



Oxford Cambridge and RSA

Thursday 22 May 2025 – Morning

AS Level Biology B (Advancing Biology)

H022/02 Biology in depth

Time allowed: 1 hour 30 minutes



You can use:

- a scientific or graphical calculator
- a ruler (cm/mm)



Please write clearly in black ink. **Do not write in the barcodes.**

Centre number

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Candidate number

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First name(s)

Last name

INSTRUCTIONS

- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.
- Where appropriate, your answer should be supported with working. Marks might be given for a correct method, even if your answer is wrong.

INFORMATION

- The total mark for this paper is **70**.
- The marks for each question are shown in brackets [].
- Quality of extended response will be assessed in questions marked with an asterisk (*).
- This document has **24** pages.

ADVICE

- Read each question carefully before you start your answer.

2

1

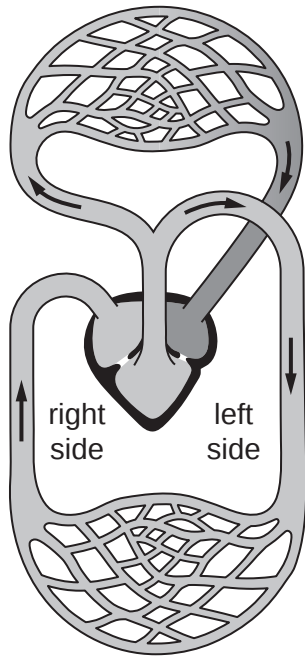
(a) The mammalian circulatory system is described as a closed double circulatory system.

(i) Explain what is meant by a closed circulatory system.

.....
 [1]

(ii) The diagram below shows the circulatory system of a frog.

Capillaries in the lungs and skin



Capillaries in the muscles

Blood leaving the heart of a frog is less oxygenated than blood leaving the heart of a mammal.

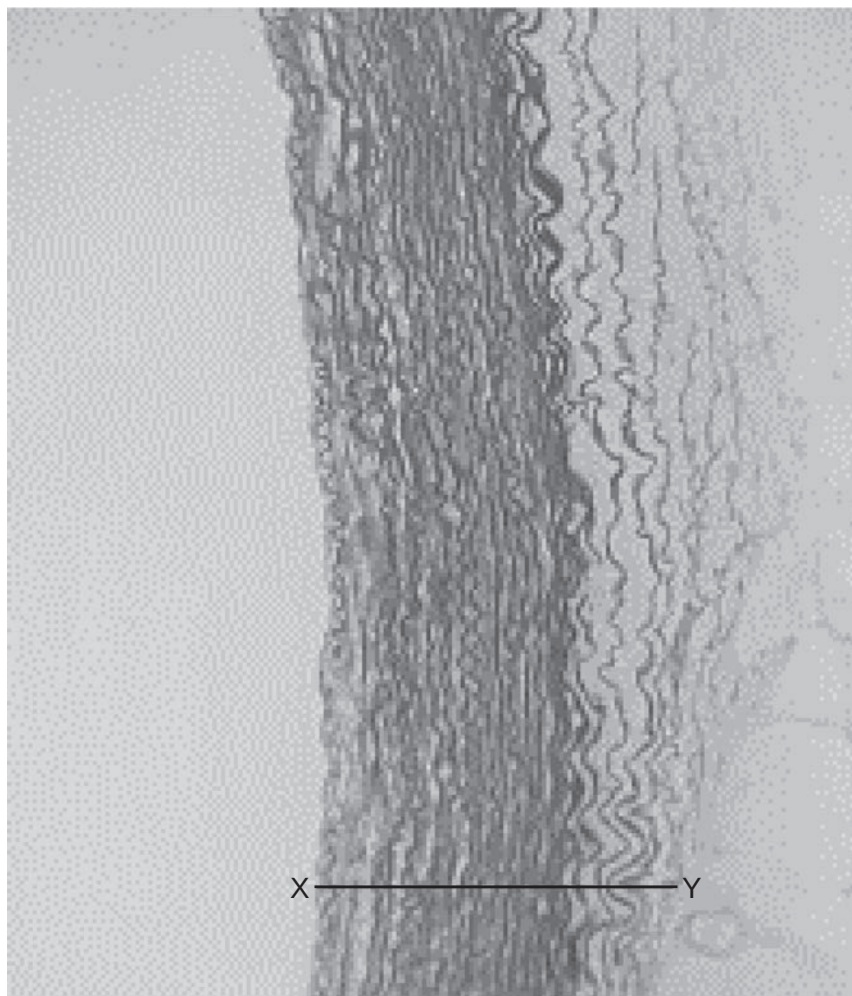
Explain why blood leaving the heart of a frog is less oxygenated than blood leaving the heart of a mammal.

