



**Cambridge International Examinations**  
Cambridge International General Certificate of Secondary Education

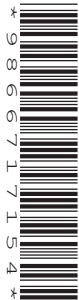
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**BIOLOGY**

**0610/41**

Paper 4 Theory (Extended)

**May/June 2017**

**1 hour 15 minutes**

Candidates answer on the Question Paper.

No Additional Materials are required.

**READ THESE INSTRUCTIONS FIRST**

Write your Centre number, candidate number and name on all the work you hand in.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

**DO NOT WRITE IN ANY BARCODES.**

Answer **all** questions.

Electronic calculators may be used.

You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **17** printed pages and **3** blank pages.

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.

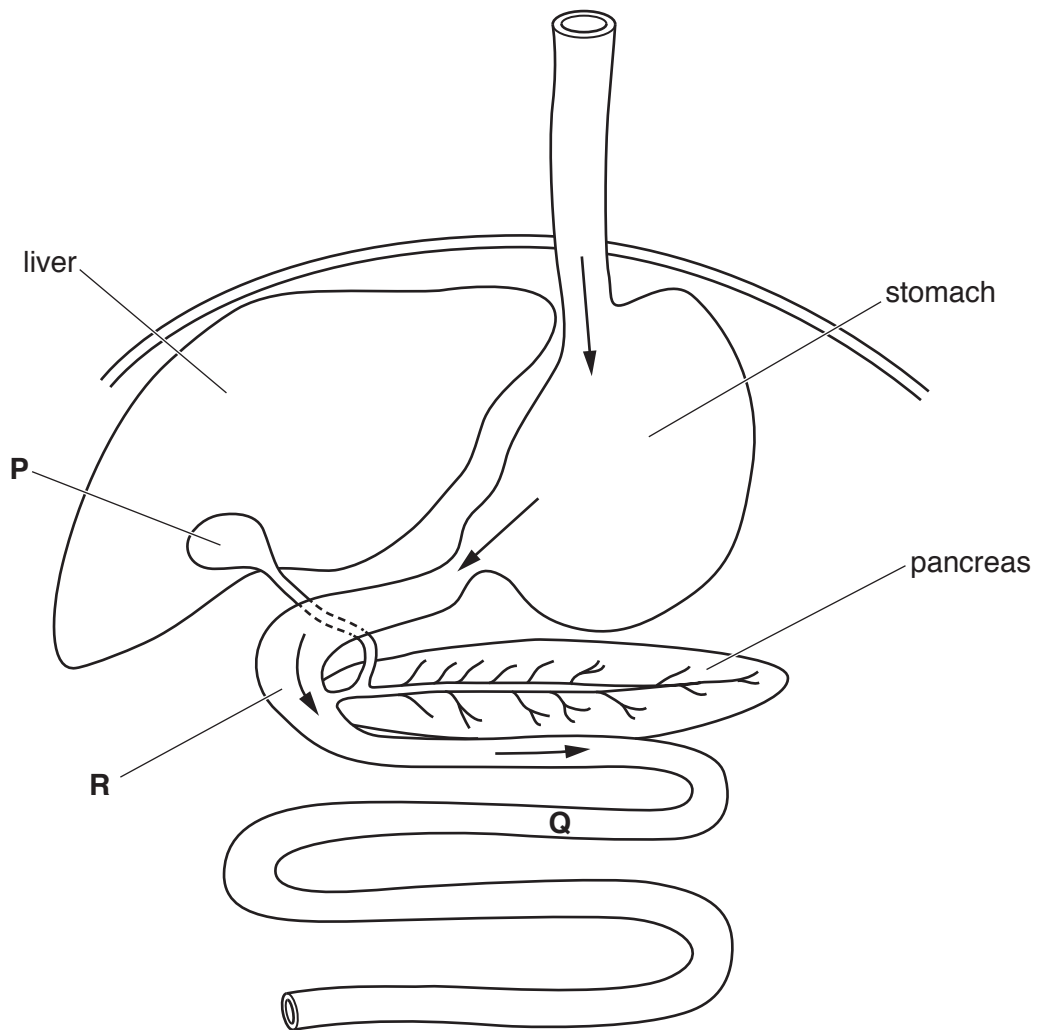


Fig. 1.1

(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.

