



General Certificate of Secondary Education  
2018

Centre Number

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Candidate Number

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# Double Award Science Biology

Unit B2  
Higher Tier

<b>ML</b>
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**[GSD42]**

**FRIDAY 8 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.**

**Do not write outside the boxed area on each page or on blank pages.**

Complete in black ink only. **Do not write with a gel pen.**

Answer **all eleven** questions.

## INFORMATION FOR CANDIDATES

The total mark for this paper is 90.

Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

Quality of written communication will be assessed in Questions **3(a)** and **11(d)**.

- 1 (a) Yvonne investigated the effects of two types of exercise on her pulse rate.

She predicted that doing star jumps for two minutes would increase her pulse rate more than jogging for two minutes.

- (i) What variable did Yvonne change in the investigation?

\_\_\_\_\_ [1]

- (ii) Give **one** variable that Yvonne kept the same in the investigation.

\_\_\_\_\_ [1]

- (iii) When did she measure her pulse rate during the investigation?

\_\_\_\_\_  
\_\_\_\_\_ [2]

- (iv) Suggest the units Yvonne used when she recorded her pulse rate.

\_\_\_\_\_ [1]

- (v) How could she have made her results more reliable?

\_\_\_\_\_  
\_\_\_\_\_ [1]

- (b) Give **one** benefit of regular exercise.

\_\_\_\_\_  
\_\_\_\_\_ [1]

2 (a) The first vaccine against smallpox was developed in 1796.

(i) Name the scientist who developed this vaccine.

\_\_\_\_\_

[1]

(ii) What observation did the scientist make about milkmaids that helped him develop the first vaccine against smallpox?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

[2]

- (b) Immunity to a disease is produced by raised antibody levels in the blood. Artificial immunity can be active or passive. Natural immunity can be innate or acquired.

The table below shows some types of immunity.

	Type of immunity	Description of the immunity
A		<p>This boy caught a disease. He was unwell for a few days and then recovered. His lymphocytes <b>produced antibodies</b> to fight the disease.</p>
B		<p>This mother is breastfeeding her baby. She is <b>passing antibodies</b> in her breast milk to the baby.</p>
C		<p>This girl stood on a nail in her garden. She is at risk of catching a disease called tetanus and is <b>being given tetanus antibodies</b> in an injection.</p>

Photo A: © Perboge / iStock / Thinkstock - Photo B: © FamVeld / iStock / Thinkstock - Photo C © yangna / iStock / Thinkstock

Use the information in the table opposite to answer the following questions.

(i) Which letter **A, B, or C** shows artificial immunity?

\_\_\_\_\_ [1]

(ii) Which letters **A, B, or C** show **two** examples of passive immunity?

\_\_\_\_\_ and \_\_\_\_\_ [1]

(iii) Give **one** advantage of type **C** immunity.

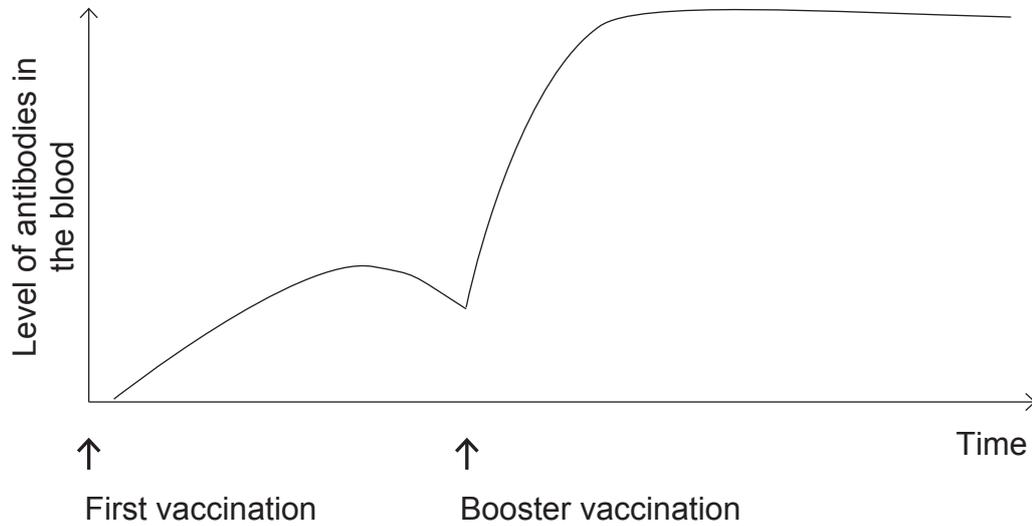
\_\_\_\_\_  
\_\_\_\_\_ [1]

(iv) Which type of immunity will last for the longest time?  
Choose from **A, B, or C**.

