



Rewarding Learning

General Certificate of Secondary Education
2016

Centre Number

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Candidate Number

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Double Award Science: Biology

Unit B2
Higher Tier

[GSD42]

MV18

FRIDAY 10 JUNE, MORNING

Time

1 hour 15 minutes, plus your additional time allowance.

Instructions to Candidates

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.

You must answer the questions in the spaces provided.

Complete in blue or black ink only.

Answer **all eleven** questions.

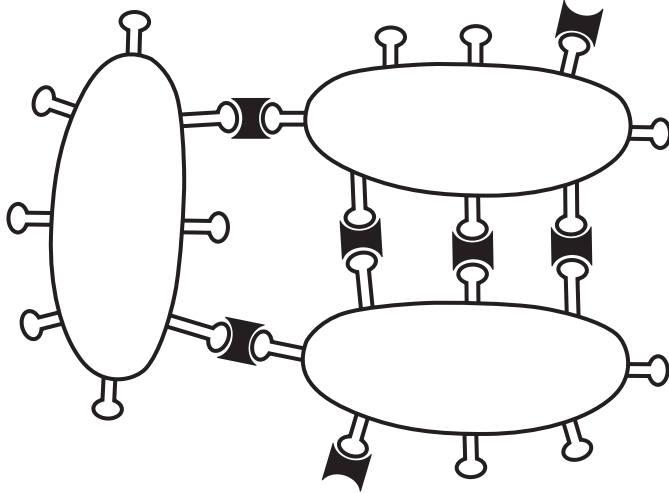
Information for Candidates

The total mark for this paper is 90.

Figures in brackets printed at the end of each question indicate the marks awarded to each question or part question.

Quality of written communication will be assessed in Questions **4(b)** and **11(b)**.

- 1 (a) The body has a number of defence mechanisms against disease-causing microorganisms. One of these mechanisms is the clumping of microorganisms. The diagram shows a clump of three microorganisms.



- (i) On the diagram, label an antigen. [1]
- (ii) Describe the stages that have occurred to produce this clump. [3 marks]

- (iii) Microorganisms in a clump cannot easily move. Suggest how this helps in the defence against disease. [1 mark]

(b) After the clump has been formed it is then destroyed by another process.

Name and describe this process. [3 marks]

