



Rewarding Learning

General Certificate of Secondary Education
2022

Centre Number

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Candidate Number

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Double Award Science Biology

Unit B2

Higher Tier

[GDW42]

GDW42

WEDNESDAY 15 JUNE, MORNING

TIME

1 hour 15 minutes.

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 ten** questions.

INFORMATION FOR CANDIDATES

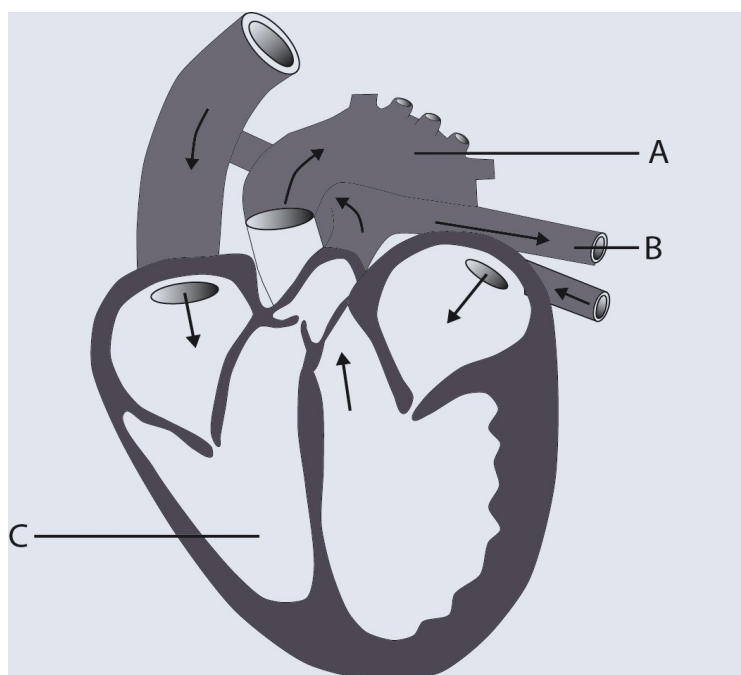
The total mark for this paper is 80.

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 Question **4(a)**.



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



Source: © CCEA

- (i) Name blood vessels **A** and **B**.

A _____

B _____

[2]

- (ii) Name the heart chamber **C**.

[1]



- (b) The table below gives some features of three types of blood vessel: arteries, veins and capillaries.

Complete the table by writing a tick (✓) in a box if the feature is present.

Feature	Arteries	Veins	Capillaries
Most have valves			
Allow exchange of materials between blood and tissues			
Thickest walls			
Largest lumen diameter			
Presence of muscle and elastic fibres in walls			

[6]



2 Students carried out an investigation into osmosis.

They placed 100 g of different concentrations of sucrose solution into each of five beakers.

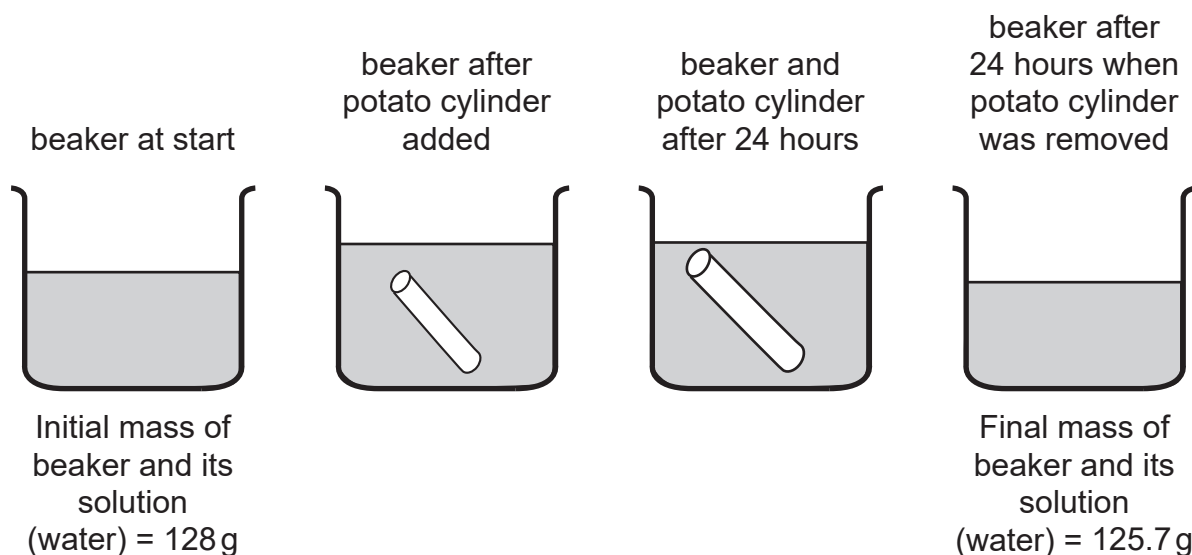
They recorded the mass of each **beaker and its solution**.

