Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER				

5660845582

BIOLOGY **0610/42**

Paper 4 Theory (Extended) **October/November 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.

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1 Fig. 1.1 shows several villi from the ileum, which is part of the small intestine.

(a) State the name of **one** other part of the small intestine.

..... [1]

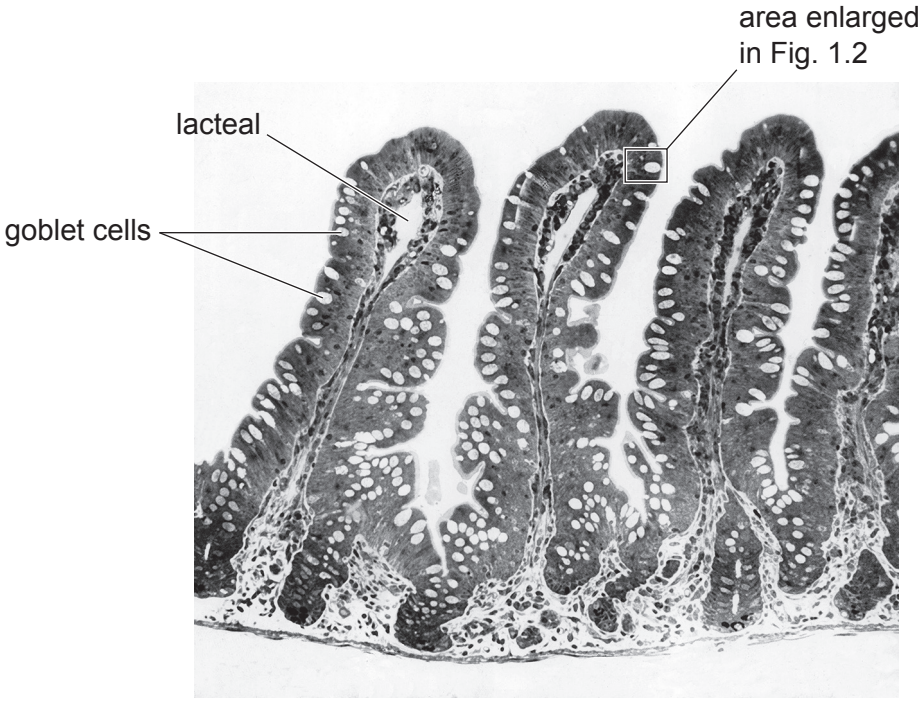

Fig. 1.1

Fig. 1.2 shows the tip of a villus in more detail.

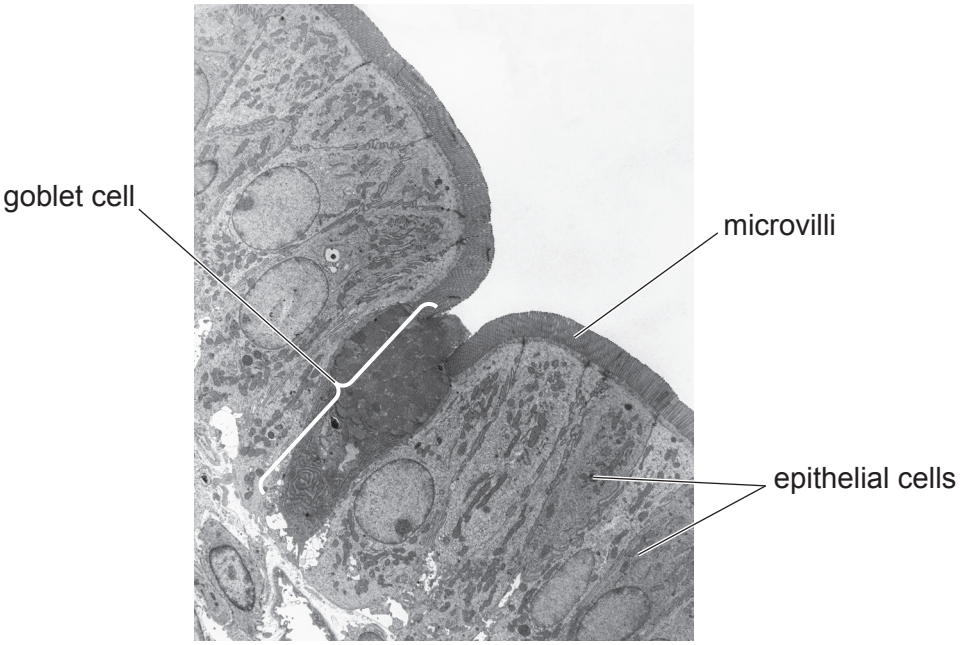

Fig. 1.2

(b) The epithelial cells of the villi absorb nutrients by diffusion and active transport.