Name _____

Description _____

2 AIDS is a disease caused by the human immunodeficiency virus (HIV).

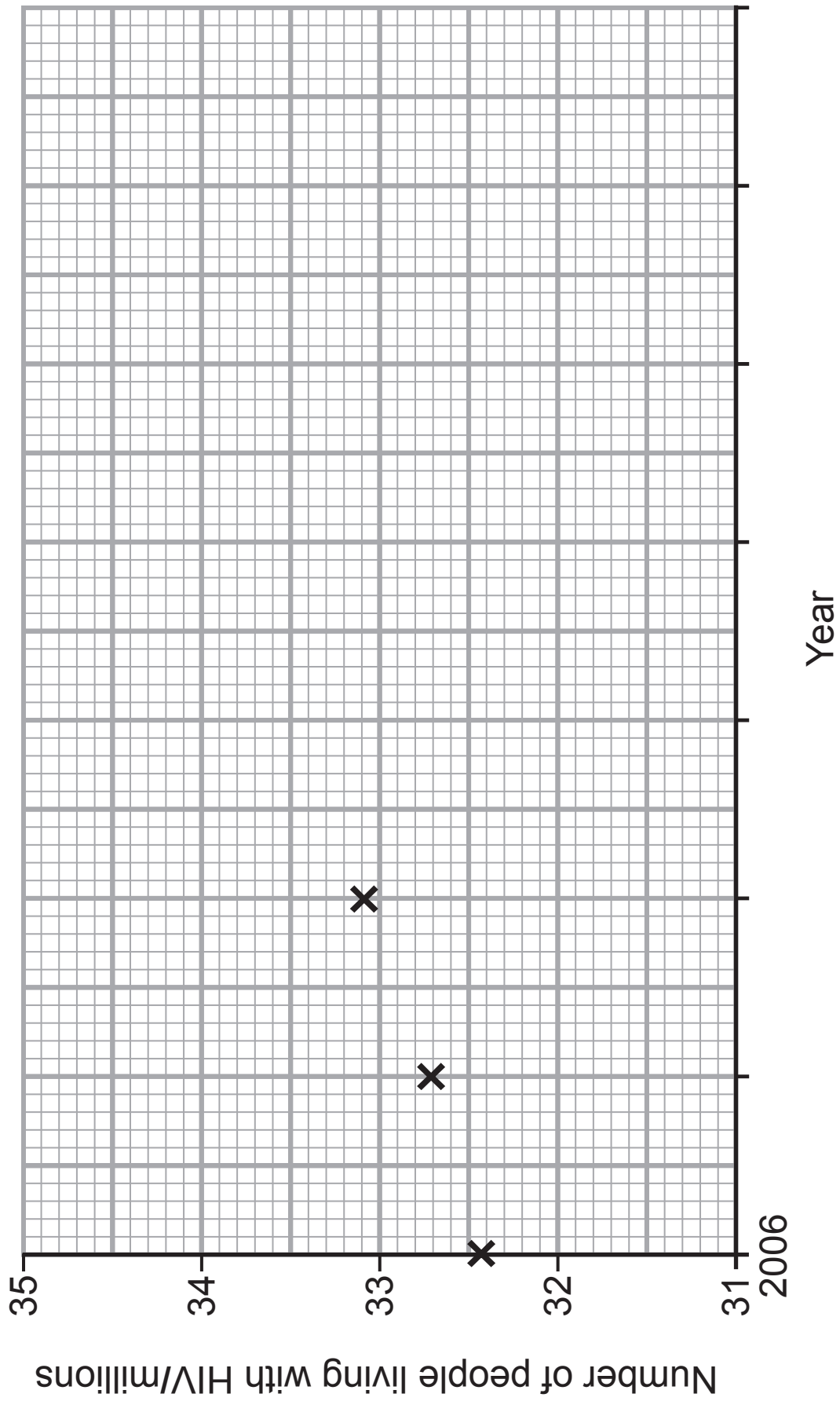
Table 1 shows worldwide data for HIV and AIDS for the years 2006 to 2013.

	Number of people worldwide/millions							
	2006	2007	2008	2009	2010	2011	2012	2013
People living with HIV	32.4	32.7	33.1	33.4	33.8	34.2	34.6	35.0
New HIV infections	2.8	2.7	2.6	2.5	2.5	2.4	2.2	2.1
AIDS related deaths	2.2	2.2	2.1	2.1	2.1	2.1	2.0	1.9
People receiving treatment				5.2	7.4	9.0	10.6	12.9

(a) (i) Use the data in **Table 1** to complete the line graph opposite to show the number of **people living with HIV** for the years 2006 to 2013.

The first three points have been plotted for you.

Add the scale to the *x*-axis. [4 marks]



- (ii) Describe the trend shown in the graph on page 5.
[1 mark]

Table 2 shows the amount of money spent on HIV and AIDS treatment and education for the same years.

Table 2	Year							
	2006	2007	2008	2009	2010	2011	2012	2013
Money spent/ billions of dollars	8.8	10.5	14.6	15.5	15.6	17.1	18.9	19.1

- (b) The number of **AIDS related deaths** decreased from 2006 to 2013.

- (i) Use the data in **Table 1 on page 4**, to calculate the percentage decrease in **AIDS related deaths** from 2006 to 2013.

Show your working. [2 marks]

_____ %

(ii) Use the data in the tables to give **two** reasons to explain this decrease in AIDS related deaths over this period. [2 marks]

