Rewarding Learning

Centre Number

71

Candidate Number

General Certificate of Secondary Education
2014

Double Award Science: Biology

Unit B2

Higher Tier

[GSD42]

MV18

FRIDAY 6 JUNE 2014, AFTERNOON

TIME

1 hour 15 minutes, plus your additional time allowance.

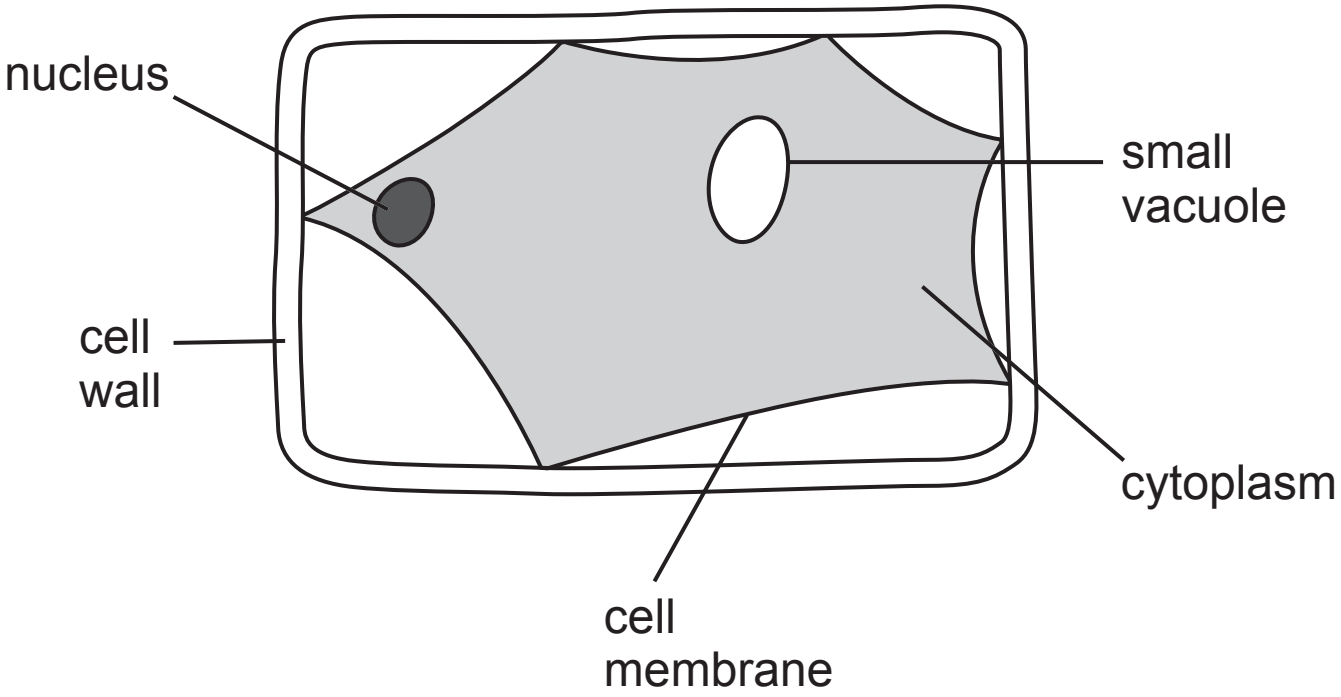
INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
Answer **all ten** 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 5(b) and 7(b)**.

1 The diagram below shows a plant cell as seen under a microscope.
The cell had been left in strong sugar solution for 30 minutes.



(a) What term describes the cell as it appears in the diagram? [1 mark]

_____

(b) Redraw the cell, **to the same scale**, as it would appear after being left in water for 30 minutes.
Label the **cell wall**, **cell membrane** and **vacuole** on your drawing. [4 marks]

2 **(a)** The photograph below shows the type of mosquito which can carry the virus that causes the disease yellow fever. When a person is bitten by this type of mosquito, the virus can be passed to that person. Approximately 7% of people who catch yellow fever die from it within three weeks.

Paul is planning to visit Africa and has been advised to be vaccinated against yellow fever before he travels.

Suggest two reasons why Paul should be vaccinated before he travels. [2 marks]

1. _____

2. _____

(b) The MMR vaccine gives immunity against measles, mumps and rubella.

The table below shows the percentage of the population who received the MMR vaccine in 2011, in the different regions of the United Kingdom.

Region of United Kingdom	**Percentage of the population who received the MMR vaccine**
England	89.1
Wales	91.5
Scotland	93.2
Northern Ireland	92.9

(i) Calculate the difference in the percentage of the population who received the MMR vaccine in Northern Ireland compared to England. [1 mark]

_____ **%**

In 2011, there were fewer cases of measles in Northern Ireland than in England.

(ii) Suggest **one** reason why there were fewer cases of measles in Northern Ireland than in England, in 2011. [1 mark]