.....

 [2]

3

(b) The image below shows a section through the wall of an artery.



×500

Calculate the actual width of the artery wall between points X and Y.

Give your answer to the nearest whole number.

Actual width = μm [2]

5

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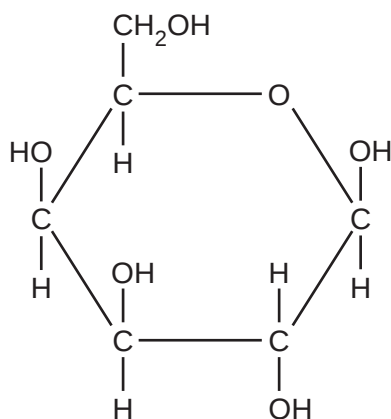
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2

(a) Lactose is a disaccharide found in milk

Galactose is one of the monosaccharides that form lactose.

The structure of galactose is shown below.



(i) Draw a molecule of lactose using the galactose molecule above .

[2]

(ii) During digestion lactose is broken down into monosaccharides.

Name the reaction involved in digestion.

..... [1]

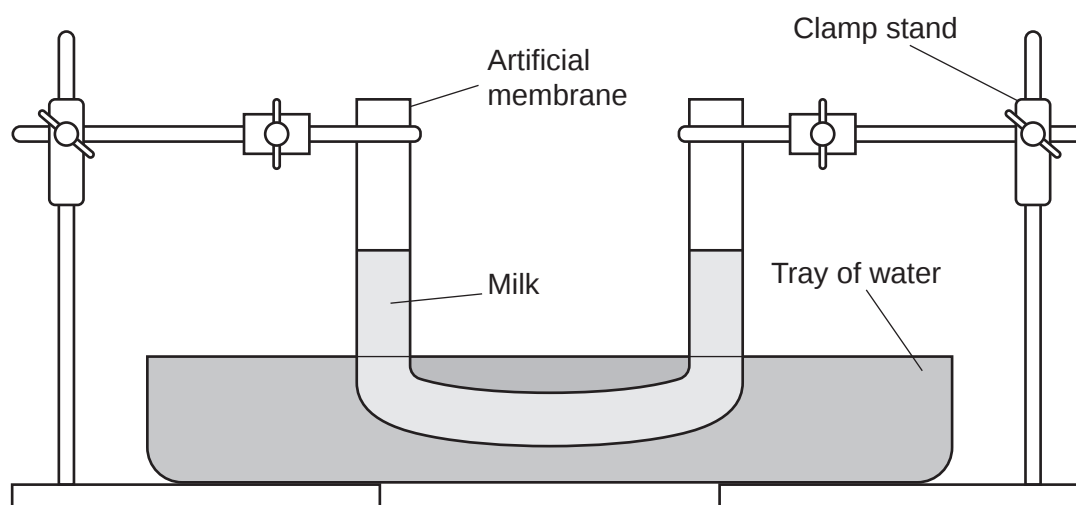
- (b) A food scientist does an experiment to investigate the effects of different types of milk on a model intestine.

An artificial selectively permeable membrane is used to model the intestine.