(i) Describe how active transport differs from diffusion.

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..... [3]

(ii) Explain the importance of the microvilli shown in Fig. 1.2.

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..... [2]

(c) Goblet cells provide protection for the epithelial cells that line the intestine.

(i) State the name of the protective substance produced by goblet cells.

..... [1]

(ii) Suggest why a protective substance is necessary in the intestines.

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..... [2]

(d) Fig. 1.1 shows a lacteal in the centre of each villus.

Describe the roles of lacteals.

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..... [2]

(e) Complete Table 1.1 by identifying the level of organisation of each structure.

Choose your answers from the list. Each word or phrase may be used once, more than once or not at all.

cell **cell structure** **organ** **organ system** **organism** **tissue**

Table 1.1

structure	level of organisation
gall bladder	
endoplasmic reticulum	
intestinal epithelium	
ileum	

[4]

(f) Many fungi are decomposers that feed on dead plants. The fungi secrete enzymes to digest large molecules.

Students made an extract from a species of fungus. The extract contained digestive enzymes.

The students carried out an investigation to find out if amylase and pectinase were present in the fungal extract.

They made agar plates by filling Petri dishes with agar jelly containing either starch or pectin. They cut four holes of the same size in the agar jelly in each Petri dish.

The holes in each Petri dish contained the same volume of:
A – 1% amylase solution
B – 1% pectinase solution
C – distilled water
D – fungal extract.

The Petri dishes were kept at 27 °C for four days. After this time a dye was poured into each dish to stain the areas where starch and pectin remained.

Fig. 1.3 shows drawings of the stained agar in the Petri dishes. The clear zones indicate the areas where no starch or pectin remained.

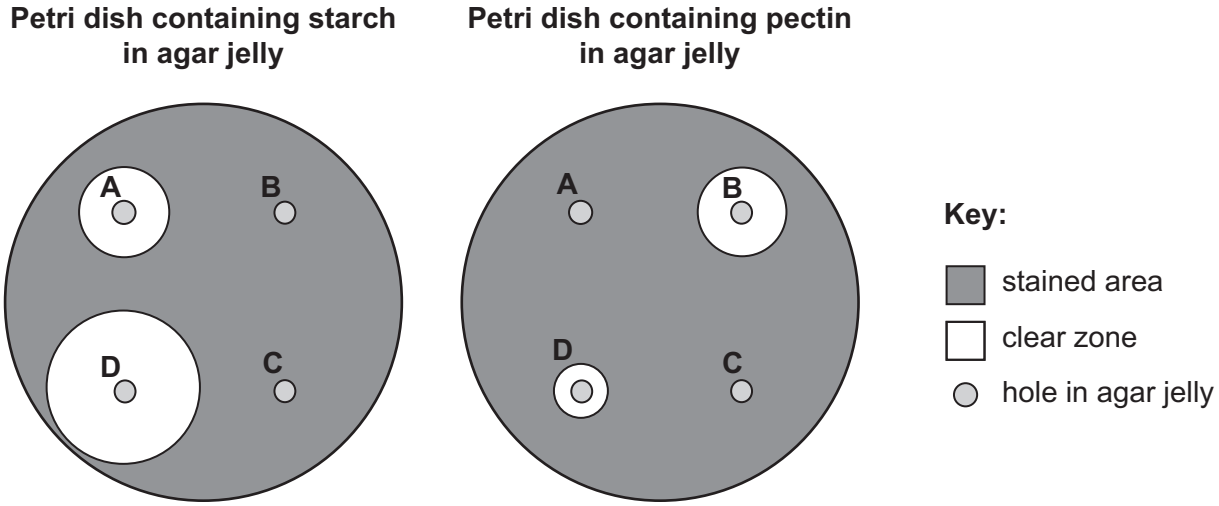

Fig. 1.3

(i) State what conclusions can be made about the enzymes in the fungal extract **and** give evidence from Fig. 1.3 to support your conclusions.

