Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER				

BIOLOGY **0610/42**

Paper 4 Theory (Extended) **May/June 2019**

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 regulated 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 Assessment International Education

[Turn over

1 Biotechnology is used in the process of bread-making.

Fig. 1.1 shows some of the steps in making bread.

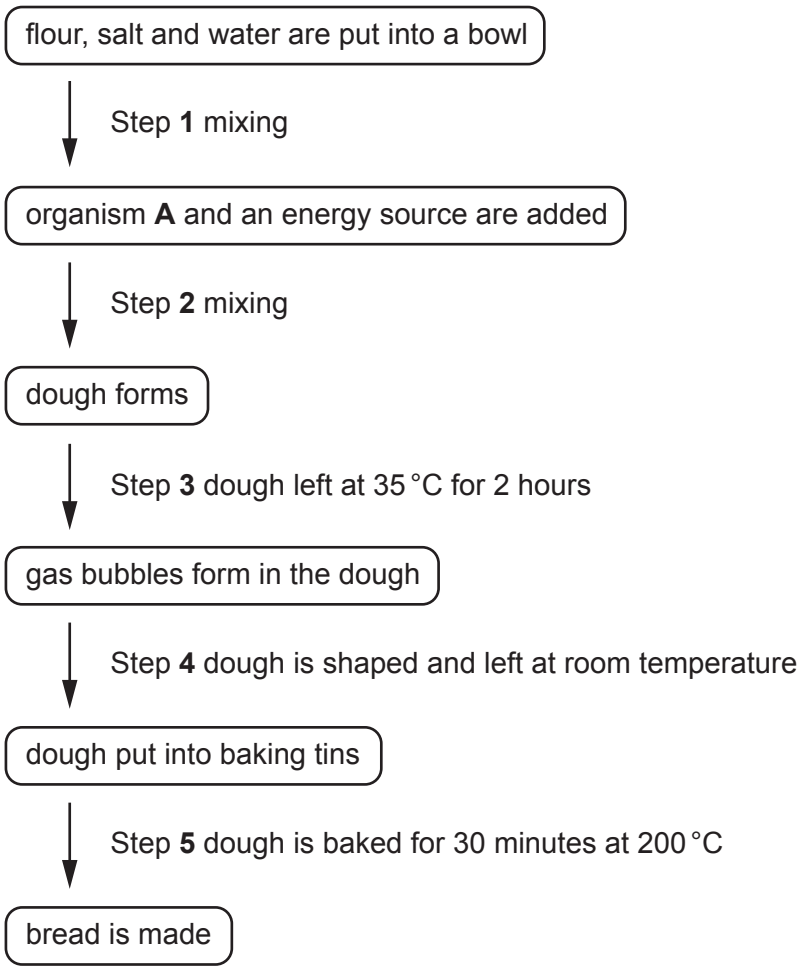

Fig. 1.1

(a) State the name of organism **A** in Fig. 1.1.

..... [1]

(b) **(i)** State the name of the source of energy used by organism **A**.

..... [1]

(ii) State the name of the process that occurs at step **3** that causes gas bubbles to form in the dough.

..... [1]

(iii) State the name of the gas that forms to create the gas bubbles in the dough.

..... [1]

(c) Explain the reasons for the different temperatures used in step **3** and step **5**.

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..... [2]

(d) State the name of **two** products of biotechnology, other than bread, that make use of microorganisms.

1 .....

2 .....
[2]

[Total: 8]

2 The concentration of atmospheric carbon dioxide has increased considerably in recent years.

(a) Describe the possible causes of increased atmospheric carbon dioxide.

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..... [3]

(b) Soybean plants, *Glycine max*, were grown in two separate plots.

Each plot used a carbon dioxide enrichment system to control the atmospheric carbon dioxide concentration.

The atmospheric carbon dioxide concentrations in the two plots were kept at:

- 370 ppm, which is similar to the current atmospheric carbon dioxide concentration
- 550 ppm, which is a possible future atmospheric carbon dioxide concentration.

When the soybean plants were fully grown, scientists calculated the average rates of photosynthesis at regular intervals from 04:00 to 22:00 for both plots.

The results are shown in Fig. 2.1.

