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3310582895

BIOLOGY **0610/41**

Paper 4 Theory (Extended) **October/November 2020**

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 **16** pages. Blank pages are indicated.

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1 Water is an essential molecule for life.

(a) Complete the statements.

Water moves into and out of cells by ..... .

Water is known as a ..... because it can dissolve solutes.

[2]

(b) A leaf cell was put into a solution. The water potential of the solution was lower than the water potential of the contents of the cell.

Fig. 1.1 is a sketch of the cell after three hours in the solution.

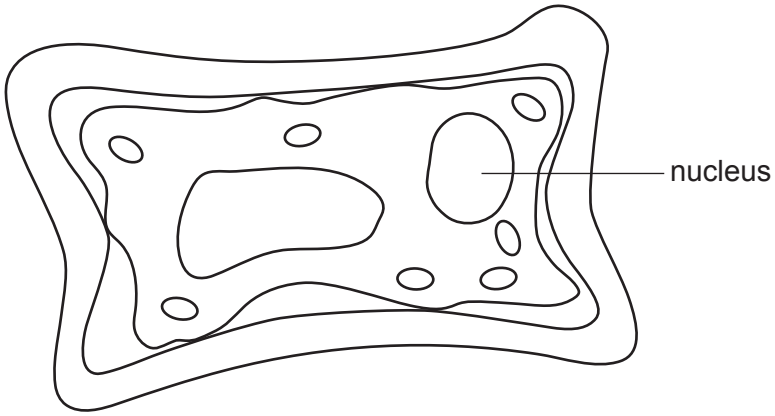


Fig. 1.1

The leaf cell was transferred into pure water.

Sketch the expected appearance of the cell after it had been in the pure water for three hours.

Draw **one** arrow on your sketch to show the direction of water movement.

[3]

(c) A plant was **not** watered for one week.

Fig. 1.2 shows a series of photographs of the plant during the week.



day 0 day 3 day 7

Fig. 1.2

Explain how the lack of water has affected the support of the leaves of the plant shown in Fig. 1.2.

Use the term *turgor pressure* in your answer.

.....

.....

.....

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..... [3]

[Total: 8]

2 Pathogens cause disease.

(a) Fig. 2.1 shows some cells that are part of the human immune system. These cells are responding to one type of pathogen.

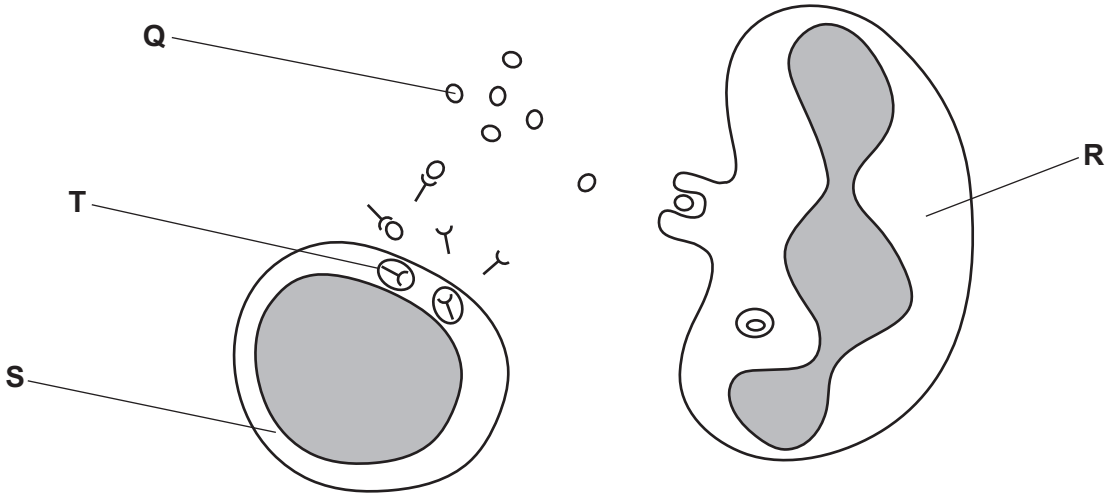


Fig. 2.1

Explain how the immune system responds to an invasion of pathogens.