1. _____

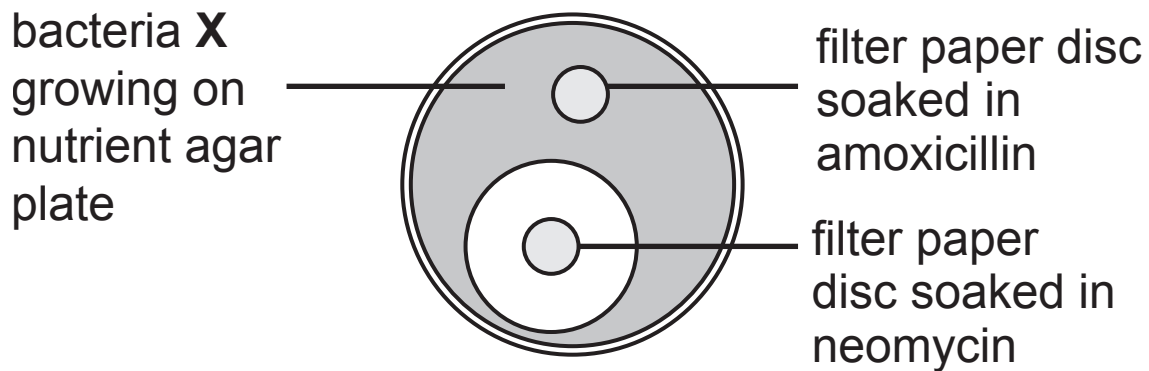
2. _____

(c) (i) Some other diseases caused by viruses can be prevented using vaccinations.

Name the scientist who developed the first vaccination. [1 mark]

(ii) What disease was this vaccination used against? [1 mark]

- 3 Antibiotics are chemicals that are used to kill bacteria. A nutrient agar plate had one type of bacteria (**X**) growing on the surface. Two discs of filter paper, each soaked with a different antibiotic, were placed on the surface of the nutrient agar plate. One disc of filter paper was soaked in amoxicillin and the other was soaked in neomycin. The diagram shows the nutrient agar plate after it had been incubated for two days.



Use the diagram and your knowledge to describe and explain the effects of the antibiotics amoxicillin and neomycin on the growth of bacteria **X**. [4 marks]

Description _____

Explanation _____

4 Infertility in women can have several causes.

(a) Give **two** causes of infertility in women. [2 marks]

1. _____

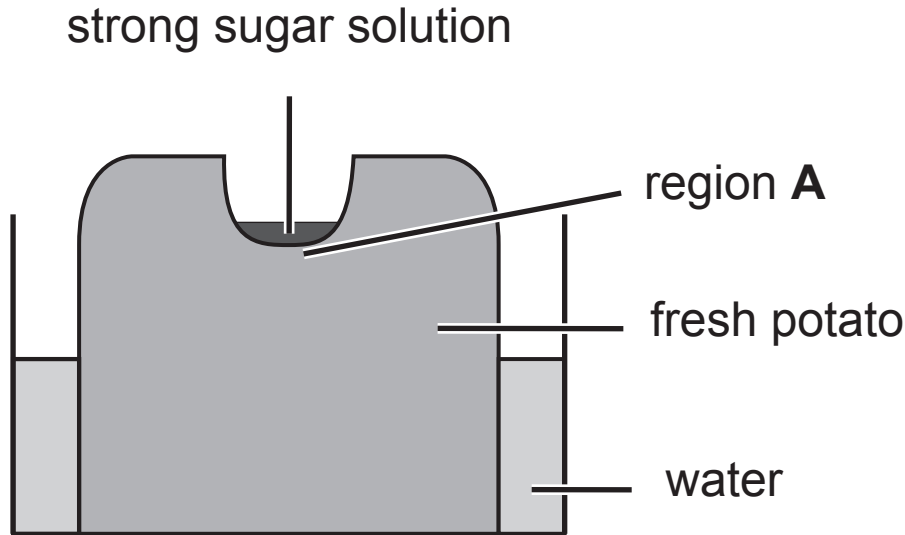
2. _____

(b) In vitro fertilisation (IVF) can be used to treat infertility in some women.

Describe the stages in the process of IVF. [6 marks]

In this question you will be assessed on your written communication skills, including the use of specialist scientific terms.

- 5 Megan and Paul set up an experiment to investigate osmosis in a potato. The diagram shows the levels of strong sugar solution and water at the start of the experiment.



The experiment was left for 4 hours.

- (a) Describe what happened to the level of the strong solution after 4 hours. Explain your answer. [3 marks]

Description _____

Explanation _____

(b) Describe how the vacuole and the cell membrane from a cell in region **A** will have changed after 4 hours, when the cell has become plasmolysed. [2 marks]

Vacuole _____

Cell membrane _____

- 6 Peony plants have plain red or red striped flowers. The photograph shows a red striped peony flower.