_____

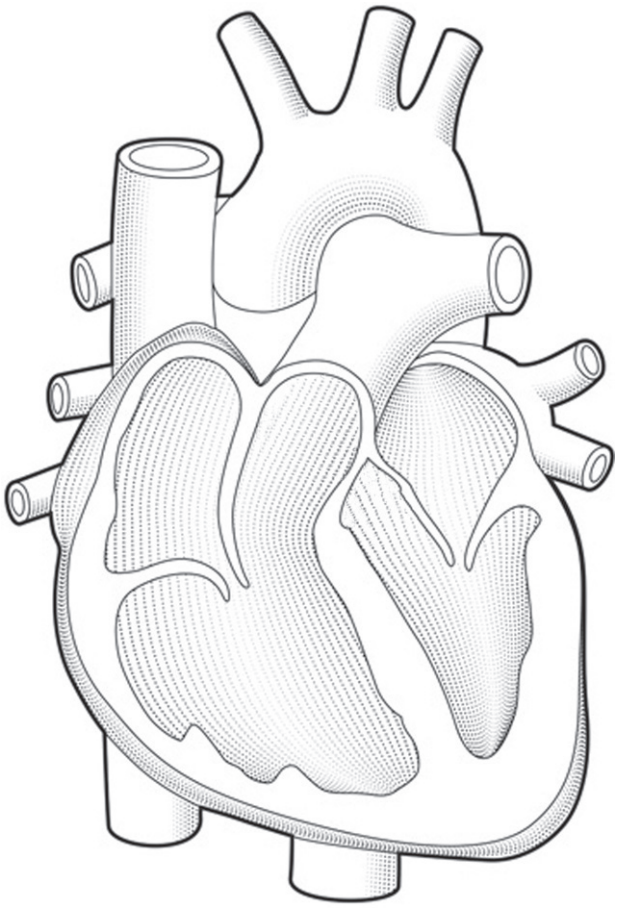
_____

(iii) Name the scientist who developed the first vaccine. [1 mark]

_____

3 The heart pumps blood around the body.

(a) The diagram below shows a section through the heart.



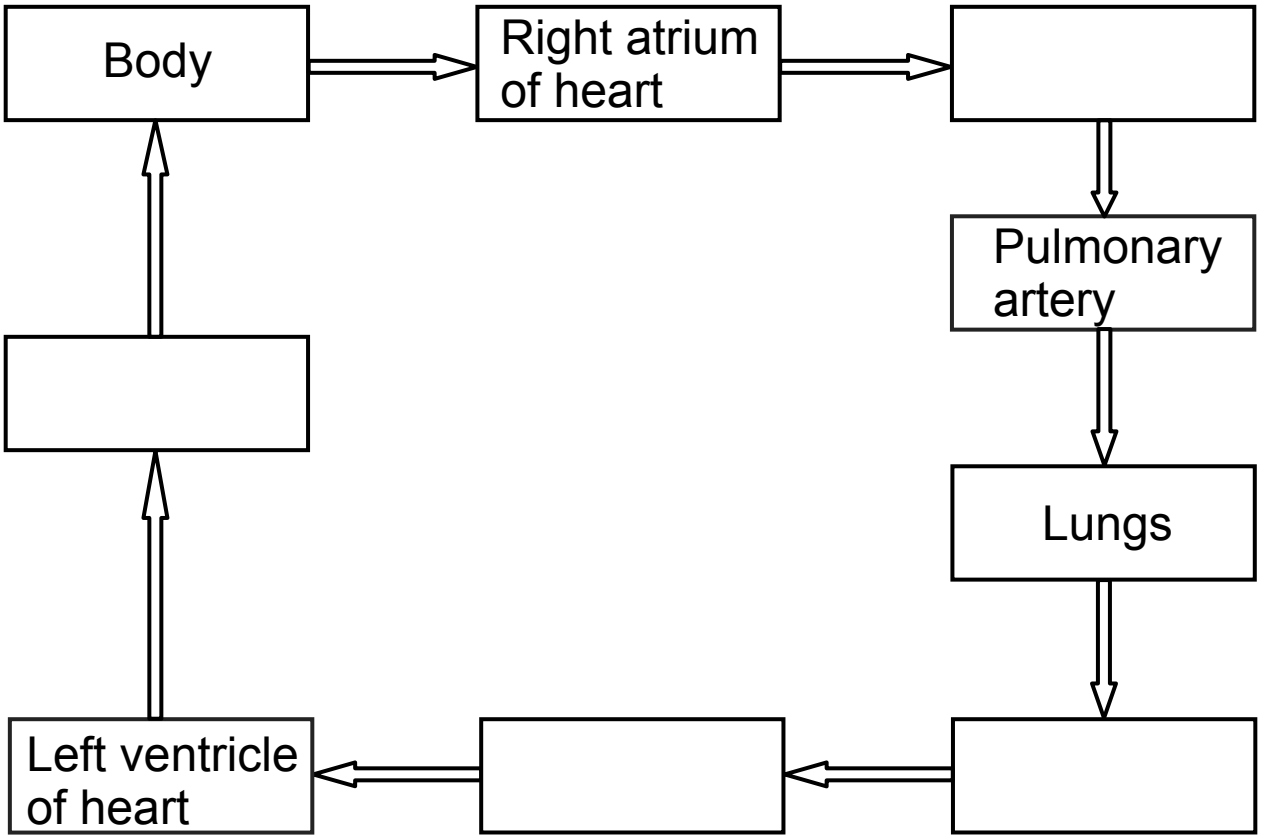
On the diagram, label the left ventricle and the pulmonary artery. [2 marks]

Blood passes through the heart twice during one complete circuit of the body.