They cut five identical potato cylinders and placed one in each beaker.

After 24 hours they removed each potato cylinder and reweighed each beaker and its solution.

They calculated the **change in mass**, in grams, of each **beaker and its solution**.

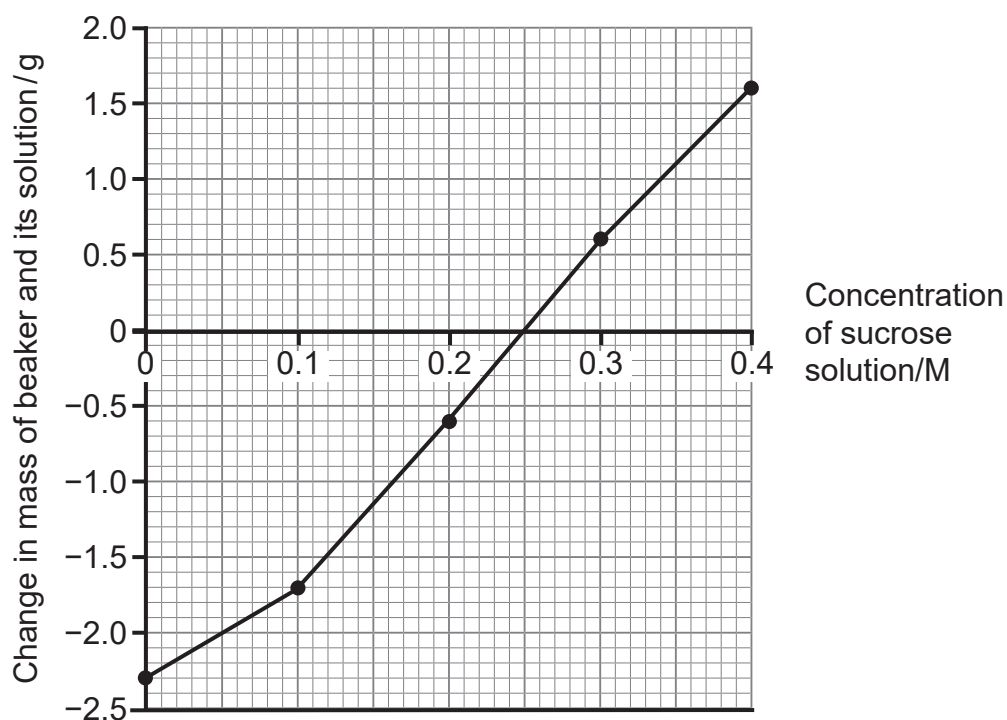
The diagram shows the experiment when the beaker contained water (0.0 M sucrose solution).



Source: Principal Examiner



The graph below shows the change in mass of each **beaker and its solution** after 24 hours.



Source: Principal Examiner

The change in mass of the beakers and their solutions after 24 hours are linked to the changes in mass of the **potato cylinders**.

- (a) Complete the table below. Write **increased**, **decreased** or **not changed** in the empty boxes to show the effect of the different concentrations of sucrose solutions on the mass of each **potato cylinder** after 24 hours.

Use the diagram opposite and the graph to help you.

Concentration of sucrose solution / M	Mass of potato cylinder has:
0.0 (water)	
0.25	
0.3	
0.4	decreased

[3]

[Turn over



(b) Explain the results for the potato cylinder in water (0.0 M sucrose solution).

[3]



3 Microorganisms can cause diseases.

HPV, potato blight and tuberculosis are diseases caused by microorganisms.

- (a) Complete the table below by writing in the empty boxes to give the type of microorganism that causes each disease.