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..... [5]

(ii) The investigation was repeated but at 5 °C instead of at 27 °C.

Predict the effect of the lower temperature on the results.

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..... [1]

[Total: 21]

2 **(a)** A scientist investigated sexual reproduction in flowering plants.

Fig. 2.1 shows the procedure for crossing two plants of the same species.

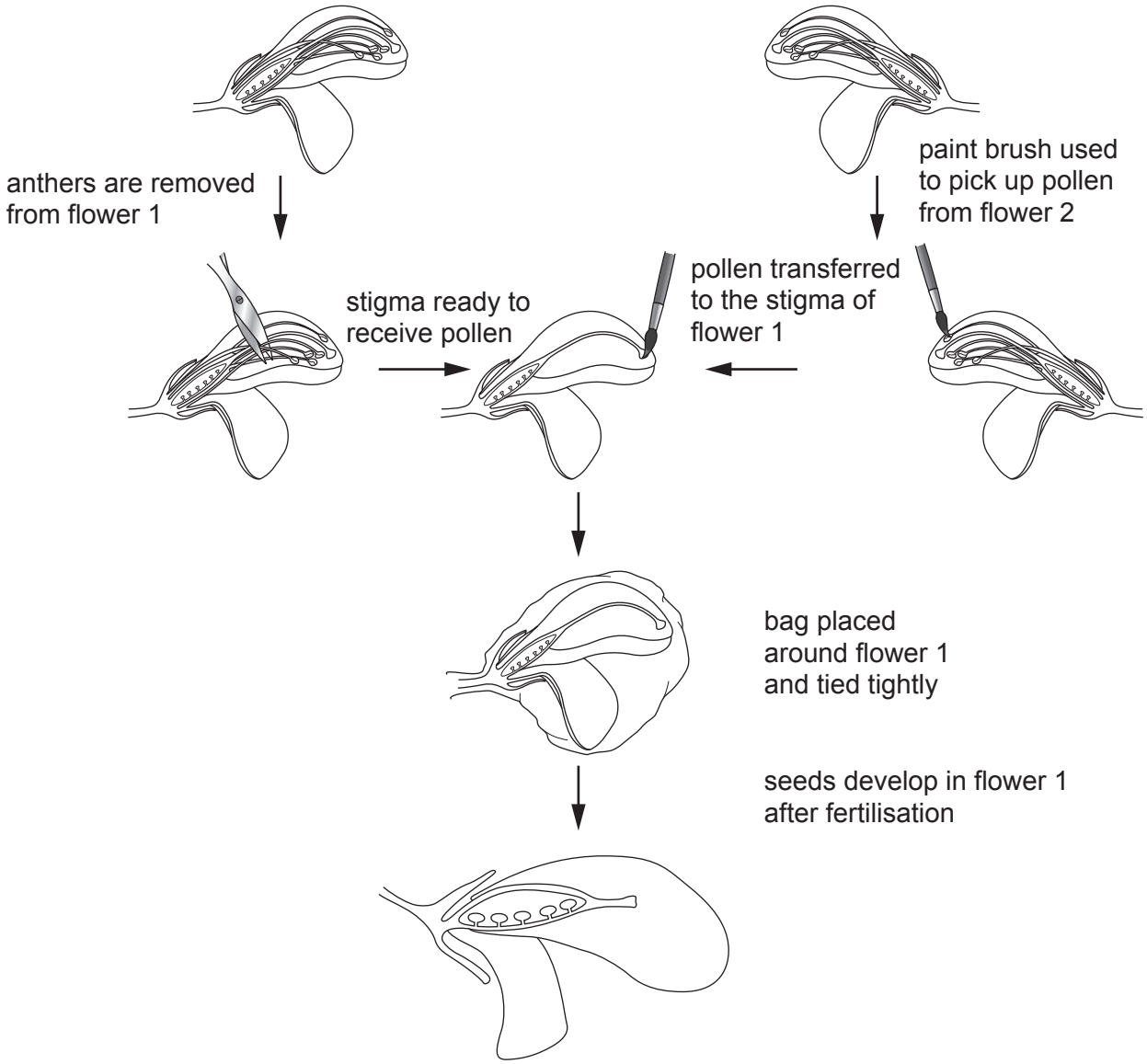

Fig. 2.1

The scientist collected the seeds and germinated them. The leaves and flowers of the offspring plants showed phenotypic variation as they were not all identical to the parent plants.

