Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

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.

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1 Fat is a necessary component of the human diet.

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

View solution

1.....

2.....

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[3]

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

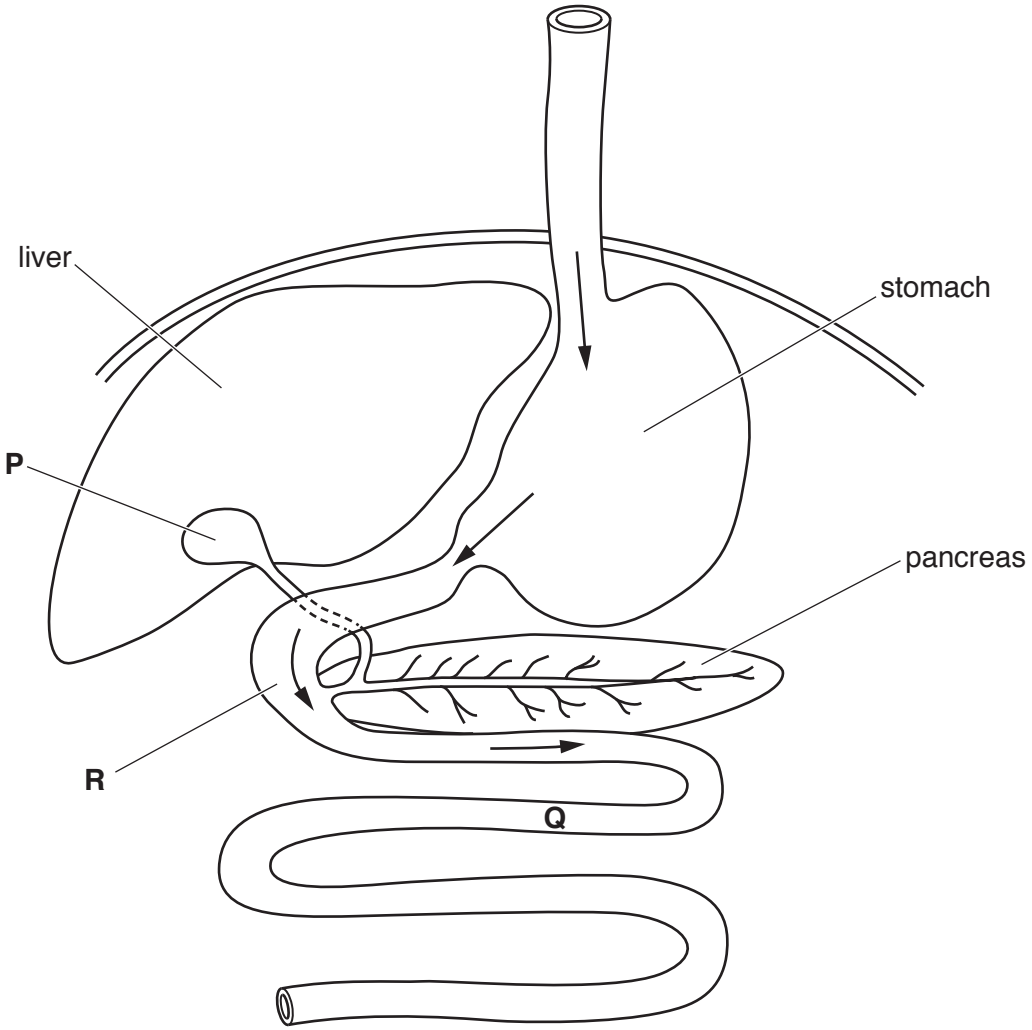

Fig. 1.1

(b) State the name of

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

View solution

.....[1]

(ii) the products of chemical digestion of fat

View solution

.....[1]

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

View solution

.....[1]

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

View solution

.....[1]

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

View solution

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.....[2]

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

View solution

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.....[3]

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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.

View solution

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.....[3]

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

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.....[6]

[Total: 21]

2 The genes for antibodies are only active in lymphocytes.

(a) Define the term *gene*.

View solution

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.....[2]

(b) Lymphocytes produce antibodies.