.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....[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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.....  
.....  
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.....  
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.....  
..... [6]

**[Total: 21]**

2 The genes for antibodies are only active in lymphocytes.

(a) Define the term *gene*.

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

(b) Lymphocytes produce antibodies.

Outline the role of antibodies in the defence of the body against pathogens.

.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
..... [4]

- (c) Fig. 2.1 is a drawing made from an electron micrograph of a lymphocyte that produces antibodies.

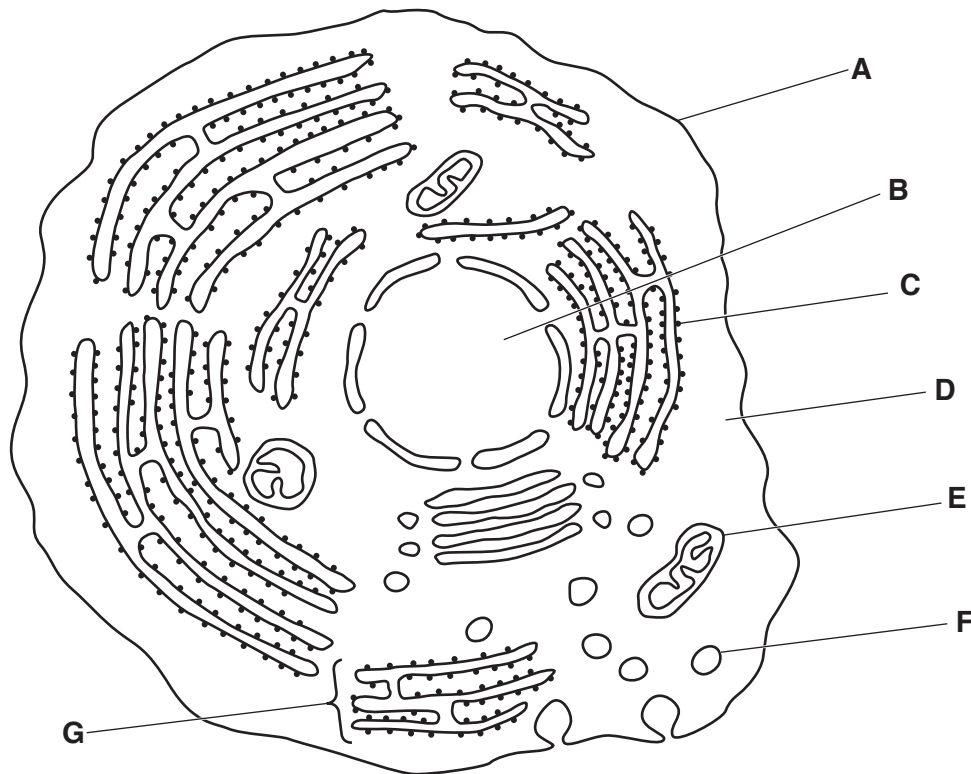


Fig. 2.1

Table 2.1 contains statements about the structures visible in Fig. 2.1.

Complete Table 2.1 by

- naming the structure
- identifying the letter that labels the structure.

The first one has been done for you.

Table 2.1

| function   | name of structure | letter from Fig. 2.1 |
|--|-------------------|----------------------|
| absorption of amino acids used in making antibodies    | cell membrane     | <b>A</b>             |
| stores genetic information as DNA                      |                   |                      |
| provides energy for making antibodies                  |                   |                      |
| site of production of antibodies                       |                   |                      |
| transport of antibody molecules for release into blood |                   |                      |

[4]

(d) State the name of **one** type of cell, other than a lymphocyte, that is involved in the defence of the body against pathogens and describe its role.

name.....

role.....