Use the letters in Fig. 2.1 in your answer.

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..... [6]

(b) A vaccine was introduced in 1942 for a particular disease.

Fig. 2.2 shows the effect of introducing the vaccine on the number of cases of the disease in one country.

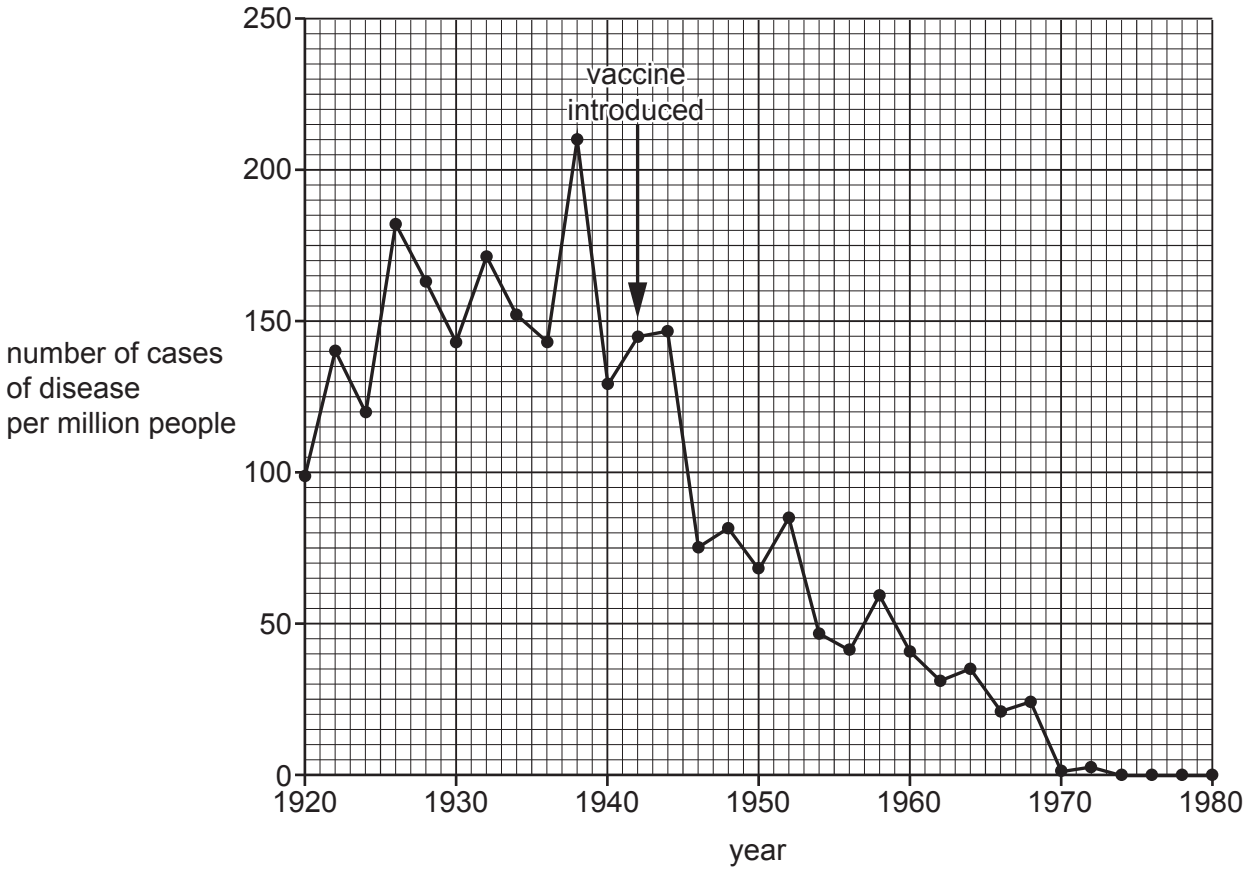


Fig. 2.2

In 1946 the government of the country concluded that the vaccine was successful.

