Cambridge International AS & A Level

**Cambridge Assessment International Education**
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

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*0797061498*

**BIOLOGY** **9700/21**

Paper 2 AS Level Structured Questions **October/November 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 document consists of **16** printed pages.


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Answer **all** questions.

**1** Fig. 1.1 shows the structure of the amino acid glycine.

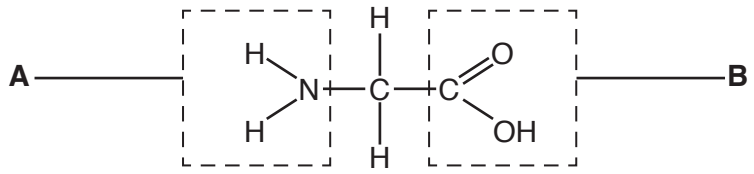



**Fig. 1.1**

**(a) (i)** Name the parts of the amino acid molecule labelled **A** and **B** in Fig. 1.1.

**A** .....

**B** .....

[2]

**(ii)** Amino acids are monomers used to build proteins.

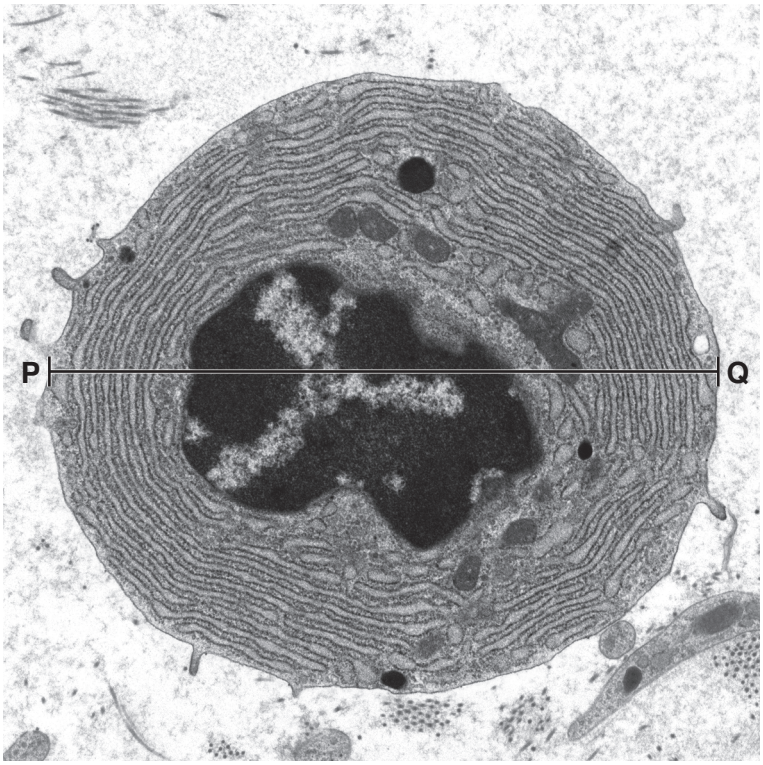
Complete Fig. 1.2 by drawing a diagram to show the formation of a peptide bond between two molecules of glycine.




**Fig. 1.2** [3]

**(b)** Plasma cells synthesise and secrete antibodies.

Fig. 1.3 is a transmission electron micrograph showing a plasma cell.




magnification ×6000

**Fig. 1.3**

**(i)** Use a label line and the label **T** on Fig. 1.3 to identify where the genes coding for the polypeptide chains of the antibodies are located. [1]

**(ii)** Calculate the actual diameter of the plasma cell shown by the line **P**–**Q**.

Write down the formula used to make your calculation.

Show your working and give your answer to the nearest micrometre (μm).

| *formula* |
| --- |
| |

actual diameter = .....μm [2]

**(iii)** The plasma cell in Fig. 1.3 is very metabolically active.

Suggest why there are very few mitochondria visible in the electron micrograph in Fig. 1.3.

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.....

..... [1]

**(c)** Sieve tube elements in plants have very few organelles such as mitochondria.

Explain how having very few organelles is an adaptation of the sieve tube element to its function.