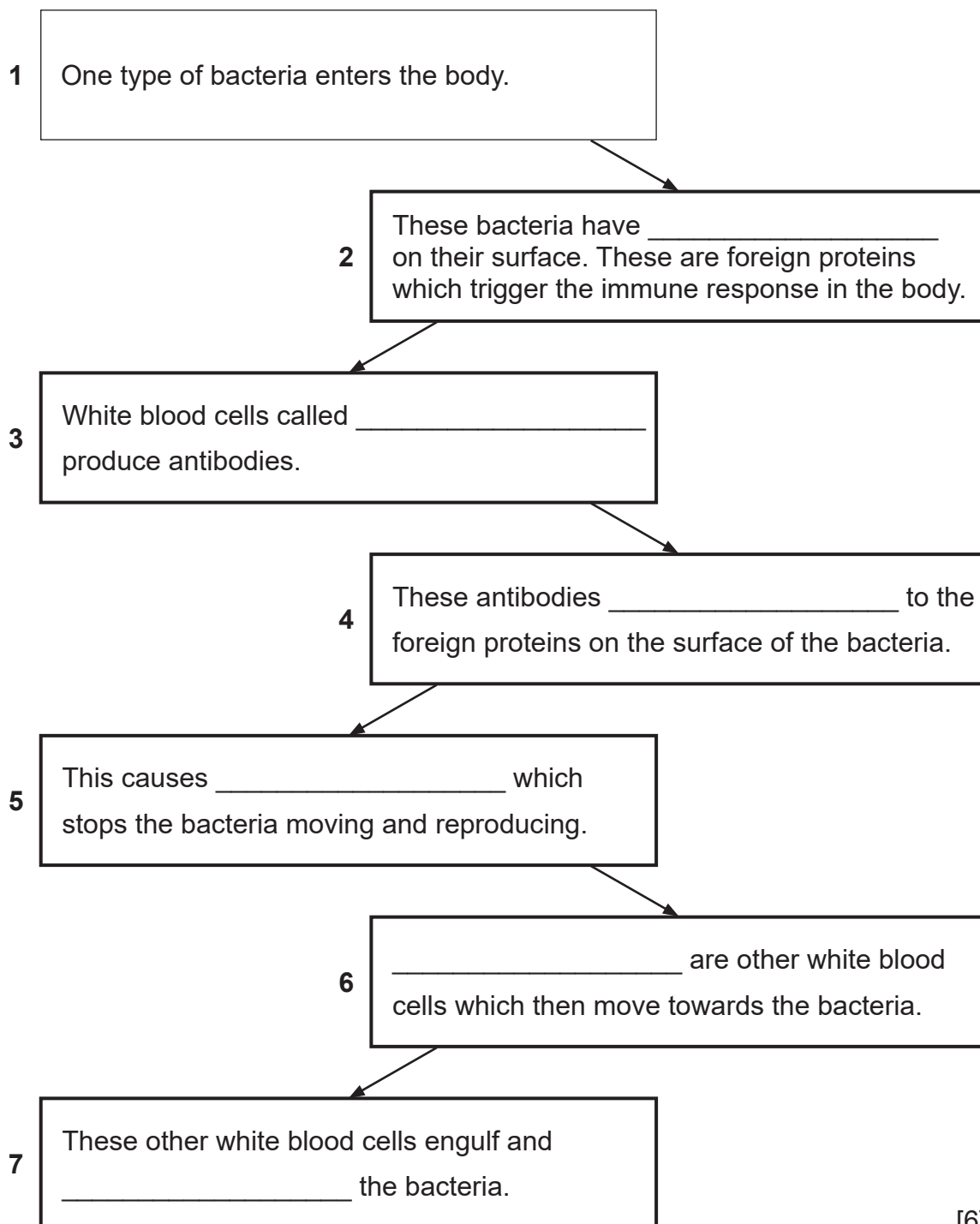
Disease	Type of microorganism that causes each disease
HPV	
Potato blight	
Tuberculosis	

[3]



- (b) The diagram below gives the sequence of events when a person is infected by one type of bacteria for the **first time**. This is called the primary response.

Complete the diagram by writing the missing words in the blank spaces in boxes 2 to 7.



[6]



A secondary response occurs when the same person is infected by the same type of bacteria a second time.

- (c) Describe how antibody production in the secondary response **differs** from antibody production in the primary response.

[3]



4 (a) Mitosis and meiosis are two types of cell division.

- Give **one** place in the body where each type of cell division occurs.
- Give four statements that are **true** for mitosis but **not true** for meiosis.

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

One place in the body where each type of cell division occurs.

Mitosis _____

Meiosis

Four statements that are **true** for mitosis but **not true** for meiosis.

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

[6]

Uncontrolled cell division can result in two different types of tumour.

(b) Give **two** features of a benign tumour and name the other type of tumour that can form as a result of uncontrolled cell division.