In peony flowers the allele **R** for plain red colour is dominant.

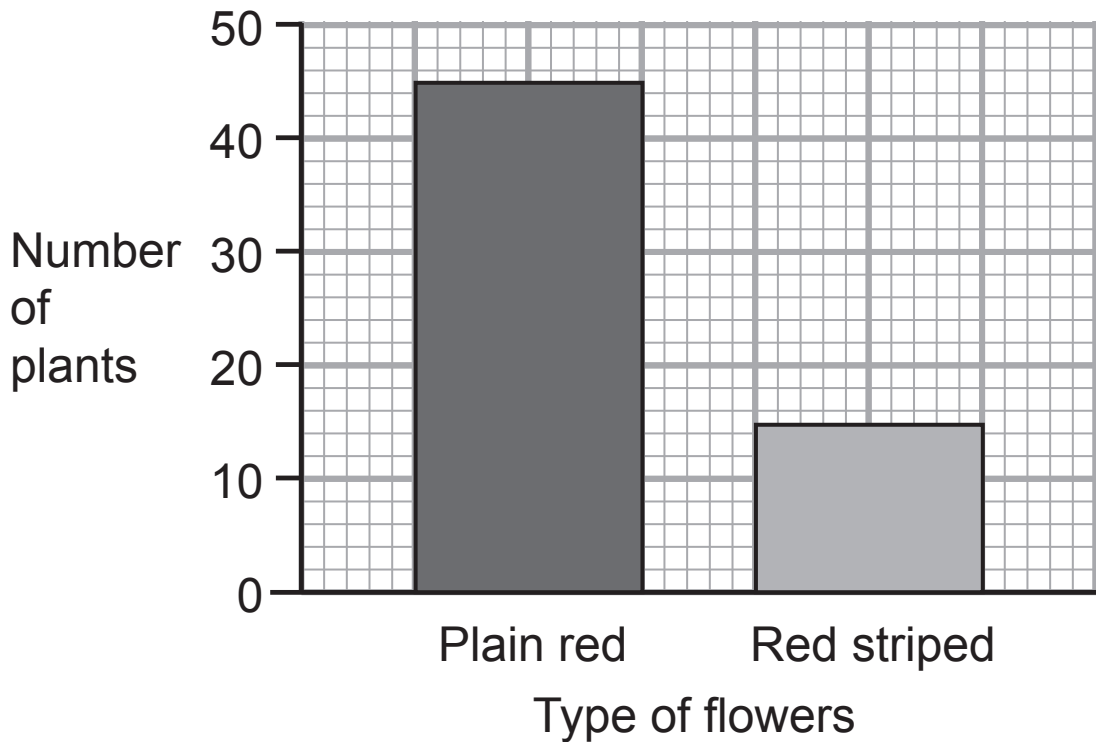
The allele **r** for red striped flowers is recessive.

- (a) A peony plant, homozygous for plain red flowers, is crossed with a heterozygous peony plant. Draw a Punnett square to show the genotypes of the flowers that would be produced from this cross. [4 marks]

(b) A breeder has a peony plant with plain red flowers.
She is unsure of its genotype.
Draw Punnett squares to show how she could use a test
(back) cross to find out the genotype of this plant.
[4 marks]

- (c) Seeds were collected from another peony plant. When plants were grown from these seeds the types of flowers produced were counted.

The bar graph shows the results.



- (i) Use the graph to give the ratio of plain red flowers to red striped flowers produced from these seeds. [1 mark]

_____ to _____

- (ii) Use the graph to give the type of variation shown by these flowers. [1 mark]

- (iii) Name a human characteristic that shows this type of variation. [1 mark]

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(Questions continue overleaf)

- 7** Plants can be cloned using tissue culture.
The diagram shows how many new plants can be reproduced from small pieces of plant tissue.

Diagram removed due to copyright issues.