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..... [2]

[Total: 11]

**2** Fig. 2.1 is a transmission electron micrograph showing the bacterial pathogen that causes tuberculosis (TB).

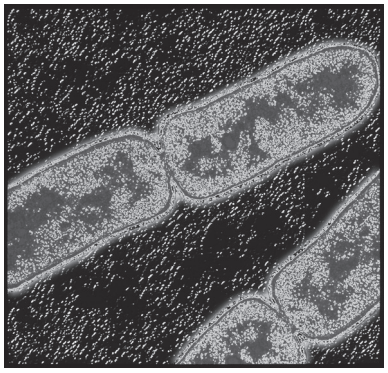


**Fig. 2.1**

**(a) (i)** Name the pathogen shown in Fig. 2.1 that causes TB.

..... [1]

The World Health Organization (WHO) introduced a strategy in 2015 to end the global TB epidemic.

An important part of the strategy is to:
- identify people at risk of becoming infected with TB
- use methods to prevent transmission of TB.

The BCG vaccination is one method of prevention recommended for use in countries where TB is common. The BCG vaccine contains a non-pathogenic, living form of the microorganism that causes TB.

**(ii)** Complete Table 2.1 by using a tick (✓) to identify the type of immunity that develops in a person who has been given the BCG vaccination.

**Table 2.1**

| | |
|---|---|
| artificial active immunity | |
| artificial passive immunity | |
| natural active immunity | |
| natural passive immunity | |

[1]

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**[Turn over**

**(b)** Rifampicin is one of the antibiotics used to treat TB.

Rifampicin inhibits RNA polymerase in bacterial cells by binding to a site other than the active site. This prevents polypeptide synthesis.

**(i)** Suggest **and** explain how rifampicin prevents polypeptide synthesis in bacterial cells.

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..... [3]

Some bacteria have developed resistance to rifampicin. However, they are still susceptible to the other antibiotics that can be used to treat TB.

Multi-drug resistant bacteria have developed resistance to at least two drugs, including rifampicin.

WHO collects data from all countries on the number of cases of TB caused by rifampicin-resistant bacteria (RR-TB) and multi-drug resistant bacteria (MDR-TB).

Fig. 2.2 shows the reported number of cases of TB between 2009 and 2013.

