Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

0893607962

BIOLOGY **9700/21**

Paper 2 AS Level Structured Questions **October/November 2020**

1 hour 15 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 60.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **16** pages. Blank pages are indicated.

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Answer **all** questions.

1 **(a)** Fig. 1.1 is a diagram of a human chromosome at a stage in mitosis.

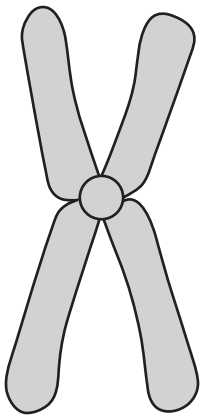


Fig. 1.1

(i) The paragraph describes the structure of the chromosome shown in Fig. 1.1.

Complete the paragraph using the most appropriate term in each space provided.

The chromosome shown in Fig. 1.1 has two genetically identical ..... joined at a ..... . The chromosome is composed of two DNA molecules, each wrapped around proteins known as ..... proteins.

[3]

(ii) State **one** stage during mitosis when the chromosome would appear as shown in Fig. 1.1.

..... [1]

(iii) Suggest the role of ATP in the process of mitosis.

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..... [2]

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(b) Prokaryotes divide by a process known as binary fission.

Fig. 1.2 shows some of the stages in binary fission.

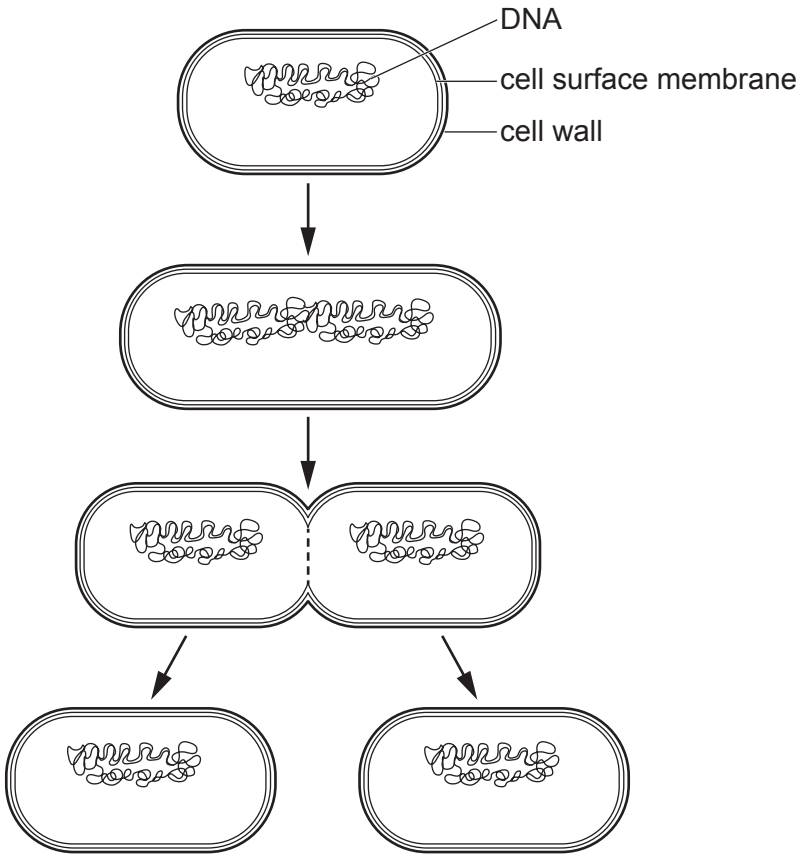


Fig. 1.2

With reference to Fig. 1.2, identify **two** events that occur during binary fission that do **not** occur during mitosis in human cells.

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..... [2]

[Total: 8]

2 **(a)** Fig. 2.1 shows the molecular structure of a triglyceride molecule.