Two features of a benign tumour.

Name of other type of tumour.

[3]

All body cells will die if they do not receive a blood supply.

In medical trials, some tumours are being treated with drugs that reduce the blood supply to the cells in the tumour.

(c) Suggest why a reduction in blood supply causes these cells to die.

[2]

[Turn over



- 5 Aspirin is a medicine used to treat people who are at risk of having a heart attack. Aspirin helps lower the risk of having a heart attack.

(a) Explain how aspirin helps lower the risk of a person having a heart attack.

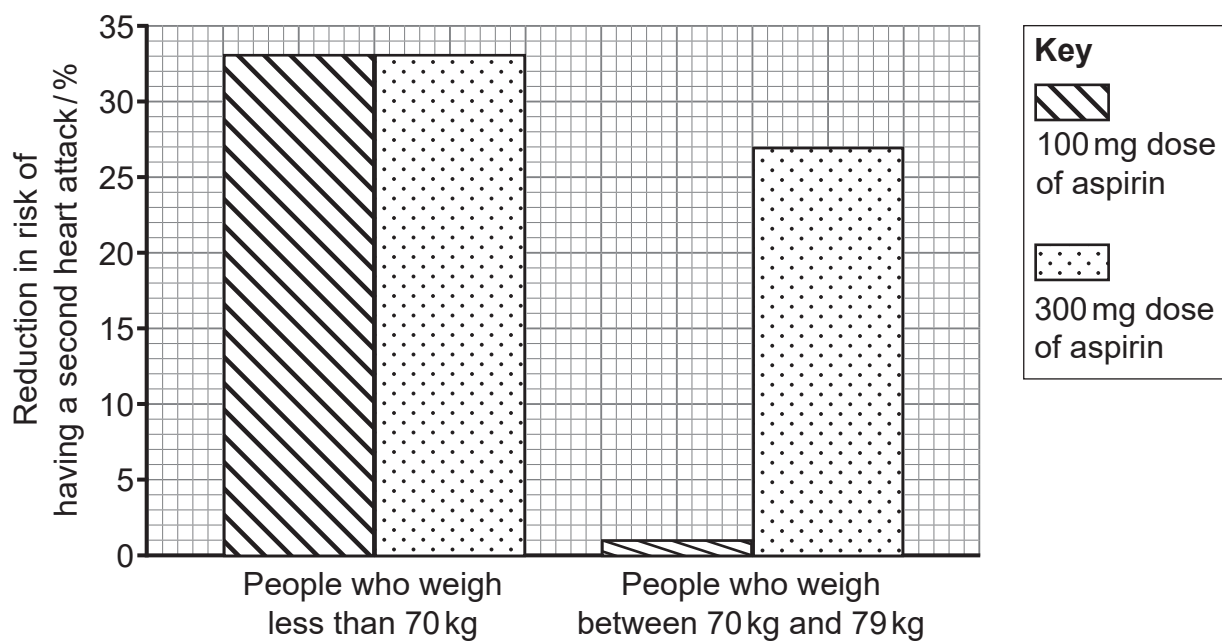
[2]

(b) Aspirin is also used to treat people who have had a heart attack to reduce the risk of a second heart attack.

A study investigated how effective different doses of aspirin were at reducing the risk of a second heart attack.

The study looked at people who weigh less than 70 kg and people who weigh between 70 kg and 79 kg.

The bar chart shows the results of this study.



Data from © NIHR



A woman who weighs 74 kg has had a heart attack.

She has been prescribed aspirin.

- (i) Use the bar chart to find the most effective dose of aspirin she should take to reduce her risk of having a second heart attack.

_____ mg [1]

- (ii) What is the reduction in risk of her having a second heart attack with this dose of aspirin?

_____ % [1]

It is good practice to take the **lowest effective** dose of any medicine.

This woman loses 5 kg of weight.

- (iii) Using **only** the graph, give **two** advantages of this weight loss.

1. _____

2. _____

_____ [2]

[Turn over



- 6** In vitro fertilisation (IVF) can be carried out if a couple are having problems becoming pregnant.

The list below gives terms referring to where some of the stages of IVF occur.

cervix	Petri dish	vagina
oviduct	uterus	ovaries

- (a)** Complete the sentences below by writing in the empty spaces.

Choose the correct term from the list above.

Multiple ova are produced in the _____.

Fertilisation takes place in the _____.

The embryos are transferred into the woman's _____. [3]

- (b) (i)** During IVF, what is given to the woman to enable her to produce multiple ova?