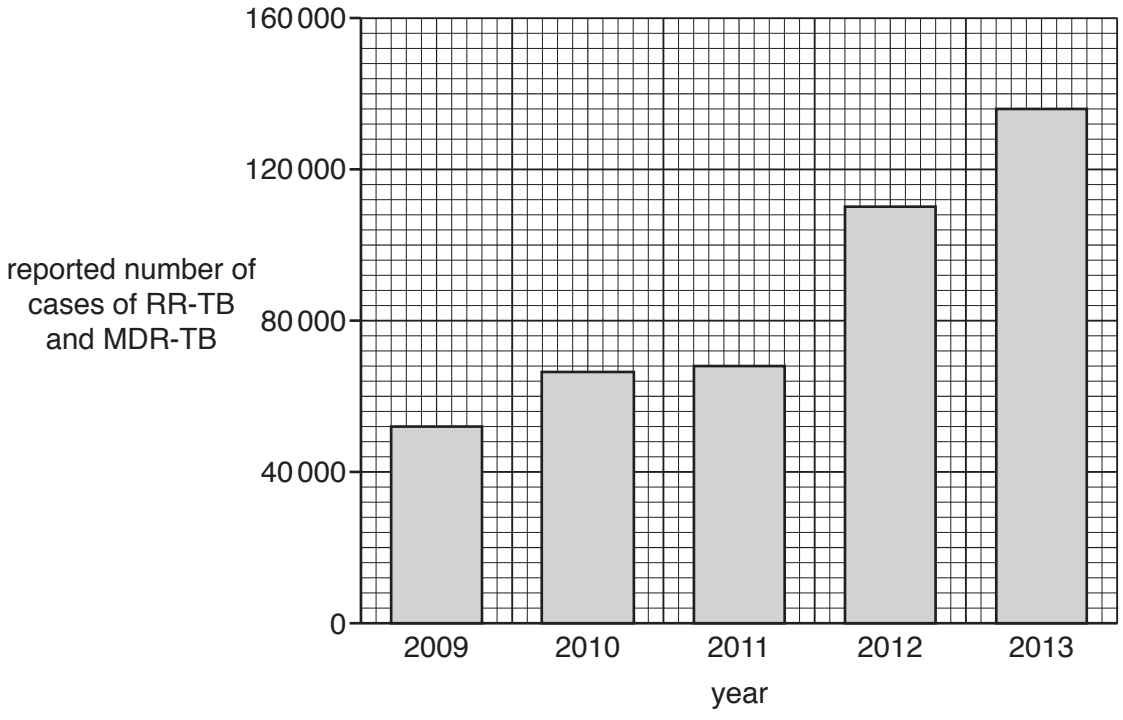



**Fig. 2.2**

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**(ii)** Describe the trend shown by the data in Fig. 2.2.

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..... [2]

**(iii)** Explain how resistance to drugs such as rifampicin develops.

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..... [4]

[Total: 11]

**3** A student carried out an experiment to investigate the effect of increasing the concentration of sucrose solution on the mass of potato tissue.

- Potato tissue was cut into cylinders of equal length and diameter.
- The mass of each cylinder was recorded.
- Each cylinder was put into a solution of sucrose, as shown in Fig. 3.1.

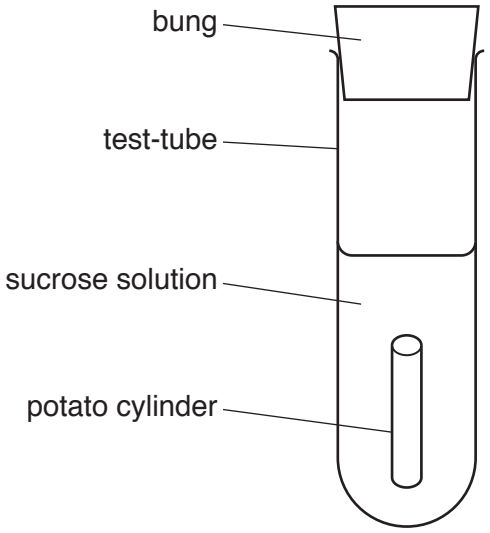



**Fig. 3.1**

- After one hour each cylinder was removed, blotted dry and reweighed.
- The percentage change in mass of each cylinder was calculated.
- The experiment was repeated three times.
- The mean percentage change in mass of the potato cylinders in each sucrose solution was calculated.

Fig. 3.2 shows the results of this investigation.