\_\_\_\_\_ [1]

[Turn over

- (c) A booster vaccination is given after the first vaccination to maintain immunity against some diseases.  
The graph below shows the level of antibodies in the blood after the first vaccination and after a booster vaccination.



Source: Principal Examiner

Use the graph to describe **three** differences in the response to the booster vaccination compared to the first vaccination.

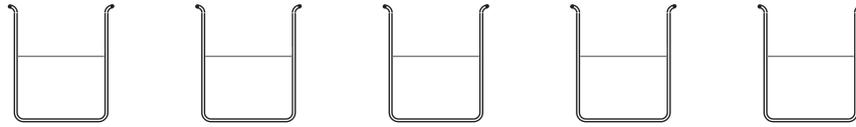
1. \_\_\_\_\_  
\_\_\_\_\_
2. \_\_\_\_\_  
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3. \_\_\_\_\_  
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[3]

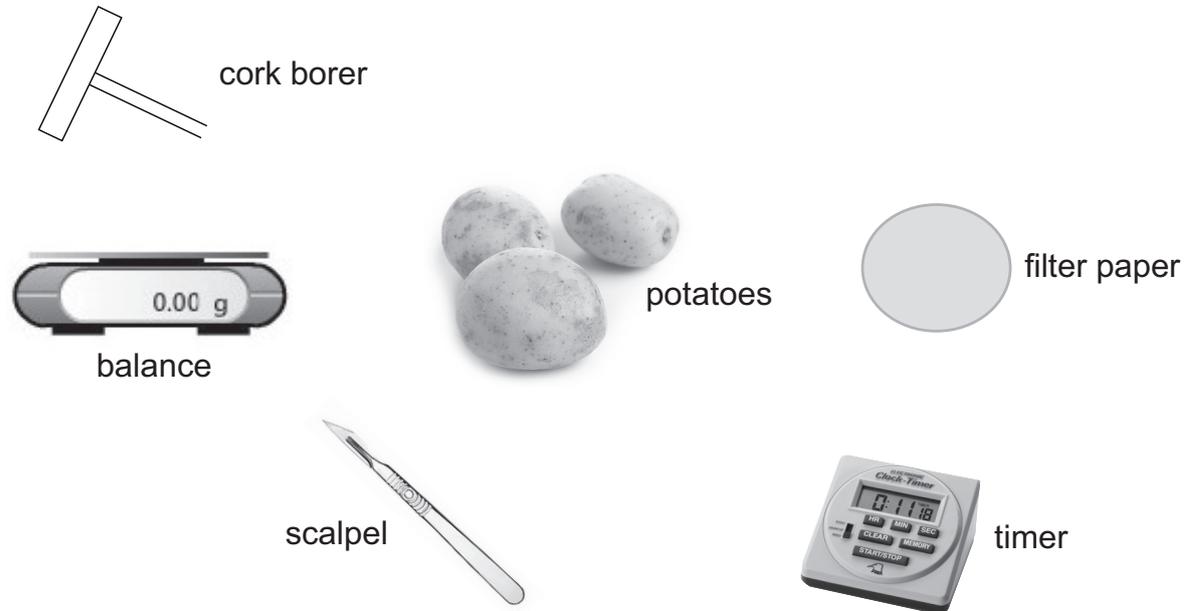


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- 3 A student used the apparatus below in an osmosis experiment to find the change in mass of potato cylinders when placed in different concentrations of sugar solution.



Five beakers each containing different concentrations of sugar solution



Potatoes: © Science Photo Library - Scalpel: © Science Photo Library - Timer: © Martyn F. Chillmaid / Science Photo Library

- (a) Describe how the student carried out the experiment. Include in your answer:
- how he obtained the potato cylinders at the start of the experiment
  - what he did with the potato cylinders
  - the measurements he took.