Discuss the evidence, shown in Fig. 2.2, for **and** against this conclusion.

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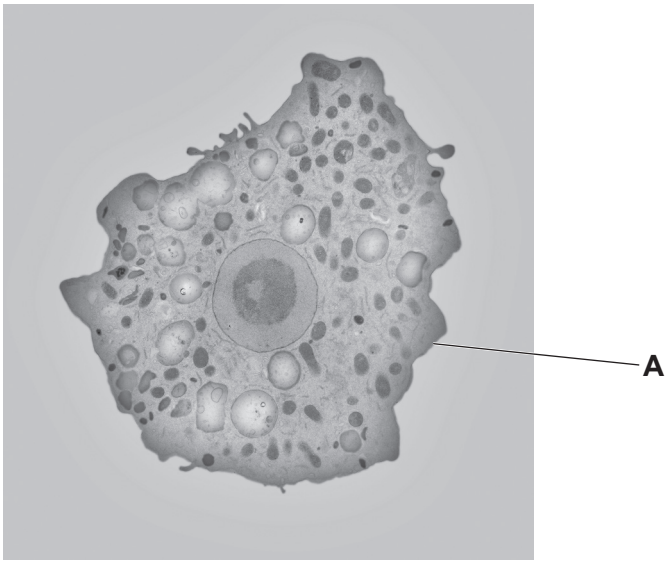
.....

..... [4]

[Total: 10]

3 All living organisms excrete waste products.

(a) Fig. 3.1 is a photomicrograph of *Naegleria fowleri*, a single-celled protoctist that lives in watery environments.



magnification ×4000

Fig. 3.1

(i) State a feature of *N. fowleri*, visible in Fig. 3.1, that distinguishes it from prokaryotes.

..... [1]

(ii) State the name and function of structure **A**.

structure .....

function .....

.....
[2]

(iii) Suggest how *N. fowleri* excretes carbon dioxide.

.....

..... [1]

(b) Urea is a toxin that is excreted by the kidneys in humans.

Describe how **and** where in the body urea is formed.

.....

.....

.....

.....

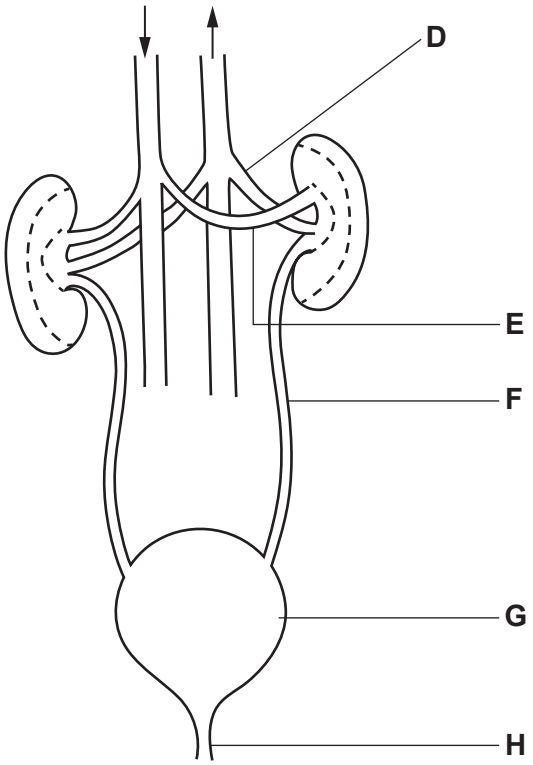
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.....

..... [3]

(c) Fig. 3.2 shows part of the human excretory system and associated blood vessels.

The arrows indicate the direction of blood flow.



not to scale

Fig. 3.2

(i) Draw a label line and the letter **X on Fig. 3.2** to show the location of the cortex in **one** of the kidneys. [1]

(ii) Table 3.1 contains statements about the labelled structures in Fig. 3.2.

