Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

1000849265

BIOLOGY **9700/21**

Paper 2 AS Level Structured Questions **October/November 2018**

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 **15** printed pages and **1** blank page.

CAMBRIDGE International Examinations

Answer **all** questions.

1 Fig. 1.1 shows the human gas exchange system.

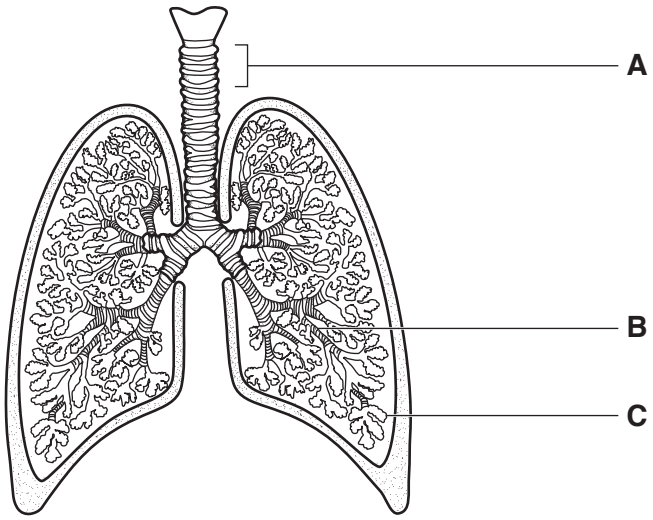

Fig. 1.1

(a) Name the structures labelled **A**, **B**, and **C** in Fig. 1.1.

A .....

B .....

C ..... [3]

(b) Name a **non-infectious** disease that affects the human gas exchange system.

..... [1]

(c) Malaria is an infectious disease.

Name the pathogen that causes malaria.

..... [1]

(d) There are a number of vaccines being developed to help control the spread of malaria.

Explain why vaccination programmes have **not** been able to eradicate malaria.

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..... [3]

(e) Fig. 1.2 shows the distribution of malaria in the Americas in 2012.

Fig. 1.2

Suggest the factors, **other than** lack of vaccines, that could be restricting the distribution of malaria to area **P**.

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..... [4]

[Total: 12]

2 Fig. 2.1 shows the disaccharide lactose, which is found in milk.

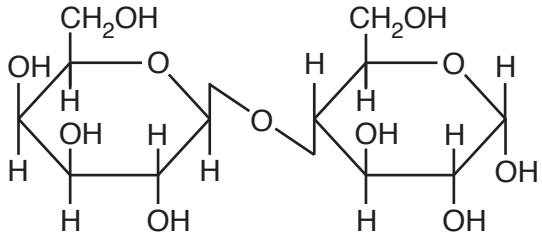

Fig. 2.1

(a) Name the type of bond that joins the two monosaccharides in lactose.

..... [1]

(b) The enzyme lactase catalyses the breakage of the bond between the two monosaccharides in lactose.

(i) Name the type of reaction that breaks this bond.

..... [1]

(ii) Some people do not produce the enzyme lactase, so cannot digest lactose.

The presence of lactose in the lumen of the intestine reduces the volume of water absorbed into the blood, resulting in diarrhoea.

Suggest why the presence of lactose in the intestine reduces the volume of water absorbed.

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..... [2]

(c) Enzymes, such as lactase, are often immobilised for use in the food industry.

A scientist carried out an investigation to determine the effects of temperature on the activity of lactase when it was immobilised and when it was free in solution.

The scientist produced alginate beads containing lactase for use in this investigation. The beads varied in size. The scientist selected small beads for the investigation and put them into a glass column.

(i) Suggest the advantage of using small beads rather than large beads.

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..... [2]

(ii) Fig. 2.2 shows the results of the investigation to determine the effects of temperature on the activity of lactase when it was immobilised, **I**, and when it was free in solution, **F**.

