Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

BIOLOGY **0610/41**

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

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

This document consists of **18** printed pages and **2** blank pages.

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CAMBRIDGE International Examinations

1 Fig. 1.1 and Fig. 1.2 show two images of villi.

Fig. 1.1 shows a surface view of many villi viewed through a scanning electron microscope.

Fig. 1.2 shows a section of one villus viewed through a light microscope.

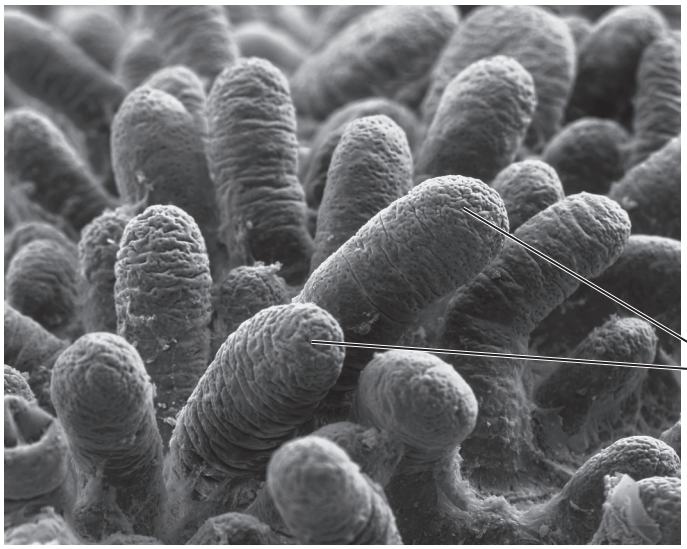

Fig. 1.1

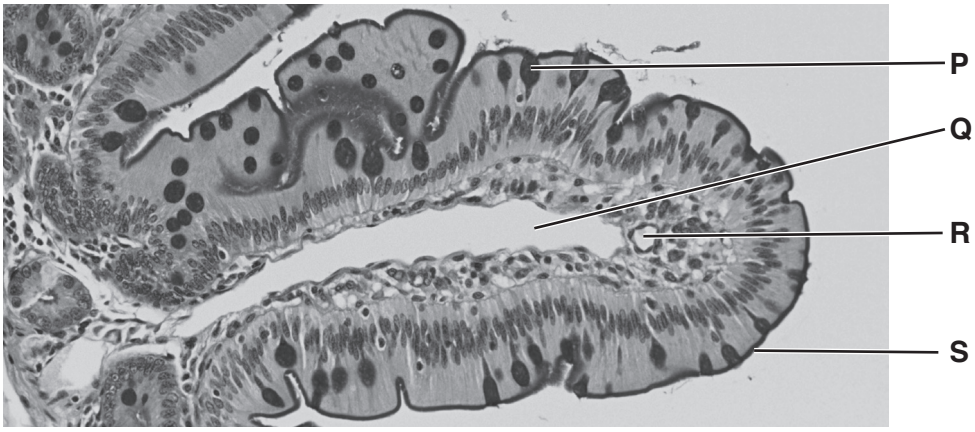

Fig. 1.2

Villi are found in the small intestine.

(a) State the function of villi.

.....

.....[1]

(b) Identify and describe **two** of the labelled components of a villus.

Use the letters in Fig. 1.2 in your answer.

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.....[4]

(c) Some infections in the small intestine can cause diarrhoea.

(i) Describe the effects of diarrhoea on the body.

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.....[2]

(ii) State the treatment for the effects of severe diarrhoea.

.....[1]

(d) **(i)** Blood transports nutrients.

State the component of the blood that transports nutrients.

.....[1]

(ii) The nutrients in the blood can be used to become part of cells.

State the name of this process.

.....[1]

(iii) Amino acids are an example of a type of nutrient transported in the blood.

State **two** examples of larger molecules found in cells that are made from amino acids.

1 .....

2 .....
[2]

[Total: 12]

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2 A group of students planned an investigation to determine the effects of physical activity on breathing rate.

(a) Describe how the students could measure their breathing rates.

.....

.....

.....[2]

(b) The students measured their breathing rates before physical activity and every minute for five minutes after cycling around the school field.

Write a hypothesis for their investigation.

.....

