Cambridge International AS & A Level

Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

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1887784298

BIOLOGY **9700/22**

Paper 2 AS Level Structured Questions **February/March 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 and Fig. 1.2 are photomicrographs of sections through the leaves of two different plants.

Fig. 1.1 is a photomicrograph of a section through a leaf of Cornish heath, *Erica vagans*.

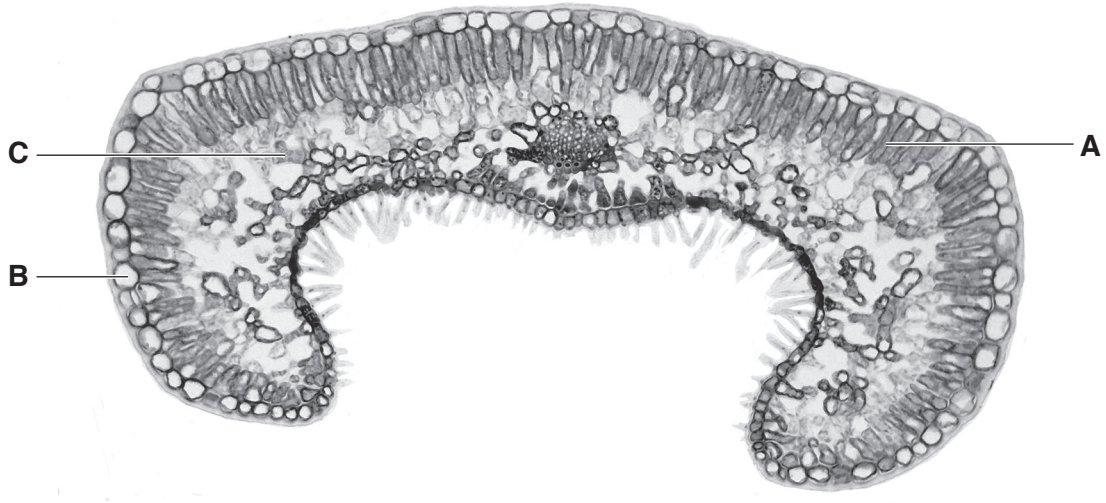


Fig. 1.1

Fig. 1.2 is a photomicrograph of a section through a leaf of Himalayan cedar, *Cedrus deodara*.

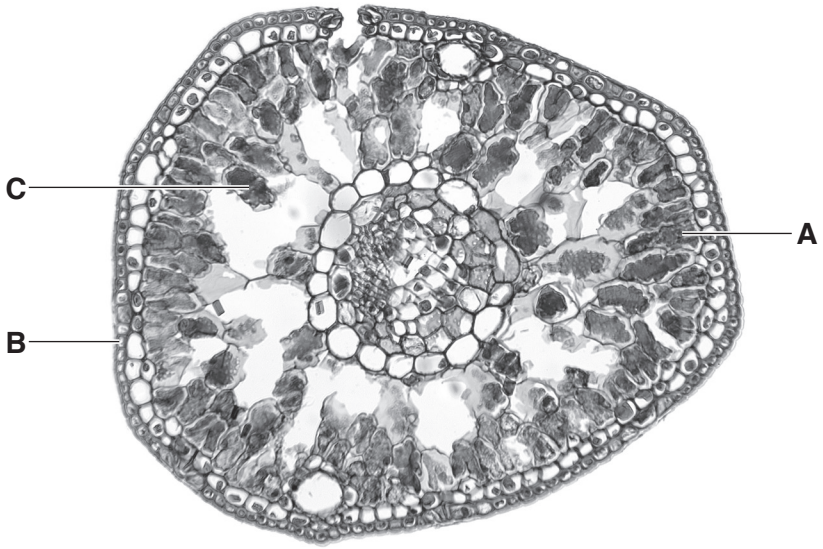


Fig. 1.2

Fig. 1.1 and Fig. 1.2 are not shown at the same magnification.

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(a) Cells labelled **A**, **B** and **C** in Fig. 1.1 and Fig. 1.2 each form a different tissue.