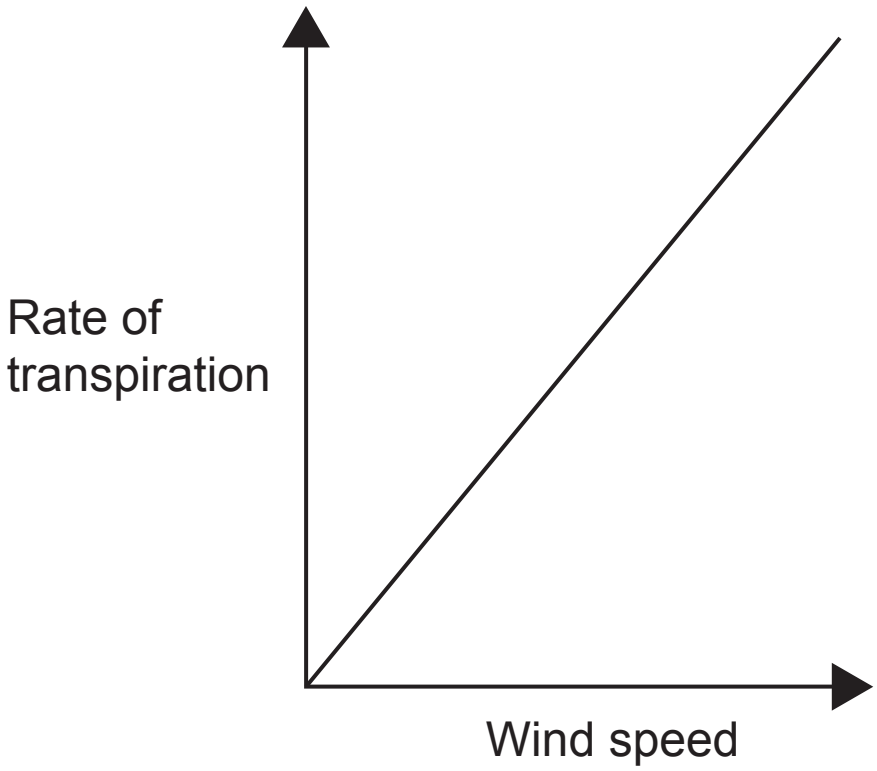
(b) What term is used to describe the passage of blood twice through the heart during one complete circuit of the body? [1 mark]

_____

(c) In the diagram below, fill in the empty boxes to show the passage of blood through the heart and around the body.
The empty boxes represent heart chambers or blood vessels. [4 marks]



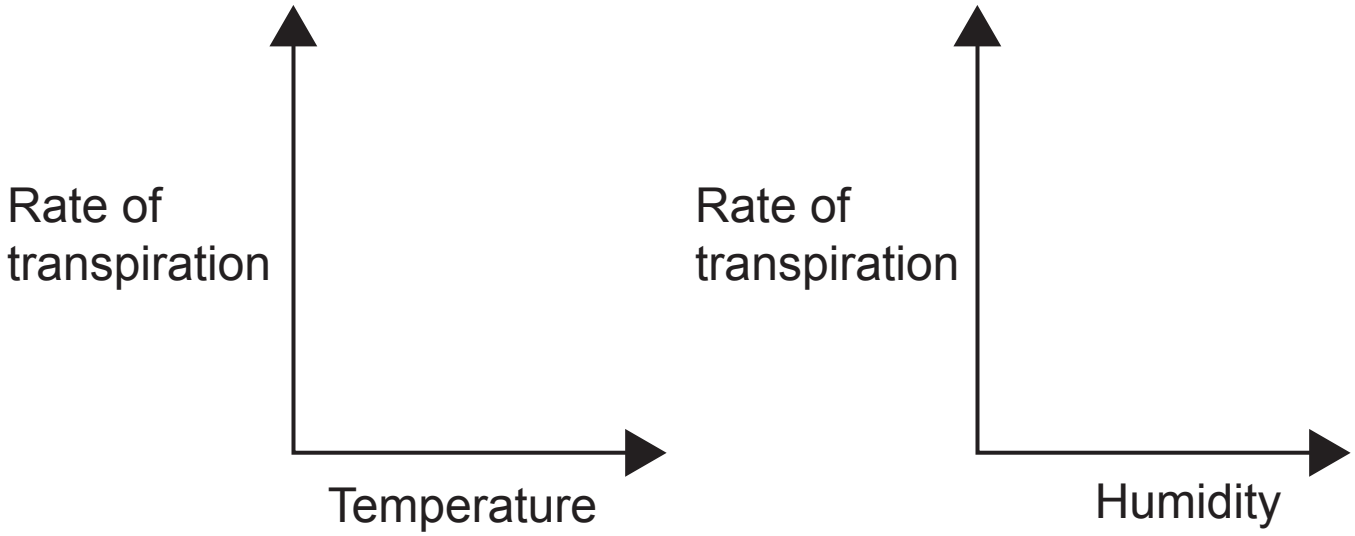
4 **(a)** The graph below shows the effect of increasing wind speed on the rate of transpiration in plants.



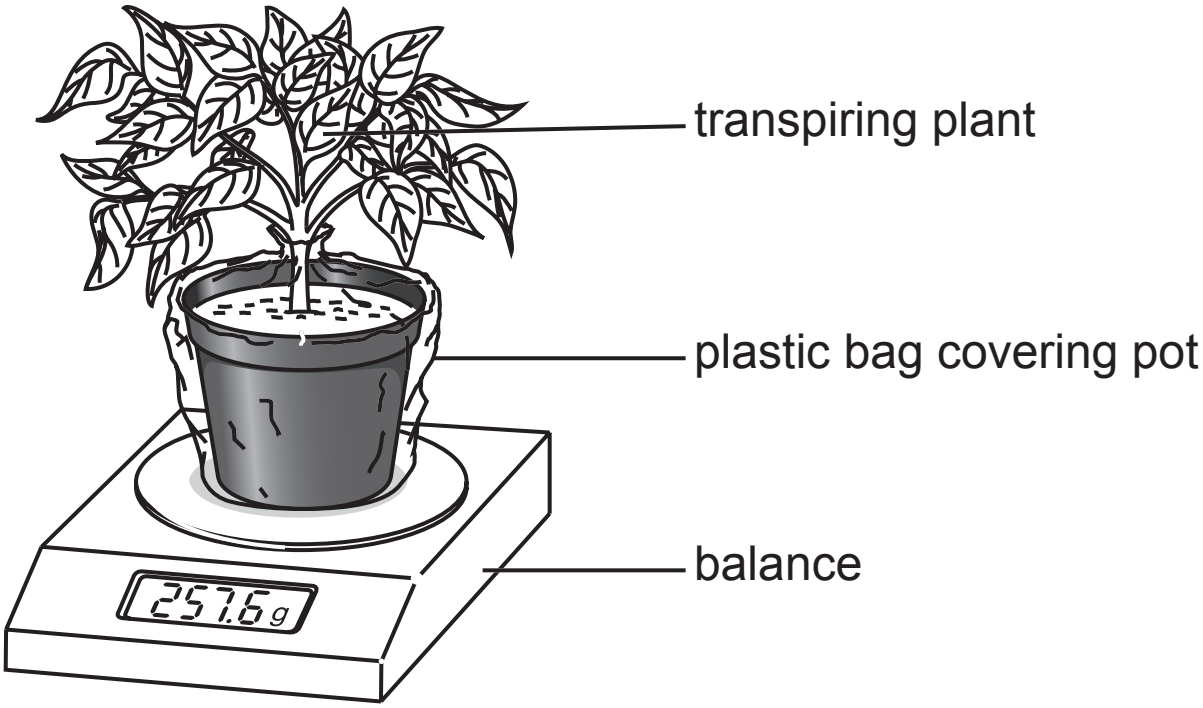
(i) Using the graph, describe the trend shown. [1 mark]

