – pancreas
accept phonetic spellings 1

- (b) (i) any **three** from:
- chewing / muscle contraction / mechanical digestion
allow churning
 - protease enzymes
allow pepsin / trypsin
 - in stomach / small intestine / duodenum / from pancreas
 - (break down protein) into amino acids
allow (poly)peptides

3

- (ii) neutralises acid pH / makes conditions alkaline

1

so lipase can work

1

emulsifies fat

1

to give large(r) surface area for lipase / enzyme action

1

- (c) (i) starch

ignore carbohydrate

1

- (ii) breakdown stops

allow slows down

1

because stomach produces / contains acid / has low pH

1

and amylase cannot work in acid / low pH

accept amylase is denatured / changes shape

1

[15]

3

- (a) (i) amino acid(s)

accept peptide(s)

do not allow polypeptide(s)

1

- (ii) protease

1

- (b) (i) 2

1

- (ii) repeat

do not allow other enzyme / substrate

1

using smaller pH intervals between pH1 and pH3

allow smaller intervals on both sides of / around pH2

allow smaller intervals on both sides of / around answer to (b)(i)

1

(iii) enzyme / pepsin denatured / shape changed

*do **not** allow enzyme killed*

allow enzyme 'destroyed'

1

enzyme / pepsin no longer fits (substrate)

allow enzyme / pepsin does not work

1

(c) hydrochloric (acid)

allow phonetic spelling

accept HCl

allow HCL

ignore hcl

*do **not** allow incorrect formula –e.g. H₂Cl / HCl₂*

1

[8]

4

(a) (i) directly proportional

gains full marks

or

0.1 rise in rate for 1% rise in concentration

*accept increased concentration: increased rate **or** positive correlation **or** proportional for 1 mark*

2

(ii) 0.6

allow ± 0.01

1

(b) (0.5% trypsin) cheaper

ignore more profit

1

(35°C) faster reaction

allow (35°C) optimum / best temperature

1

so takes less time to make product

1

extra heating cost outweighed by savings on enzyme cost

1

(c) (i) any **two** from:

- breaks down / digests food
allow pre-digests protein / food
allow easier for baby to digest
- from protein into amino acids / peptides
- makes soft(er) / runni(er)
allow description of texture change
allow make (more) soluble

2

(ii) correct named enzyme

1

correct function

to gain 2 marks function must relate to correctly named enzyme

Eg

carbohydrase

accept amylase / maltase / lactase

1

starch → sugar **or** lactose → glucose **or** making sugar syrup

or

isomerase

glucose → fructose **or** making slimming foods

or

lipase

fats / oils → fatty acids **or** removal of grease stains

accept other correct example

[11]

5

(a) (i) muscular

1

(ii) 7

1

(iii) an electrical device

1

(b) (i) in sequence:

5

1

- 7 1
- 2 1
- (ii) 3 1
- (c) (i) prevent backflow (of blood) / allow flow in only one direction / in the correct direction 1
- (ii) **A**
no mark, but max 2 marks if incorrect
 2 / atrium contracts / pressure in 2 increases 1
- blood pushes ball (down / towards ventricle / towards 5)
allow this point even if valve in wrong part of heart 1
- (opens valve which) allows blood into 5 / ventricle
or converse points re closing the valve 1
- (d) (i) involvement of platelets / eg platelets 'trigger' clotting process / release enzyme(s) / release 'clotting factors' 1
- fibrinogen to fibrin
or
 meshwork formed (which traps blood cells) 1

- (ii) any **four** from:
*to gain 4 marks candidates should include at least:
one advantage and one disadvantage*

Advantages

(improved circulation / O₂ supply) provides:

- more cell respiration
- more energy released
- (more) active life / not so tired / more physical activity

Disadvantages

- danger of surgery / operation
- infection from surgery / operation
- valve may need replacing
- clots may form and block blood vessels
may need to take anti-coagulants – eg warfarin
- clots may cause heart attacks / strokes

4

[17]