



Rewarding Learning

General Certificate of Secondary Education
2023

Centre Number

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Candidate Number

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Double Award Science Biology

Unit B2

Higher Tier

[GDW42]

FRIDAY 9 JUNE, AFTERNOON



GDW42

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

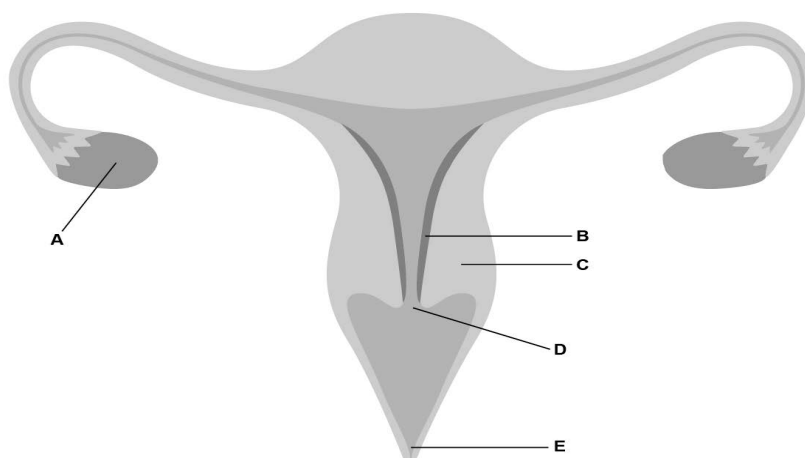
The total mark for this paper is 80.

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 **3**.



1 The diagram shows the female reproductive system.



© Getty Images

(a) How often does ovulation usually occur in a female of reproductive age?

Circle the correct answer from the list below.

once every two months once a month twice a month [1]

(b) (i) Give the letter of the part of the reproductive system where ovulation takes place.

[1]

(ii) Give the letter of the part of the reproductive system that is lost if fertilisation does **not** occur.

[1]



(c) Contraceptive methods can be used to prevent pregnancy.

(i) Mark on the diagram, with the letter **X**, the part of the female reproductive system that is altered in female sterilisation. [1]

(ii) Explain how **this** contraceptive method prevents pregnancy.

 [1]

(iii) Give **one** disadvantage of **this** type of contraceptive method.

 [1]

(d) The contraceptive pill is another contraceptive method.

Explain how the contraceptive pill works to prevent pregnancy.

 [2]

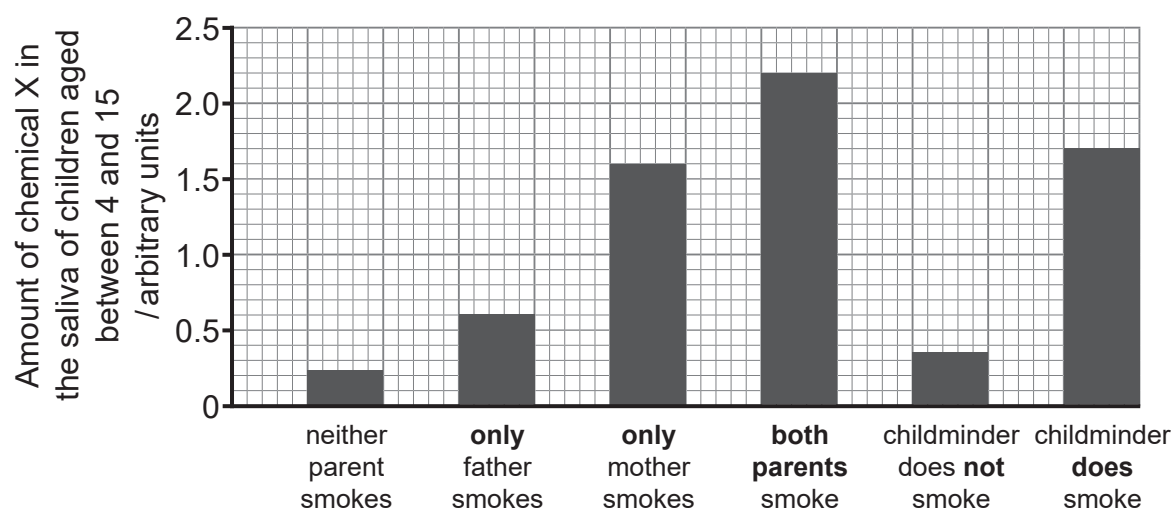
[Turn over



- 2 Passive smoking occurs when a person who does not smoke breathes in cigarette smoke.