Complete the table by:

- stating the name of the structure
- identifying the letter that labels that structure.

Table 3.1

description	name of structure	letter from Fig. 3.2
organ that stores urine		
tube that carries urine out of the kidney		
blood vessel with the lowest concentration of urea		
blood vessel with the lowest concentration of carbon dioxide		
tube that carries urine out of the body		

[5]

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(d) Doctors wanted to investigate the effect of exercise on the excretion of salts.

They collected urine from people before and after running a long distance on a hot day.

The results of their investigation are shown in Table 3.2.

Table 3.2

	before running	after running
average volume of urine / cm^3	1156.0	569.0
average concentration of sodium in urine / mmol per dm^3	85.6	78.2

(i) Suggest why there is a difference in the volume of urine produced before running compared with after running.

Use the information in Table 3.2 in your answer.

.....

.....

.....

.....

..... [2]

(ii) Calculate the percentage decrease in the average sodium concentration after running compared with before running.

Give your answer to one significant figure.

Space for working.

..... %
[3]

(iii) Describe how the kidney tubules enable the excretion of salts.

.....

.....

.....

.....

.....

.....

..... [3]

(e) Large plasma proteins are usually prevented from entering the urine.

State the name of **one** protein found in blood plasma.

..... [1]

[Total: 22]

4 **(a)** Fig. 4.1 shows a bee with pollen on its legs.



Fig. 4.1

Bees are insects that pollinate some flowering plants. They are attracted to the flowers by their colour, scent and nectar.

(i) Describe other ways in which flowers and pollen grains are adapted for insect pollination.

.....

.....

.....

.....

.....

.....

..... [3]

(ii) State where pollen is produced in a flower.

..... [1]

(iii) State the name of the process that produces haploid pollen nuclei.

..... [1]

(iv) Explain why it is important that the pollen nuclei are haploid.

.....

..... [1]

(b) **(i)** Describe how the pollen that is carried by an insect to another flower results in the formation of a plant embryo.

.....

.....

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.....

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.....

..... [5]

(ii) Describe the advantages of cross-pollination.

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..... [2]

(c) Some people are concerned that genetically modified plants might cross-pollinate with wild varieties of plants.

(i) Suggest how farmers could prevent cross-pollination between genetically modified plants and wild varieties of plants.

.....

.....

..... [1]

(ii) State **two** advantages of genetically modified crops.

1 .....

2 .....

[2]

[Total: 16]

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5 Milk is a source of some of the nutrients that are part of a balanced diet.

(a) Calcium and protein are two nutrients found in milk.

Describe the importance of calcium and protein in the diet.

calcium .....

.....

.....

protein .....

.....

.....

[4]

(b) Lactose is found in cows' milk. Some people do not have the enzyme to digest lactose.

State the names of **two** organs, associated with the alimentary canal, that produce enzymes.

1 .....

2 .....

[2]

(c) Fig. 5.1 shows a flow diagram for the production of lactose-free milk.