_____ [1]

- (ii)** Suggest an advantage of producing multiple ova during IVF.

_____ [1]

During IVF, the fertilised egg divides to form a ball of cells called an embryo.

- (c)** How many cell divisions take place to produce an embryo with 16 cells?

_____ [1]





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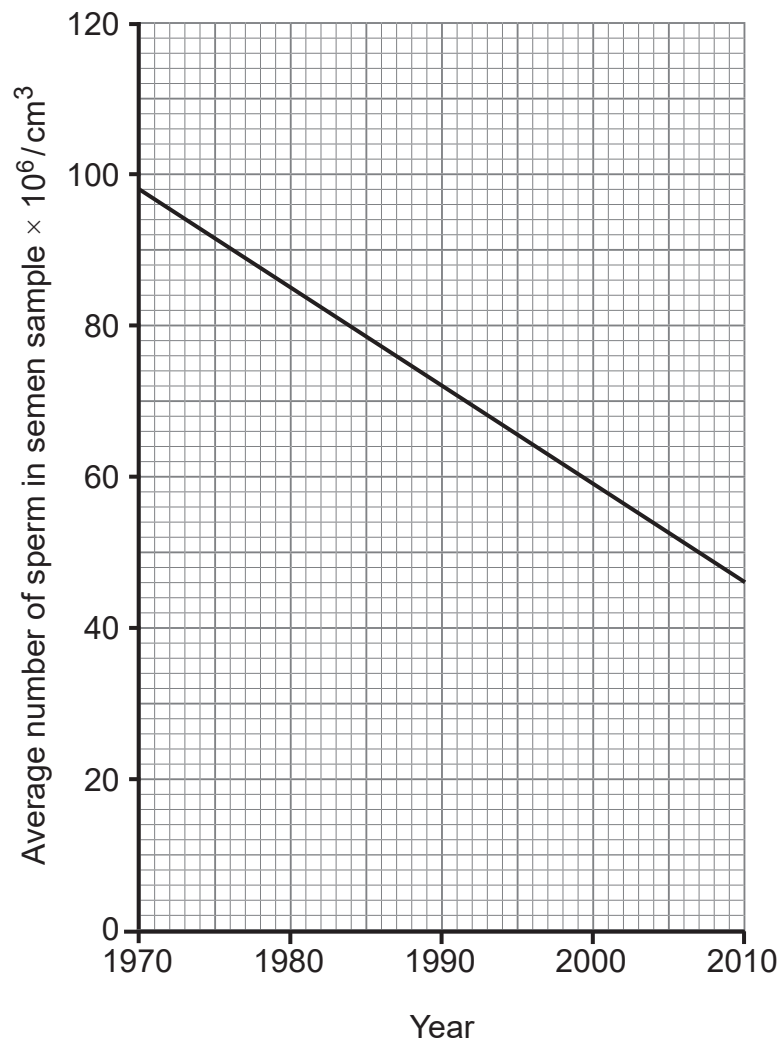


28GDW4215

(d) A study showed that male fertility has decreased since 1970.

One cause of low fertility in men is the decrease in the number of sperm per cm^3 of semen. Semen is a fluid that carries sperm.

The graph below shows the average number of sperm per cm^3 in semen samples taken between 1970 and 2010.



© OUP. 'Human Reproduction Update', Vol.23, No.6, pp.646-659, 2017



- (i) Use the graph to work out the **percentage (%) decrease** in the average number of sperm in the semen sample between **1970** and **2010**.

Show your working.

Give your answer to **one** decimal place.

_____ % [4]

Another cause of low fertility in men is sperm that cannot swim properly.

- (ii) Suggest what is missing from some sperm which prevents them from swimming properly.