Name each tissue formed.

tissue formed from **A** .....

tissue formed from **B** .....

tissue formed from **C** .....

[3]

(b) *Erica vagans* and *Cedrus deodara* are xerophytic plants.

With reference only to xerophytic features, describe the **differences** between the leaves of *E. vagans* and *C. deodara* **visible** in Fig. 1.1 and Fig. 1.2.

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(c) Transpiration is a consequence of gas exchange in leaves.

Explain why the rate of transpiration is greater during the day than during the night.

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..... [3]

[Total: 9]

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[Turn over

2 In mammalian red blood cells, carbonic anhydrase has an important role in the transport of carbon dioxide.

Carbonic anhydrase is an enzyme.

(a) Outline the features of an enzyme.

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(b) Complete Fig. 2.1 to show the reversible reaction involving carbonic anhydrase that takes place within red blood cells.

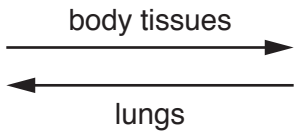


Fig. 2.1

[2]

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(c) A ribbon structure of a molecule of carbonic anhydrase is shown in Fig. 2.2. The zinc ion is associated with the active site of the enzyme and is essential for the enzyme to function.



Fig. 2.2

The molecule of carbonic anhydrase has primary, secondary and tertiary structure.

Explain the extent to which Fig. 2.2 shows the primary, secondary and tertiary structure of carbonic anhydrase.

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[Total: 10]

3 In 2015, the World Health Organization (WHO) published the Global Technical Strategy for Malaria 2016–2030. The aim of this global strategy, which follows on from the 2008 Global Malaria Action Plan (GMAP), is to make progress in the control and elimination of malaria.

Both the global strategy and GMAP aim to reduce:

- the case incidence (number of new cases each year) of malaria
- the mortality rate (number of deaths each year) from malaria.

(a) Fig. 3.1 shows data for the four countries in the WHO Western Pacific Region that had the highest proportion of cases of malaria in 2015.

For each of these four countries, the percentage change in the case incidence and the percentage change in the mortality rate over the five-year period from 2010 to 2015 are shown.