This is the method that they use:

- add 25cm^3 of soya milk to a 30 cm long tube of artificial membrane
- attach the membrane between two clamp stands
- place the artificial membrane into a tray of water for 2 hours
- pour the milk out of the artificial membrane into a measuring cylinder and record the volume
- repeat the procedure using other types of milk

The diagram shows the equipment used in the investigation.



- (i) Suggest a source of random error in the method.

..... [1]

- (ii) Explain how the method can be modified to reduce the effect of random error.

.....
 [1]

8

The table shows the data from the investigation.

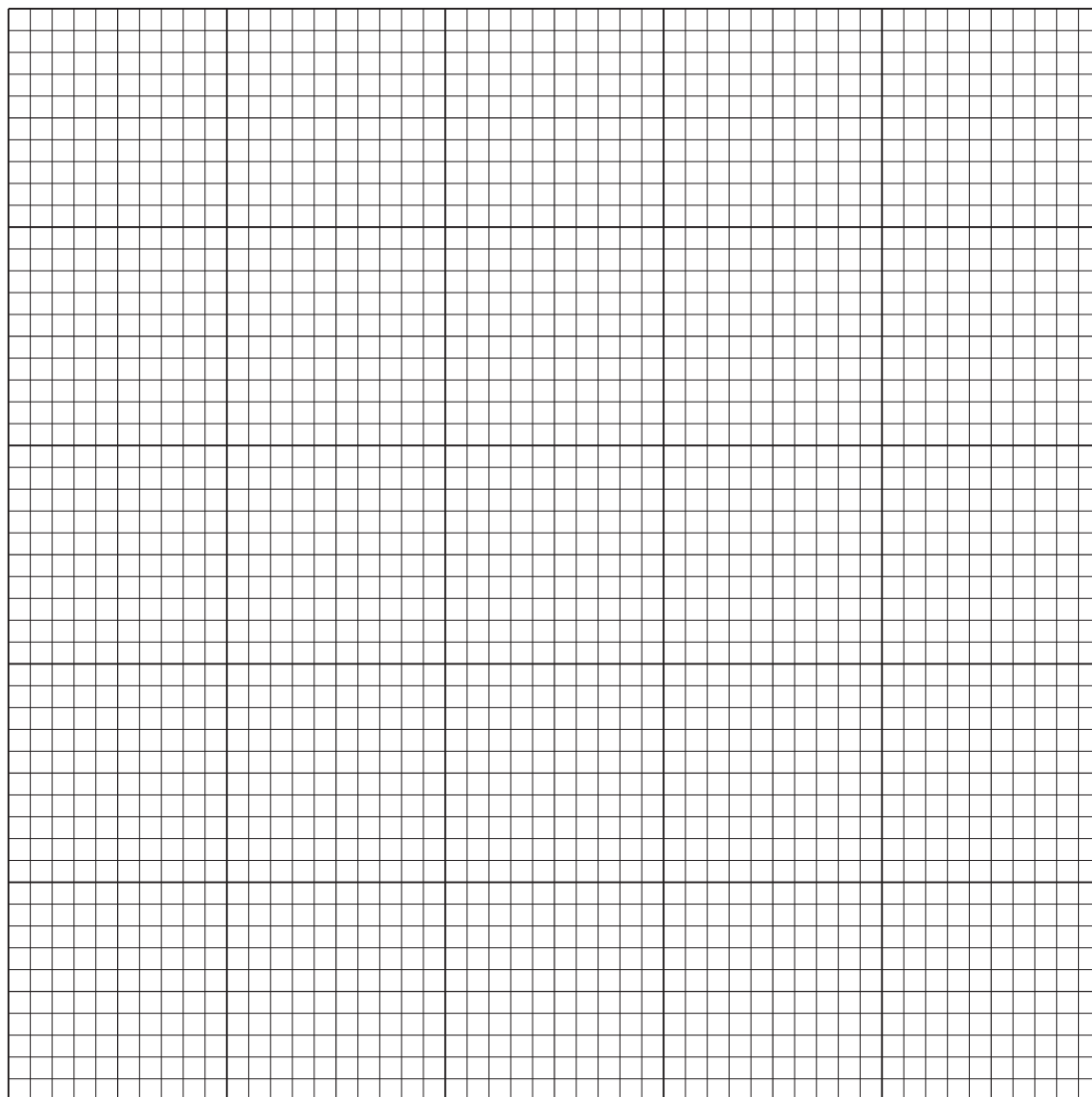
Type of milk	Volume of milk at 0 hours (cm ³)	Volume of milk at 2 hours (cm ³)	Percentage change in volume (%)
Soya	25.0	25.4	1.6
Skimmed	25.0	26.6	6.4
Semi-skimmed	25.0	26.1	4.4
Whole	25.0	25.9	3.6
Condensed	25.0	31.2	