Temperature and humidity are two other factors that have an effect on the rate of transpiration in plants.

(ii) On the axes below, draw a line to show the effect of increasing temperature and a line to show the effect of increasing humidity on the rate of transpiration. [2 marks]



(b) The diagram below shows apparatus used to investigate the effect of surface area of leaves on the rate of transpiration in a plant.



(i) Suggest why the pot was covered with a plastic bag. [1 mark]

_____

The plant was weighed, left for **24 hours** and then reweighed.

The **rate** of transpiration was calculated as 3.8 g per hour.

Some leaves were removed from the plant and the experiment was repeated.

The table below shows the result for the second experiment.

Mass of plant at start/g	Mass of plant after 24 hours/g
257.6	185.6

(ii) Using the data in the table above, calculate the rate of transpiration (in g per hour) in the second experiment. [2 marks]

Show your working.

_____ g per hour

(iii) Explain why the rate of transpiration is lower when some leaves were removed. [2 marks]

_____

_____

_____

(iv) Plants use water in transpiration.

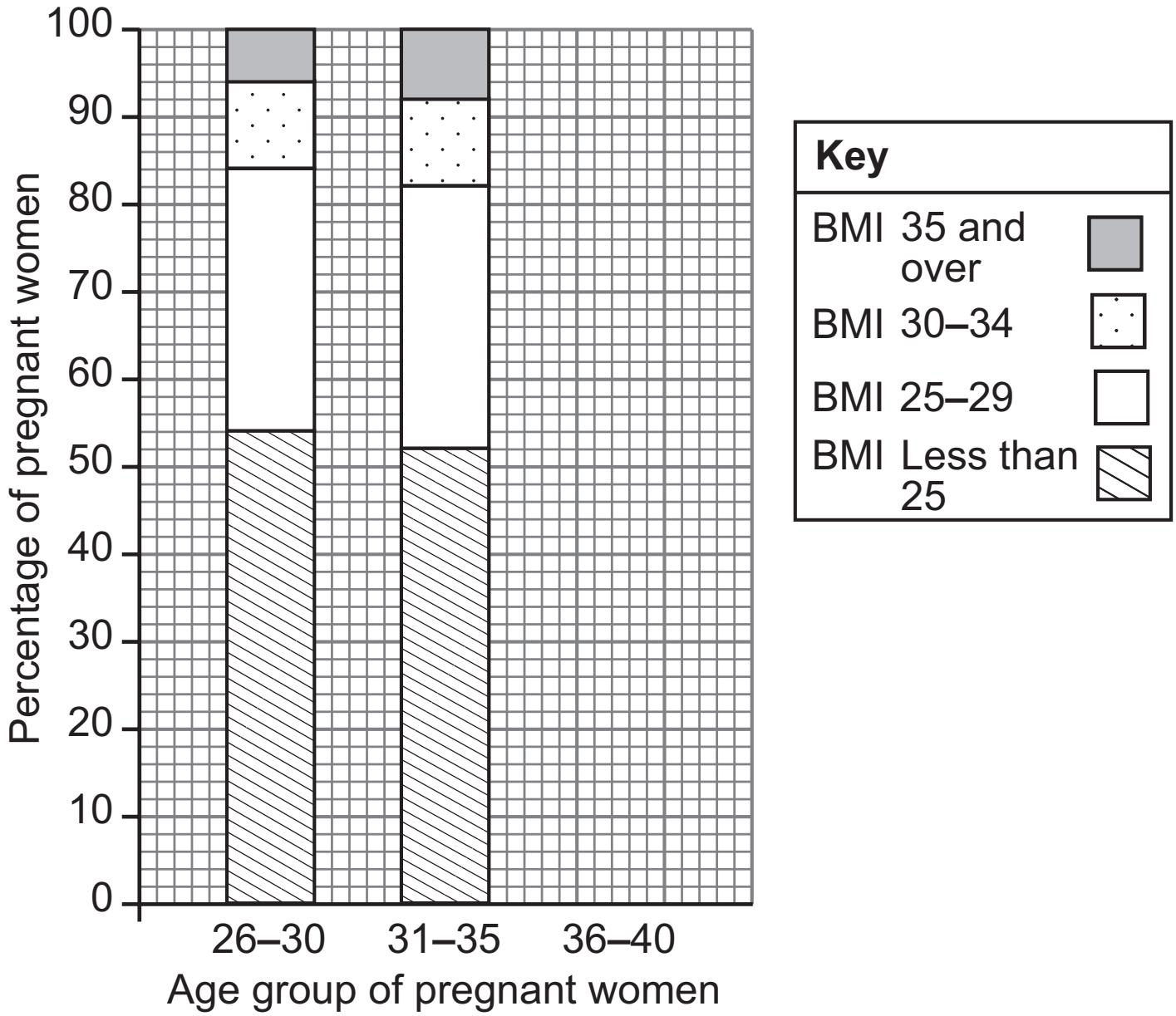
Give two **other** uses of water by a plant. [2 marks]

1. _____

2. _____

5 **(a)** Obesity in pregnant women can increase the risk of health problems in the developing baby.