View solution

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

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

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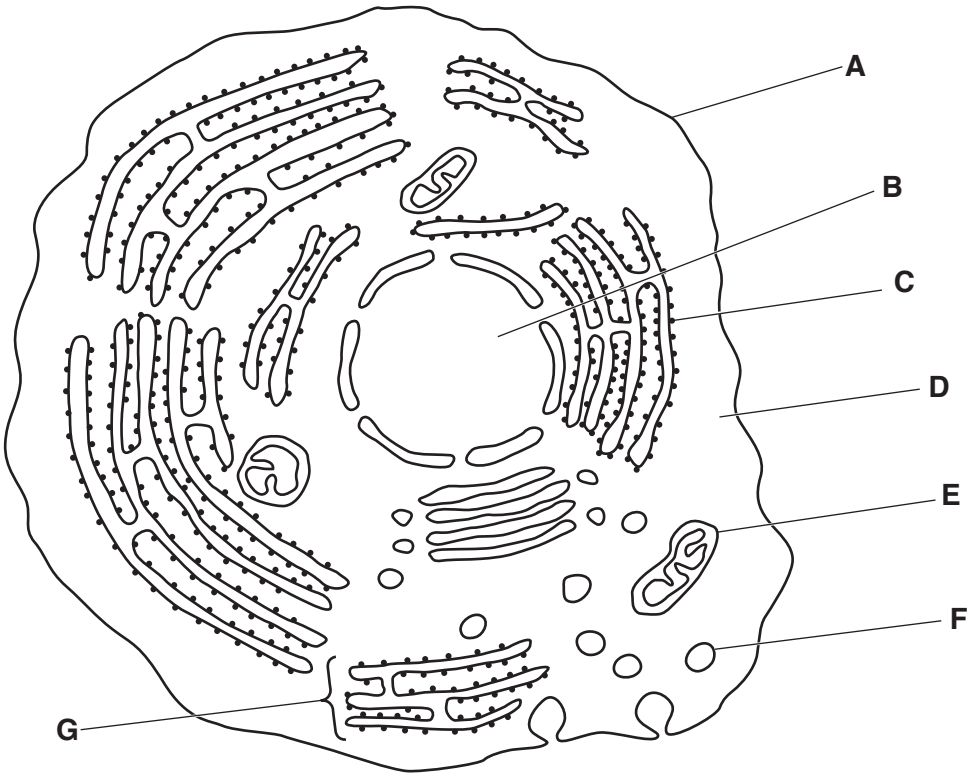

Fig. 2.1

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	**A**
stores genetic information as DNA		
provides energy for making antibodies		
site of production of antibodies		
transport of antibody molecules for release into blood		

[4]

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(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]

View solution

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

(a) Define the term *drug*.

View solution

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.....[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.

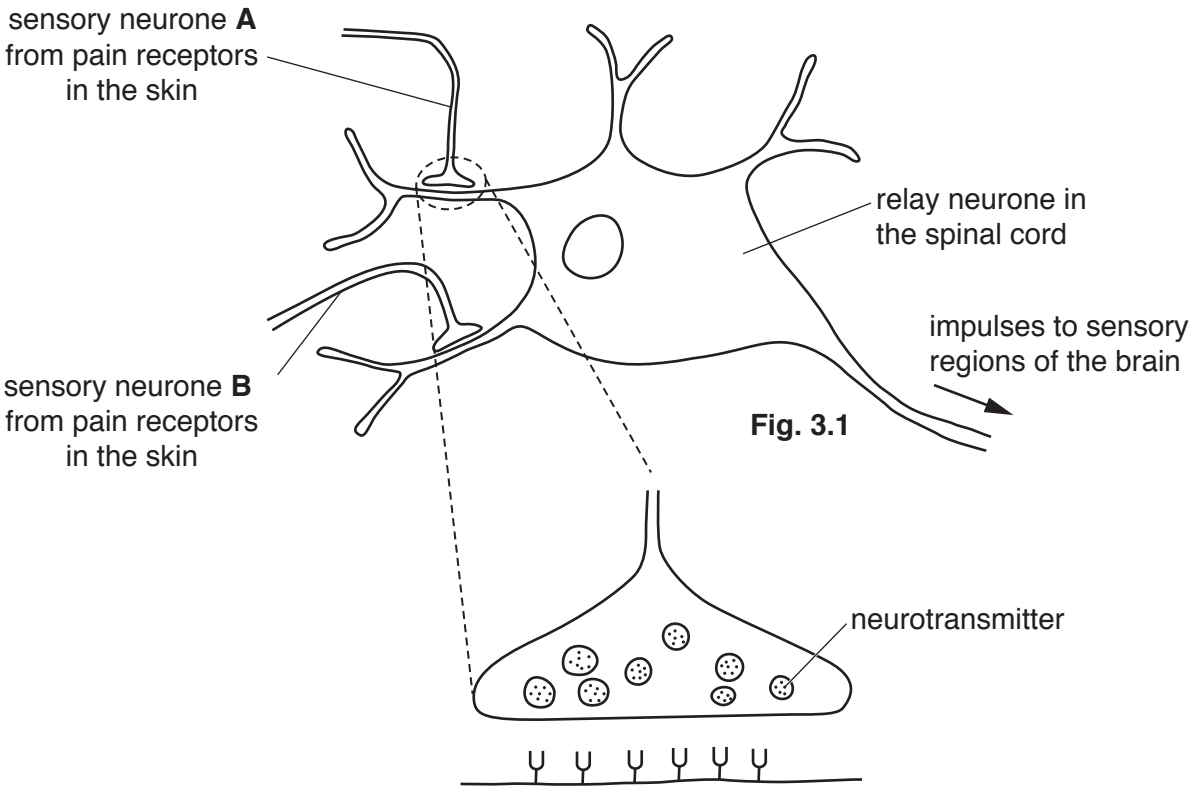

Fig. 3.1

Fig. 3.2

(b) Describe how impulses are transmitted across the synapse.