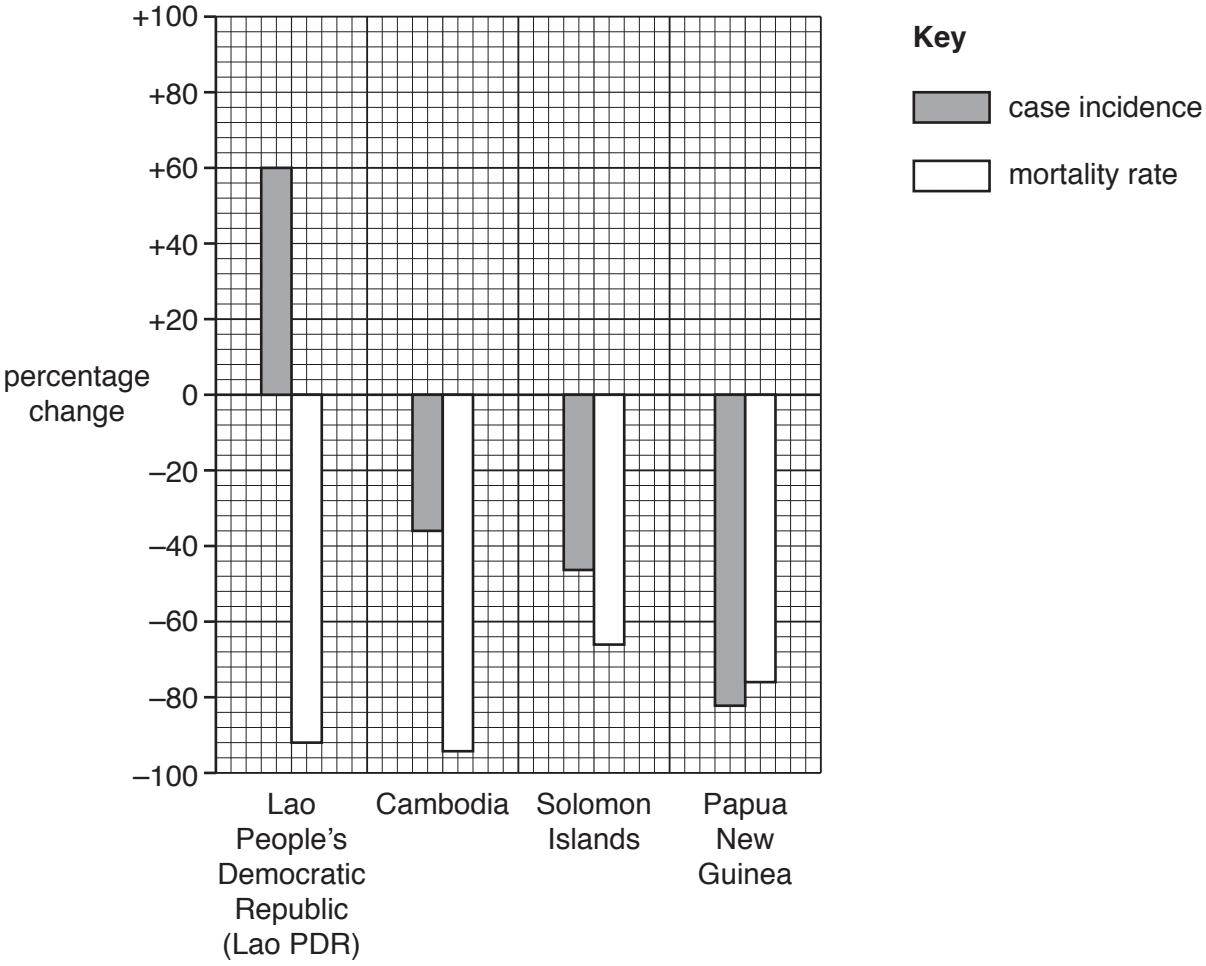


Fig. 3.1

(i) With reference to Fig. 3.1, describe the progress made in the control of malaria in the four countries between 2010 and 2015.

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..... [4]

(ii) All the countries shown in Fig. 3.1 supplied households at risk of malaria with insecticide-treated nets (ITNs). This is one of the recommendations in the GMAP and the global strategy.

Describe **and** explain the role of ITNs.

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..... [2]

(b) Another recommendation of the global strategy is to carry out rapid diagnostic testing (RDT) of individuals who may have malaria. This involves testing human blood samples for the presence of proteins specific to *Plasmodium*. Test sticks can be used.

Table 3.1 contains information about two RDT test sticks.

Table 3.1

test stick	***Plasmodium* protein tested for**	**species of *Plasmodium* that produce the protein**
1	pLDH (parasite lactate dehydrogenase)	*P. vivax* *P. falciparum* *P. ovale* *P. malariae*
2	HRP-2 (histidine-rich protein 2)	*P. falciparum* only

Some details of the design of these RDT test sticks are shown in Fig. 3.2.