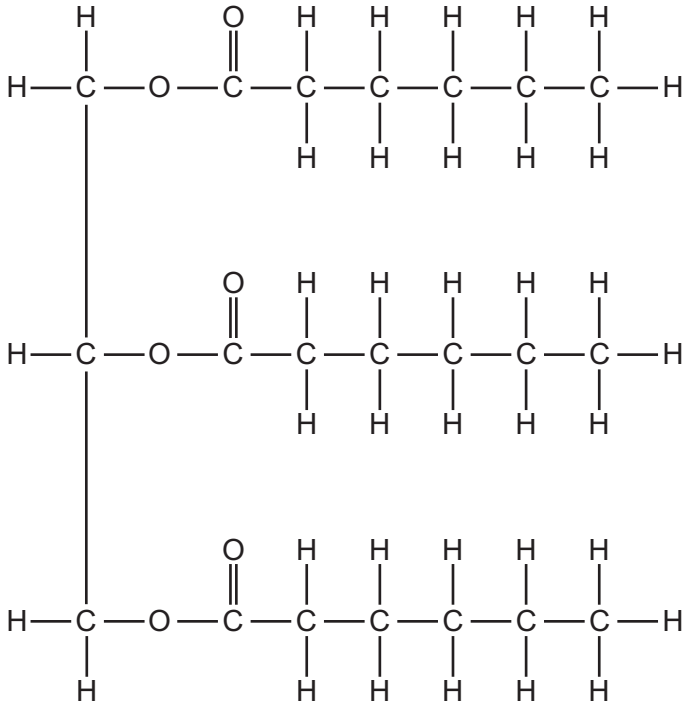


Fig. 2.1

(i) Draw a circle around an ester bond shown in Fig. 2.1. [1]

(ii) Name the type of reaction used to produce a triglyceride from its components.

State the number of water molecules produced during this reaction.

type of reaction .....

number of water molecules produced .....
[2]

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(b) Lipases are enzymes that digest triglycerides in the lumen of the human intestine. These enzymes are released by exocytosis from intestinal epithelial cells.

(i) Underline **all** the terms from the list that are used to describe these lipases.

macromolecule **extracellular enzyme** **fibrous protein** **polysaccharide**

[1]

Scientists have found that treating milk with lipase can improve its taste.

The scientists carried out an experiment to determine the effect of lipase activity on the triglycerides found in milk.

- Lipase was immobilised in alginate beads.
- The pH of a known volume of milk was adjusted to pH 8 by adding an alkali.
- The beads were then mixed with this milk in a beaker.
- The pH of the reaction mixture was recorded over a period of 24 hours.

The results are shown in Fig. 2.2.

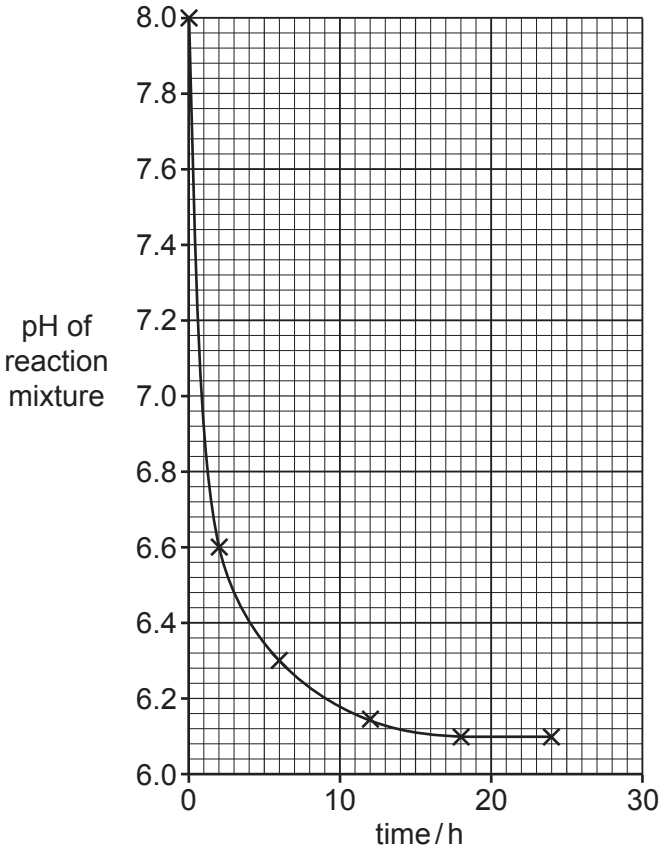


Fig. 2.2

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Fig. 2.2 shows that the pH decreases steeply and then, after 18 hours, remains constant.