The scientist then investigated the chromosomes of all the offspring plants and found that they had exactly the same number of chromosomes as the parent plants.

(i) Define the term chromosome.

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.....

..... [2]

(ii) Suggest why the scientist placed a bag around flower 1.

.....

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..... [1]

(iii) Explain how sexual reproduction results in the variation that the scientist discovered in the offspring plants.

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..... [2]

(iv) The chromosome number of the offspring plants is the same as the chromosome number of the parent plants in this investigation.

Explain how the chromosome number is maintained from one generation to the next.

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..... [2]

(b) The plant *Camellia japonica* has flowers that can be white, red or a mixture of these two colours. When red-flowered plants are crossed with white-flowered plants, all the offspring plants have flowers with petals that are a mixture of red and white, as shown in Fig. 2.2.

Fig. 2.2

- The gene for petal colour in *C. japonica* is given the symbol **P**.
- The allele for white petals is given the symbol $\mathbf{P^W}$.
- The allele for red petals is given the symbol $\mathbf{P^R}$.

(i) Table 2.1 shows the phenotypes of three different pairs of parent plants.

Complete Table 2.1 by giving all the possible genotypes of the offspring plants that could be produced by these parent plants.

Space for working.

Table 2.1

phenotype of male parent	phenotype of female parent	all the possible genotypes of offspring plants produced by this cross
red petals	red petals	
white petals	red petals	
petals that are both red and white	petals that are both red and white	

[3]

(ii) State the type of inheritance that is shown by petal colour in *C. japonica*.

..... [1]

[Total: 11]