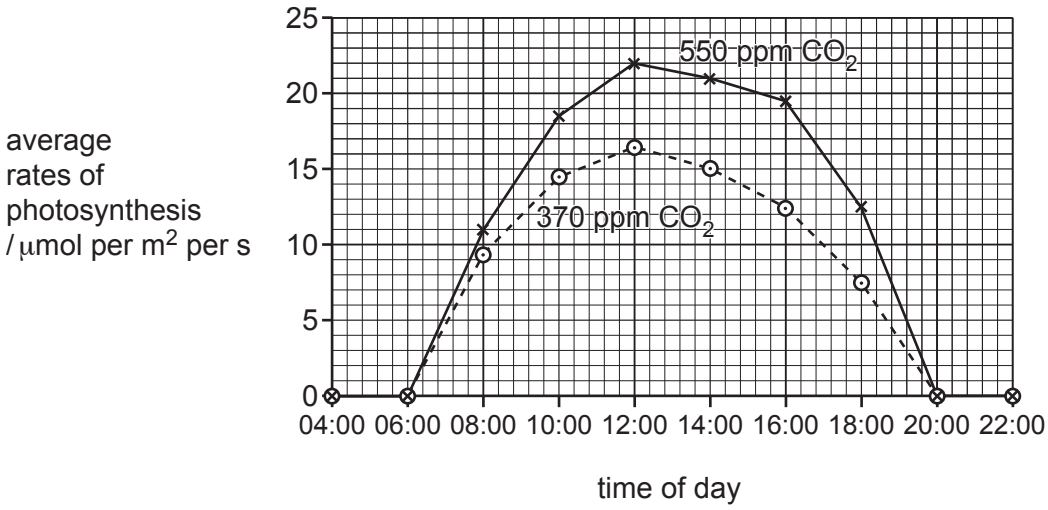

Fig. 2.1

Describe **and** explain the effect of carbon dioxide concentration on the average rates of photosynthesis of the soybean plants from 04:00 to 22:00.

Use the data from Fig. 2.1 in your answer.

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..... [6]

(c) The scientists also made observations of the leaf structure of the soybean plants.

Epidermis and mesophyll tissues are adapted for photosynthesis.

Complete Table 2.1 by stating **two** structural features of each of these tissues **and** explain how each feature is an adaptation for photosynthesis.

Table 2.1

tissue	feature	how the feature is an adaptation for photosynthesis
epidermis	1	.....
	.....	.....
	.....	.....
	2	.....
	.....	.....
	.....	.....
mesophyll	1	.....
	.....	.....
	.....	.....
	2	.....
	.....	.....
	.....	.....

[4]

(d) When the scientists were working in the plot with a carbon dioxide concentration of 550 ppm, their breathing rates were higher than when they worked in the other plot.

Suggest why their breathing rates were higher.

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..... [2]

[Total: 15]

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3 Very small pieces of plastic, called microplastics, are found in many products such as soaps and toothpaste.

Fig. 3.1 shows toothpaste that contains microplastics.

Fig. 3.1

(a) **(i)** It is estimated that microplastics make up 5% of the mass of some toothpastes.

Each person uses approximately 2 g of toothpaste a day.

There were estimated to be 1.2×10^9 people using toothpaste that contained microplastics in some countries in 2013.

Calculate the mass of microplastics contained in the toothpaste used on one day in 2013 for these countries.

Show your working and state appropriate units with your answer.

.....
[3]

(ii) State **one** recommendation, other than regular brushing, for the proper care of teeth.

..... [1]

(b) Lugworms live in sand on coastal beaches and are eaten by wading birds. Lugworms feed on diatoms. Diatoms are photosynthetic protoctists that require ammonium ions as a source of nitrogen. Beach sand contains ammonium ions.

(i) Construct a food chain for these marine organisms.

[2]

(ii) There is some evidence that microplastics affect ammonium ions. Affected ammonium ions cannot be used by diatoms. A group of researchers thought that this could affect lugworms living in sand polluted by microplastics.

The researchers collected 30 healthy lugworms, all with the same initial mass.

They divided them into three groups, **A**, **B** and **C**. Each group contained 10 lugworms.

Each group of lugworms was placed in a bucket containing the same mass of beach sand and ammonium ions and:

A biodegradable microplastics
B non-biodegradable microplastics
C no microplastics.

The measurements that were recorded at the **end** of the investigation are shown in Table 3.1.