- (a) (i)** Name the type of reproduction that involves cloning using tissue culture. [1]

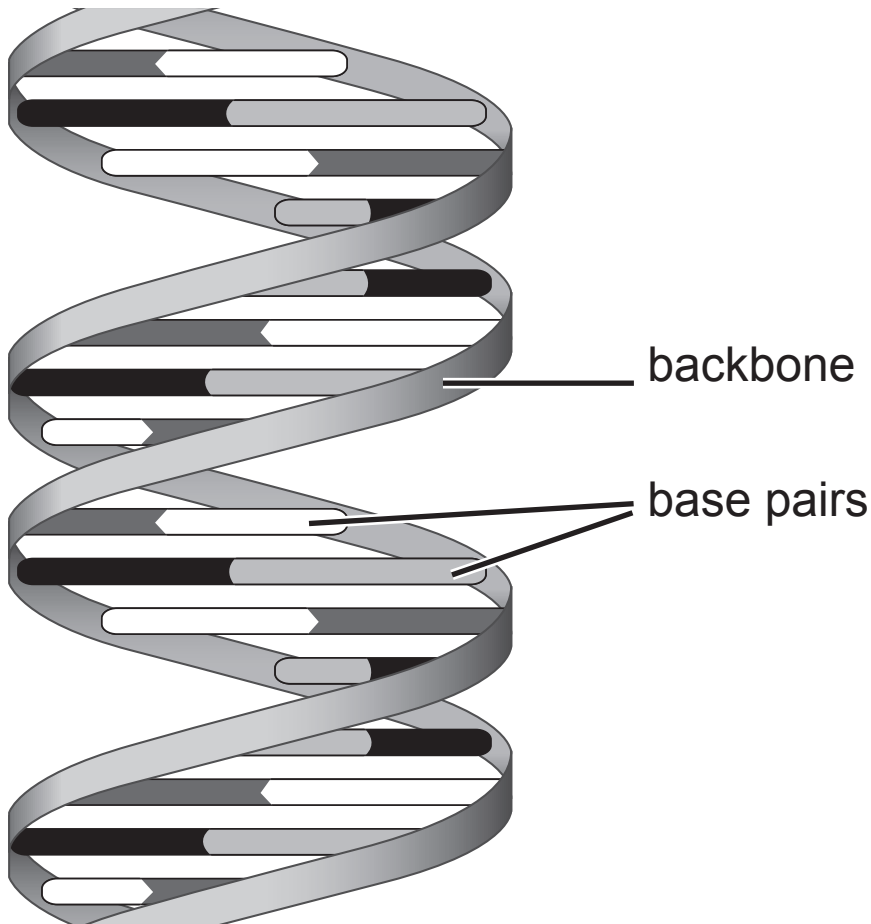
- (ii)** What type of cell division does this reproduction involve? [1 mark]

(b) Suggest **two** advantages of reproducing plants by this method. [2 marks]

(c) A parent plant used in tissue culture was found to have a genetic disease.

Suggest why the plantlets from this plant could not be sold by a plant breeder. [1 mark]

- 8 Chromosomes are structures found in the nucleus of a cell. Chromosomes are made of DNA. The diagram shows a DNA molecule.



- (a) What term describes the shape of the DNA molecule?
[1 mark]

- (b) Name the **two** chemicals that make up the backbone of DNA. [2 marks]

1. _____

2. _____

(c) A DNA molecule has four different bases.
Give the **two** base pairs in a DNA molecule. [2 marks]

1. _____ and _____

2. _____ and _____

(d) Name the **two** scientists who first used X-ray
crystallography (diffraction) in the discovery of the
structure of DNA. [2 marks]

_____ and _____

- 9 (a) A protein, produced by genetically engineered bacteria, is used to treat diabetes.
Name this protein. [1 mark]

- (b) A different protein, called chymosin, is used to make cheese from milk.
For many years it was obtained from the stomachs of calves.
It is now produced using genetically engineered bacteria.

- (i) Draw a **labelled** diagram in Box 1 to show the chymosin gene in a calf's DNA. [2 marks]
- (ii) Draw a **labelled** diagram in Box 2 to show a bacterial plasmid after the chymosin gene has been inserted into it. [2 marks]



Box 1



Box 2

(iii) The genetically engineered bacteria are placed in a fermenter.

What do these bacteria do to produce large amounts of chymosin? [1 mark]

(iv) Name the type of molecule used by the bacteria to build up the chymosin protein. [1 mark]

(v) Genetically engineered bacteria produce large amounts of chymosin.