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

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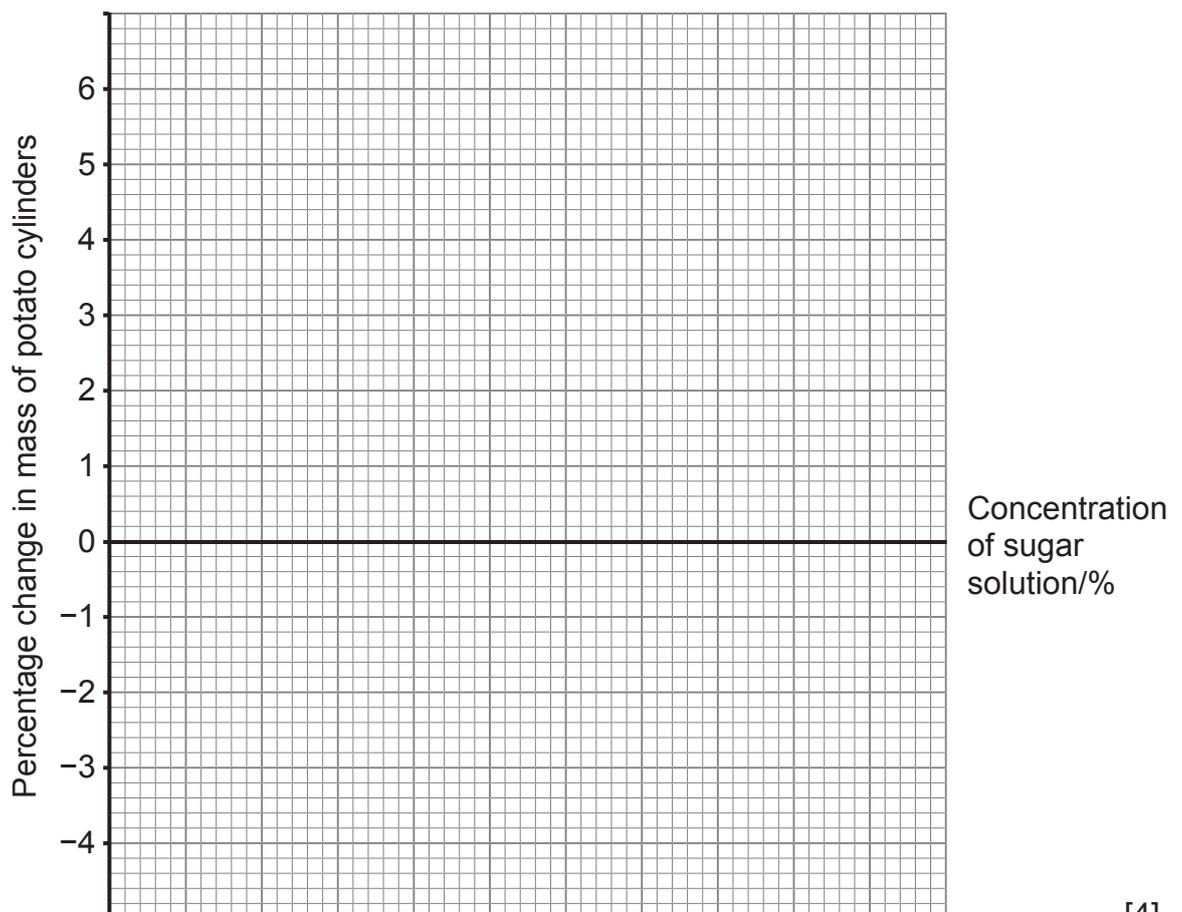
The student calculated the **percentage change** in mass for each potato cylinder.

The table shows his results.

Concentration of sugar solution/%	Percentage change in mass of potato cylinders
2	+5.6
4	+3.2
6	+0.8
8	-1.6
10	-4.0

(b) Use the data in the table to draw a line graph on the grid below.

Add a scale on the x axis.



[4]

(c) The student found that the sugar concentration inside the potato cells was 6.6%. Use the graph and your knowledge of osmosis to explain how he obtained this value.

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[3]

- 4 Pea plants can produce flowers that are either purple or white.

The photograph shows a pea plant with white flowers.



© Maria Mosolova / Science Photo Library

The allele **D** for purple flowers is dominant to the allele **d** for white flowers.

A plant breeder crossed two heterozygous pea plants.

- (a) Use a Punnett square to show the possible genotypes of the offspring of this cross.

[4]

- (b) Give the phenotypes of the offspring and their ratio.

Phenotypes \_\_\_\_\_ and \_\_\_\_\_

Ratio \_\_\_\_\_ to \_\_\_\_\_

[2]

(c) The breeder had a purple flowering pea plant. He did not know its genotype.

- (i) Use Punnett squares to show the test (back) crosses that he could use to determine the genotype of this purple flowering pea plant.

[4]

- (ii) A pea plant with white flowers was produced as a result of one of the test (back) crosses.

Give the genotypes of the parents of the cross that produced the white flowered pea plant.