.....

.....[2]

(c) Fig. 2.1 shows a woman on a stationary bicycle. The mask fitted over her nose and mouth measures the composition of the air she breathes out.

Fig. 2.1

Fig. 2.2 shows the concentration of carbon dioxide in the air expired by the woman in the five minutes after she stopped exercising.

The dashed line on the graph shows the concentration of carbon dioxide in her expired air when she was at rest, before she began to exercise.

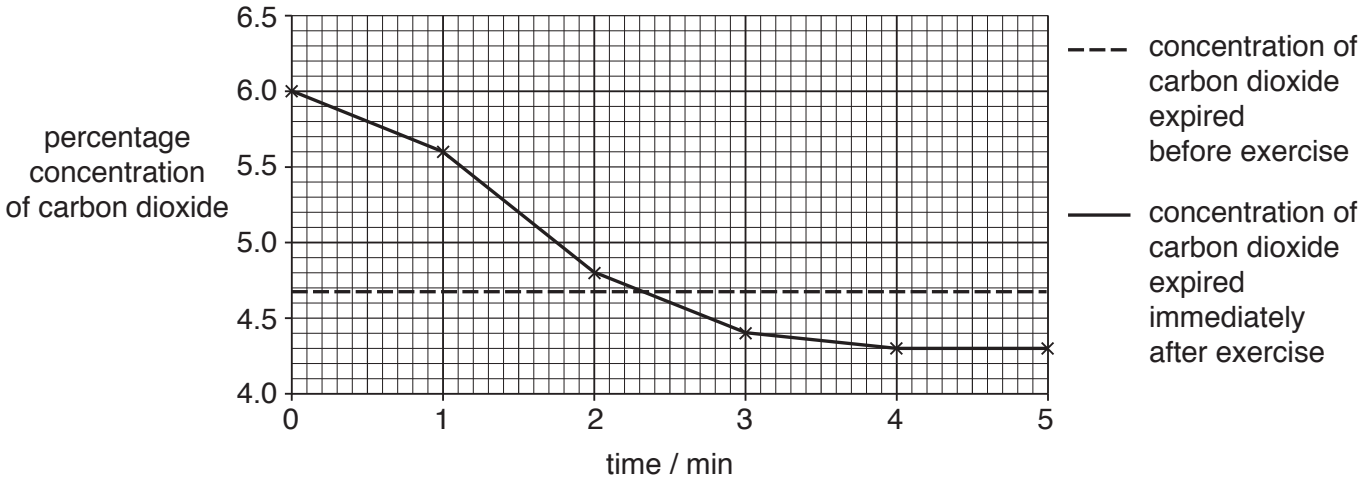

Fig. 2.2

Describe **and** explain the results of the investigation shown in Fig. 2.2.

Use the data in Fig. 2.2 in your answer.

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.....

.....[6]

(d) Before starting the investigation, the researchers confirmed that the woman did not have coronary heart disease.

(i) Suggest why.

.....

.....[1]

(ii) Explain why exercise is recommended for people with a high risk of developing coronary heart disease.

.....

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.....

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.....

.....

.....[3]

[Total: 14]

3 The flowers of pea plants can be pollinated by bees.

(a) State **three** features of flowers that would attract insects such as bees.

1 .....

.....

2 .....

.....

3 .....

.....
[3]

(b) Successful pollination results in fertilisation.

Describe the events that occur after pollen grains leave the anther of a flower until fertilisation takes place.

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.....

.....

.....

.....

.....[5]

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(c) Following fertilisation, seeds will form.

In pea plants there are two alleles for height:

- tall (**T**)
- dwarf (**t**)

(i) Define the term *allele*.

.....

.....

.....[1]

(ii) A farmer wanted to identify the genotype of tall pea plants as either homozygous dominant or heterozygous.

He used a homozygous recessive dwarf pea plant to determine the genotype of the tall pea plants.

State the name of this type of genetic cross.

.....[1]

(iii) Complete the genetic diagram to determine the genotype of the parent plant if all the offspring from the cross are tall plants.

parental phenotypes	tall	×	dwarf	
parental genotypes	.....	×	.....	
gametes	....	+	.....	.....

offspring genotype .....

offspring phenotype .....
[4]

(iv) Another farmer wants to produce pure-breeding dwarf pea plants.