View solution

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.....[4]

(c) Suggest how the structure of a synapse ensures that impulses travel in one direction.

View solution

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.....[2]

(d) When an impulse arrives along sensory neurone **B**, a different neurotransmitter is released. This **prevents** the production of an impulse in the relay neurone.

Molecules of heroin have a similar shape to the neurotransmitter released from these neurones.

Explain how heroin affects the function of the synapse.

View solution

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

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[3]

[Total: 14]

View solution

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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.

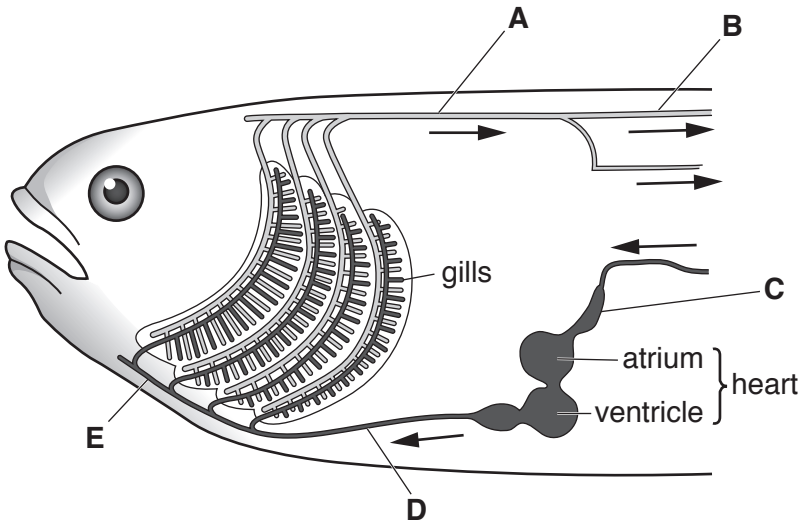

Fig. 4.1

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

State what is meant by a *single circulation.*

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.....[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.....

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2.....

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[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. View solution

.....[1]

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

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.....[3]

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

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2.....

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[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.


View solution

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.

View solution

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
A	1937	12	4	8	1.0
B	1953	9	5	4	0.9
C	1985	5	3	2	2.1
D	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]

View solution

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.

View solution

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.....[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.

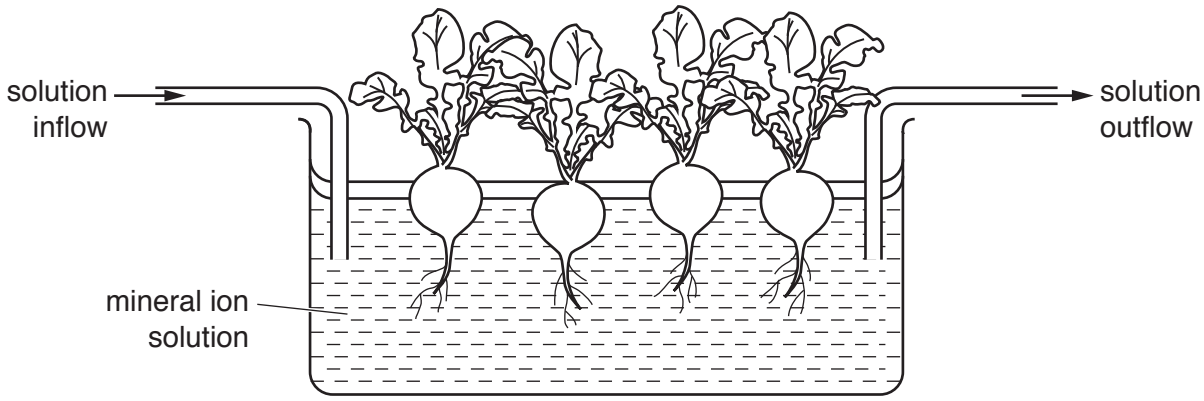

Fig. 6.1

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(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.

View solution

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**).

View solution

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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.....

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explanation.....

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[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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