\_\_\_\_\_ and \_\_\_\_\_

[1]

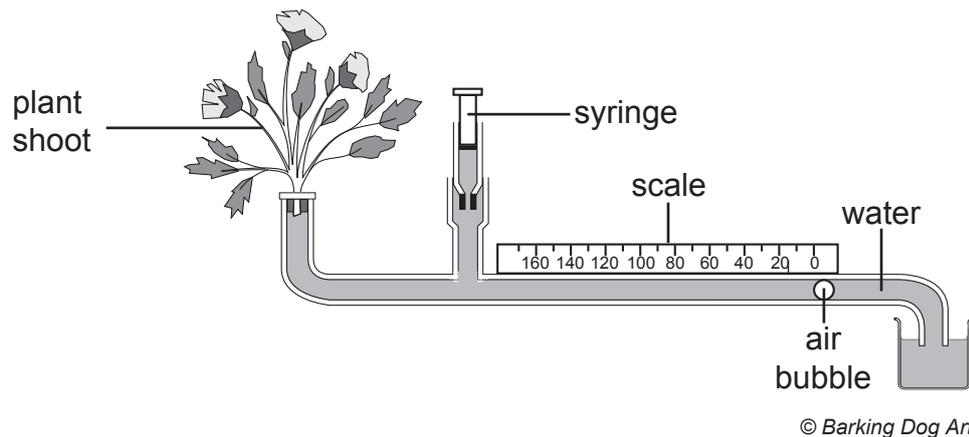
[Turn over

5 (a) Give **two** uses of water in plants.

1. \_\_\_\_\_
2. \_\_\_\_\_ [2]

Students used a potometer to investigate how different treatments of the leaves affected the rate of water uptake in plant shoots.

The diagram shows a potometer.



(b) Name another piece of apparatus needed by the students to work out the **rate** of water uptake in the plant shoot.

\_\_\_\_\_ [1]

(c) The students carried out the investigation using four identical plant shoots and vaseline. Vaseline is a waterproof jelly that blocks stomata.

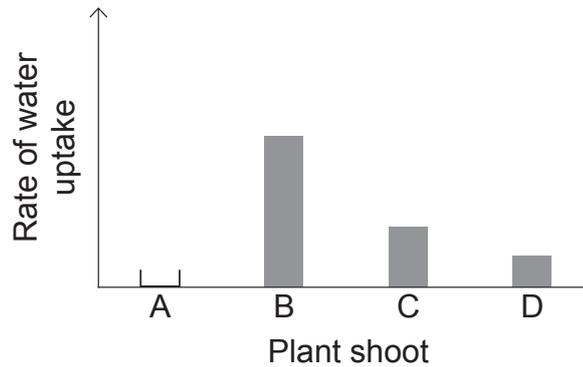
The table shows the treatments given to the plant shoots.

Plant Shoot	Treatment with vaseline
A	None
B	Only the upper leaf surfaces were covered
C	Only the lower leaf surfaces were covered
D	Upper and lower leaf surfaces were covered

They kept all other conditions constant.

The students measured the rate of **water uptake** for each plant shoot.

The graph shows the results for plant shoots B, C and D.



(i) On the graph draw the bar that you would expect for plant shoot A. [1]

(ii) Each plant shoot was left for five minutes in the potometer before readings were taken.

Suggest why.

\_\_\_\_\_ [1]

The plant shoots have stomata on both the upper and lower surfaces of their leaves.

(iii) Use the table and graph to describe and explain the difference in the results for the rate of water uptake in plant shoots B and C.

\_\_\_\_\_

\_\_\_\_\_

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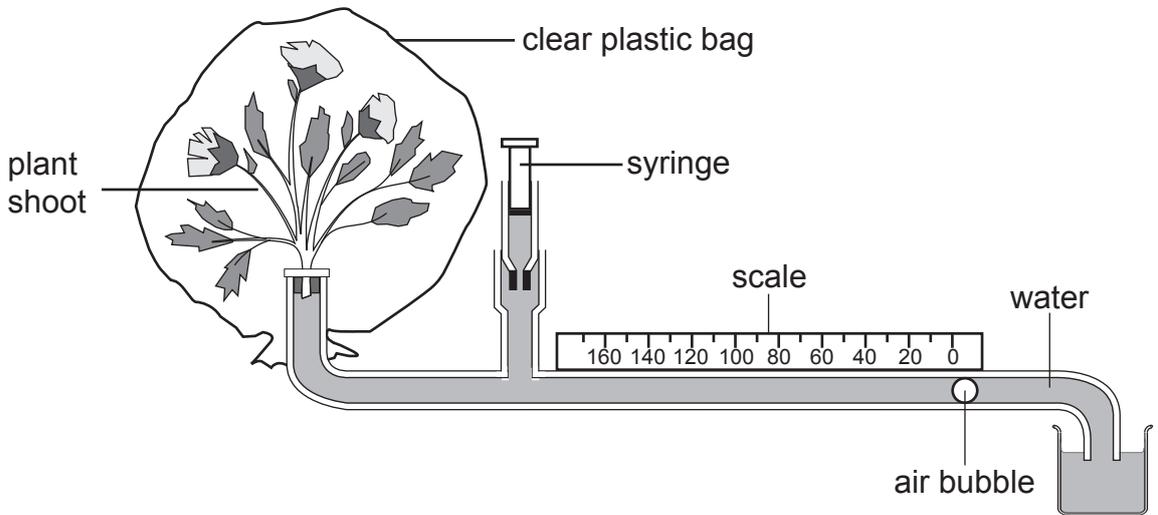
\_\_\_\_\_

