Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

BIOLOGY **0610/42**

Paper 4 Theory (Extended) **February/March 2016**

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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CAMBRIDGE International Examinations

1 A researcher used a light microscope to observe epithelial cells from a human cheek.
Fig. 1.1 is a photograph that the researcher made of these cells.

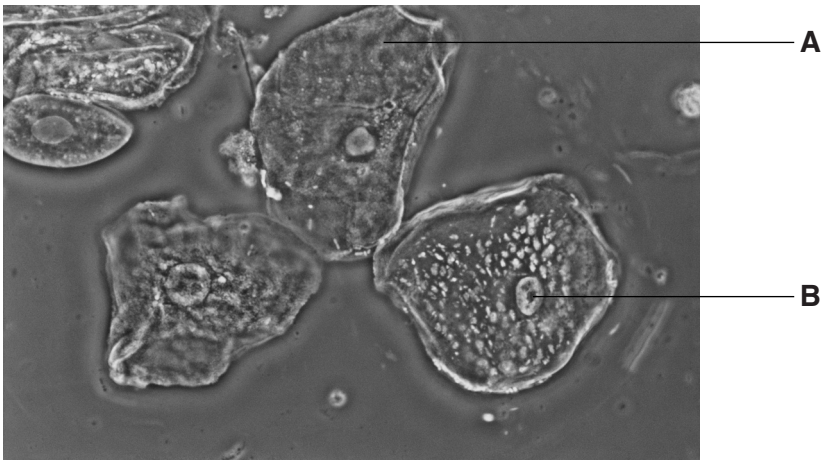

Fig. 1.1

(a) **(i)** Name the parts labelled **A** and **B**.

A .....

B .....
[2]

(ii) The cells in Fig. 1.1 each have a cell membrane.

State **one** of the functions of a cell membrane.

.....

.....[1]

(iii) State how the shape of the cells shown in Fig. 1.1 differs from the shape of a palisade mesophyll cell in a leaf.

.....

.....

.....[1]

(b) Fig. 1.2 shows an electron micrograph of a mitochondrion.

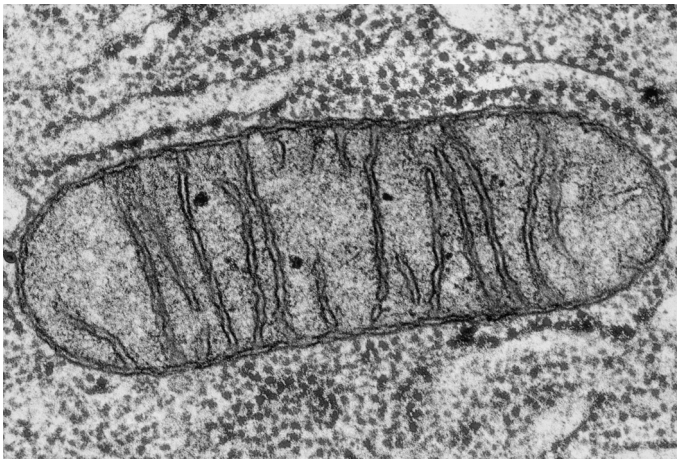

Fig. 1.2

Mitochondria have two membranes, an inner membrane and an outer membrane. The inner membrane is folded and used in respiration.

Suggest why the inner membrane of mitochondria is folded.

.....

.....

.....[1]

(c) Table 1.1 shows different specialised cells and the average number of mitochondria each cell contains.

Table 1.1

specialised cell type	average number of mitochondria
liver cell	1000–2000
red blood cell	0
sperm cell	25–75
heart muscle cell	1500

Explain the differences between the average numbers of mitochondria in the cells shown in Table 1.1.

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.....[4]

[Total: 9]

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2 Reflexes are simple responses that protect the body.
The pathway that nerve impulses travel along during a reflex is called a reflex arc.

(a) Letters **A** to **G** show the components of a reflex arc.

A stimulus
B motor neurone
C sensory neurone
D receptor cell
E response
F relay neurone
G effector

Put the components into the correct sequence. Two have been done for you.

A						**E**

[1]

(b) Impulses travel between neurones across a synapse.

Describe how impulses travel across the synapse from one neurone to another.