Table 3.1

variable measured	group		
	A	**B**	**C**
ammonium ion concentration in the bucket / μmol per dm^3	19.3	47.0	27.4
average respiration rate of lugworms / mg oxygen per hour per g mass	5.2	9.6	5.1
volume of lugworm faeces / cm^3	60.0	25.0	40.0
average lugworm mass / g	9.1	7.0	9.1

Describe **and** explain why the researchers concluded that non-biodegradable microplastics are the most harmful to lugworms.

Use the information in Table 3.1 in your answer.

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..... [4]

(c) Ammonium ions are an important part of the nitrogen cycle. They can be converted into nitrate ions, which are used by plants and protoctists such as diatoms.

(i) State the name of the molecules that are converted into ammonium ions in the nitrogen cycle.

..... [1]

(ii) State the name of the process of converting ammonium ions into nitrate ions.

..... [1]

(iii) Explain the effects of nitrate ion deficiency on plant growth.

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..... [3]

(d) Non-biodegradable plastics are also harmful to terrestrial ecosystems.

Discuss the effects of non-biodegradable plastics on terrestrial ecosystems.

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..... [5]

[Total: 20]

4 Neurones are part of the nervous system. Neurones are connected to each other by synapses.

(a) **(i)** Describe how the structure of a neurone is related to its function.

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..... [3]

(ii) The nervous system is made up of the central nervous system and the peripheral nervous system.

State the names of the organs that make up the central nervous system.

..... [1]

(b) Reflex actions allow the body to respond rapidly to changes in the external environment.

(i) Outline the pathway in a reflex arc in response to shining a bright light into the eye.

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..... [3]

(ii) Doctors sometimes check the reflexes of people who are unconscious.

Suggest why reflexes occur in people who are unconscious.

..... [1]

(c) Fig. 4.1 is a diagram of a synapse and parts of two neurones.

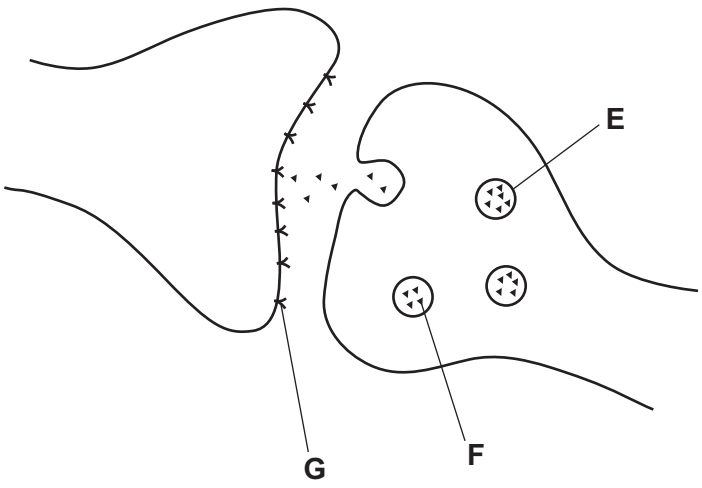

Fig. 4.1

(i) State the names of the labelled parts in Fig. 4.1.

E .....

F .....

G .....
[3]

(ii) Draw an arrow on Fig. 4.1 to show the direction in which the signal travels across the synapse. [1]

[Total: 12]

5 **(a)** The testes are part of the endocrine system because they produce hormones.

(i) State the name of the hormone released from the testes.

..... [1]

(ii) The testes are also part of the reproductive system. This means that the testes are part of two organ systems.

Complete Fig. 5.1 by stating **two** other organs that also belong to **two** organ systems.

One has been completed for you.