\_\_\_\_\_ [3]

[Turn over

The students then placed a clear plastic bag over another plant shoot. They worked out the rate of water uptake for this plant shoot.

The diagram shows how they set up the investigation.



© Barking Dog Art

- (d) The rate of water uptake in this shoot was different when compared to an identical plant shoot **not covered** with a plastic bag.

Describe and explain the difference in the results.

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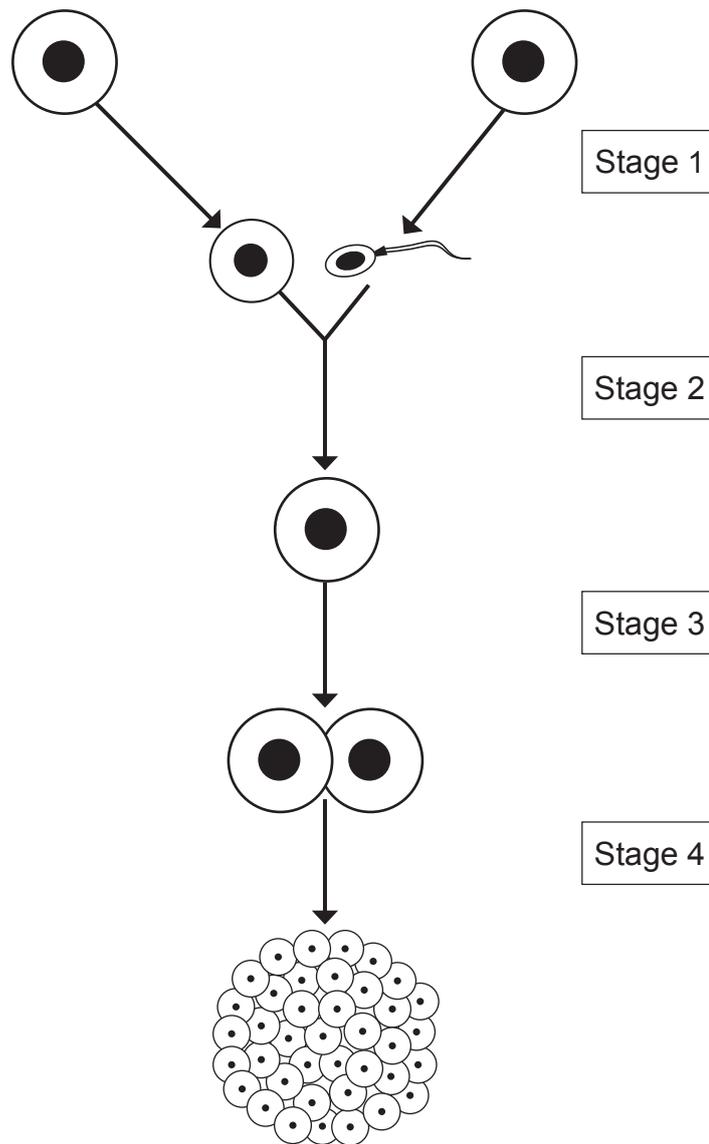
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[3]



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- 6 The diagram shows fertilisation and some of the early stages in the development of an embryo.



- (a) Give the stage where meiosis occurs.

Stage \_\_\_\_\_

[1]

- (b) What is formed during stage 2?

\_\_\_\_\_

[1]

(c) The ball of cells formed during stage 4 implants into the uterus lining where differentiation occurs.

What is differentiation?

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[1]

(d) After implantation the placenta is formed.

(i) How is the placenta adapted for its function?

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[1]

(ii) Name **one** substance that crosses the placenta **from the foetus** to the mother.