(iii) Calculate the percentage change in volume for condensed milk

Percentage change = [2]

9

(iv) Plot these data using an appropriate format on the grid below.



[4]

(c) Soya milk does not contain lactose.

Suggest why the soya milk increased in volume.

.....

..... [1]

10
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3

(a) Cancer can be treated using a number of different methods.

Complete the table to show the method of treating cancer and a description of the method.

Method of treating cancer	Description of method
Surgery	
.....	Cytotoxic drugs that are taken orally or by injection but can weaken the immune system
Hormone-related treatment	Drugs that are taken orally or by injection to reduce the level of some hormones in the body
.....	Does not directly treat the cancer but can reduce the side effects from other treatments
Radiotherapy	

[4]

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(b) Imatinib is a cytotoxic drug used to treat cancer.

Scientists took 30 mice that had been genetically modified to produce tumours.

15 mice were given 150 mg kg^{-1} of imatinib twice per day for 18 days.

15 mice were given a placebo twice per day for 18 days.

The graph shows the data from the investigation.

Adapted from ar.iiarjournals.org/content/anticancer/26/2A/1247.full.pdf. Item removed due to third party copyright restrictions.

(i) State why the scientists used a placebo in this investigation.

.....
..... [1]

(ii) State what conclusions can be made from the data in this investigation.

..... [4]

(iii) The mean mass of the mice was 25 g.

Calculate the mass of imatinib that the scientists used in the investigation.

Include units in your answer.

Mass of imatinib = Units = [3]

(iv) The scientists used genetic modification to produce tumours in the mice.

Suggest **one** reason for **and one** reason against using genetic modification to produce tumours in mice.

For

.....

Against

[2]

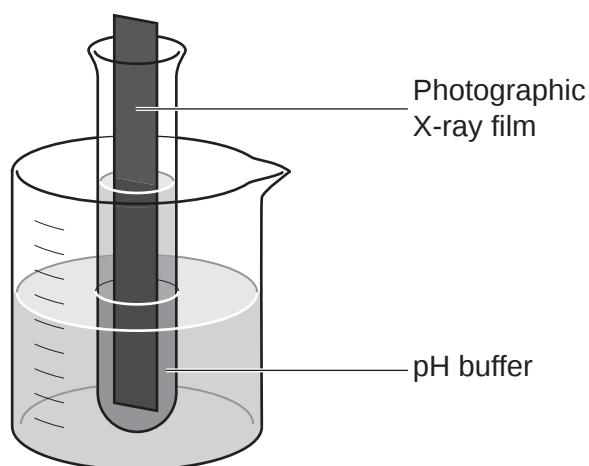
4

- (a) Some students do an experiment to find out how the activity of trypsin (a protease enzyme) varies at different pH and different temperatures.

This is the method that they use:

- place pH 4 buffer solution containing trypsin into a test tube
- place the test tube containing buffer solution into a water bath at 35 °C for 10 minutes
- place a strip of photographic X-ray film into the buffer and start a stop clock
- check the photographic X-ray film regularly by lifting it out of the test tube
- time how long it takes for the photographic X-ray film to turn clear
- repeat the experiment using a range of pH from 4 to 12
- repeat the experiment at 50 °C.