Between 1996 and 2006, scientists measured the amount of a chemical (chemical X) in the saliva of groups of children between the ages of 4 and 15.

The bar chart shows some of their results.



(a) Use the bar chart to complete the table.

Place a tick [✓] in the empty box for the correct response for each statement.

Statements	True	False	Can't tell
The amount of chemical X in the saliva of children who have a childminder who smokes is the same as in children who have a childminder who does not smoke.			
The amount of chemical X in the saliva of children where neither parent smokes is the lowest in any group.			
The amount of chemical X in the saliva of children who have only a father who smokes is lower than the amount in children who have only a mother who smokes.			
The amount of chemical X in the saliva of children aged between 4 and 7 is exactly the same as the amount in children aged between 8 and 11.			
The amount of chemical X in the saliva of children where both parents smoke is equal to the figure for the amounts where only the father smokes and the figure for only the mother smokes added together .			

[5]

[Turn over



The higher the amount of chemical X in the saliva of children, the higher the amount of nicotine in their blood.

- (b) Suggest why children are more likely to become smokers when they grow up if at least one parent or their childminder smokes.

[1]

- (c) Parents and childminders who smoked, smoked both inside the house and in public areas.

Smoking in public areas was banned in the UK in 2007.

This caused the amount of chemical X in the saliva of children aged between 4 and 15 to decrease.

Suggest why.

[3]





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(Questions continue overleaf)

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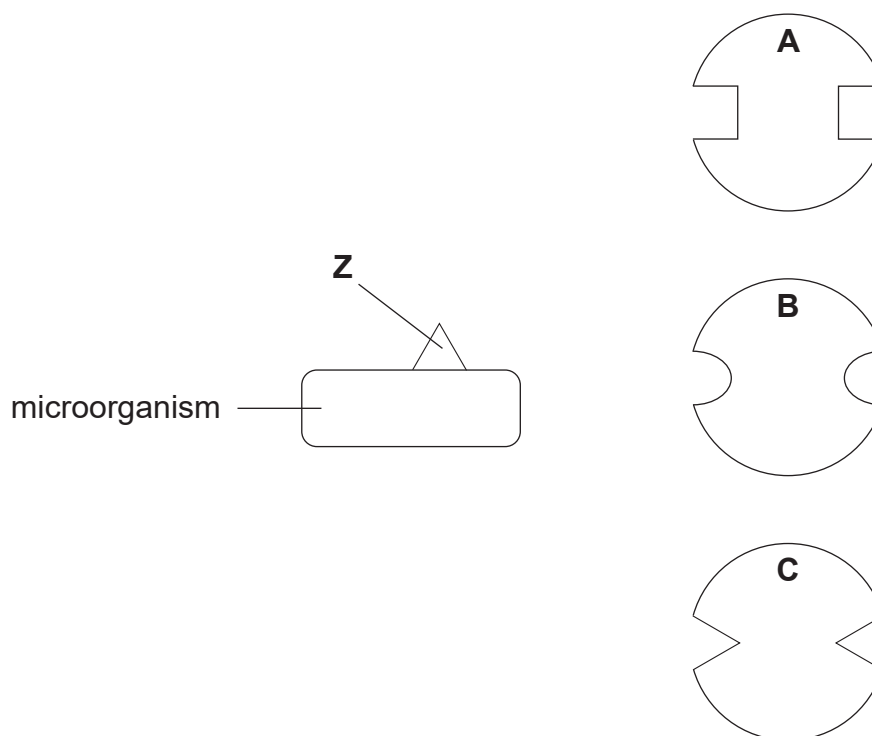
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32GDW4207

- 3 When a microorganism enters the body, the body produces antibodies to defend itself and provide immunity.

The diagram shows an example of a microorganism and three possible antibodies, **A**, **B** and **C**.



Use the diagram and your knowledge to describe and explain the steps that occur to protect the body against **this** microorganism.

Your answer should include how antibodies are made and how they work.