The graph below shows the BMI (body mass index) of pregnant women, in different age groups, in Northern Ireland in 2010–2011.



Women are defined as being obese if they have a BMI of 30 and over.

(i) What percentage of pregnant women aged 31–35 were classed as being obese? [2 marks]

Show your working.

_____ **%**

The table below shows the BMI of pregnant women aged 36–40.

BMI	**Key**	**Percentage of pregnant women aged 36–40**
35 and over		10
30–34		10
25–29		38
Less than 25		42

(ii) **Complete the graph on page 12** by using this data to draw the bar for pregnant women aged 36–40. [3 marks]

(iii) Using the completed graph, give the age group of pregnant women that is **least** likely to have a developing baby with health problems. [1 mark]

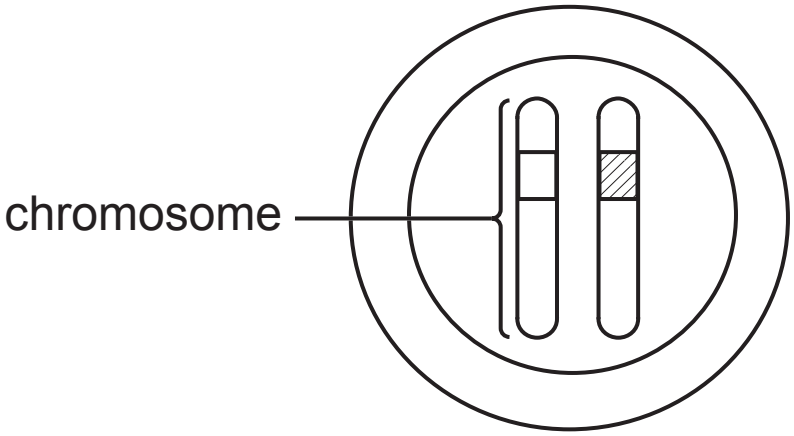
_____

(b) As well as causing problems in pregnancy, obesity can result in high cholesterol levels.

Describe and explain how a diet which is high in cholesterol could lead to a heart attack. [6 marks]

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

6 **(a)** The diagram below shows a cell containing a nucleus with two chromosomes.



(i) Name the molecule that makes up chromosomes. [1 mark]

_____

(ii) In the space below, draw the cells and chromosomes that would be produced when this cell divides by **mitosis**. [3 marks]

(b) Genes control characteristics in organisms.

Peas can be smooth or wrinkled.

This characteristic is shown in the photograph below.

smooth

wrinkled

Let H represent the allele for smooth peas.

Let h represent the allele for wrinkled peas.

(i) Using a Punnett square, show the possible offspring produced when a heterozygous, smooth pea plant is crossed with a wrinkled pea plant. [4 marks]

(ii) Using your Punnett square, give the ratio of smooth pea plants to wrinkled pea plants. [1 mark]

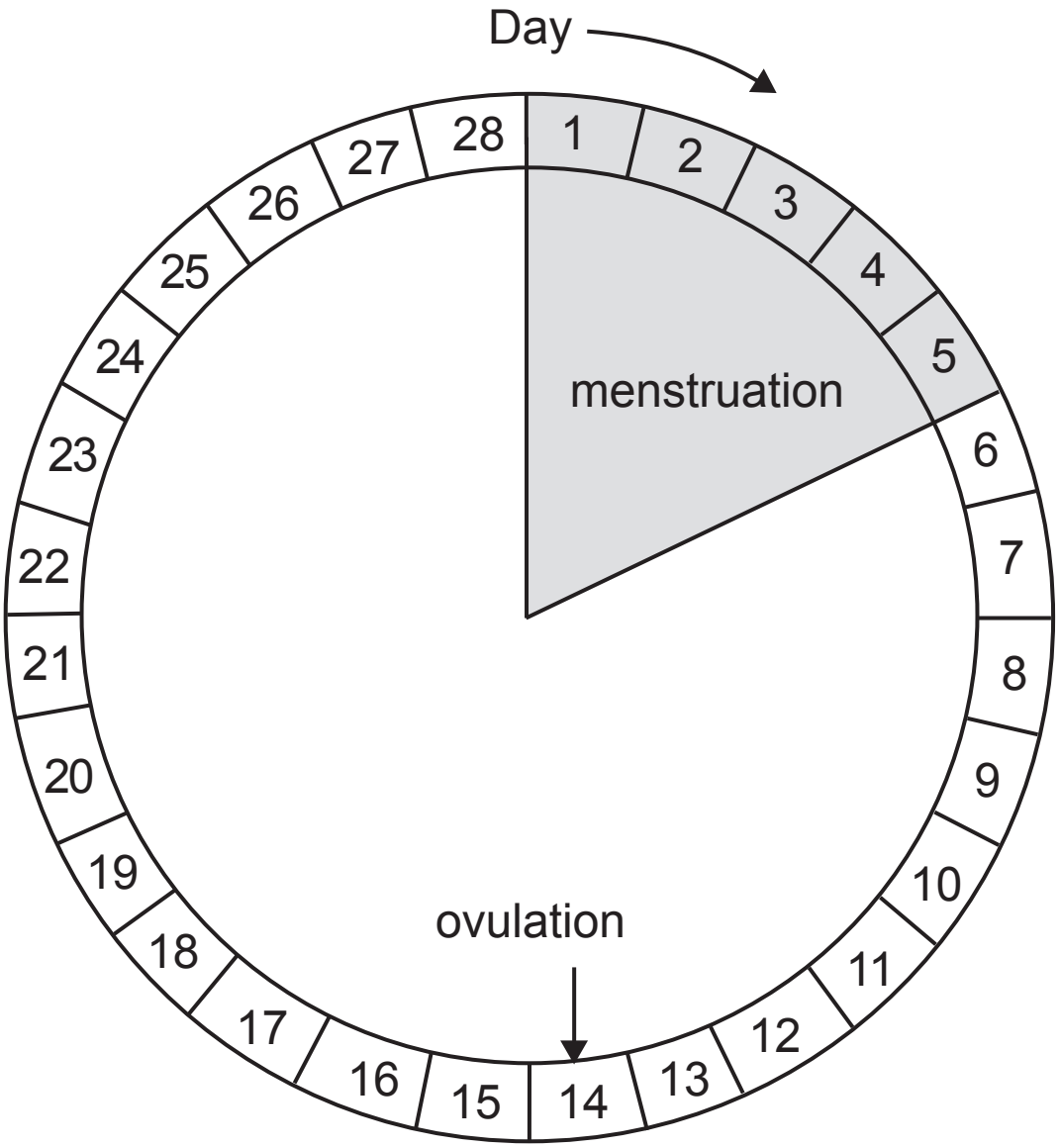
(c) Explain how a test (back) cross could be used to determine the possible genotypes of a smooth pea plant. [3 marks]