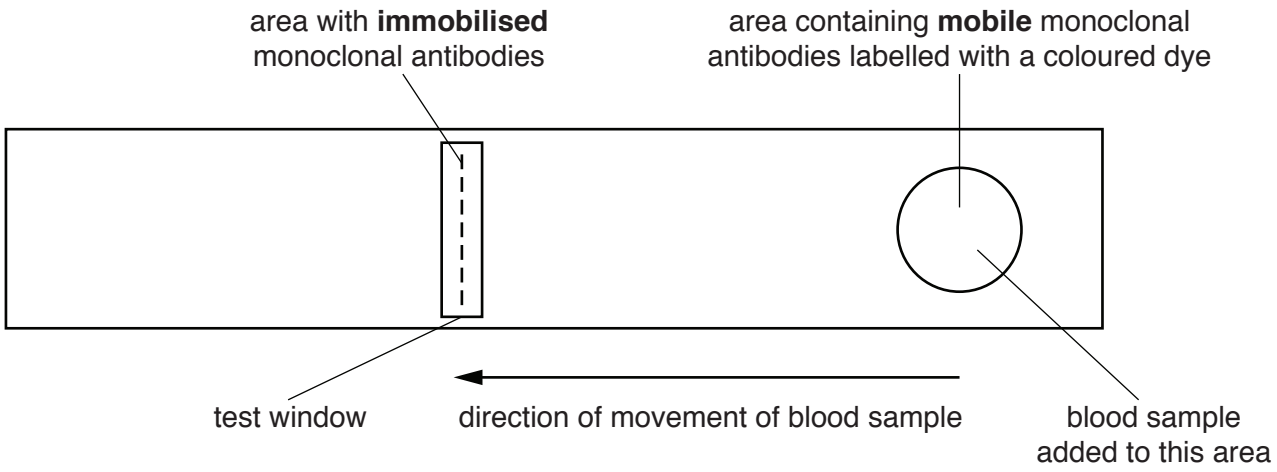


Fig. 3.2

The **immobilised** monoclonal antibodies in the test window are not visible.

If the blood sample contains a *Plasmodium* protein that can be detected by the RDT test stick:

- the **mobile** monoclonal antibodies bind to one part of the protein
- the **immobilised** monoclonal antibodies bind to another part of the protein
- a coloured line in the test window indicates a positive result for the protein.

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(i) With reference to Table 3.1 and Fig. 3.2, explain why test stick 1 and test stick 2 will contain **different** mobile monoclonal antibodies.

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..... [2]

(ii) Two blood samples were removed from a person. One sample was added to test stick 1 and the other sample was added to test stick 2.

With reference to Table 3.1 and Fig. 3.2, explain what can be diagnosed for this person from a **positive** result for test stick 1 and a **negative** result for test stick 2.

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..... [2]

[Total: 10]

4 In a double circulatory system, blood passes through the heart twice in one complete circuit of the body. The complete circuit consists of the pulmonary circulation and the systemic circulation.

(a) Fig. 4.1 is a diagram of a vertical section through the mammalian heart. The differences in the thickness of cardiac muscle in the walls of the four chambers of the heart are shown.