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



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[6]

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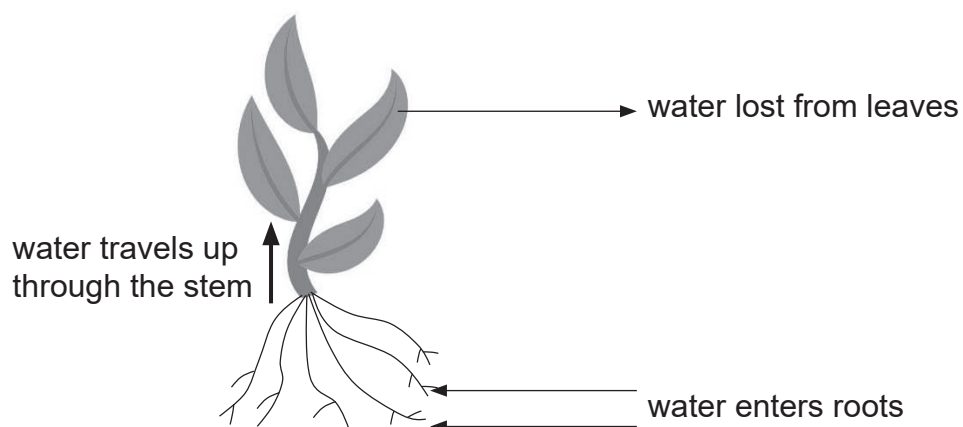
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4 The diagram shows the pathway of water through a plant.



(a) (i) Name the process by which **water** enters the roots of a plant.

[1]

(ii) Name the process where water is lost by diffusion through the stomata in the leaves of a plant.

[1]



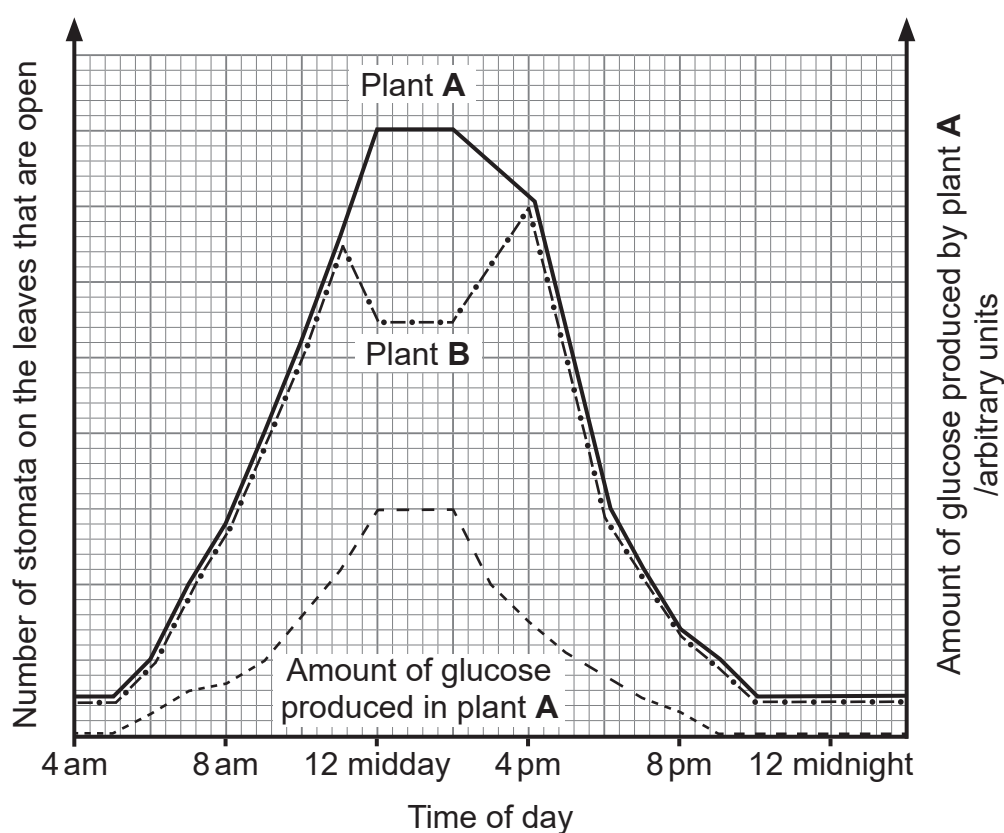
- (b) Scientists investigated the number of stomata that were open at different times of the day in two different types of plants, plant **A** and plant **B**.