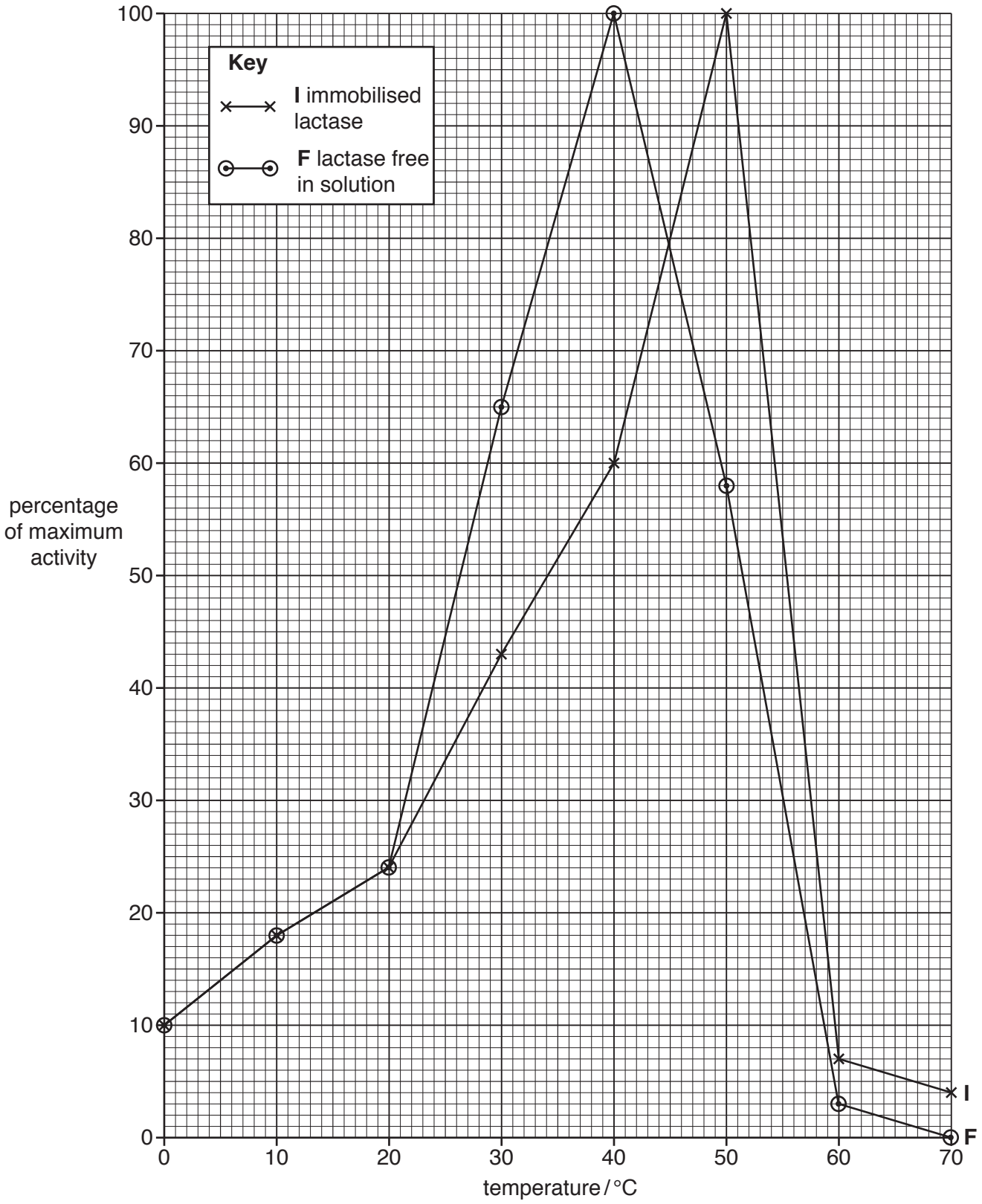

Fig. 2.2

With reference to Fig. 2.2, compare the effect of temperature on the activity of immobilised lactase, **I**, and lactase free in solution, **F**.

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..... [3]

[Total: 9]

3 **(a)** Fig. 3.1 is a transmission electron micrograph showing two adjacent cells in a leaf.

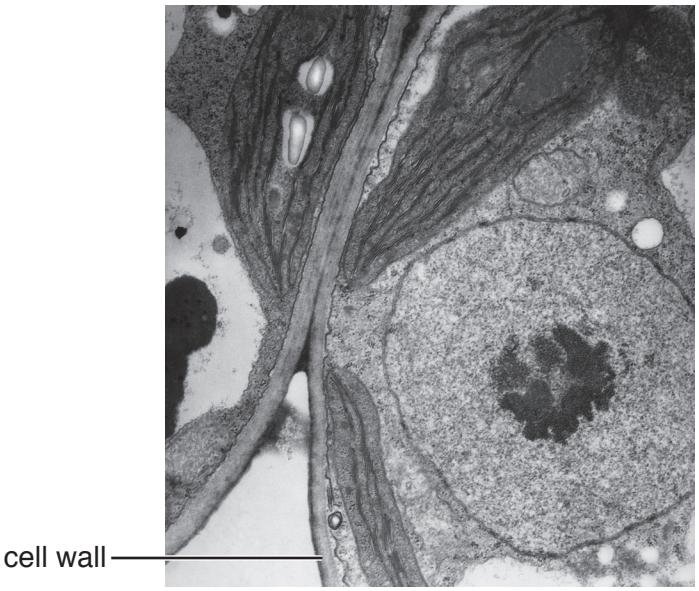

Fig. 3.1

(i) Cellulose is the main polysaccharide in cell walls of plants.