Suggest **one other** advantage of producing chymosin using genetic engineering. [1 mark]

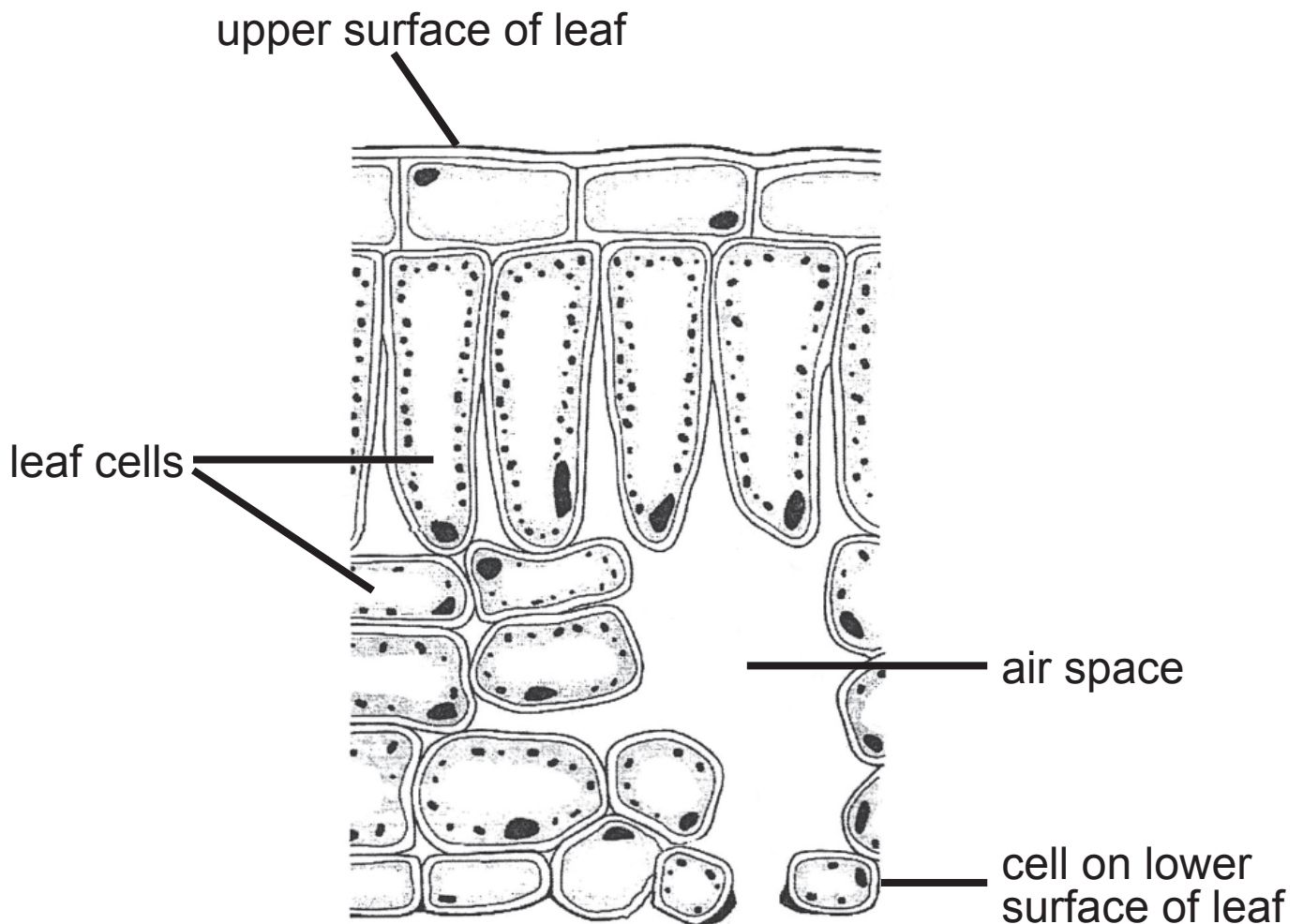
10 (a) Plants lose water from their leaves.

The water evaporates from the leaf cells and then diffuses out through stomata.