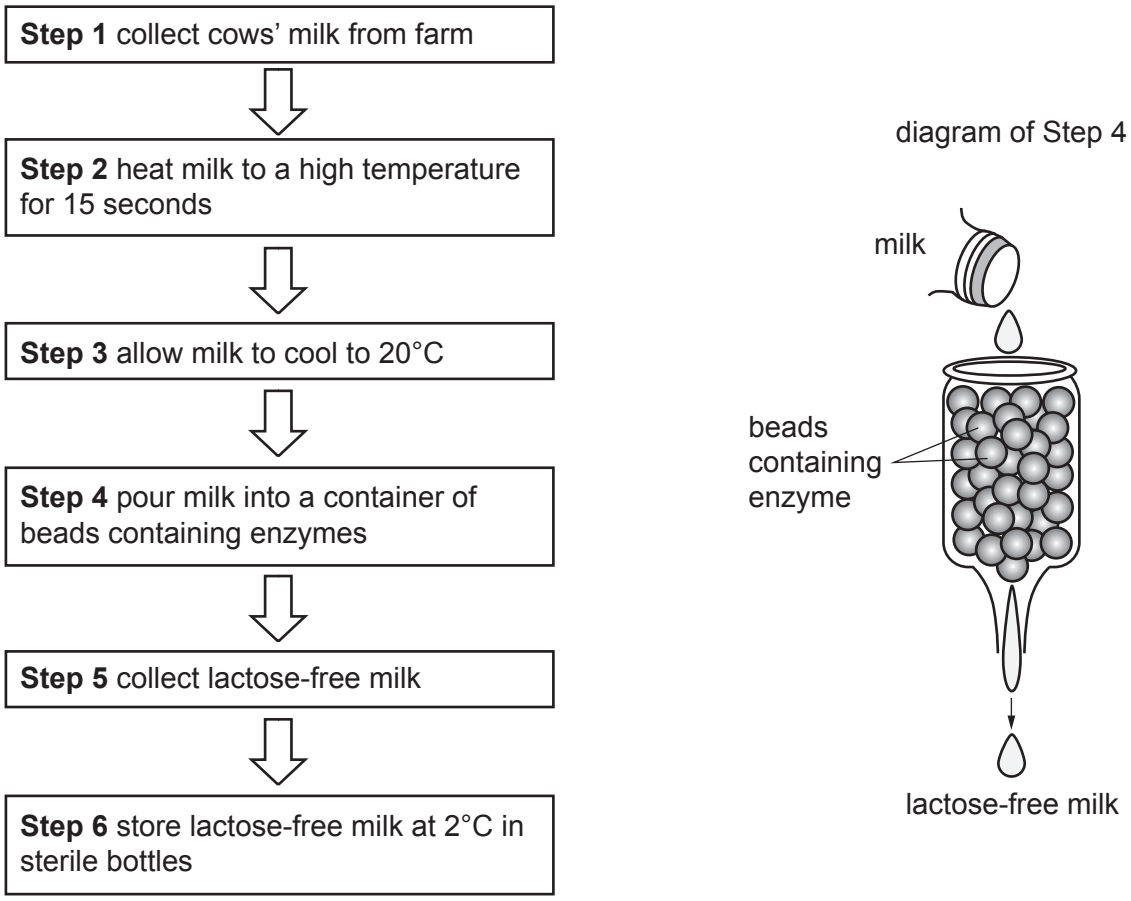


Fig. 5.1

(i) Explain how heating the milk in **step 2** in Fig. 5.1 ensures the hygienic preparation of lactose-free milk.

.....

.....

..... [1]

(ii) Explain why the milk must be cooled in **step 3** before it makes contact with the enzymes.

.....

.....

.....

.....

..... [2]

(iii) State the name of the enzyme used to make lactose-free milk in **step 4**.

..... [1]

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(iv) Suggest why the enzymes are kept in the beads in **step 4** rather than mixed as an enzyme solution with the milk.

.....

.....

..... [1]

(d) Milk is produced by mammals.

(i) Explain the advantages to newborn mammals of breast milk.

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..... [4]

(ii) Explain why breast-feeding mothers are advised to drink plenty of water and avoid excessive alcohol consumption.

.....

.....

.....

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..... [2]

[Total: 17]

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[Turn over

6 Sensitivity is one of the characteristics of all living organisms.

(a) Define the term *sensitivity*.

.....

.....

..... [2]

(b) The eye is an example of a sense organ.

(i) Define the term *sense organ*.

.....

.....

..... [2]

(ii) Adrenaline is a hormone that is released in 'fight or flight' situations. It causes a change in the eye.

Complete Table 6.1 by stating the parts of the eye that change when adrenaline is released into the blood.

Table 6.1

action	part of the eye
muscle that relaxes	
muscle that contracts	
widens	

[3]

[Total: 7]

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