.....

.....

.....

.....

.....

.....

.....[3]

(c) Drugs such as heroin restrict the movement of impulses across synapses. Users can become addicted to heroin. When users stop taking heroin they may experience withdrawal symptoms.

(i) State **two** withdrawal symptoms that heroin users may experience.

1 .....

2 .....
[2]

(ii) Suggest why heroin abuse may increase criminal activity.

.....

.....

.....[1]

(d) Heroin abuse may lead to HIV infection. There is currently no approved vaccine that prevents the spread of HIV. Vaccination stimulates active immunity against specific pathogens.

(i) Explain how vaccination stimulates active immunity.

.....

.....

.....

.....

.....

.....

.....

.....

.....[4]

(ii) Explain what is meant by passive immunity.

.....

.....

.....

.....

.....[2]

[Total: 13]

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3 Yeast is used in bread-making. It respires anaerobically, producing carbon dioxide.

(a) Write the balanced chemical equation for anaerobic respiration of yeast in bread-making.

.....[2]

A baker wants to increase the rate of carbon dioxide production in the bread-making process.
The baker trialled different concentrations of glucose solution in the bread dough.
Fig. 3.1 shows the results.

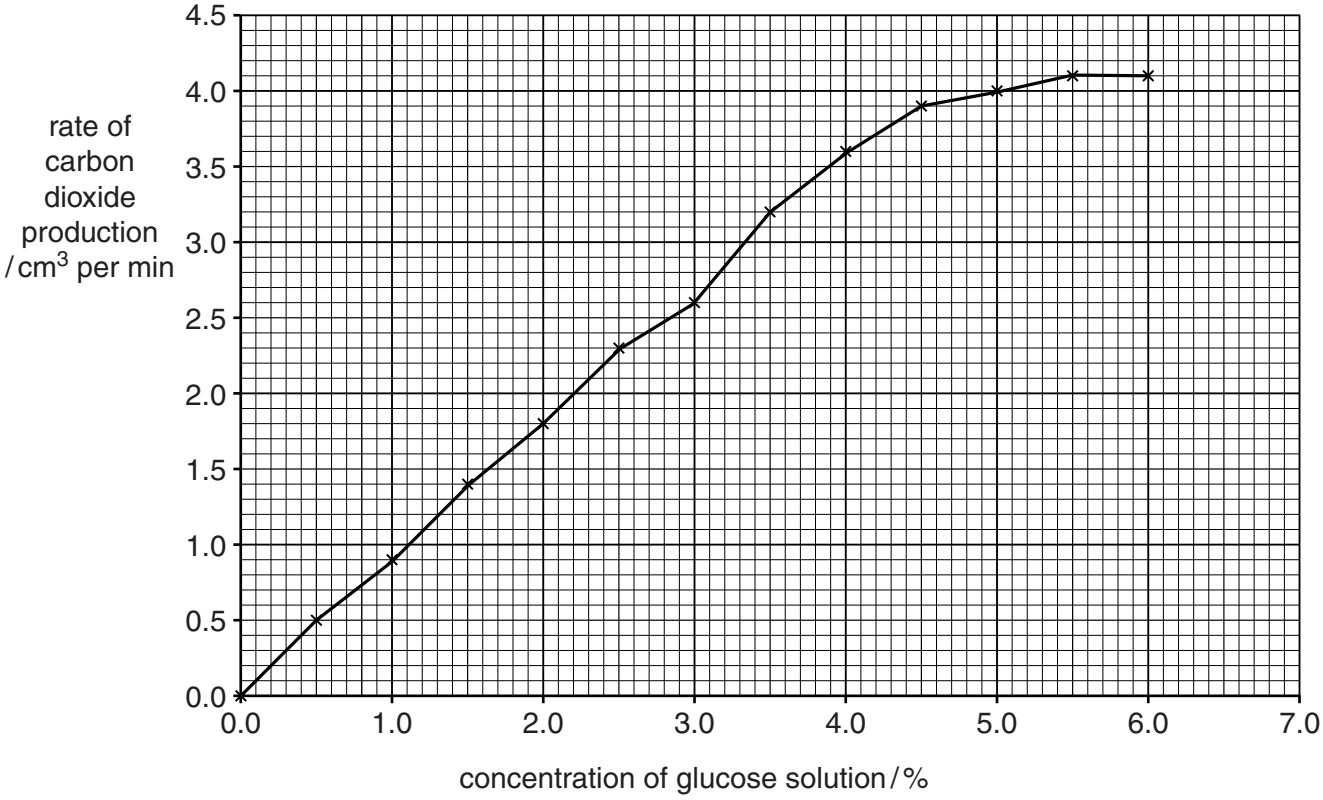

Fig. 3.1

(b) **(i)** Predict the rate of carbon dioxide production if the concentration of the glucose solution was 7.0%.

..... cm^3 per min [1]

(ii) The baker carried out the trials at 30 °C.
The trials were repeated at 20 °C.
Draw a line on Fig. 3.1 to show the rate of carbon dioxide production at 20 °C. [2]

(iii) The baker carried out another trial at 80 °C. No carbon dioxide was released.

State why no carbon dioxide was produced.

.....[1]

(c) Name **one** other industrial process that uses yeast.

.....[1]

(d) During the production of penicillin, large fermenters are used. Fig. 3.2 shows a fermenter.

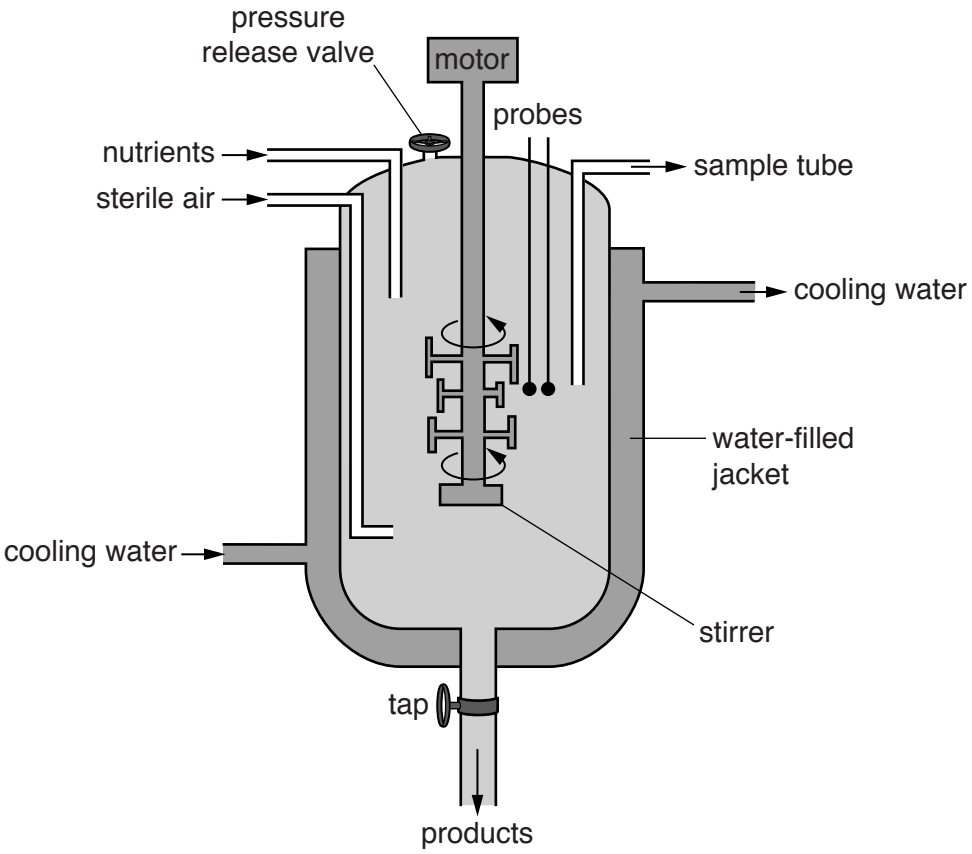

Fig. 3.2

(i) Explain the functions of the following parts of the fermenter:

stirrer .....

.....

water-filled jacket .....

.....

probes .....

.....
[3]

(ii) The air and nutrients that are added to the fermenter are sterile.

State why they must be sterile.

.....

.....