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[1]

7 Strawberry plants reproduce by cloning.

The photograph shows reproduction in a strawberry plant.



parent plant

cloned plant

© Alan and Linda Detrick / Science Photo Library

(a) What is a clone?

\_\_\_\_\_ [1]

(b) What type of reproduction produces clones?

\_\_\_\_\_ [1]

(c) Name the type of cell division that produces the cloned strawberry plant.

\_\_\_\_\_ [1]

(d) Suggest **one** disadvantage to the strawberry plant of reproducing by cloning.

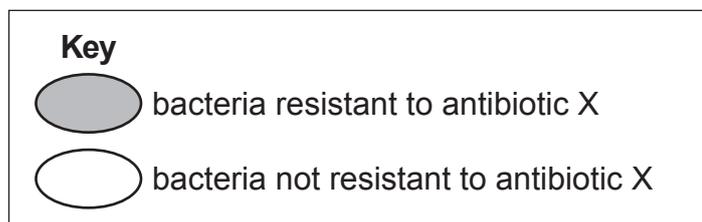
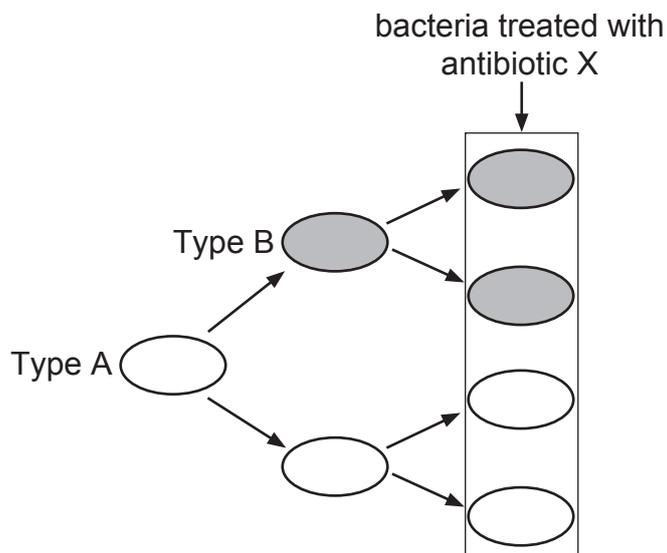
\_\_\_\_\_ [1]

8 The diagram shows one type of bacterium, type A, dividing.

During division, some type A bacteria mutate and produce a new type of bacterium, type B, that is resistant to antibiotic X.

Both types of bacteria were then treated with antibiotic X.

(a) Use the key to show any bacteria that result from the next division **after** treatment with antibiotic X.



[3]

© Barking Dog Art

Infections caused by antibiotic resistant bacteria have increased in recent years.

(b) Give **one** precaution used in hospital wards to limit the spread of antibiotic resistant bacteria.

\_\_\_\_\_

\_\_\_\_\_ [1]

[Turn over

- 9 (a) The passage below gives information about the snowshoe hare.

The snowshoe hare lives in northern USA.

It is prey for large wild cats called lynx.

The snowshoe hare is found in woodland areas that are covered with snow in the winter.

During the winter, the snowshoe hare's fur is white.

In late spring, a chemical reaction occurs in the hares that causes their fur to turn from white to brown.

The photographs show the snowshoe hare in winter and in spring.

Winter



White fur

Spring



Brown fur

© Dr P. Marazzi / Science Photo Library

Use the information in the passage above and your knowledge of **natural selection** to answer the following questions.

- (i) Suggest why it is an advantage for a snowshoe hare to have white fur in winter.

\_\_\_\_\_ [1]

- (ii) Give a reason for your answer.

\_\_\_\_\_ [1]

(b) Climate change is causing the snow to melt earlier in spring in northern USA.

Some snowshoe hares have a mutated gene that causes their fur to turn brown **earlier** in the spring.

(i) Describe how climate change would affect the numbers of snowshoe hares with the mutated gene.