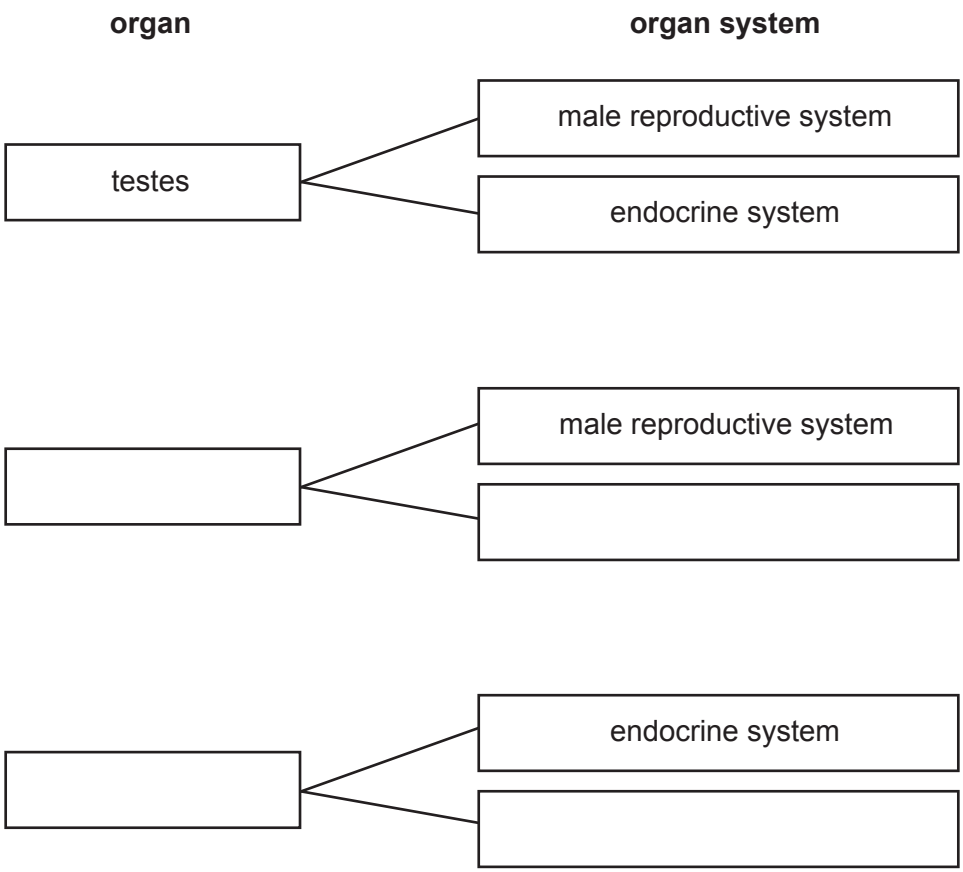

Fig. 5.1

[4]

Fig. 5.2 is a photomicrograph of part of a mammalian testis.

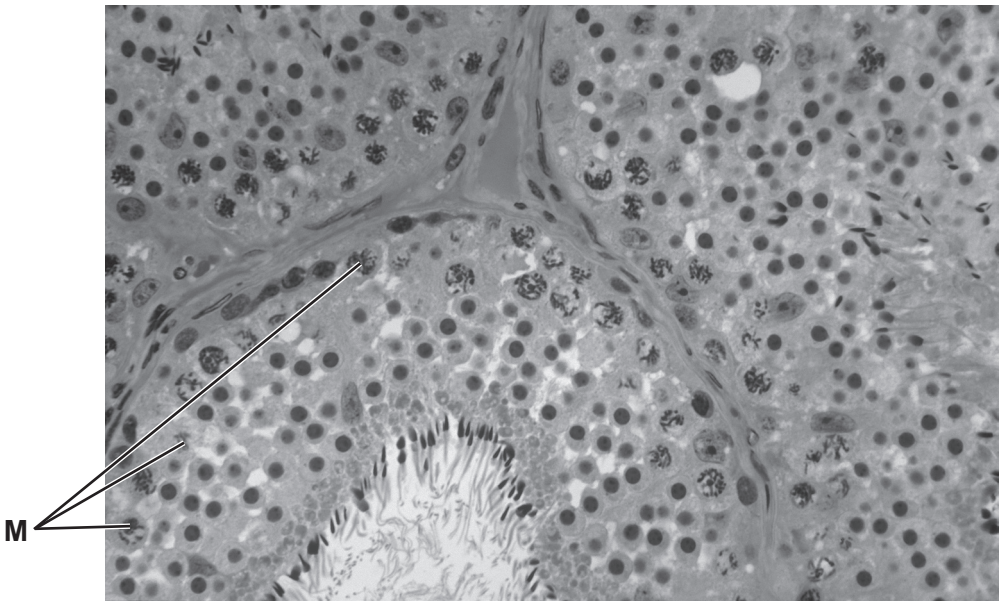

Fig. 5.2

(b) The cells labelled **M** in Fig. 5.2 are undergoing meiosis.