.....[1]

[Total: 11]

4 **(a)** Increasing human population is linked to a change in carbon dioxide concentration in the atmosphere. Fig. 4.1 shows the carbon dioxide concentration between 1958 and 2010 measured at Mauna Loa, Hawaii.

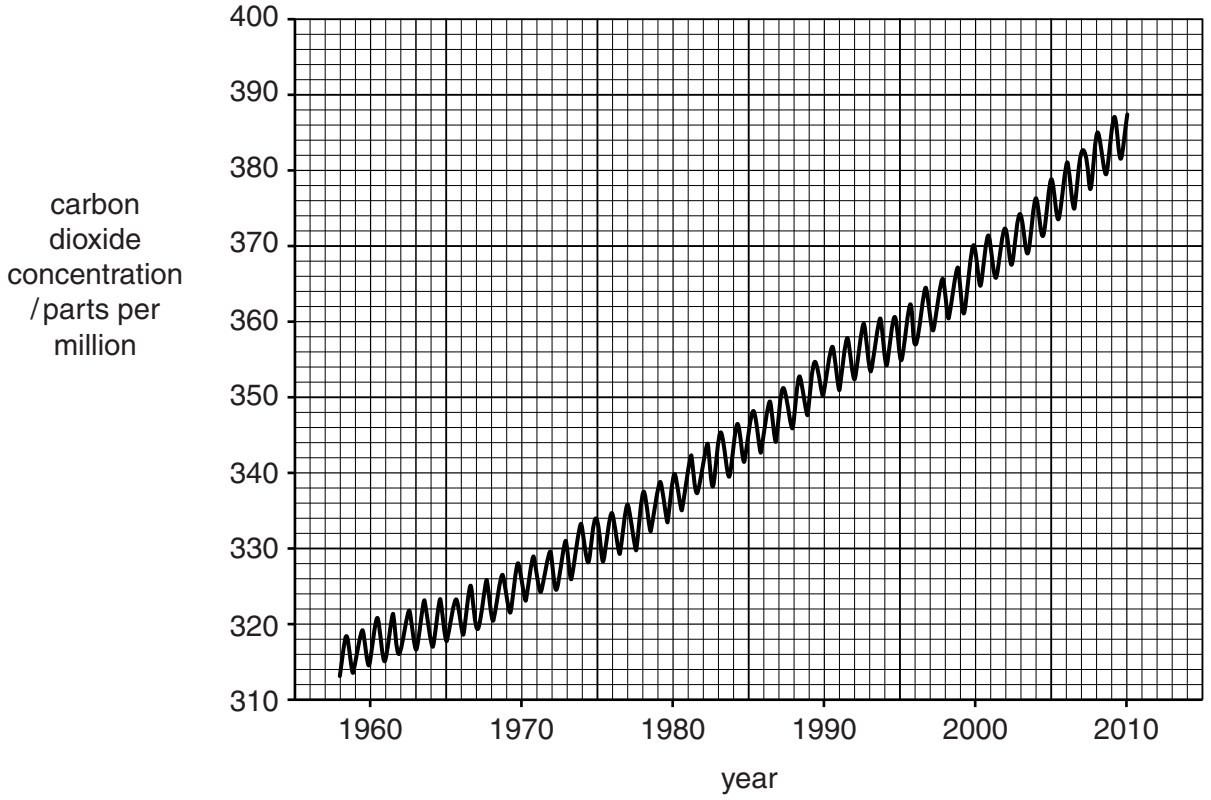

Fig. 4.1

Describe how the carbon dioxide concentration has changed between 1958 and 2010.
You will gain credit for using data from Fig. 4.1.

.....

.....

.....

.....

.....

.....

.....[3]

(b) **(i)** Carbon dioxide is a greenhouse gas.
Name **one other** greenhouse gas.

.....[1]

(ii) Explain how carbon dioxide enhances the greenhouse effect.

.....

.....

.....

.....

.....

.....

.....[3]

(c) Mineral ions are needed for plant growth.

Complete Table 4.1 to show the function and effect of the lack of some mineral ions on plants.

One has been done for you.