3 Fig. 3.1 shows the changes in the concentrations of the hormones FSH and LH during a menstrual cycle.

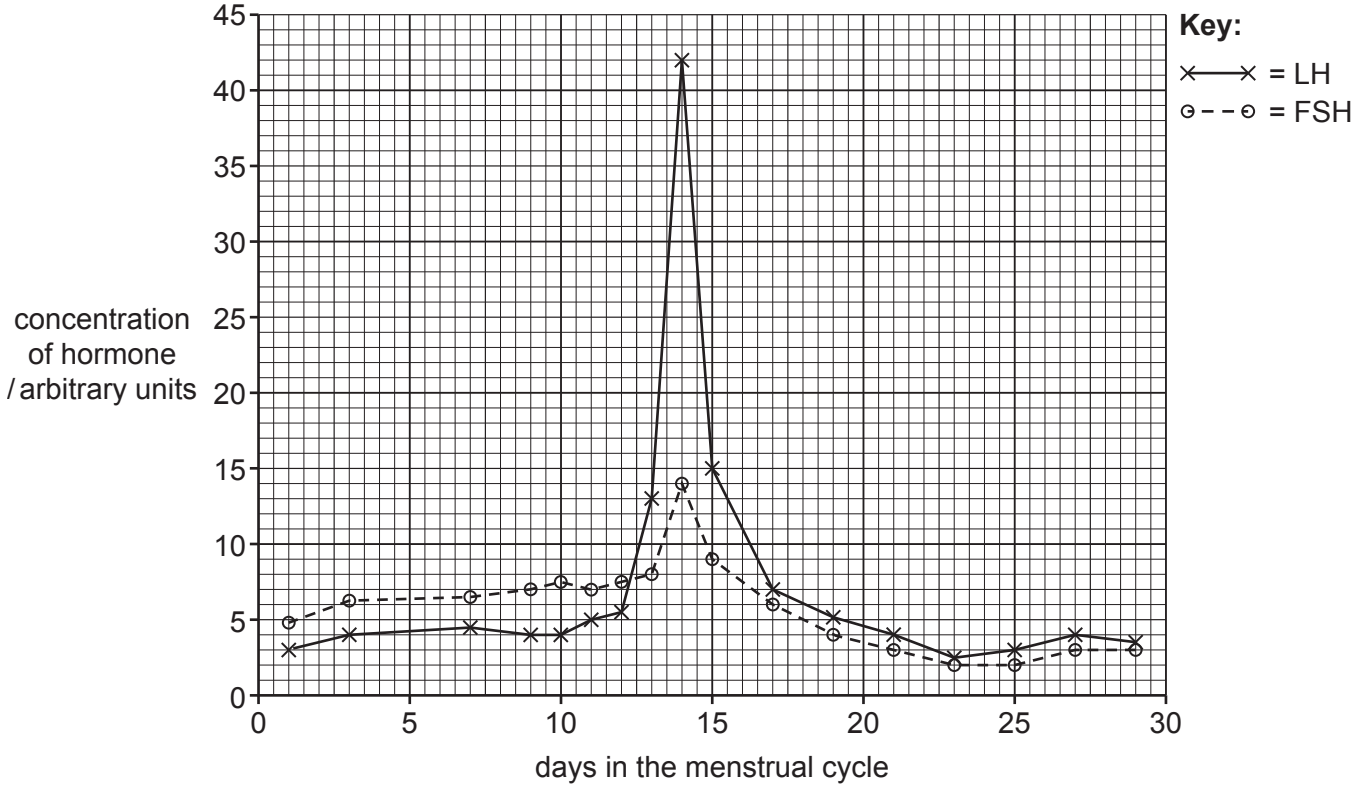

Fig. 3.1

(a) **(i)** Suggest the target organ for FSH.

..... [1]

(ii) State how FSH reaches its target organ.

..... [1]

(iii) Describe the relationship shown by the two hormones in Fig. 3.1.

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..... [2]

(b) Describe the roles of FSH and LH in the menstrual cycle.

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..... [4]

(c) Describe the changes that occur in the lining of the uterus during one menstrual cycle.

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..... [3]

(d) Oral contraceptives are a method of birth control taken by women.

Outline how the hormones in contraceptives act as a method of birth control.

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..... [3]

[Total: 14]

4 Involuntary actions occur because nerve impulses travel along the components of reflex arcs.

An example of an involuntary action is the rapid movement of a hand after unexpectedly touching a very hot object.

Fig. 4.1 shows the structures that are involved in the movement of the hand.