Explain why meiosis is necessary in the testes.

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..... [3]

(c) Fig. 5.3 is a photomicrograph of a section through a sperm.

Fig. 5.3

Table 5.1 shows information about the sperm shown in Fig. 5.3.

Complete Table 5.1.

Table 5.1

letter on Fig. 5.3	name of the structure	function
P		
	haploid nucleus	
		releases energy
	flagellum	

[4]

(d) Draw and label **one** human egg cell.

Include at least one labelled feature that is not found in a sperm cell.

[3]

(e) Describe what happens to a fertilised egg cell before implantation in the uterus.

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..... [3]

[Total: 18]

6 Fig. 6.1 shows some of the many different varieties of potato, *Solanum tuberosum*, that are cultivated across the world for food.

Fig. 6.1

All varieties of *S. tuberosum* are classified as the same species.

(a) Define the term *species*.

.....

.....

..... [2]

(b) Fig. 6.2 shows a method of reproduction that some potato farmers use to produce more potato plants.

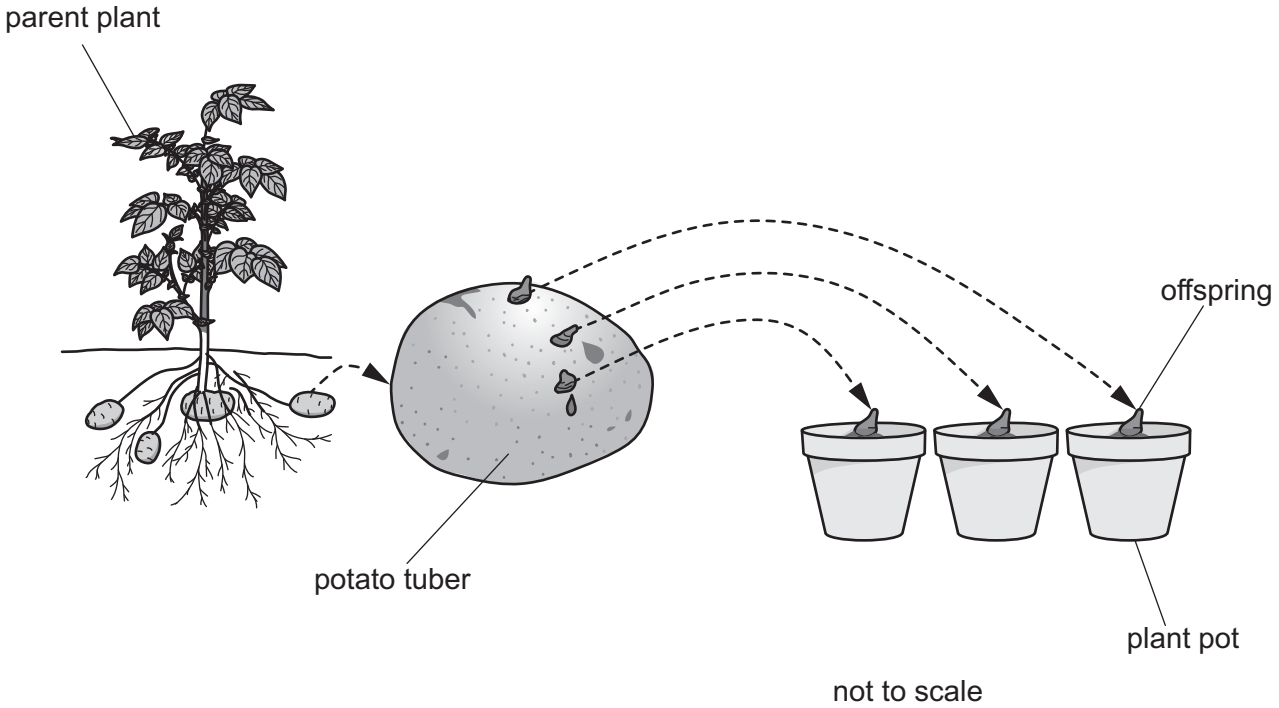

Fig. 6.2

Describe the advantages of the type of reproduction shown in Fig. 6.2 in crop production.

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..... [3]

(c) Potato tubers store starch.

Explain why plants store starch.

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..... [2]

[Total: 7]

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