Table 4.1

mineral ion	function in plants	effect of lack of mineral ion on plants
nitrate		
magnesium		
phosphate	used for making DNA	poor root growth

[4]

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(d) Fertilisers can cause pollution to aquatic systems. Overuse of fertilisers may cause eutrophication. Lake Udai Sagar in India is an example of an aquatic system that shows high levels of eutrophication.

Explain what happens in aquatic environments, such as Lake Udai Sagar, when eutrophication occurs.

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.....[6]

[Total: 17]

5 Fig. 5.1 shows the different types of human teeth.

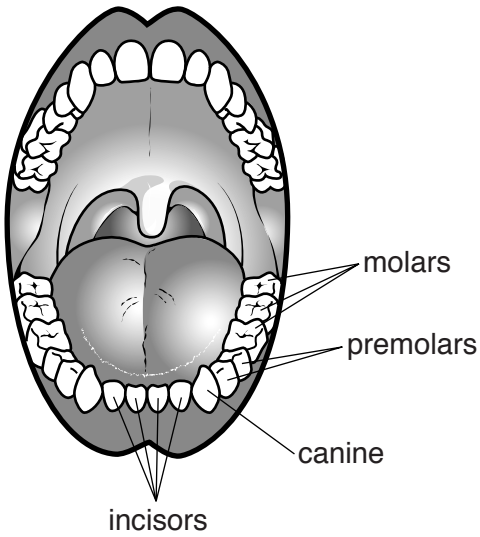

Fig. 5.1

(a) Describe the functions of the canine and molar teeth.

.....

.....

.....

.....

.....[2]

(b) Fig. 5.2 shows the skulls of a tiger and a rabbit.

tiger

rabbit

Fig. 5.2 not to scale

(i) State **two** ways in which the teeth of a tiger differ from the teeth of a rabbit, using evidence from Fig. 5.2.

.....

.....

.....

.....

.....[2]

(ii) Suggest **one** feature **visible** in Fig. 5.2 that indicates the tiger is a carnivore.

.....

.....

.....[1]

(c) Omnivores are animals that eat both animals and plants. Scientists use the number and types of teeth to classify animals as carnivores, herbivores or omnivores.
Table 5.1 shows examples of different types of mammals and their teeth.

Table 5.1

mammal	carnivore, herbivore or omnivore	incisors	canines	premolars	molars	total number of teeth
1	omnivore	12	4	16	12	
2	omnivore	12	4	16	12	44
3	herbivore	12	4	12	12	40
4	herbivore	6	2	12	12	32
5	carnivore	12	4	16	10	42
6	carnivore	12	4	10	8	34
X		12	4	12	8	36

(i) Calculate the number of molars as a percentage of the total number of teeth for mammal 1.
Show your working.
Give your answer to the nearest whole number.

.....%
[2]

(ii) The skull of an unidentified mammal, **X**, is likely to be a carnivore.
Discuss the evidence in Table 5.1 for **and** against classifying mammal **X** as a carnivore.

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.....[4]

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(d) Mechanically digested food travels from the mouth to the stomach. The gastric juice in the stomach contains hydrochloric acid, giving a low pH environment.

Explain why it is important to have a low pH in the stomach.

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.....[3]

(e) Products of digestion are absorbed through the villi in the small intestine.
Explain how villi are adapted for absorption.

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.....[3]

(f) Coeliac disease is caused by a reaction to a protein called gluten. The villi become damaged causing a reduction in the absorption of nutrients.

Suggest possible effects on the body of a reduction in the absorption of nutrients.

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.....[3]

[Total: 20]

6 A new species of frog was discovered in 2009 in the Amazon rainforest in Peru.

Fig. 6.1 shows this frog, *Osteocephalus castaneicola*.

Fig. 6.1

(a) State the genus of this animal.

.....[1]

In the past, anatomy was a way to classify species. DNA is now used to aid the classification of organisms.

(b) **(i)** Draw and annotate a diagram to show the structure of DNA.

[3]

(ii) Describe how DNA can be used to classify organisms.

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.....[2]

(c) DNA controls cell function by controlling the production of proteins.

(i) Proteins are coded for by a length of DNA.

What is the name given to the length of DNA which codes for a protein?

.....[1]

(ii) Describe the role of mRNA in protein synthesis.

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.....[3]

[Total: 10]

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