The diagram below shows the equipment used in the investigation.



Photographic X-ray film is made by attaching black photosensitive crystals to a clear sheet of plastic using a protein called gelatin. When gelatin is digested the crystals fall off the black plastic sheet and the sheet turns clear.

- (i) Explain why the students waited 10 minutes to add the photographic film to the test tube.

.....
 [1]

- (ii) Give **two** reasons why the students' results may not be valid.

1
 2
 [2]

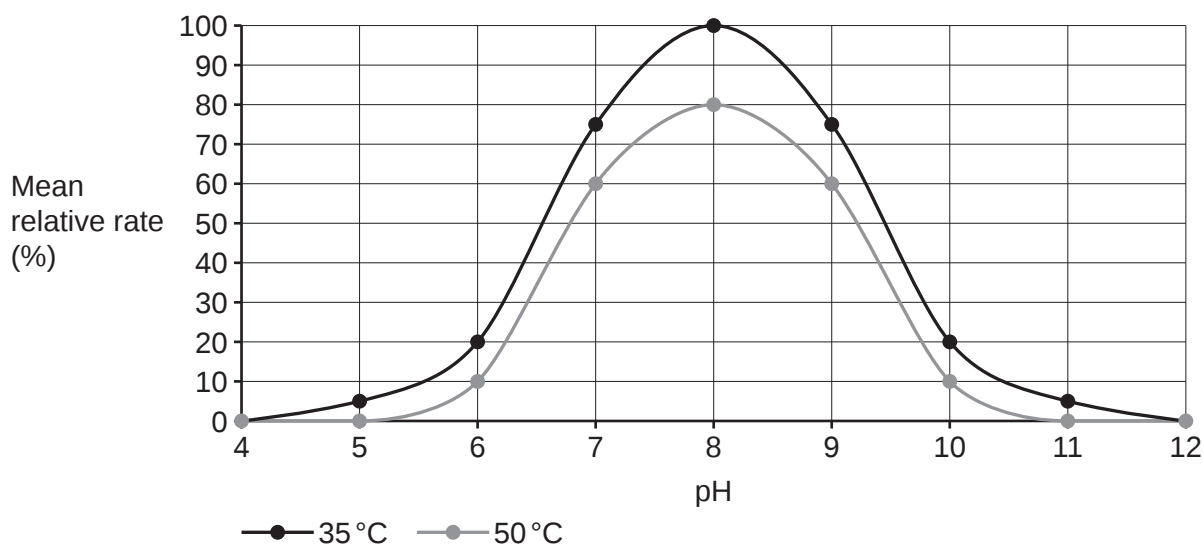
- (b) Explain why trypsin can digest the gelatin protein in the photographic X-ray film but cannot digest other protease molecules.

.....
 [1]

15

- (c) The students also plotted the mean relative rate of enzyme activity.

The graph shows the data from the investigation.



- (i) Explain how the students also plotted the relative rate of enzyme activity in this investigation.

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..... [2]

- (ii) State **two** conclusions that can be made from the data in the graph.

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..... [2]

- (iii) State **two** explanations for the differences in the results for trypsin activity at 35°C and 50°C.

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..... [2]

Extra answer space if required.