7 Sex hormones are involved in the menstrual cycle.

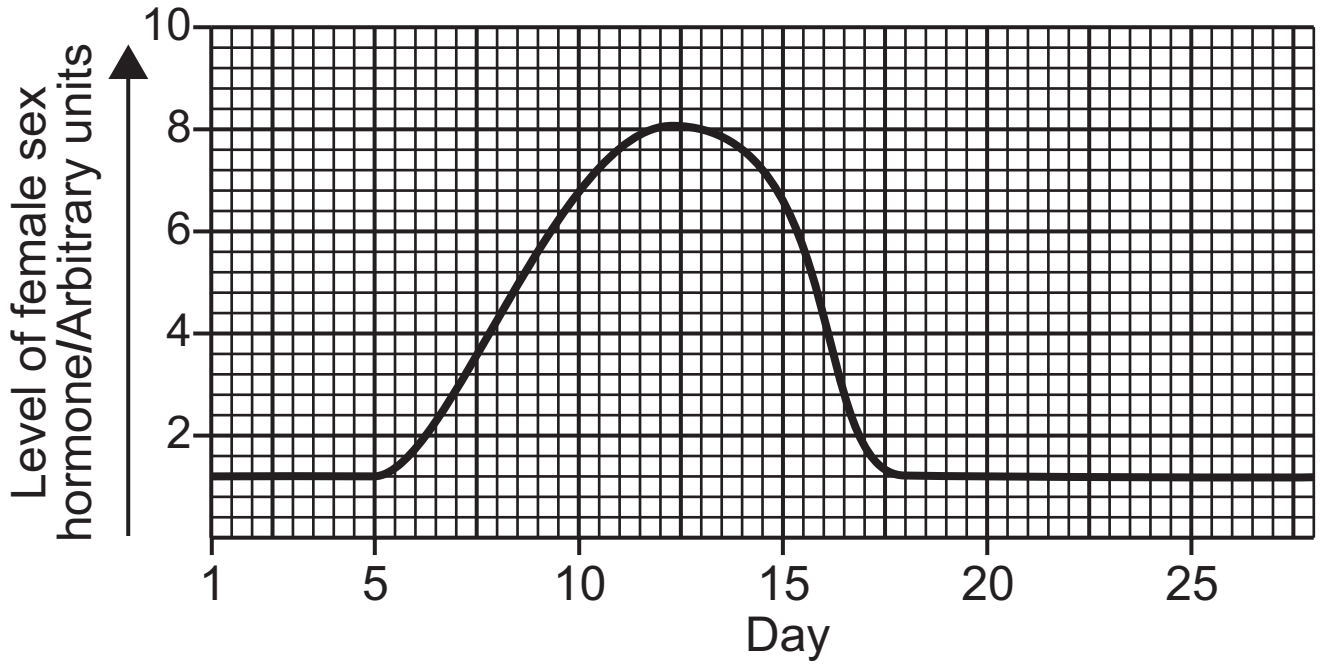
(a) How are hormones transported around the body?
[1 mark]

_____

(b) The diagram below shows a 28 day menstrual cycle.



The graph below shows how levels of a female sex hormone change during the menstrual cycle.



Using the diagram, the graph and your knowledge, describe the changes during the menstrual cycle from Day 1 to Day 16.

Suggest how the events of the menstrual cycle are linked to the hormone levels shown in the graph.
[6 marks]

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

(c) In vitro fertilisation (IVF) may be used to treat childless couples who have fertility problems.