Most plants have more stomata on the lower surface of their leaves.

(i) Name the process described above. [1 mark]

The diagram shows a section through a leaf.



(ii) Use the information above and your knowledge to draw arrows on the diagram to show the pathway of water out of the leaf. [2 marks]

(b) Water that is lost from leaves is usually replaced by water from the soil.

In drought conditions water may not be available in the soil to replace the water lost.

Plants in desert regions have become adapted to survive long periods of drought.

The photograph shows quiver trees from the Namib desert in Africa.



During long periods of drought these trees can drop all of their leaves.

Suggest how dropping all of their leaves can help quiver trees to survive long periods of drought. [2 marks]

(c) Another desert plant, called the unarmed saltwort, closes its stomata to prevent water loss. The graph opposite gives information about the number of stomata open and the rate of water loss in the unarmed saltwort over a 12 hour period.

Use the graph and your knowledge to answer the following questions.

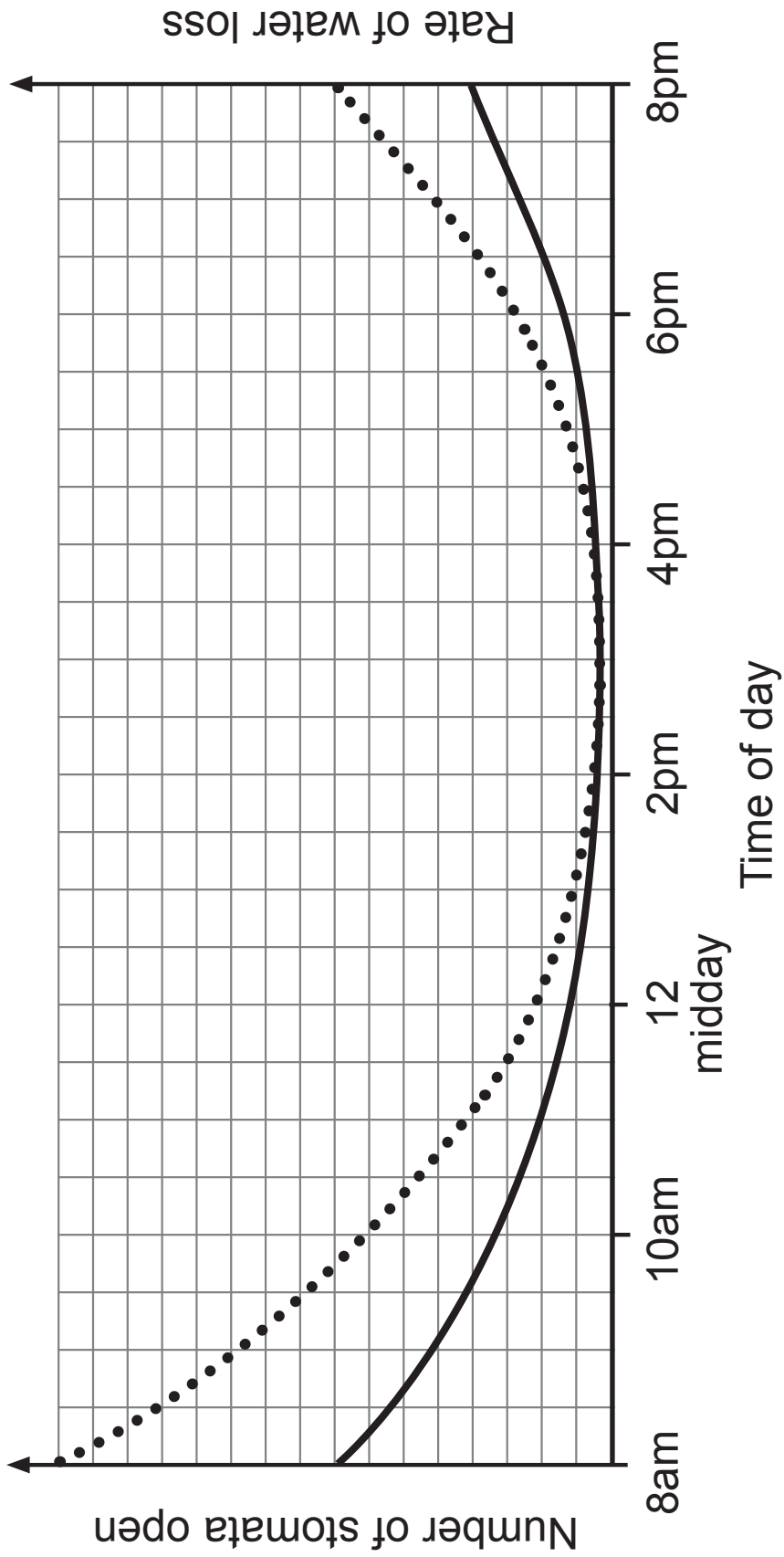
(i) During which **four** hour period is the least number of stomata open?