5

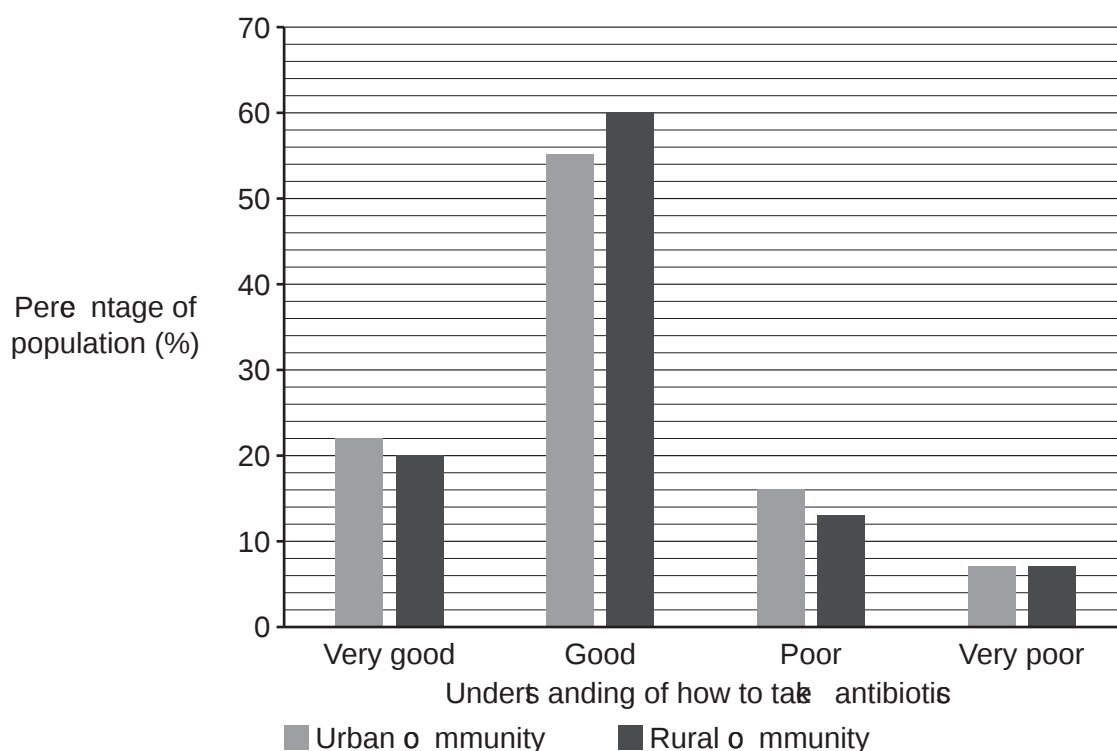
(a) Tuberculosis (TB) is caused by the bacterium *Mycobacterium tuberculosis*.

There are different strains of TB.

Educating people on the correct use of antibiotics has been a major focus in reducing the development of a strain of TB called multi-drug resistant tuberculosis (MDR-TB).

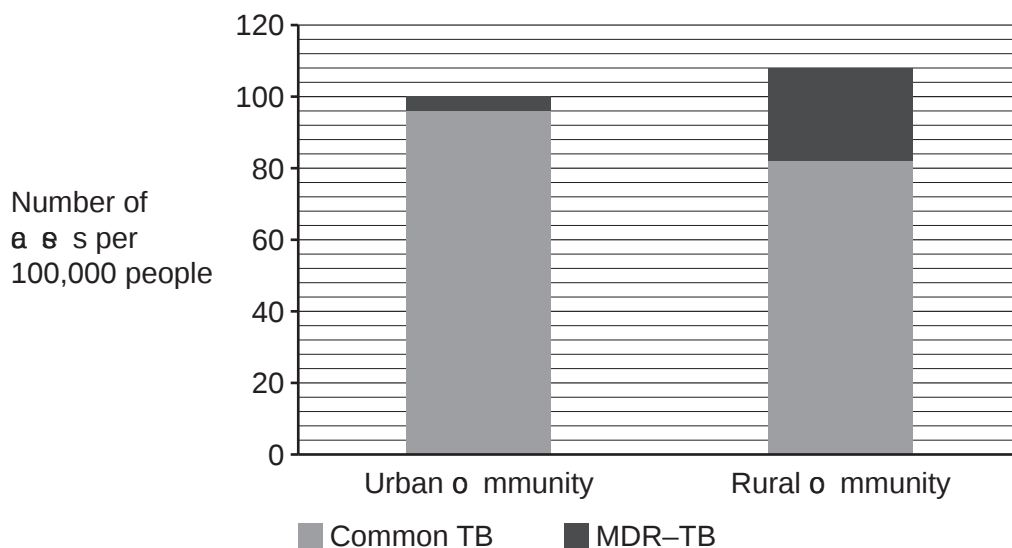
In a region where TB is endemic, two communities completed a survey asking them how well they understood how to take antibiotics correctly. The results of the survey are shown in **Fig. 5.1**.