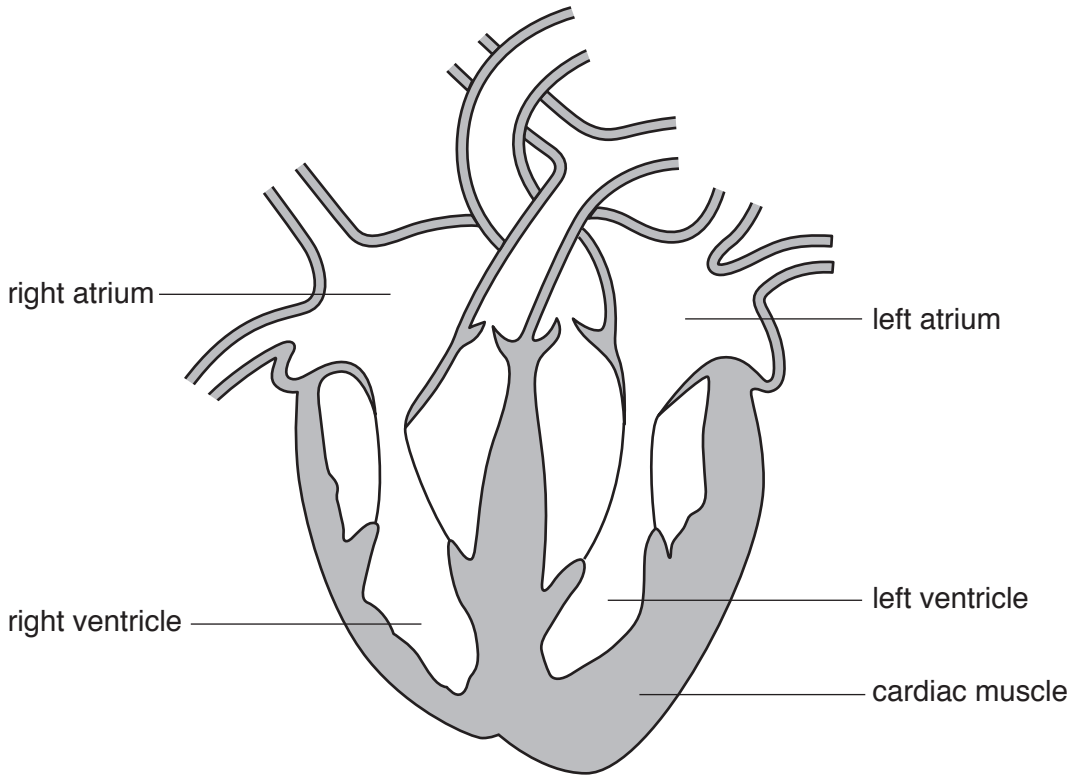


Fig. 4.1

Explain, with reference to their functions, the difference in the thickness of the walls of the left ventricle and right ventricle of the heart.

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..... [3]

(b) The alveolus is the gas exchange surface in mammals. For efficient oxygen uptake, a steep diffusion gradient is maintained between the alveolar air and the blood.

Suggest how the steep diffusion gradient for oxygen is maintained at the gas exchange surface.

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..... [2]

(c) Compared to when they were non-smokers, the ability of people who smoke tobacco to deliver oxygen to their body tissues is reduced. Two causes of this reduction include:

- a decrease in the volume of air per breath moving towards the alveoli
- a decrease in the ability of red blood cells to carry oxygen.

(i) Suggest **one** reason why smoking tobacco, even after only a short time, may cause a decrease in the volume of air per breath moving towards the alveoli.

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..... [1]

(ii) Explain why smoking tobacco causes a decrease in the ability of red blood cells to carry oxygen.

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..... [2]

[Total: 8]

5 Human prolactin (hPRL) is a globular protein. It is a single polypeptide composed of 199 amino acids. The protein is transported in the bloodstream and has an effect only on cells that have a cell surface membrane protein known as PRLR.

One effect of hPRL is to stimulate cells in the mammary glands to produce breast milk. Cells that have been stimulated by hPRL need more glucose and therefore the passive uptake of glucose increases.

(a) State **one** reason why the cells in the mammary glands that have been stimulated by hPRL need more glucose.

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..... [1]

(b) An experiment was carried out to investigate the movement of glucose and hPRL across Visking tubing membrane.

- A short section of Visking tubing, tied at both ends and containing distilled water, was placed into a beaker containing a solution of glucose and hPRL.
- After 20 minutes, separate samples of the solution in the Visking tubing and the solution in the beaker were each tested for the presence of protein and reducing sugar.

A summary of the methods used, the experimental results and the deductions made are shown in Table 5.1.

Table 5.1

sample	method used	colour obtained after testing	deduction
solution in Visking tubing	biuret solution added to sample		protein absent from solution in Visking tubing
solution in beaker			protein present in solution in beaker
solution in Visking tubing	Benedict's solution added to sample and mixture heated in a water-bath		reducing sugar present in solution in Visking tubing
solution in beaker			reducing sugar present in solution in beaker

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(i) Complete the column in Table 5.1 headed **colour obtained after testing**. [2]

(ii) With reference to the deductions made in Table 5.1, explain the movement of hPRL and reducing sugar across Visking tubing membrane.

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(c) Outline how glucose crosses the cell surface membranes of the cells of the mammary glands.

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(d) The production of milk by the cells of the mammary glands involves the action of several different enzymes. The cell surface membranes of these cells contain the membrane protein PRLR.

Fig. 5.1 shows an outline summary of hPRL involvement in the production of breast milk.