_____ [1]



7 The DNA molecule carries the genetic code.

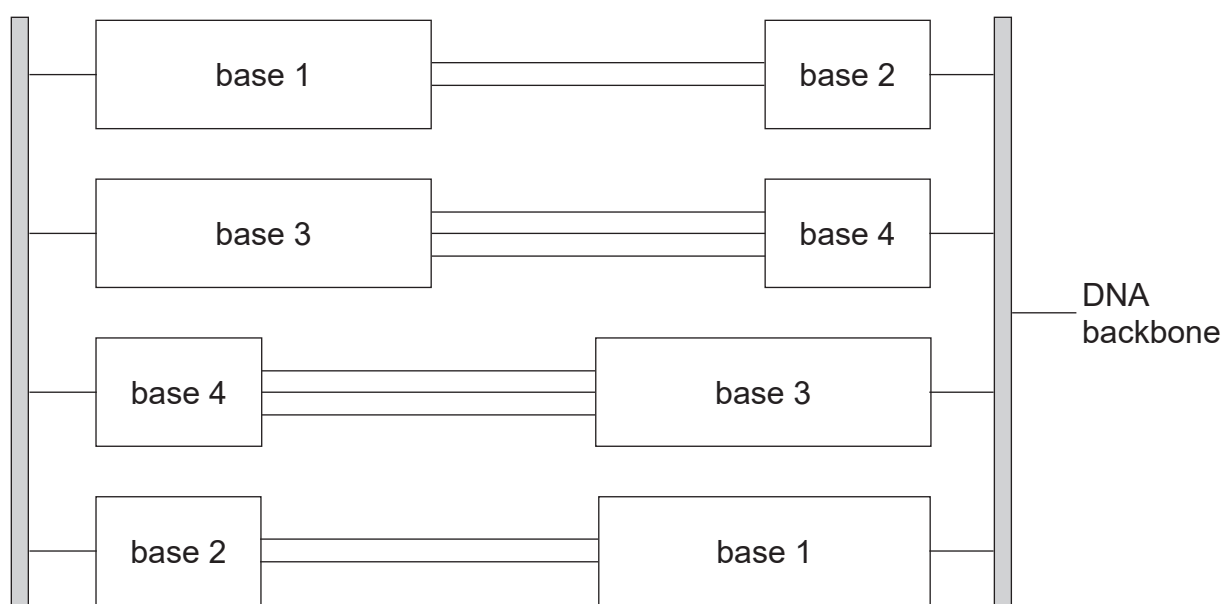
(a) Give the term that describes the shape of the DNA molecule.

[1]

(b) The diagram below shows an outline of the structure of part of a DNA molecule.

It includes the four bases in the DNA molecule, their relative sizes and the bonds between the bases.

Each horizontal line on the diagram represents one bond.



(i) Base 1 is A (adenine).

Give the letters for the possible bases for **base 3**.

_____ or _____ [1]



(ii) Use **only** the diagram to suggest **two** reasons why base 1 always bonds with base 2 and base 3 always bonds with base 4.

1. _____

2. _____

_____ [2]

(c) What does each sequence of three bases on a DNA molecule code for?

_____ [1]

Many sequences of three bases on a DNA molecule make up a gene.

(d) What does a gene code for?

_____ [1]

[Turn over



- 8 A dog breeder has a male poodle with black coat colour and a female poodle with brown coat colour.

The allele for black coat colour is dominant to the allele for brown coat colour.

Coat colour in poodles is not sex-linked.

Let **B** represent the allele for black coat colour.

Let **b** represent the allele for brown coat colour.

- (a) Use the information above to complete the table below.

Phenotype	Description of genotype	Genotype
brown coat colour	homozygous recessive	bb
		Bb
black coat colour		BB

[3]

The dog breeder does not know the genotype of the poodle with the black coat colour.

- (b) In the space below, draw Punnett squares to show the test (back) crosses the dog breeder would use to determine the genotype of the poodle with the black coat colour.

[4]





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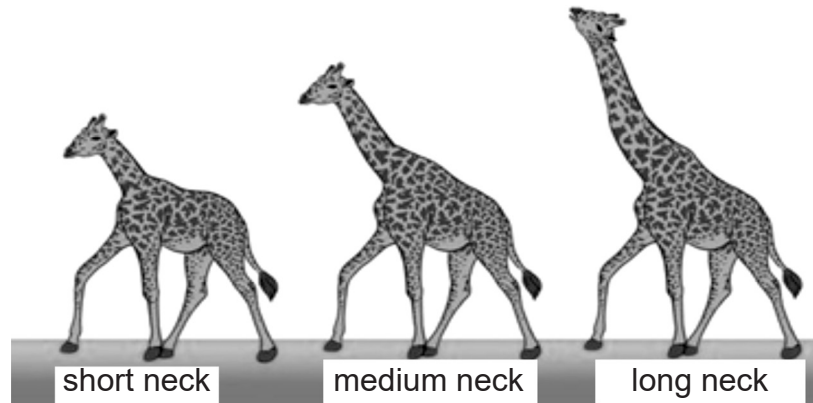


28GDW4221

9 Giraffes feed on leaves from acacia trees.

Giraffes have different neck lengths.

The diagram below shows the variation in neck length of giraffes in one area.