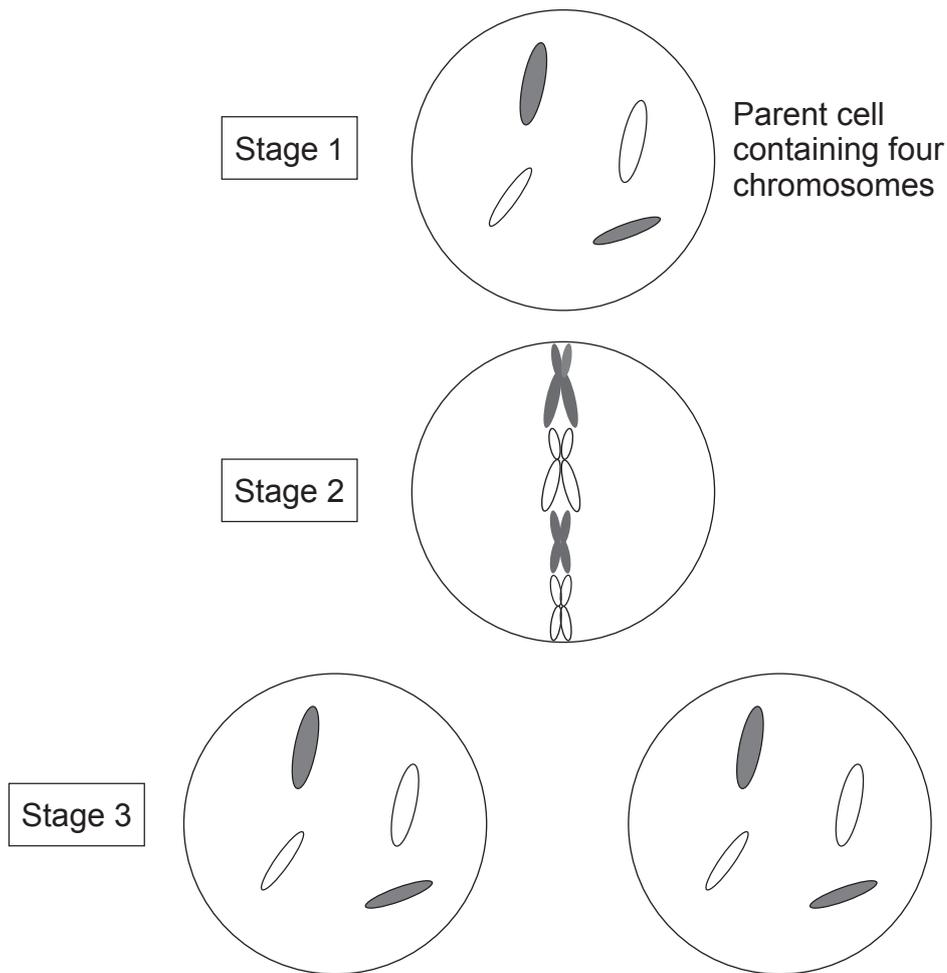
\_\_\_\_\_ [1]

(ii) Explain your answer.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [2]

[Turn over

10 (a) The diagram shows the process of mitosis.



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

(i) Describe **two** changes that have occurred between stage 1 and stage 2.

1. \_\_\_\_\_
2. \_\_\_\_\_ [2]

(ii) Compare the cells produced at stage 3 with the parent cell at stage 1.

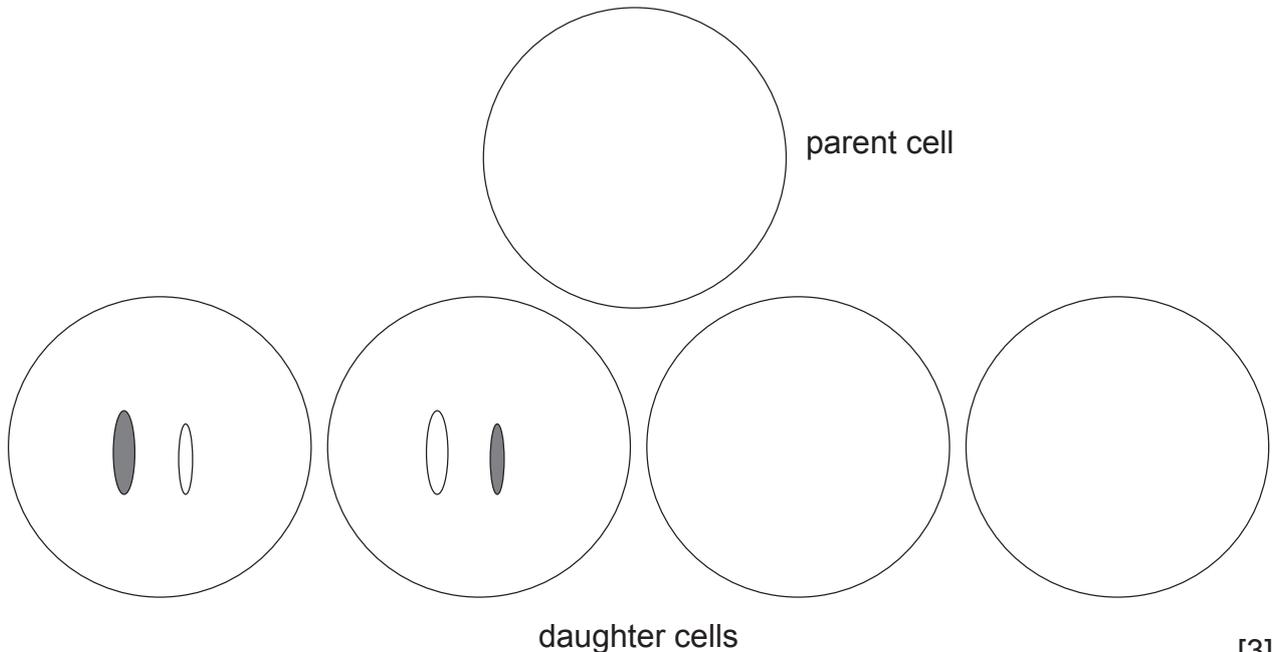
\_\_\_\_\_  
 \_\_\_\_\_ [1]