Fig. 5.1



The strain and prevalence of TB cases in the urban and rural communities is shown in **Fig. 5.2**.

Fig. 5.2



(i) The following conclusions were drawn from the data in **Figs. 5.1** and **5.2**.

- Urban communities have a better understanding of antibiotic use.
- There is less risk of getting TB in a rural community.

Evaluate these conclusions

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..... [4]

(ii) Outline how a population of *M. tuberculosis* may become multi-drug resistant.

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..... [3]

20

(b) Capreomycin is an antibiotic that can be used to treat TB.

Capreomycin inhibits protein synthesis in *M. tuberculosis*.

(i) Explain why capreomycin is safe for human use.

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..... [2]

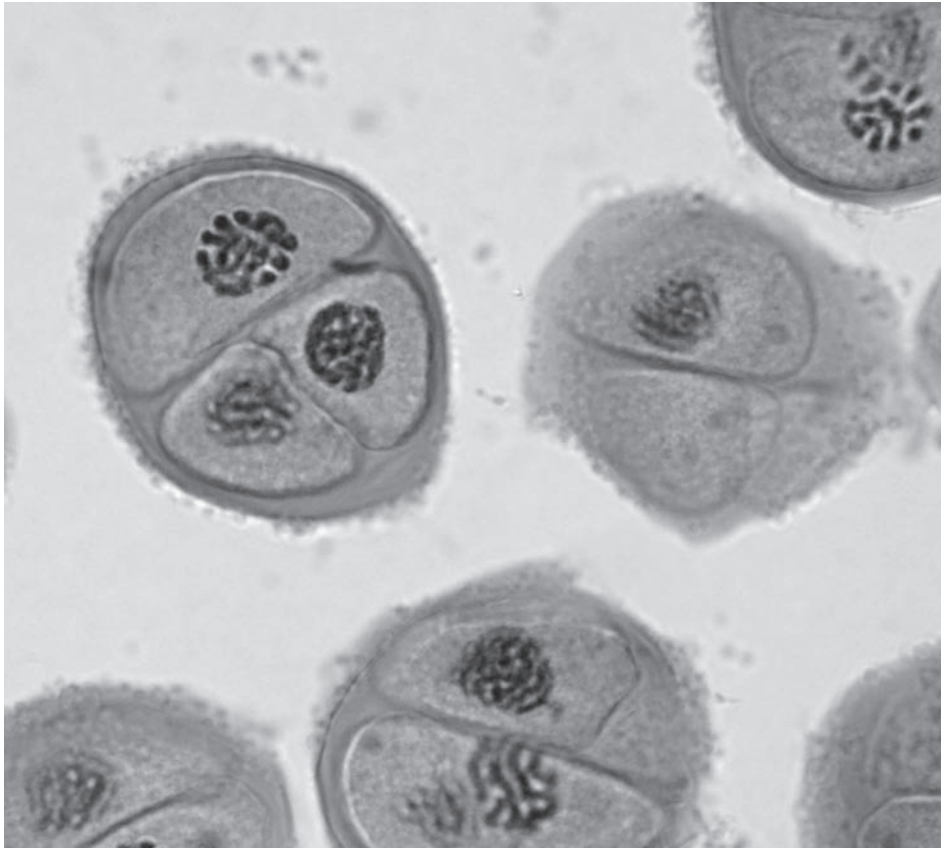
(ii) Suggest why capreomycin may cause side effects despite being safe for human use.

.....

..... [1]

6

- (a) The image shows pollen grains in various stages of meiosis



- (i) State the type of microscope used to produce this image.