(ii) Calculate the time taken for the pH to decrease from pH 6.6 to pH 6.3.

time taken = ... h [1]

(iii) Explain the results shown in Fig. 2.2.

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..... [4]

(iv) The scientists repeated the experiment using a higher concentration of lipase. All other variables remained constant.

Predict how an increase in the concentration of the lipase would affect the results of the experiment.

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..... [2]

[Total: 11]

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[Turn over

3 **(a)** The circulatory system of mammals is a double circulation.

(i) Explain what is meant by the term double circulation.

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.....

..... [1]

(ii) Fig. 3.1 is a photograph showing one valve in the mammalian heart.

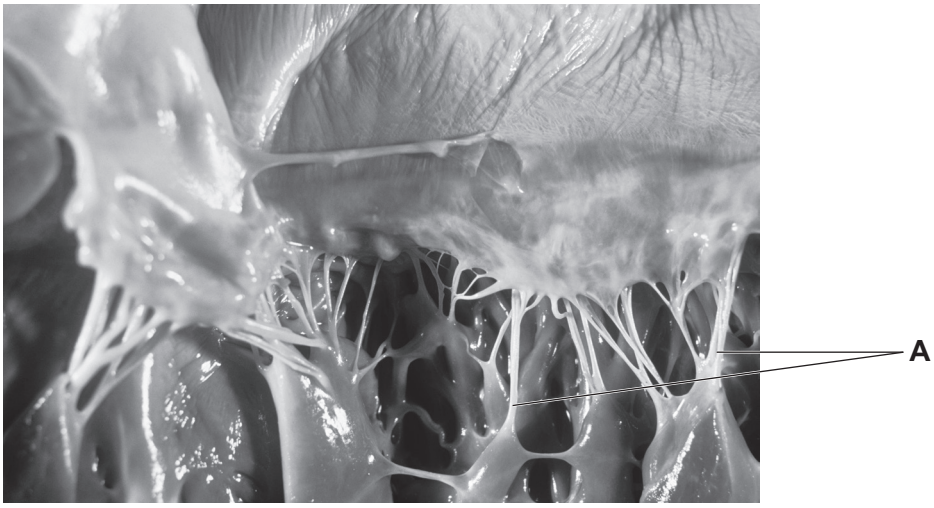


Fig. 3.1

Identify the structures labelled **A** in Fig. 3.1 **and** describe their role during the cardiac cycle.

structure **A** .....

role of structure **A**

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.....

.....

.....

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.....

.....

[3]

(b) The endocardium is a thin layer of tissue lining the chambers of the heart. A serious condition called endocarditis results if bacteria infect this tissue.

Endocarditis is treated with a combination of antibiotics. This increases the effectiveness of the treatment and reduces the risk of antibiotic resistance in bacteria.

Table 3.1 shows the action of two antibiotics used together to treat endocarditis.

Table 3.1

antibiotic used in treatment	action of antibiotic
gentamicin	binds permanently to the bacterial ribosomes
penicillin G	inhibits an enzyme involved in cell wall synthesis

(i) With reference to Table 3.1, explain why treating endocarditis with a combination of gentamicin and penicillin G reduces the risk of developing antibiotic resistance.

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..... [2]

(ii) Describe how the bacteria that cause endocarditis could become resistant to gentamicin.

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..... [3]

[Total: 9]

4 **(a)** Fig. 4.1 is a scanning electron micrograph of a section of a plant cell wall.

In living plant tissue cytoplasmic strands form part of structure **W**.