.....  
[2]

**[Total: 12]**

3 Heroin is a drug that acts on the nervous system.

(a) Define the term *drug*.

.....

.....

.....

.....[2]

There are pain receptors in the skin. These receptors transmit impulses along sensory neurones to the spinal cord.

Fig. 3.1 shows the synapses between sensory neurone **A** and a relay neurone and sensory neurone **B** and a relay neurone, in the spinal cord.

Fig. 3.2 is an enlarged view of the synapse between sensory neurone **A** and the relay neurone, as indicated by the circle on Fig. 3.1.

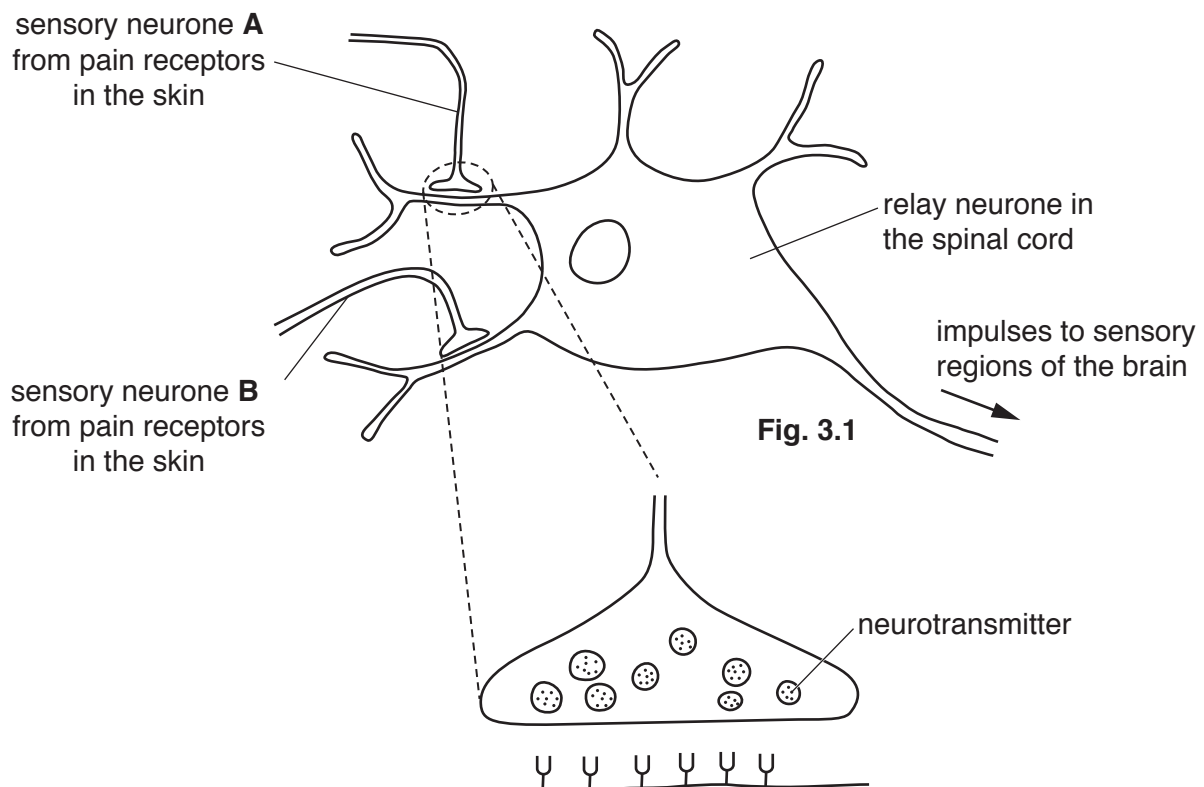


Fig. 3.2





(e) List **three** stimuli, other than pain, which humans can detect.