Meiosis is the other type of cell division.

In meiosis, independent assortment of chromosomes occurs.

- (b) Complete the diagram below to show the chromosomes in the parent cell and in the daughter cells that would be produced from this parent cell.

Two daughter cells have been completed for you.



- (c) Independent assortment of chromosomes in meiosis results in **two** of the following:

diploid cells	variation	genetically identical cells	muscle cells	haploid cells
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Draw circles around the **two** correct answers.

[2]

[Turn over

11 Mutations can occur in humans.

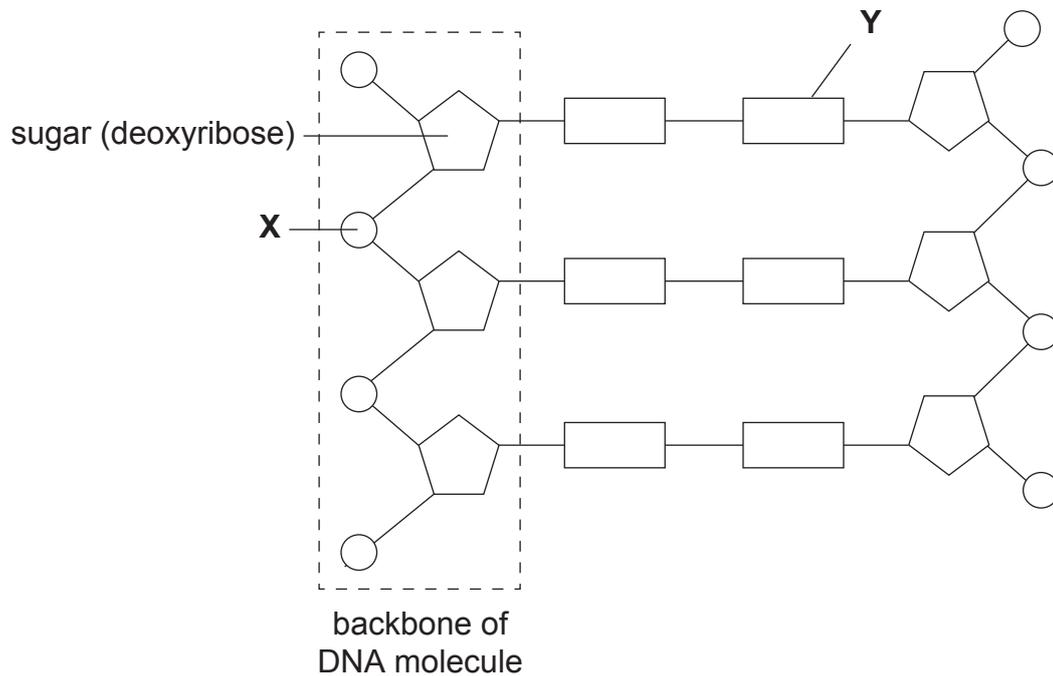
- (a) Name **one** condition in humans caused by each of the following types of mutation.

A chromosome mutation \_\_\_\_\_ [1]

A gene mutation \_\_\_\_\_ [1]

- (b) Chromosomes and genes are made of DNA.

The diagram shows part of a DNA molecule.



Source: Principal Examiner

- (i) Name part X.

\_\_\_\_\_ [1]

- (ii) Name part Y.

\_\_\_\_\_ [1]

(c) Outline the contribution Edwin Chargaff made to the discovery of the structure of the DNA molecule.

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[2]



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Examiner Number

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