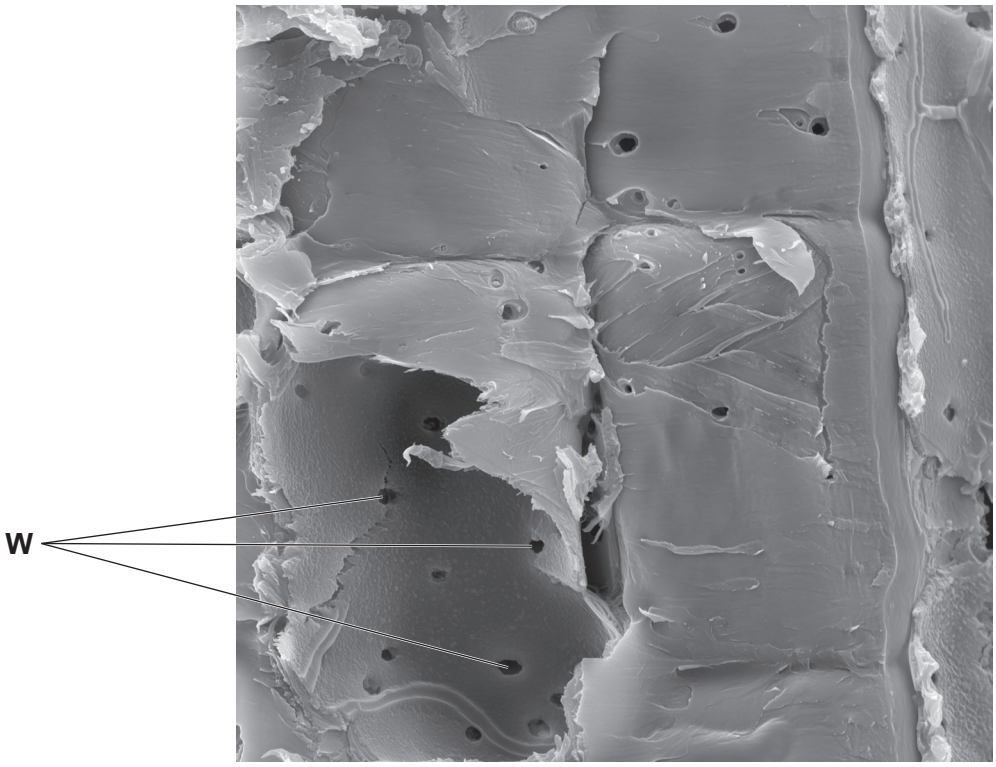


Fig. 4.1

(i) Identify the structures labelled **W** in Fig. 4.1.

..... [1]

(ii) Describe the function of structure **W**.

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..... [2]

(b) Viruses can infect plant cells.

(i) Outline the key structural features of a virus.

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..... [2]

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(ii) Many plant viruses can travel through the plant to enter companion cells in the phloem tissue. The viruses then travel with assimilates in the phloem sap to other areas of the plant.

Explain the mechanism that allows assimilates and viruses to travel through phloem sieve tubes to other areas of the plant.

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..... [5]

[Total: 10]

5 **(a)** Fig. 5.1 is a photomicrograph of a section through the lungs showing a bronchus and some alveoli.