Source: Modified from © CK12 Biology Advanced Concepts, Chapter 10, 36. Natural Selection and Populations Advanced. Figure 2

Giraffes with short necks are **only** able to eat leaves from the lower branches of the trees.

Giraffes with medium necks are able to eat leaves from the lower **and** middle branches of the trees.

Giraffes with long necks are able to eat leaves from **all** of the branches **but** are slower to run from predators.

- (a) Use the information above to complete the sentences below to explain why most of the giraffe population in this area is made up of giraffes with medium necks.

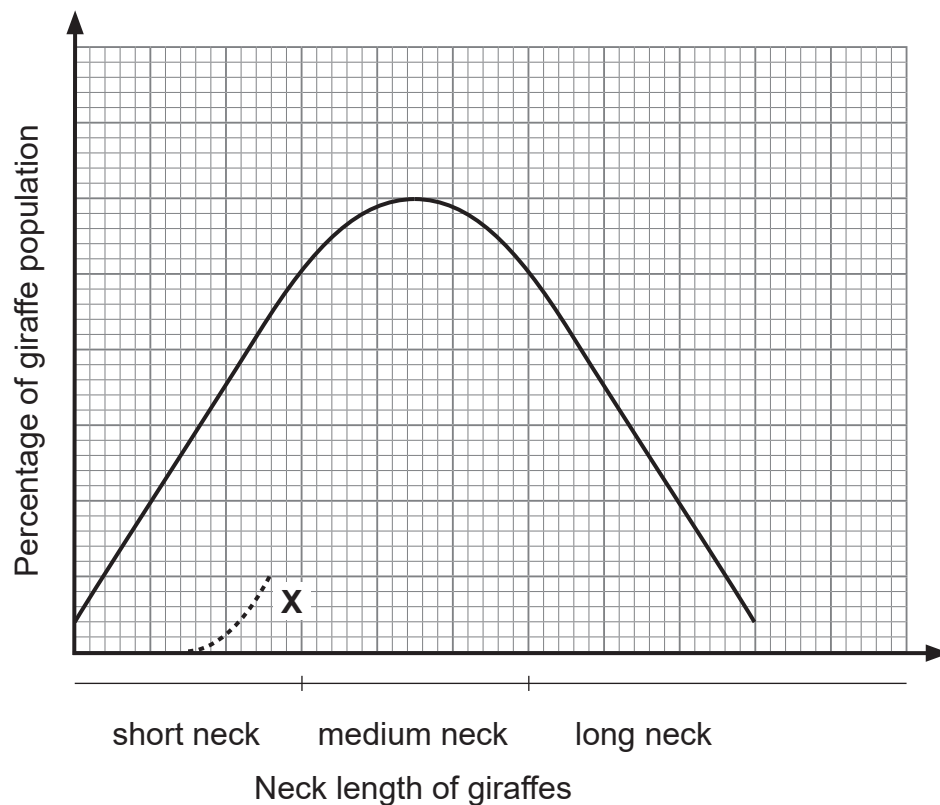
Giraffes with medium necks can get more _____ than giraffes with _____ necks.

Giraffes with medium necks have less chance of _____ than giraffes with _____ necks.

[2]



The graph below shows the percentage of giraffes with short, medium and long necks in a population before an environmental change took place.



Over a long period of time, an environmental change caused acacia trees to produce more leaves on the highest branches and fewer leaves on the lower and middle branches.