Describe the structure of cellulose.

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..... [3]

(ii) State **one** feature **visible** in Fig. 3.1, other than the cell wall, that identifies the cells as plant cells.

..... [1]

(iii) Outline the role of ATP in a leaf cell.

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Water is a main component of plant cells.

(b) Fig. 3.2 shows two water molecules linked by a hydrogen bond.

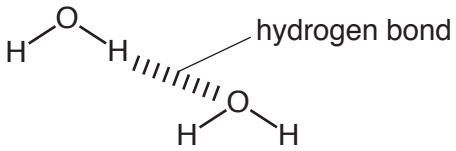

Fig. 3.2

Explain how hydrogen bonding occurs between water molecules.

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..... [2]

(c) Suggest why water is an excellent solvent for ions.

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..... [2]

[Total: 11]

4 Fig. 4.1 is a photomicrograph of a cross-section of a tubular structure in the kidney made from epithelial cells.

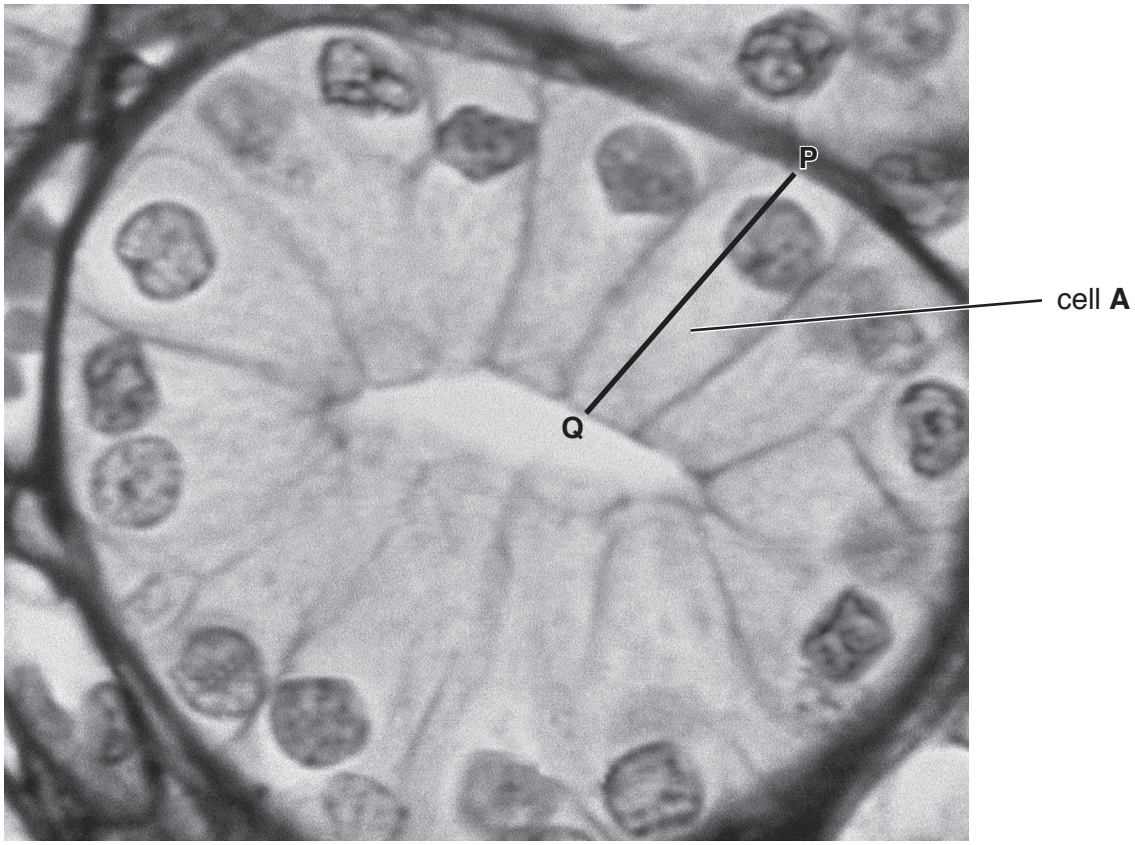

Fig. 4.1

(a) The actual length of epithelial cell **A** along the line **P**–**Q** is 35 μm.