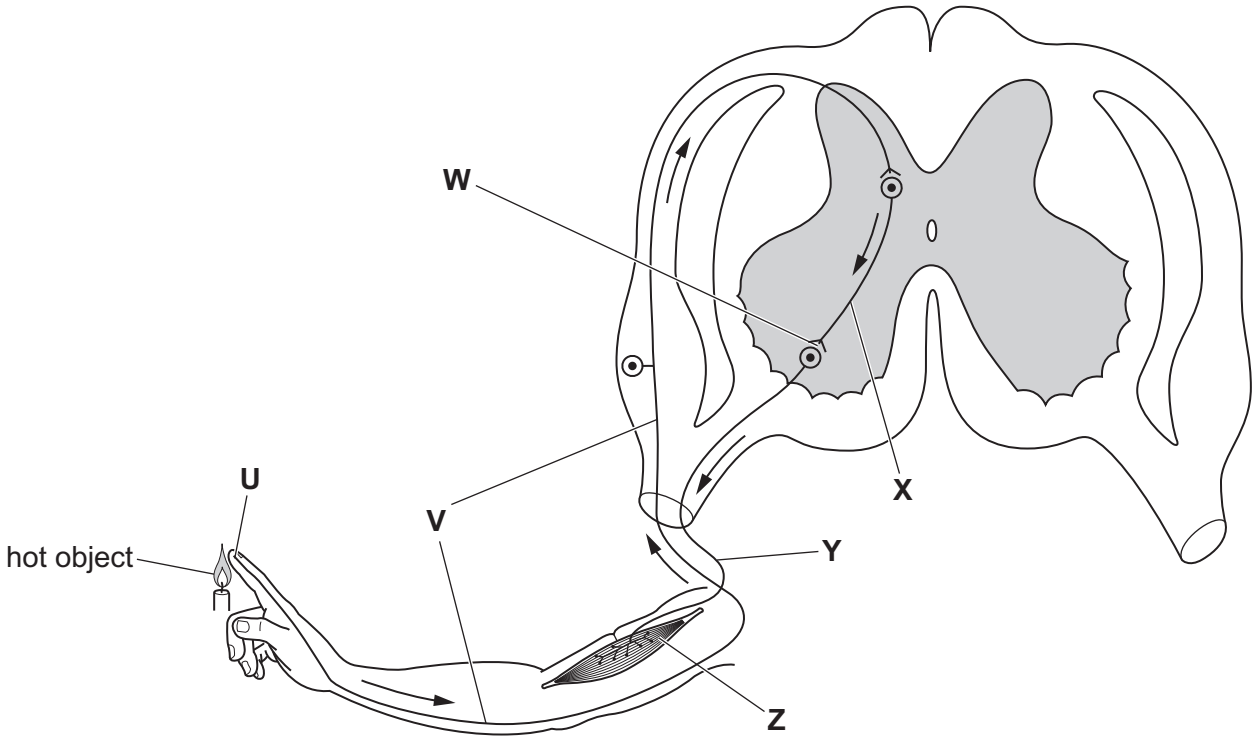

Fig. 4.1

(a) Table 4.1 shows the functions of some of the structures shown in Fig. 4.1, the names of the structures and the letter from Fig. 4.1 that identifies each structure.

Complete Table 4.1.

Table 4.1

function	name	letter on Fig. 4.1
conducts impulses to central nervous system (CNS)		
conducts impulses to an effector		
conducts impulses only within the CNS		
	receptor	
		Z

[5]

(b) Fig. 4.2 shows the structure of the synapse at **W** on Fig. 4.1.

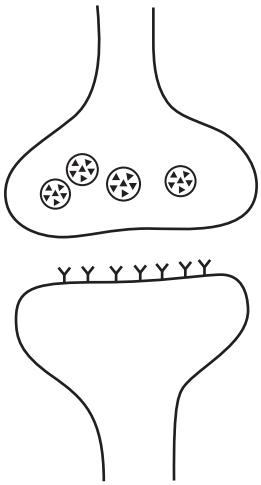

Fig. 4.2

Describe how an impulse travels across the synapse shown in Fig. 4.2.

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..... [4]

(c) State **one** example of a reflex action that occurs in the eye.

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..... [1]

[Total: 10]

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5 **(a)** State **two** factors that affect the volume of urine produced in the human body.

1 .....

2 .....
[2]

(b) Nitrogen is an important element for organisms.

In a livestock farm, waste from animals contains protein. This waste is often spread on farmland as a fertiliser.

Describe how the nitrogen in protein is recycled in the soil into a form that plants can absorb and use.

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..... [5]

(c) Waste from livestock farms often pollutes water courses, such as streams and rivers, leading to a reduction in biodiversity.

Explain how the pollution of water courses by animal waste leads to a reduction in biodiversity.

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..... [6]

[Total: 13]

6 Enzymes are catalysts.

(a) Define the term catalyst.

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..... [2]

(b) Fig. 6.1 shows diagrams of three enzymes and eight different substrates.

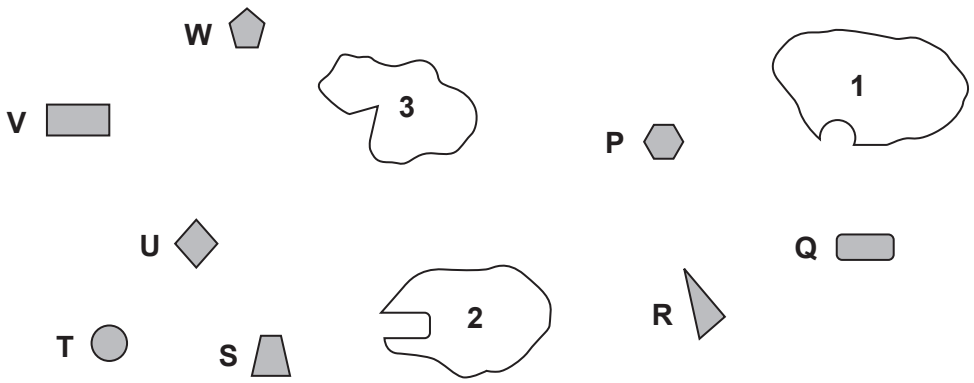

Fig. 6.1

(i) State the letter of the substrate that will be broken down by enzyme 1.

..... [1]

(ii) Explain, in terms of enzyme structure, the reason for your choice in **6(b)(i)**.

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..... [2]

(c) Table 6.1 lists some enzymes and the reactions that they catalyse.

Complete Table 6.1.

Table 6.1

enzyme	reaction
maltase	breakdown of maltose to .....
.....	breakdown of proteins to amino acids
lipase	breakdown of fats to ..... and .....
.....	breakdown of lactose to simpler sugars
.....	insertion of a short length of DNA into a plasmid
restriction enzyme	.....

[6]

[Total: 11]

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