The two plants were the same size and had the same number of stomata on their leaves.

The scientists also measured the amount of glucose produced by **plant A** during the same day.

The graph shows their results.

- The left-hand axis is the number of stomata on the leaves that are open.
- The right-hand axis is the amount of glucose produced by plant **A**.



- (i) Between what times were the highest number of stomata open in plant **A**?

_____ and _____

[1]



- (ii) Suggest and explain why the highest number of stomata were open between these two times in Plant **A**.

[4]

- (c) (i) The number of stomata that were open in plant **B** was different to the number of stomata that were open in plant **A** for part of the day.

Describe what plant **B** did to its stomata between **11 am** and **2 pm**.

[1]

- (ii) Suggest why this has happened in plant **B**.

[1]

- (d) Plant **B** produced **less glucose** than plant **A**.

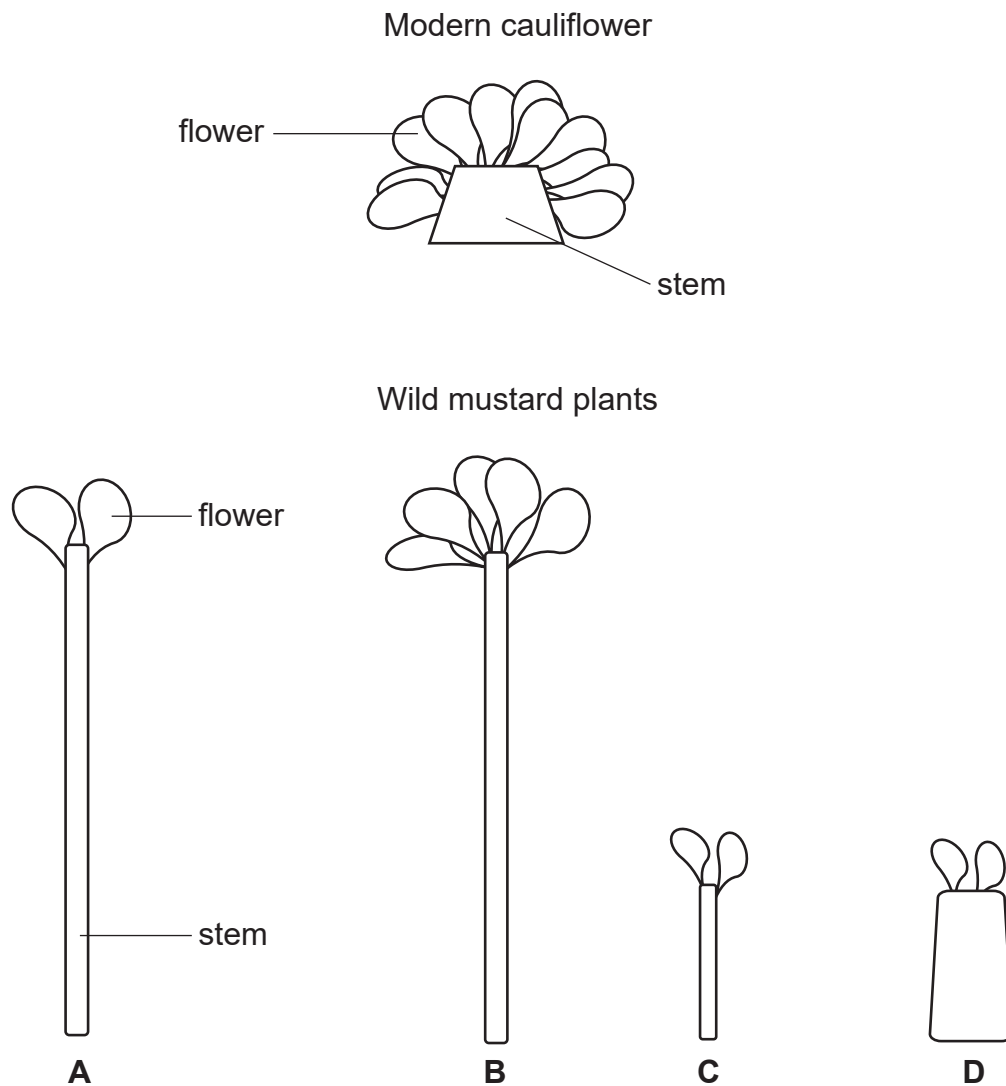
Suggest why.