1.....

2.....

3.....

[3]

[Total: 14]

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4 Fig. 4.1 shows part of the circulatory system of a fish.

The arrows show the direction of blood flow.

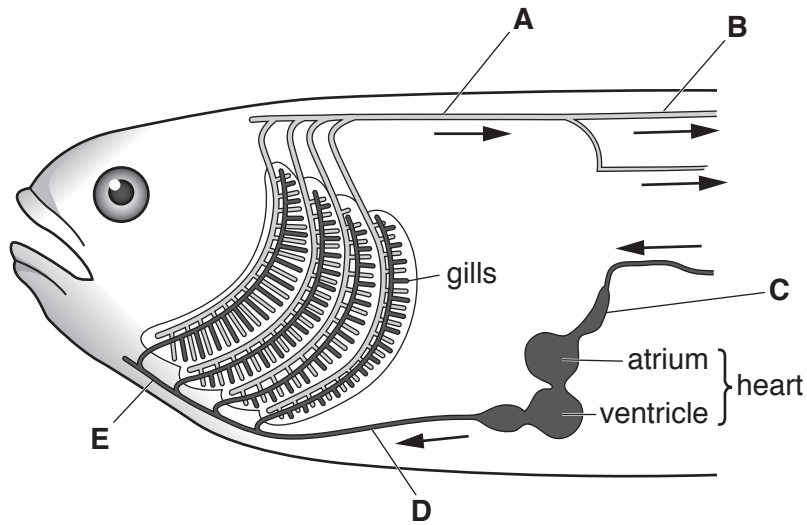


Fig. 4.1

(a) The circulatory system of fish is described as a single circulation.

State what is meant by a *single circulation*.

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

(b) State the letter of the blood vessel in Fig. 4.1 that contains blood at the highest pressure.

..... [1]

(c) The gills are the site of gas exchange.

State **two** features of gas exchange surfaces.

1.....  
 .....  
 2.....  
 ..... [2]

[Total: 4]

5 The giant quiver tree, *Aloe pillansii*, shown in Fig. 5.1, is an endangered species.

These long-lived trees grow in harsh environments. Some populations of *A. pillansii* are found within the Richtersveld National Park, but one population is found just outside on a mountain called Cornell's Kop in southern Africa.



Fig. 5.1

(a) (i) State the genus of the giant quiver tree.

.....[1]

(ii) Explain why the *A. pillansii* trees on Cornell's Kop represent a population.

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

(b) Suggest **three** reasons why the giant quiver tree is an endangered species.

1.....  
.....  
2.....  
.....  
3.....  
.....

[3]

- (c) It was estimated in 2005 that the total number of giant quiver trees in the wild was less than 3000, which is considered to be very low compared with other tree species.

Explain the risks to a plant species of having very small numbers.

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.....

.....[3]

- (d) The population of *A. pillansii* trees on Cornell’s Kop was surveyed and photographed at four sites, **A** to **D**, from 1937 onwards. Researchers took photographs at all four sites in 2004 and compared them with the original photographs.

The results are shown in Table 5.1.

**Table 5.1**

| site     | date of the original photograph | number of living trees in the original photograph | number of living trees in 2004 | number of dead tree stumps | average annual mortality rate /percentage of deaths per year |
|----------|---------------------------------|---|--------------------------------|----------------------------|--|
| <b>A</b> | 1937                            | 12  | 4                              | 8                          | 1.0  |
| <b>B</b> | 1953                            | 9   | 5                              | 4                          | 0.9  |
| <b>C</b> | 1985                            | 5   | 3                              | 2                          | 2.1  |
| <b>D</b> | 2001                            | 6   | 5                              | 1                          | 5.6  |

- (i) Calculate the percentage decrease in the number of living trees at site **B** from 1953 to 2004.

Show your working and give your answer to the nearest whole number.