(i) How are zygotes produced in the laboratory during IVF? [2 marks]

_____

_____

(ii) Suggest **one** reason why zygotes produced during IVF are left to grow to the eight cell stage (embryo) before being transferred into the uterus. [1 mark]

_____

_____

(iii) Suggest two ethical issues associated with IVF. [2 marks]

1. _____

2. _____

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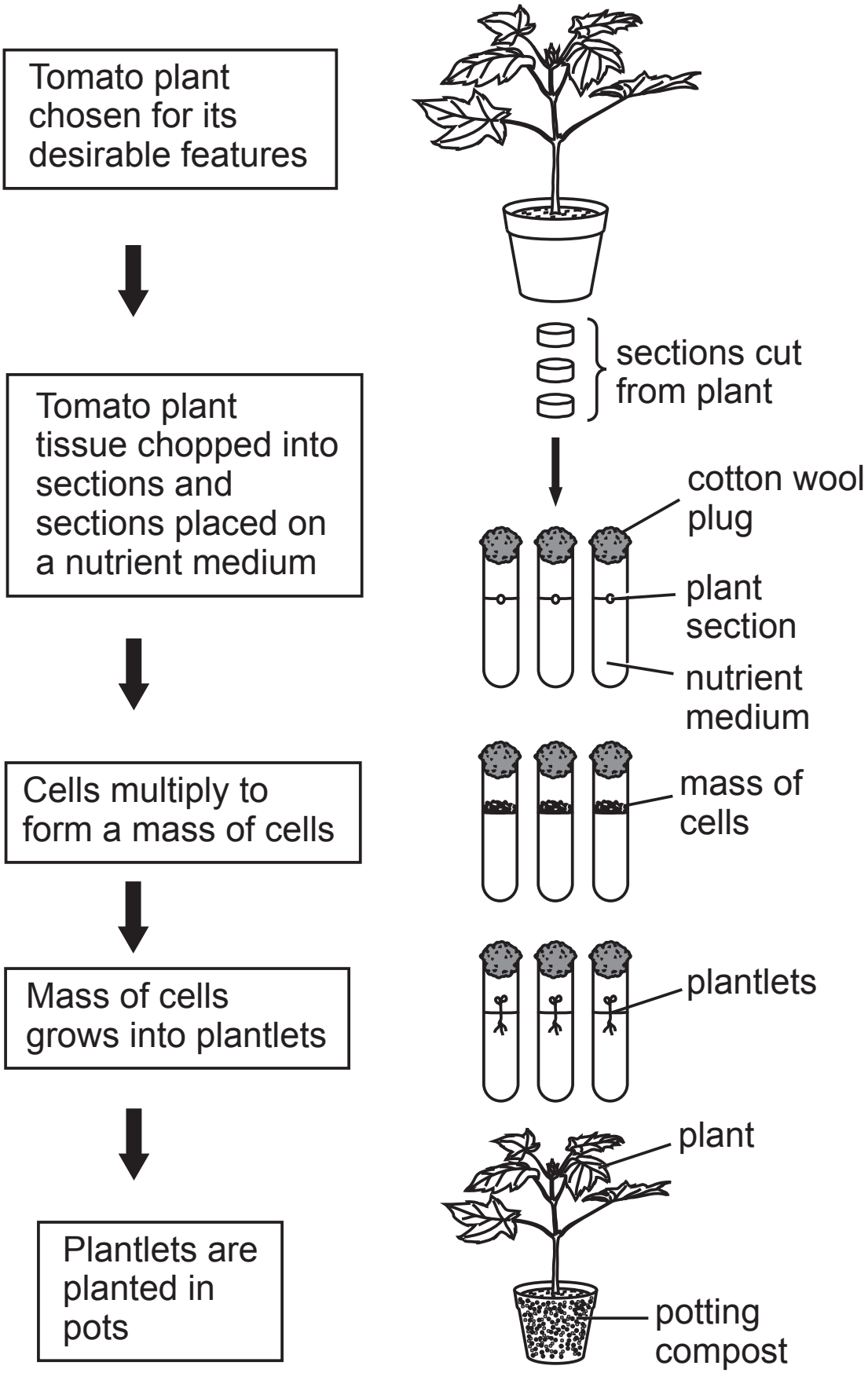
8 **(a)** Explain why cloning in plants can be described as asexual reproduction. [1 mark]

(b) The diagram shows one method of asexual reproduction by which plants can be cloned.



(i) What is the name given to this method of asexual reproduction (cloning) in plants? [1 mark]

_____

(ii) It is important for a grower to select a suitable plant for this method. Suggest two desirable features that a suitable plant would have. [2 marks]

1. _____

2. _____

(iii) Suggest **one** disadvantage of cloning. [1 mark]

_____

9 In a grassland there were equal numbers of brown and white rabbits. A farmer changed the use of this land from grassland to woodland.

Several years after the change in land use he surveyed the rabbit population. The results showed that there was the same number of rabbits but the number of brown rabbits had increased while the number of white rabbits had decreased.

Foxes hunt and eat rabbits. The population of foxes in the area did not change.

(a) Describe how natural selection can account for the **increase** in the number of brown rabbits in the rabbit population as a result of the change in land use.
[4 marks]