[2]

[Turn over



- 5 Some food plants have been produced by selective breeding over many years. One example is the production of the modern cauliflower from wild mustard plants. The flowers are the part of the cauliflower that people eat. The diagram shows a modern cauliflower and four different wild mustard plants, **A**, **B**, **C** and **D**.



- (a) Give the letters of the **two** wild mustard plants used to produce modern cauliflowers by selective breeding.

Explain your answer.

Letters _____ and _____ .

Explanation _____
_____ [2]

- (b) Suggest **two other** characteristics that could be selected for in cauliflowers.

1. _____

2. _____ [2]



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6 Antibiotics are used to treat bacterial infections.

However, the overuse of antibiotics can result in the development of superbugs such as MRSA.

(a) (i) Which of the following substances is an antibiotic?

Circle the correct answer in the list.

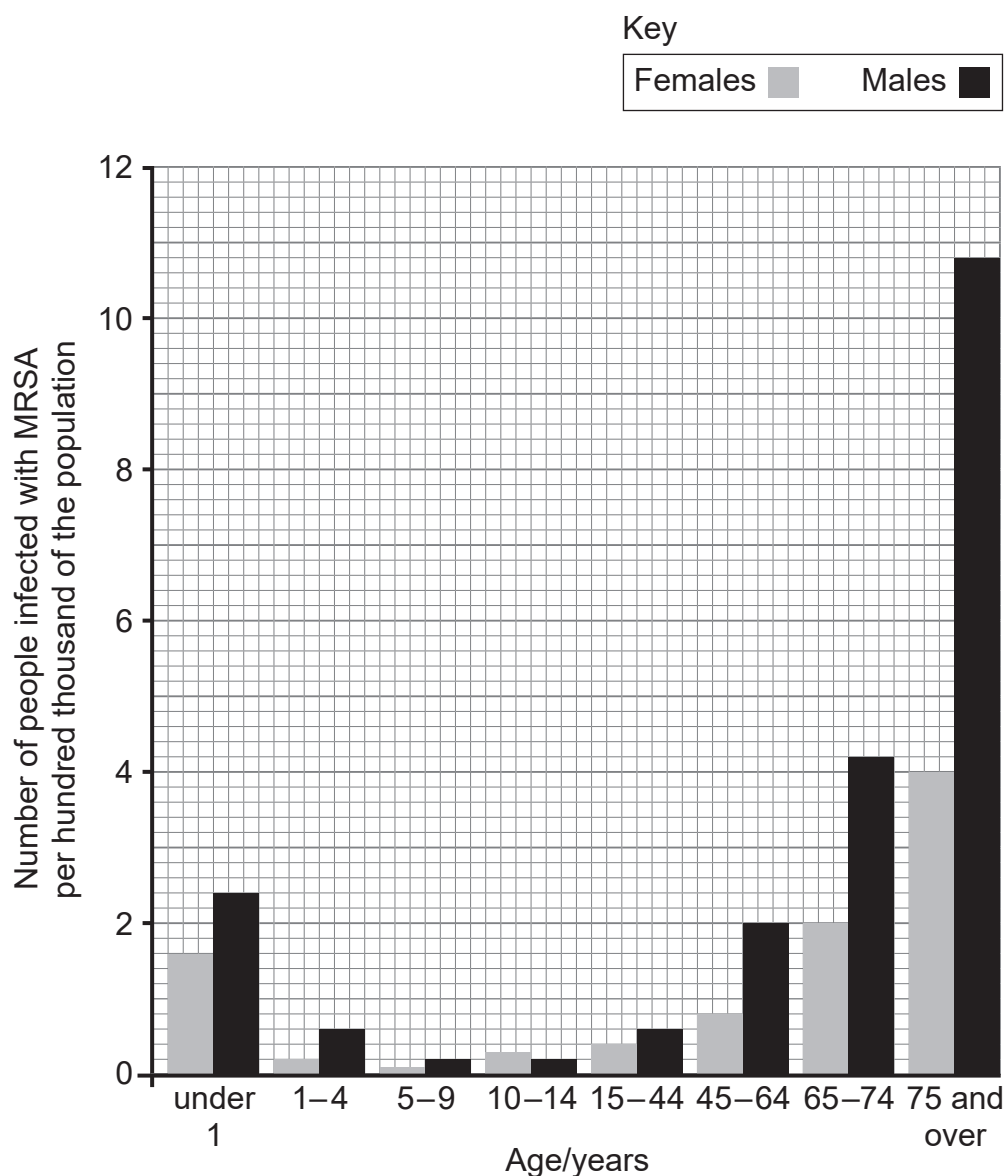
progesterone penicillin aspirin [1]

(ii) Why is MRSA described as a superbug?