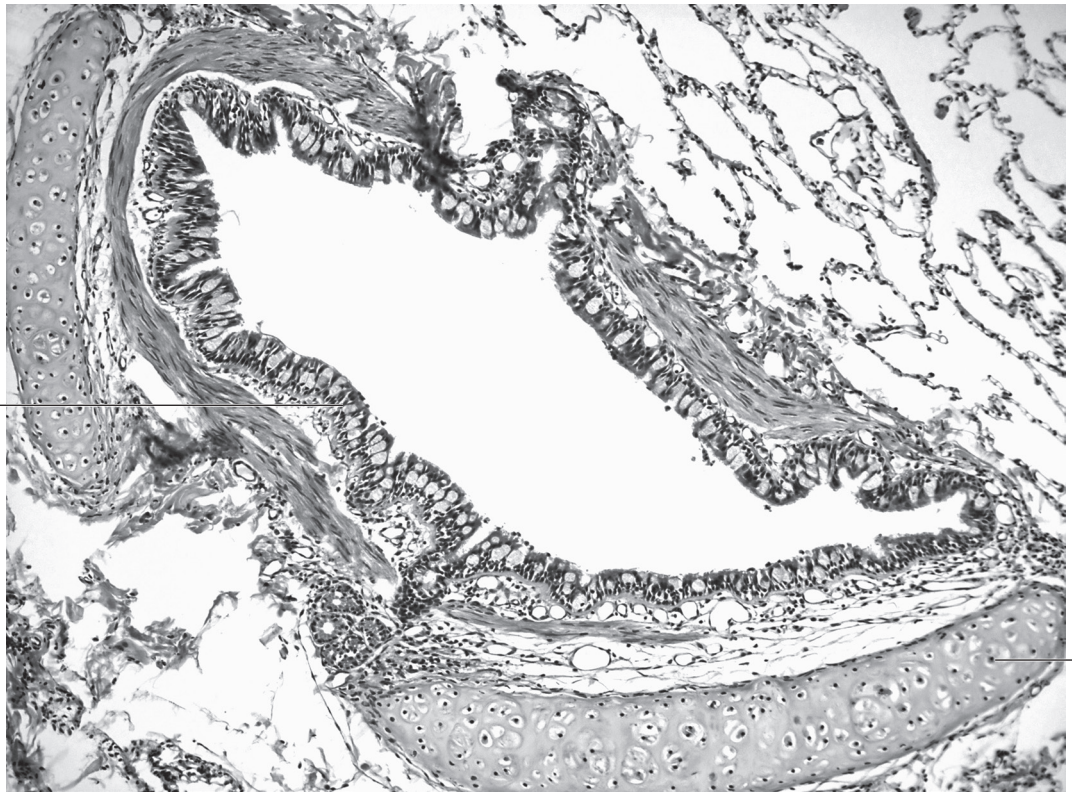


Fig. 5.1

(i) State the function of tissue **X** labelled in Fig. 5.1.

.....

..... [1]

(ii) Describe how the distribution of tissue **X** in the trachea differs from that shown in Fig. 5.1.

.....

..... [1]

(iii) Describe how the epithelial tissue, **Y**, is adapted for its function.

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..... [2]

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(b) Fig. 5.2 is a photograph of two African elephants, *Loxodonta africana*.



Fig. 5.2

(i) Describe the difference in surface area to volume ratio between the adult elephant and baby elephant shown in Fig. 5.2.

.....

..... [1]

(ii) Suggest why animals such as elephants require a gas exchange system.

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..... [3]

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[Turn over

(iii) The feet of elephants are protected by structures under the skin known as cushions. The cushions are made up of a large number of cells surrounded by connective tissue containing many fibres of collagen. The fibres help to maintain the structure of the cushion.

The collagen fibres are made of collagen molecules.

Describe the structure of a **collagen molecule**.

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..... [4]

(iv) The cushion in the foot is very strong and is able to resist extremely large forces acting on it due to the large mass of the elephant.

Suggest how the structure of a **collagen fibre** can help the cushion resist these large forces.

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.....

..... [1]

[Total: 13]

6 **(a)** Mutations in body cells can sometimes result in a tumour. Some tumours are cancerous.

(i) Outline how mutations can result in the development of a tumour.

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..... [2]

(ii) Tumour cells have antigens on their cell surface that are not present on non-tumour cells.

These antigens are the result of gene mutations and are known as tumour specific antigens (TSA).

One type of TSA differs in structure from the protein found on the cell surface of non-tumour cells by a single amino acid.

Explain how a gene mutation could result in the production of this TSA.

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..... [2]

Question 6 continues on page 16

(b) Immunotherapy is a form of treatment for cancer which aims to stimulate the immune system to destroy tumour cells.

One form of immunotherapy for cancer uses a vaccine which contains one specific type of TSA.

(i) Describe how vaccination with a specific type of TSA could lead to the destruction of tumour cells by T-lymphocytes in the body.

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..... [3]

(ii) Vaccines that contain tumour cells instead of a TSA are being developed for use during immunotherapy. Tumour cells are removed from a patient's body and used in a vaccine for the patient.

Suggest **one** advantage and **one** disadvantage of using a patient's tumour cells in a vaccine rather than a TSA.

advantage .....

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disadvantage .....

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[2]

[Total: 9]

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