_____

_____

_____

_____

_____

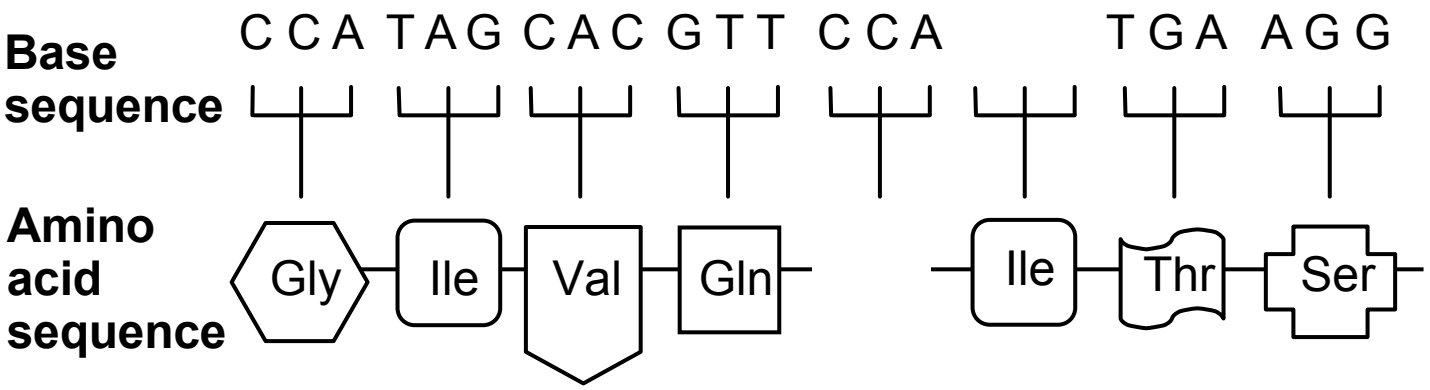
_____

(b) Suggest two changes that could cause the number of **white** rabbits in the population to increase in the future.
[2 marks]

1. _____

2. _____

10 (a) The diagram below shows part of the base sequence of DNA which is used to code for specific amino acids. The amino acids join to make a protein molecule such as insulin.



(i) Complete the diagram by:

- adding the missing three bases in the base sequence.
- drawing the missing amino acid in the amino acid sequence. [2 marks]

(ii) Insulin is a protein made up of 51 amino acids.

How many bases are needed to code for this protein? [1 mark]

_____

(iii) Explain what would happen if the first base (C) in the base sequence above was removed. [2 marks]

_____

_____

_____

(b) Bacteria can be genetically engineered to make human insulin to treat people with diabetes.

(i) Draw a genetically engineered bacterium which contains a gene for human insulin.

Label the human insulin gene and the plasmid.
[3 marks]

(ii) The genetically engineered bacterium is placed in a fermenter with optimum conditions.

What happens next so that large quantities of human insulin can be produced? [1 mark]

_____

(iii) Until scientists developed the process of producing insulin by genetic engineering, it was obtained from cows and pigs.

State **two** advantages of producing human insulin by genetic engineering. [2 marks]

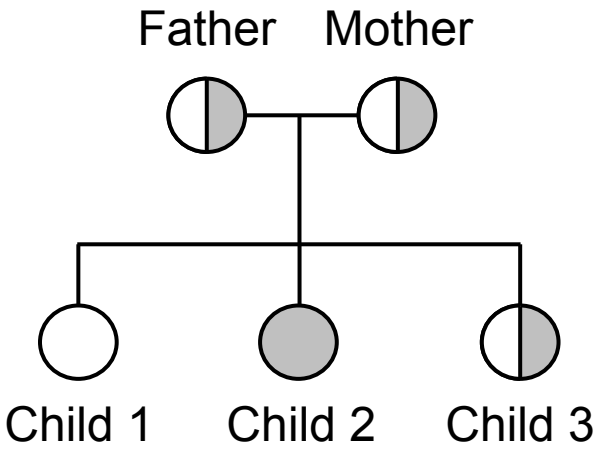
_____

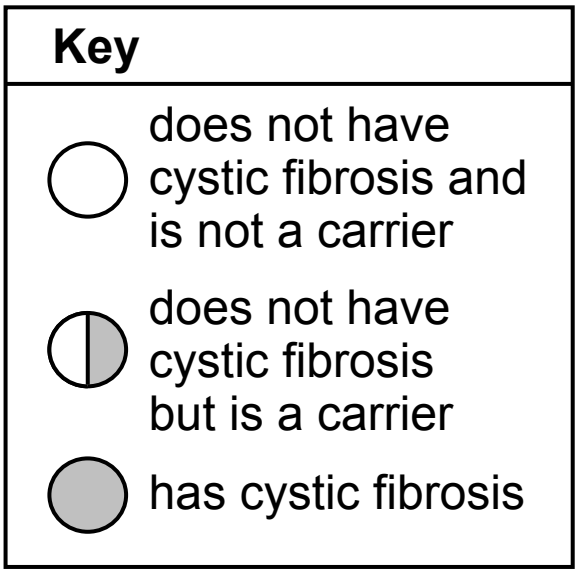
_____

_____

(c) Cystic fibrosis is an inherited condition. The diagram below shows how two parents who are carriers can have a child with cystic fibrosis.

A carrier is a person who has an allele for a condition but does not have the condition.





(i) Using the diagram and your knowledge, explain how two parents who are carriers can have a child with cystic fibrosis. [2 marks]

(ii) Anne and Niall have a child with cystic fibrosis.

Anne is pregnant with a second baby and has asked her doctor for information on genetic screening.

Suggest two ethical issues associated with genetic screening during pregnancy. [2 marks]

1. _____

2. _____

(iii) Cystic fibrosis is caused by a change in the genes.

Name one genetic condition that is caused by a change in the **number of chromosomes**. [1 mark]

_____

THIS IS THE END OF THE QUESTION PAPER

SOURCES

Pg2 Q1 Diagram showing a plant cell as seen under a microscope, © CCEA
Pg4 Q2(a) Photograph of a mosquito, © Sinclair Stammars/ Science Photo Library
Pg6 Q3(a) Diagram showing a section through the heart, © Paul Wootton/ Science Photo Library
Pg10 Q4(b) Diagram showing apparatus used to investigate the effect of surface area on the rate of transpiration in a plant, © CCEA
Pg15 Q6(a) Diagram showing a cell containing a nucleus with two chromosomes, © CCEA
Pg16 Q6(b) Photograph of a smooth pea and a wrinkled pea, © Walter Eberhart, Visuals Unlimited/ Science Photo Library
Pg24 Q8(b) Diagram showing one method of asexual reproduction by which plants can be cloned, © CCEA

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Question Number	**Marks**
1	
2	
3	
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Total Marks	