Calculate the magnification of the image shown in Fig. 4.1. Write down the formula and use it to make your calculation. Show your working.

formula

magnification × ..... [2]

(b) Some epithelial cells in the kidney release the protein vascular endothelial growth factor (VEGF). This protein is a cell signalling molecule that stimulates cell division in endothelial cells in blood vessels.

(i) State what occurs during interphase to prepare a cell for division.

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..... [2]

(ii) Explain how a cell signalling molecule, such as VEGF, can lead to a response in a cell.

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..... [2]

(c) Uncontrolled cell division may result in a tumour. Tumour cells in the kidney respond to VEGF.

Kidney cancer can be treated with monoclonal antibodies. These monoclonal antibodies bind to VEGF.

Outline the hybridoma method for the production of monoclonal antibodies that will target the VEGF protein.

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..... [4]

(d) Monoclonal antibodies used as a treatment need to be given more than once. Repeated treatment can cause side effects to the person or can become less effective.

Suggest why repeated treatment with monoclonal antibodies may have these effects.

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..... [1]

[Total: 11]

[Turn over

5 **(a)** Fig. 5.1 shows the structure of a prokaryotic cell.

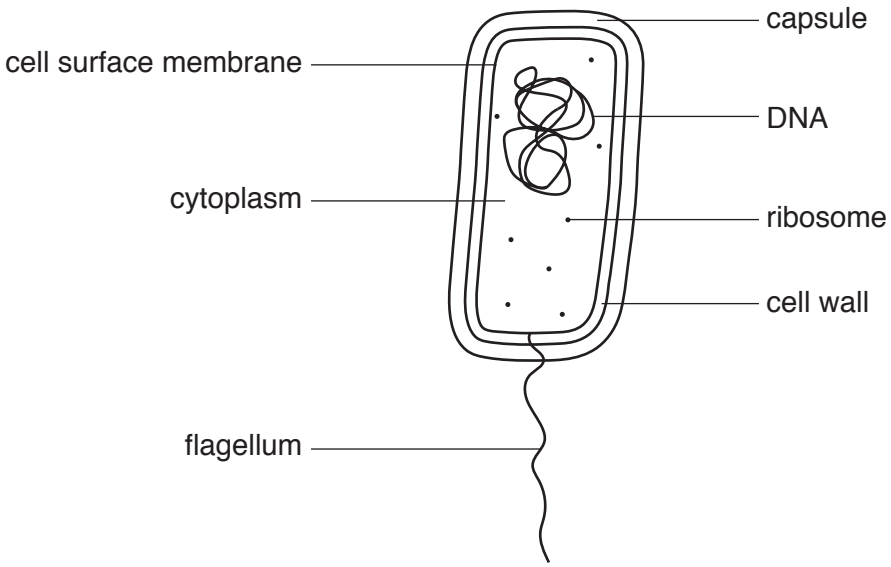

Fig. 5.1

Fig. 5.1 has **not** been fully labelled to confirm that the cell is prokaryotic.

State what **other** information could be added to **two** of the labels to confirm that this cell is prokaryotic and **not** eukaryotic.

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..... [2]

(b) Some prokaryotes are plant pathogens.

Liberibacter is a group of prokaryotic plant pathogens that causes severe damage to a variety of plant crops across the world.

Scientists made observations about plants infected with these pathogens compared to uninfected plants:

- starch accumulates in the leaves
- starch does not accumulate in roots and other storage organs
- fruits are smaller
- the pathogen is widely distributed throughout the plant and is found in a number of different organs including the root and leaf.

The scientists deduced that the pathogen infected the phloem tissue.

Suggest why the scientists were able to deduce that the pathogen infected the phloem tissue.

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..... [2]

(c) DNA and RNA both contain nucleotides with adenine.

Complete Table 5.1 to compare:

- a DNA nucleotide with adenine
- an RNA nucleotide with adenine
- ATP.

Table 5.1

feature	DNA nucleotide with adenine	RNA nucleotide with adenine	ATP
contains nitrogen (yes or no)			
contains a pyrimidine base (yes or no)			
number of phosphate groups			
name of the sugar component			

[5]

[Total: 9]

[Turn over

6 **(a)** Haemoglobin is a globular protein which is able to transport oxygen and is soluble in water.

(i) Explain how the structure of a haemoglobin molecule makes it able to transport oxygen efficiently.

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..... [3]

(ii) Explain how the structure of a haemoglobin molecule allows it to be soluble in water.