State the genotypes of both of the parent pea plants the farmer should use.

Give a reason for your choice.

genotypes .....

reason .....

.....
[2]

[Total: 16]

4 A neurone is a type of specialised animal cell.

(a) **(i)** Neurones develop from unspecialised cells.

State the name of these unspecialised cells.

.....[1]

(ii) All animal cells have some common features.

State **two** structural features common to all animal cells.

1 .....

2 .....
[2]

(iii) Most neurones are longer than other types of animal cell.

Suggest why most neurones are very long.

.....

.....[1]

(b) Some neurones connect to effector organs.

(i) State the name of the type of neurone that connects to an effector organ.

.....[1]

(ii) State **one** example of an effector organ.

.....[1]

(c) Fig. 4.1 shows parts of two neurones. The area in the dashed circle has been magnified.

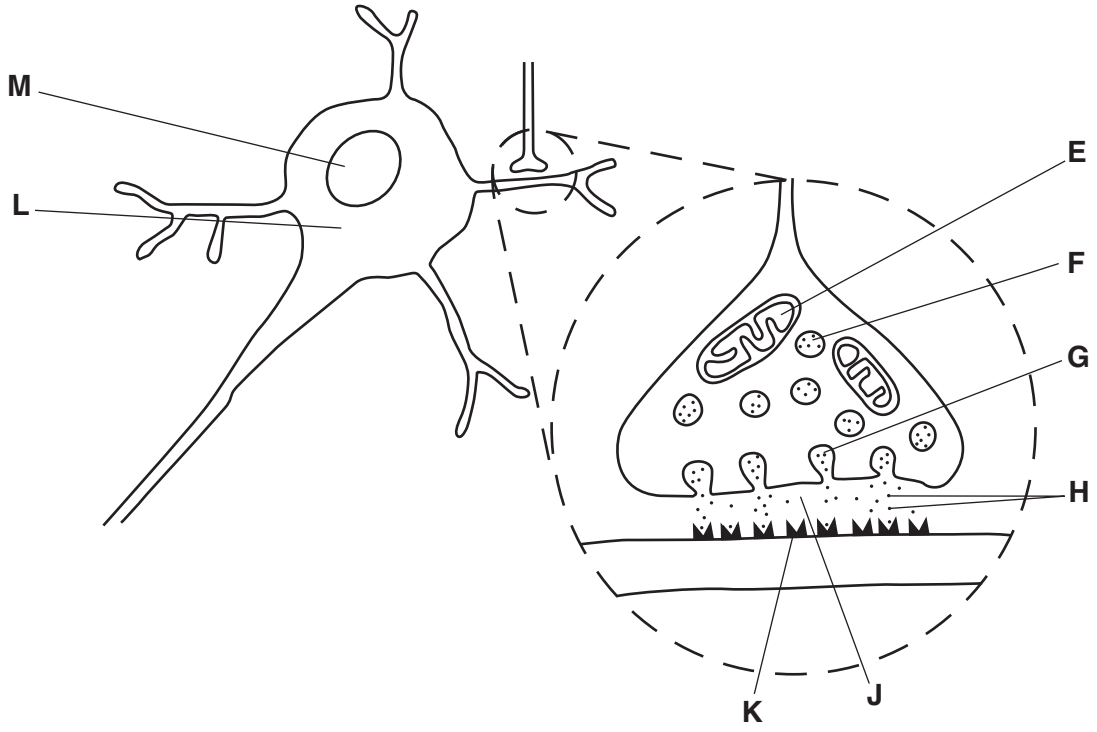

Fig. 4.1

(i) Complete Table 4.1. One row has been done for you.

Table 4.1

letter from Fig. 4.1	name	description
		component of the cell that releases energy during aerobic respiration
H	neurotransmitters	chemicals that transmit signals from one neurone to the next neurone
		the gap between two neurones
		the sac in which neurotransmitters are transported to the cell membrane
		the molecules that the neurotransmitters bind to
		the structure that controls the activities in the cell

[5]

(ii) State where in the body the neurones in Fig. 4.1 would be found.

.....[1]

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(d) Describe how neurotransmitters move across the gap between two neurones.