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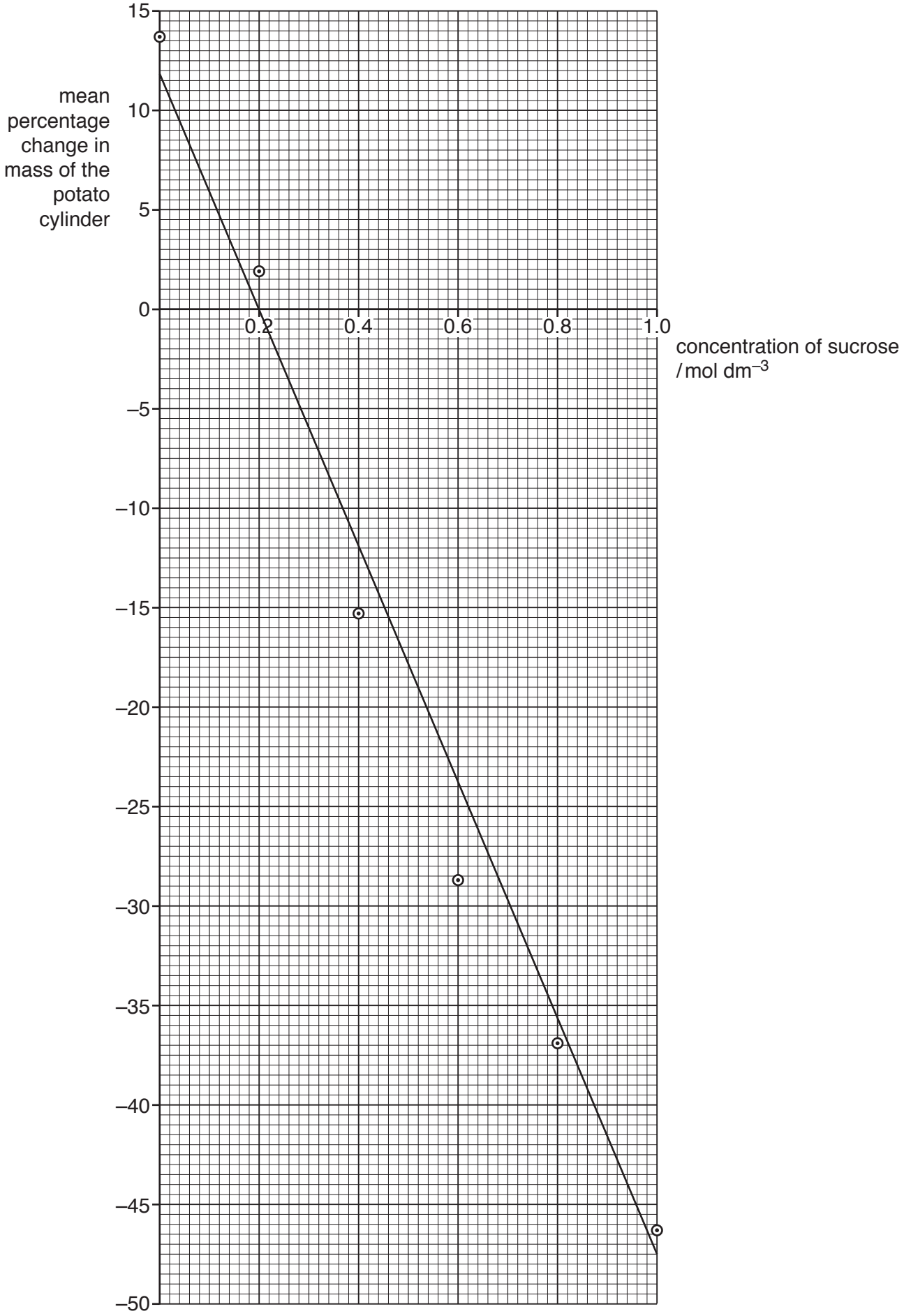



**Fig. 3.2**

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**[Turn over**

**(a)** With reference to Fig. 3.2, describe the effect of increasing the concentration of sucrose solution on the mass of the potato cylinders.

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..... [3]

**(b)** Explain why there was a change in mass for the potato cylinders in 0.6 mol $dm^{-3}$ sucrose solution.

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..... [3]

[Total: 6]

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**4** **(a)** Fig. 4.1 is a photomicrograph of a human blood smear.

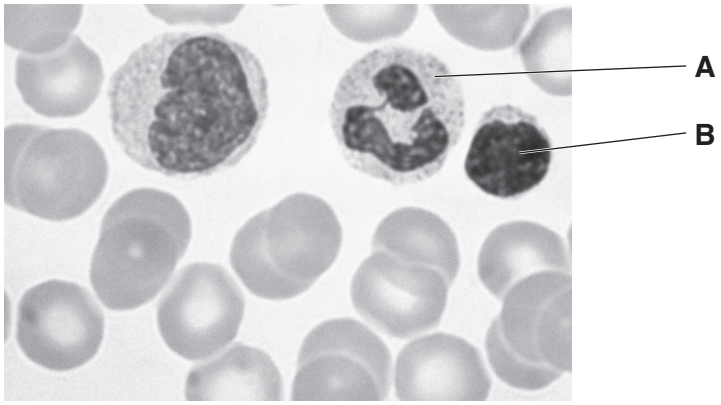



**Fig. 4.1**

Name the cells labelled **A** and **B** in Fig. 4.1.