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..... [2]

(b) Llamas are mammals that are adapted to live at high altitudes.

Fig. 6.1 shows oxygen dissociation curves for haemoglobin of llamas and humans.

(i) The partial pressure of oxygen in the lungs of mammals at 3500 m is 6.4 kPa.

Use Fig. 6.1 to state the percentage saturation of haemoglobin of llamas and humans at an oxygen partial pressure of 6.4 kPa.

llamas ..... %

humans ..... % [1]

(ii) With reference to Fig. 6.1, explain the advantage to llamas of having an oxygen dissociation curve positioned to the left of the curve for humans.

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.....[2]

[Total: 8]

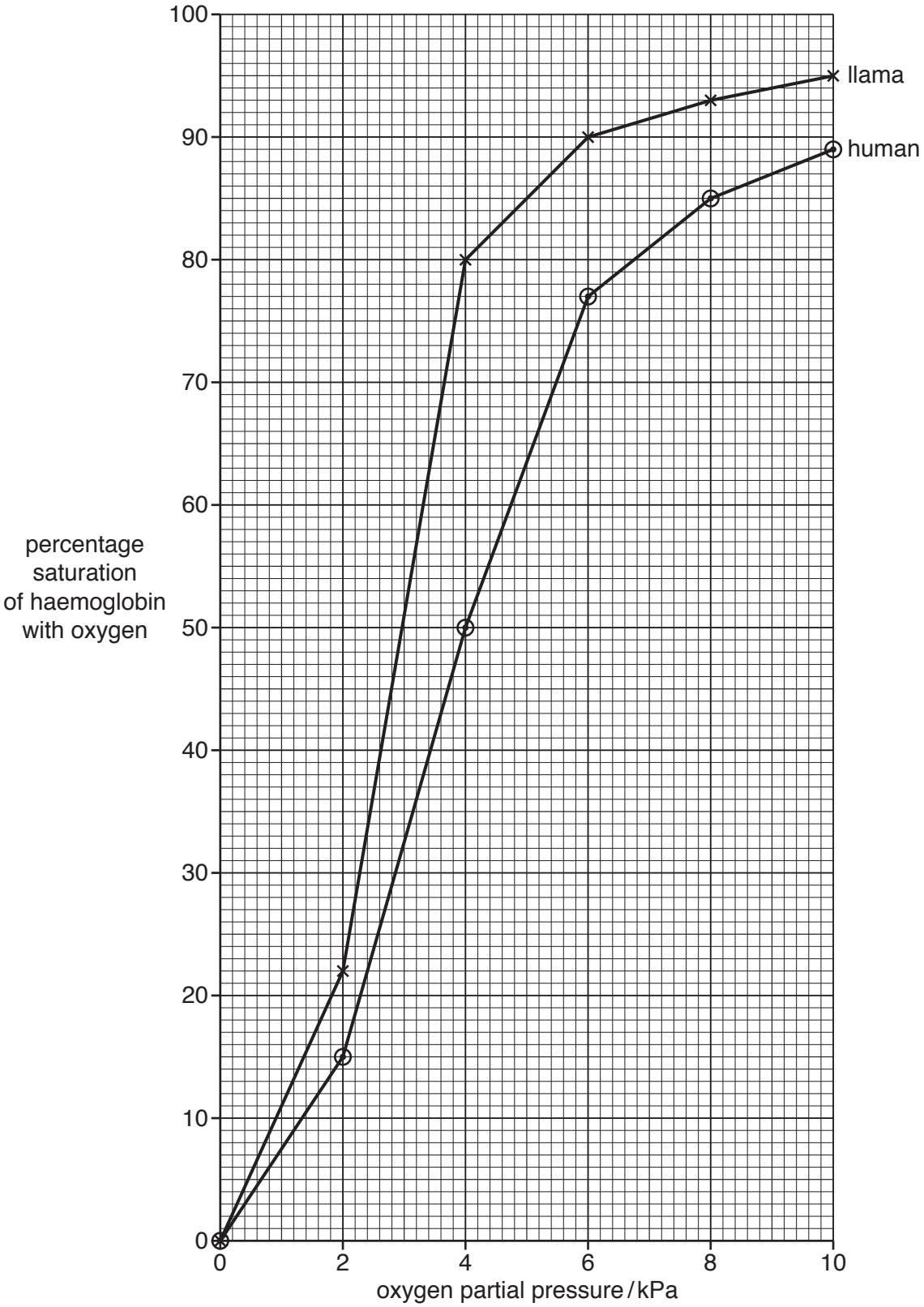

Fig. 6.1

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