.....

.....

.....

.....

.....[3]

(e) Nerves and hormones coordinate the functions of the body.

Suggest why blinking of the eyes is coordinated by nerves and not hormones.

.....

.....[1]

[Total: 16]

5 **(a)** Yeast can respire aerobically and anaerobically.

State the balanced chemical equation for aerobic respiration by yeast.

.....[2]

(b) When yeast respires anaerobically, ethanol is released.

Ethanol is a type of sustainable resource that can be produced from a wide range of crops. It can be used as a biofuel.

Table 5.1 summarises some information about crops that are used to make biofuel.

Table 5.1

crop	biofuel produced	energy yield / GJ per ha	optimum growth temperature / °C	optimum annual rainfall range / mm
wheat	ethanol	53–84	24	800–1200
corn	ethanol	63–76	18	360–1000
sugar beet	ethanol	110–122	18	360–1000
sugar cane	ethanol	110–140	28	800–1200
oil palm	oil	150–166	28	1100–2500

(i) Uruguay has an average temperature range of 12 °C to 24 °C and an average annual rainfall of 1000 mm.

Suggest **and** explain which crop would be the **most** suitable crop to grow for producing biofuel in Uruguay.

Use the information in Table 5.1 to justify your choice.

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.....[3]

(ii) Sugar cane requires soil with high concentrations of nitrogen and potassium.

Describe how the lack of nitrate ions would affect the production of sugar cane.

.....

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.....[3]

(iii) Researchers in Brazil are considering using microscopic algae that live in water to produce biofuels. They have found that algae can produce a maximum amount of energy of 200 GJ per m^2.

$1\,m^2 = 0.0001$ ha

Convert the production of biofuel from algae into GJ per ha.

Space for working.

..... GJ per ha [1]

(iv) Suggest why people who are concerned about the environment want countries to produce more biofuel from algae rather than the crops listed in Table 5.1.

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.....[3]

(c) Define the term *sustainable development*.

.....

.....

.....[2]

[Total: 14]

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6 Viruses can cause diseases.

(a) **(i)** State **two** other features of all viruses.

1 .....

2 .....
[2]

(ii) Describe how vaccination can prevent the spread of disease.

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.....[5]

(b) Fig. 6.1 shows four different viruses.

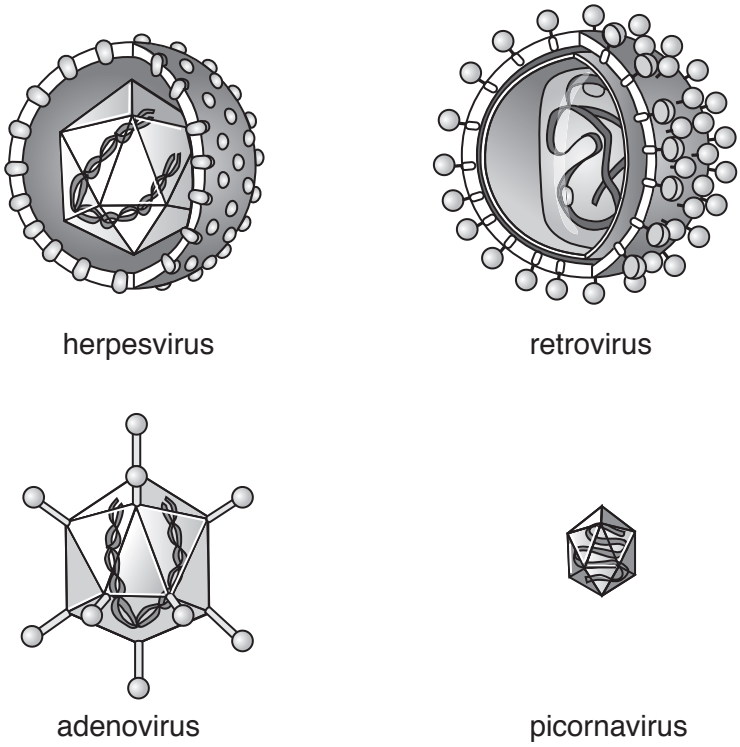

Fig. 6.1

Suggest **one** feature that could be used to classify viruses into groups.

.....

.....[1]

[Total: 8]

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