Give a reason for your answer.

Type

Reason

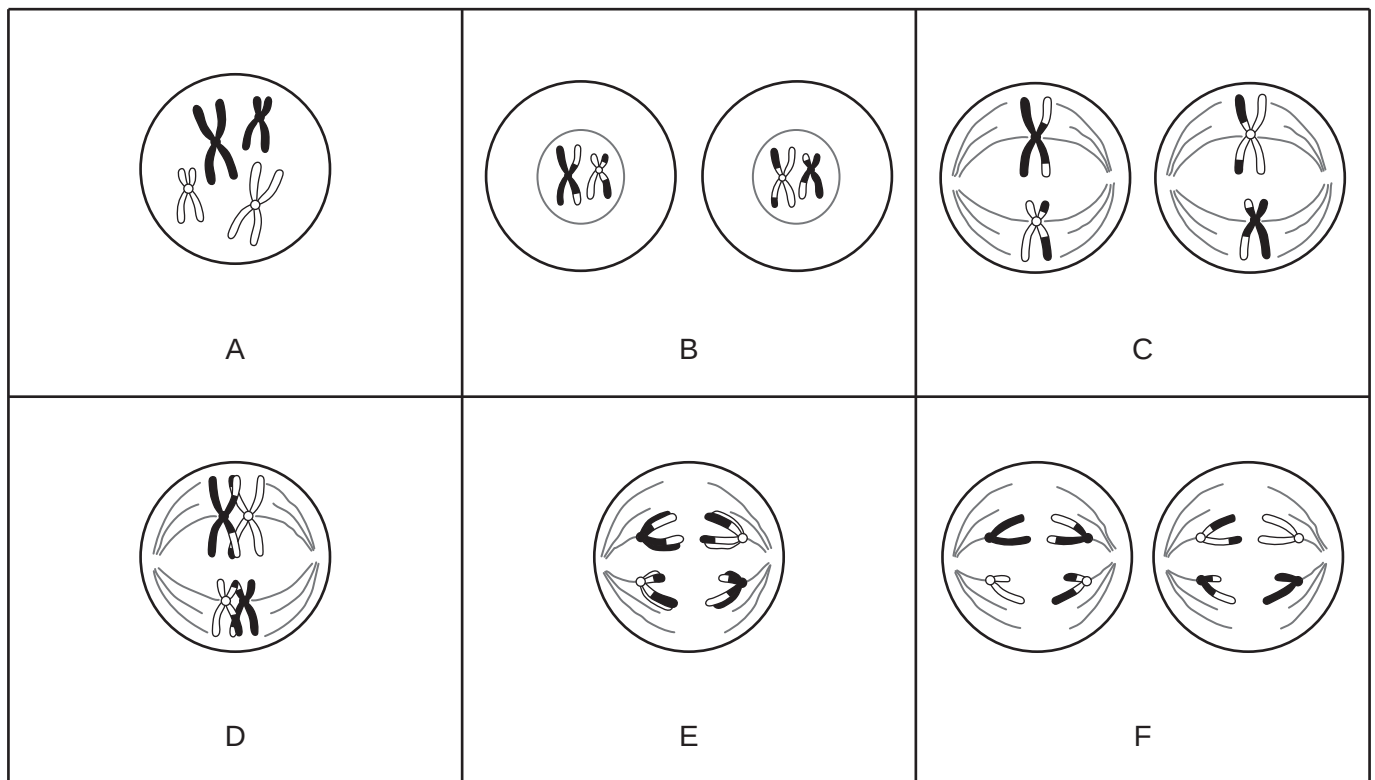
[2]

- (ii) Using the image, state how meiosis in plants differs from meiosis in animals

.....

..... [1]

(b) The image below shows some stages of meiosis in an animal.



Write the letters in the boxes to show the stage being described in each of the following statements.

Separation of sister chromatids

Formation of haploid cells

Independent assortment of chromosomes

Crossing over is occurring

[4]

END OF QUESTION PAPER

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