_____ to _____

[1 mark]

(ii) Use the graph to describe the relationship between the number of stomata open and the rate of water loss in the plant. [1 mark]

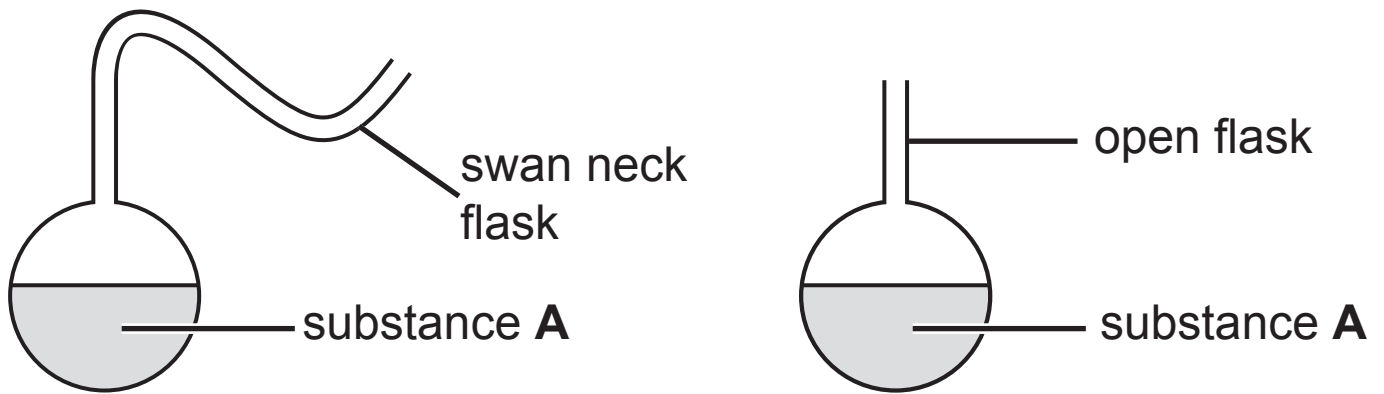
(iii) Draw a line on the graph to show the rate of water loss that would be expected if the stomata did **not** close over the 12 hour period. [2 marks]



(iv) Over a long period of time some species of desert plant became extinct as the desert became drier. The unarmed saltwort survived.

Use your knowledge of **natural selection** to explain why the unarmed saltwort survived but these other species of desert plant became extinct. [3 marks]

11 The diagram shows the apparatus **at the start** of an investigation similar to one carried out by Louis Pasteur.



(a) (i) Name the theory Pasteur was investigating.
[1 mark]

(ii) Name substance **A** and describe how it would have been treated **before the start** of the investigation.
[2 marks]

Name _____

Treatment _____

(iii) Why was substance **A** treated in this way?
[1 mark]

(iv) What results would Pasteur have observed in the two flasks if the theory he was investigating was **correct**? [1 mark]

THIS IS THE END OF THE QUESTION PAPER

SOURCES

Q1(a)Source: Principal Examiner

Q2.....Table 1: © UNAIDS, Global Report 2013, Fact Sheet

Q2.....Table 2: © UNAIDS, Global Report 2013, Fact Sheet

Q6.....© Ian Gowland / Science Photo Library

Q8.....© Chief Examiner

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Q10(b) ...© Iaranik / iStock / Thinkstock

Q10(c)....Source: Principal Examiner

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Question Number	Marks
1	
2	
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Total Marks	
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Examiner Number

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