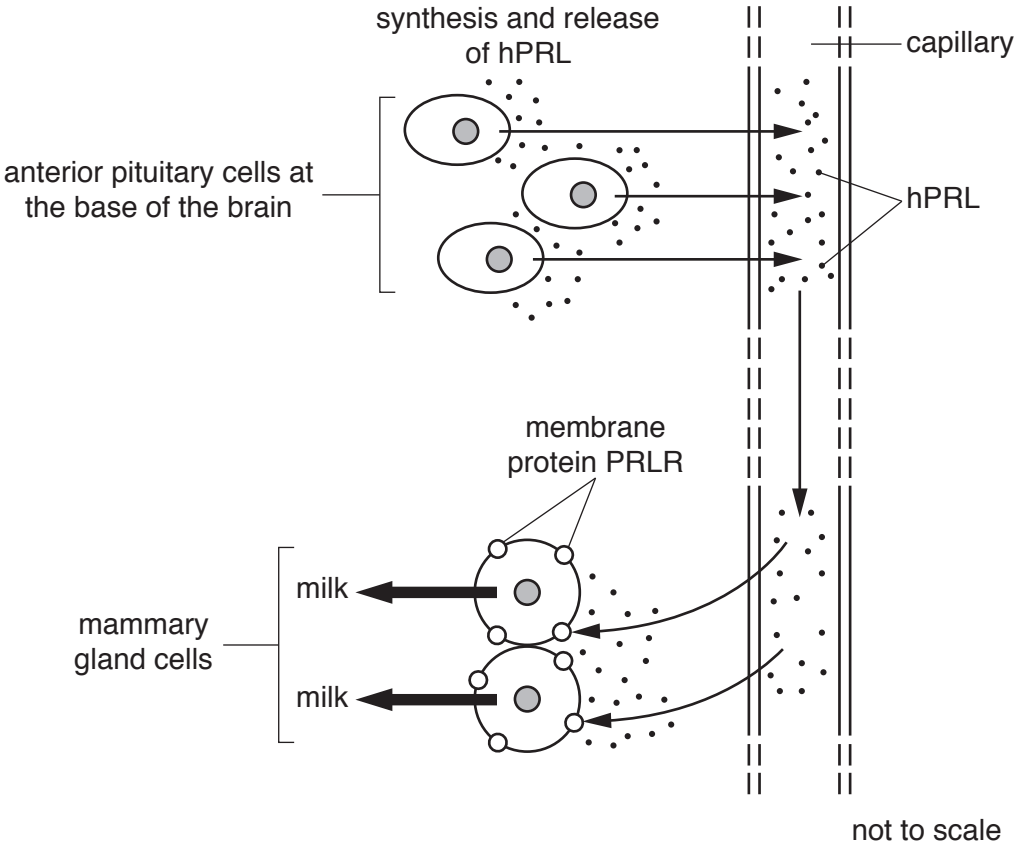


Fig. 5.1

Explain why the production of breast milk can be described as an example of a cell signalling process.

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..... [4]

[Total: 11]

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6 Plant and animal cells carry out mitosis to form two genetically identical cells from one original cell.

(a) State **other** reasons why mitosis is important in **both** plants and animals.

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..... [2]

(b) Plant cells require microtubules to form structures that are needed for mitosis.

Name **one** of these structures.

..... [1]

(c) During the mitotic cell cycle, free nucleotides are used for the synthesis of both types of nucleic acid: RNA and DNA.

Complete sentences **A**, **B**, **C** and **D** to provide information about nucleotides and the synthesis of nucleic acids.

Write the correct term in the spaces provided in each sentence.

A Each nucleotide has three main components: a ..... group, a ..... (5 carbon) sugar and a nitrogenous organic base.

B The nitrogenous organic base of a nucleotide is either a purine or a ..... .

C In a DNA nucleotide, the sugar is deoxyribose and in an RNA nucleotide the sugar is ..... .

D The synthesis of RNA from a template strand of DNA is known as ..... .

[5]

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[Turn over

(d) A virus named *Pandoravirus salinus* was discovered in 2013 by French scientists.

The virus was so large that the scientists initially thought that *P. salinus* was a bacterium.

P. salinus was confirmed to be a virus after further research.

(i) List **three** key features of viruses.

1 .....

2 .....

3 .....

[3]

(ii) The dimensions of viruses are usually stated in nanometres (nm).

As *P. salinus* is so big, it has been described as 1 μm long and 0.5 μm wide.

Convert the **width** of *P. salinus* to nanometres.

width = ... nm [1]

[Total: 12]

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