.....%

[2]

- (ii) Describe what the analysis of the photographs shows about the population of *A. pillansii* on Cornell’s Kop.

.....

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.....[3]

[Total: 15]

6 Students investigated the effect of mineral ion deficiencies on the growth of radish plants.

The seeds that were used in the experiment were from plants that had been self-pollinated for many generations and were therefore all genetically identical.

(a) Explain the advantage of using genetically identical radishes in this investigation.

.....

.....

.....

.....[2]

The radish seedlings were divided into four groups. Each group was grown in a different mineral ion solution as follows:

- 1 complete solution containing all the major mineral ions
- 2 solution with all the major mineral ions except **nitrate ions**
- 3 solution with all the major mineral ions except **magnesium ions**
- 4 solution with all the major mineral ions except **phosphate ions**

The apparatus used to investigate the growth of the plants is shown in Fig. 6.1.

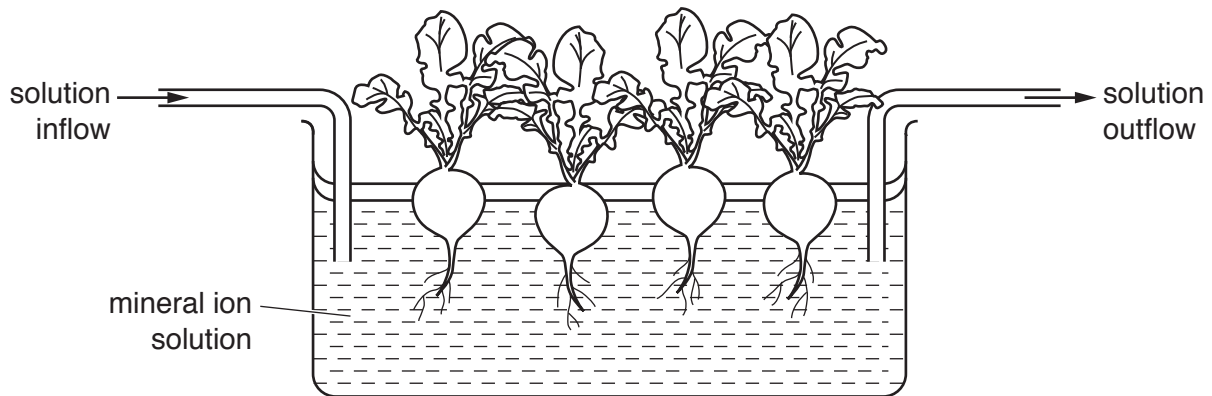


Fig. 6.1



(b) State **three** other environmental factors that could affect the growth of the seedlings.

1.....

2.....

3.....

[3]

The results of the investigation are shown in Table 6.1.

**Table 6.1**

| group | mineral ion solution   | number of plants | total dry mass of all plants/mg |       |       | mean dry mass of one plant/mg |
|-------|------------------------|------------------|---------------------------------|-------|-------|-------------------------------|
|       |                        |                  | leaves                          | roots | total |                               |
| 1     | complete               | 8                | 1880                            | 1110  | 2990  | 374                           |
| 2     | without nitrate ions   | 10               | 1410                            | 750   | 2160  | 216                           |
| 3     | without magnesium ions | 9                | 1600                            | 260   | 1860  | 207                           |
| 4     | without phosphate ions | 9                | 1670                            | 140   | 1810  | 201                           |

(c) Describe **and** explain the results for the radishes grown without nitrate ions (group 2).

.....  
.....  
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.....  
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[4]

(d) Describe the likely appearance of the radish plants grown in the solution without magnesium ions (group 3) and explain your answer.

appearance.....

.....

explanation.....

.....

.....

[3]

(e) Phosphate ions are a component of DNA.

Suggest why the radish plants in group 4 grew less than the radish plants in the complete solution (group 1).

.....

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.....

.....

..... [2]

[Total: 14]

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