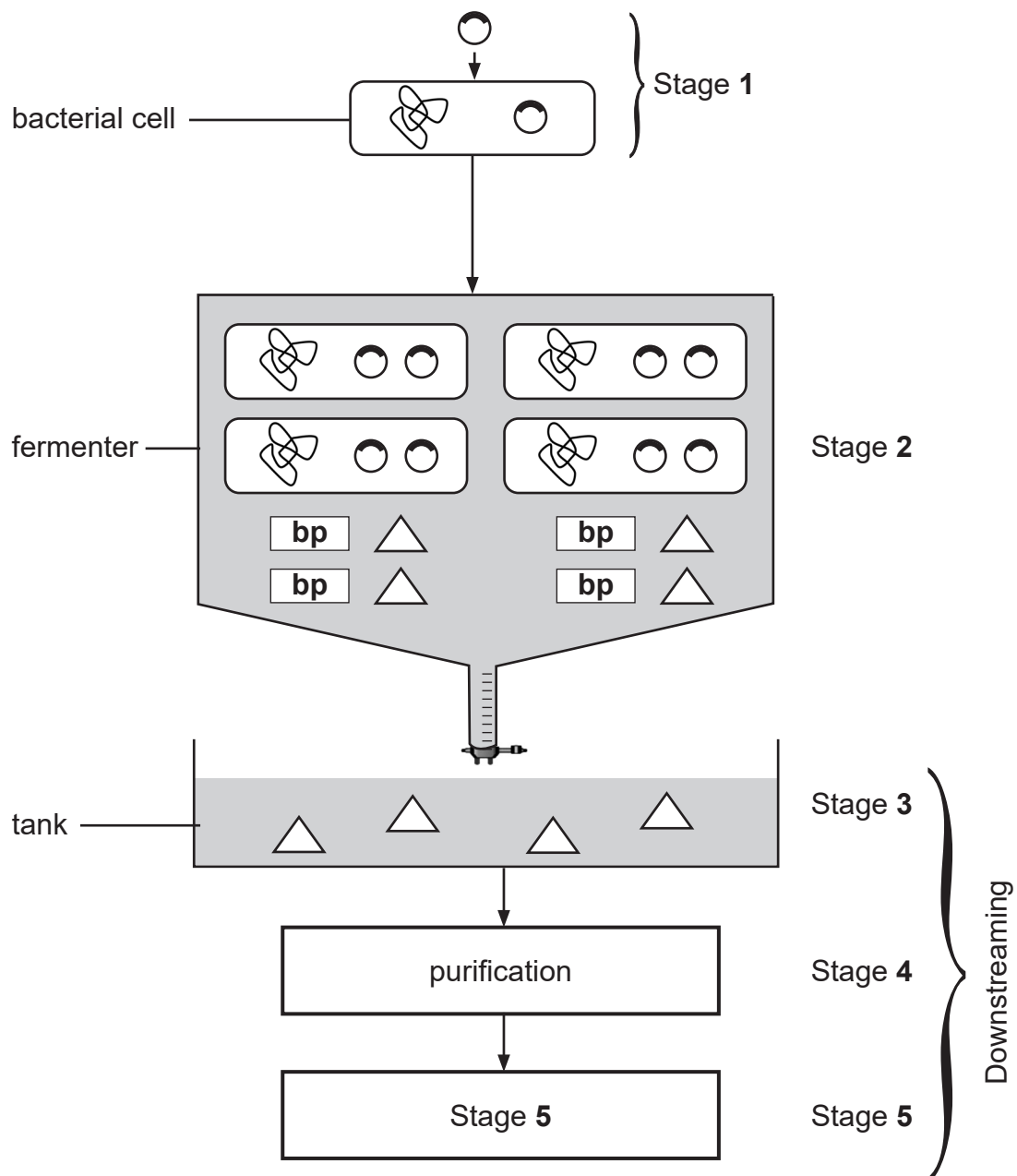
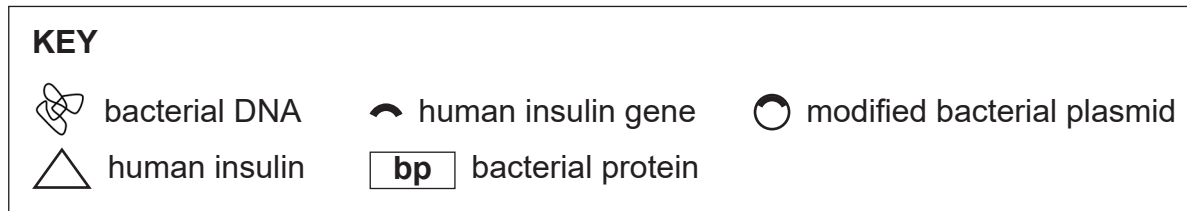
This caused the neck length of the giraffe population to change over many generations.

- (b) On the graph above, continue the curve from **X** to predict how the change to the acacia trees would have affected the neck lengths of the giraffe population after many generations. [3]

[Turn over]



- 10 The diagram below shows some stages in the process of genetic engineering to produce human insulin.



Source: Chief Examiner



Use the diagram to answer the following questions.

(a) (i) Describe what happens in stage 1.

_____ [1]

(ii) Describe **four** processes that happen in the fermenter in stage 2.

Process 1 _____

Process 2 _____

Process 3 _____

Process 4 _____

_____ [4]

Stages 3, 4 and 5 are the stages in the downstreaming process.

(b) Name stages 3 and 5.

Stage 3 _____

Stage 5 _____ [2]

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For Examiner's use only	
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Examiner Number

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