**A** .....

**B** .....

[2]

**(b)** Blood and lymph are both fluids that transport substances within the human body.

**(i)** Table 4.1 shows components found in both blood and lymph.

Complete Table 4.1 to show whether the concentration of each of these components is **higher** or **lower** or the **same** in the lymph, when compared with the concentration in the blood in the aorta.

You may use the words **higher** or **lower** or **same** once, more than once or not at all.

**Table 4.1**

| component | concentration **in lymph** compared to the concentration in blood in the aorta |
|---|---|
| oxygen | |
| carbon dioxide | |
| red blood cells | |

[2]

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**[Turn over**

**(ii)** The presence of a pathogen infecting the body leads to an increase in the concentration of protein in lymph.

Suggest an explanation for this increase in protein concentration.

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..... [2]

**(c)** Blood is circulated around the body by the heart.

The action of the heart is coordinated and controlled by structures located in its walls, such as the sinoatrial node (SAN) and the atrioventricular node (AVN).

**(i)** Describe the role of the SAN.

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..... [2]

**(ii)** In a healthy heart, the AVN provides the only pathway for electrical impulses to travel from the atria to the ventricles.

The bundle of Kent is a structure found in the heart in a small number of people.

Some electrical impulses do not pass through the AVN but travel directly from the atria to the ventricles through the bundle of Kent.

Suggest **and** explain the effects that the presence of the bundle of Kent may have on heart rate.

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..... [3]

[Total: 11]

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**5** Myasthenia gravis is a condition that results in muscle weakness by affecting the immune response.

**(a)** Explain what is meant by the term *immune response*.

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..... [2]

**(b)** Myasthenia gravis is an autoimmune disease which disrupts a cell signalling pathway involving muscle cells.

**(i)** Suggest how the immune system acts to disrupt this cell signalling pathway.

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..... [3]

Enzyme **Y** is found in the cell surface membrane of muscle cells. Enzyme **Y** acts to break down the cell signalling molecules which trigger muscle contraction when they are no longer needed.

**(ii)** Using the induced fit hypothesis of enzyme action, explain how enzyme **Y** breaks down the cell signalling molecules.

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..... [4]

**(c)** Rituximab is a monoclonal antibody used in the treatment of myasthenia gravis.

Rituximab acts against the cell surface membrane protein CD20. This protein is found on the surface of the B-lymphocytes that cause myasthenia gravis.

Explain the advantages of using monoclonal antibodies in the treatment of diseases such as myasthenia gravis.

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..... [3]

[Total: 12]

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**6** **(a)** Outline the role of DNA polymerase in the replication of DNA.

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..... [3]

**(b)** Floxuridine is a drug used to treat cancer.

**(i)** Floxuridine inhibits DNA replication.

Suggest why the inhibition of DNA replication is an effective treatment for cancer.

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..... [1]

**(ii)** Floxuridine prevents thymine nucleotides being produced.

Explain why floxuridine does **not** affect transcription.

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..... [1]

**(c)** Fig. 6.1 is a scanning electron micrograph of a lung cancer cell in a stage of the cell cycle.

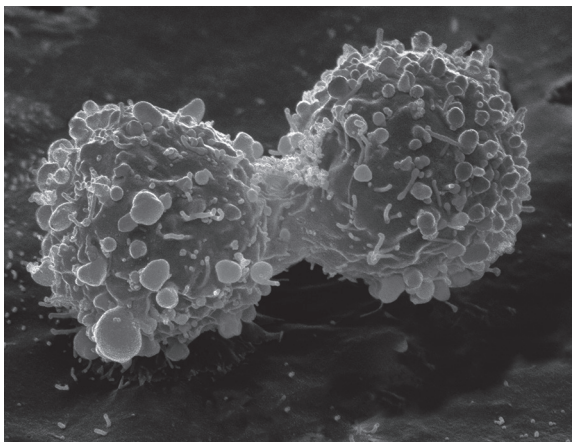


**Fig. 6.1**

**(i)** Name the stage of the cell cycle occurring in Fig. 6.1.

..... [1]

**(ii)** Explain why smoking tobacco increases the risk of developing lung cancer.

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..... [3]

[Total: 9]

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