_____ [1]



- (b) The graph shows the number of people infected with MRSA per hundred thousand of the population by age and gender in England, Wales and Northern Ireland in 2018.



- (i) Which age group shows a **difference** in the normal trend for the two **genders**?

Age group _____

[1]



- (ii) **In children**, which age group has the highest number of people infected with MRSA?

Suggest a reason for your answer.

Age group _____

Reason _____

_____ [2]

- (iii) Suggest why the highest number of people infected with MRSA is in the 75 and over age group.

_____ [1]

- (c) (i) The use of antibacterial sanitisers is one method that helps to lower the number of people infected with MRSA.

Suggest how this method would reduce the number of MRSA organisms on **a person's hands**.

_____ [1]

- (ii) If an individual uses an antibacterial sanitiser on their hands, suggest how this helps reduce the rate of MRSA infections in the **whole population**.

_____ [1]

[Turn over



7 Genetic engineering is a process that modifies the genetic material of an organism.

(a) What term describes **the entire** genetic material of an organism?

[1]

Genetic engineering can be used to produce human insulin.

(b) (i) In the space below draw a **large, labelled** diagram to show a bacterial cell that has had its genetic material modified to allow it to produce human insulin.

Label the following:

- a plasmid
- sticky ends
- human insulin gene

[4]



(ii) Name the type of enzyme that produces sticky ends.

[1]

To produce human insulin, bacterial cells that have had their genetic material modified are placed in a fermenter.

(iii) Describe **two** processes that take place in the fermenter that will result in human insulin being produced.

1. _____

2. _____ [2]

After human insulin has been produced, it undergoes a process to extract, purify and package it.

(iv) Name this process.

[1]



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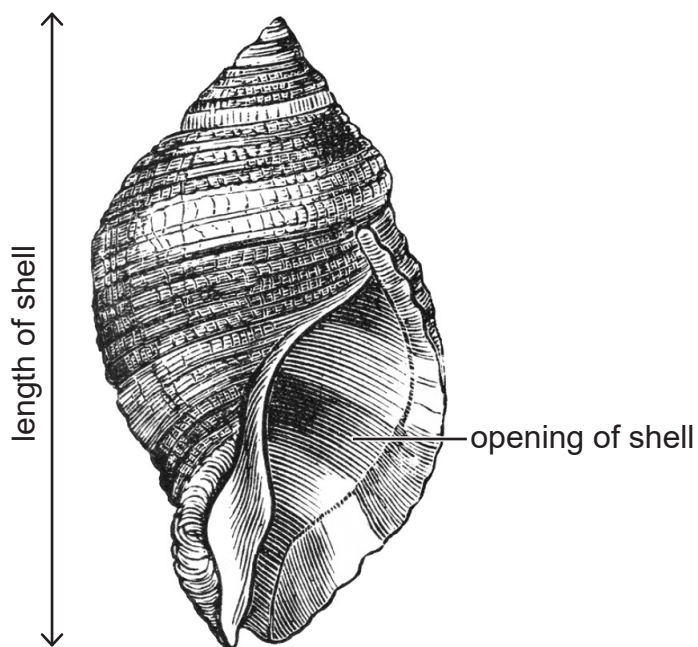


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8 Dog whelks are sea snails that can be found on rocky shores around the UK.

They are made up of a body and a muscular foot inside a shell.

The picture shows a dog whelk shell. The dog whelk is inside the shell.



Dog whelks attach themselves to rocks with their muscular foot. This extends out through the opening of the shell.

Dog whelks live on both exposed shores and sheltered shores.

The table gives some information about exposed shores and sheltered shores.

Exposed shore	Sheltered shore
Large, rough waves	Small, gentle waves



The table shows some adaptations of dog whelks that live on exposed shores and sheltered shores.

Feature	Adaptation	
	on exposed shore	on sheltered shore
Muscular foot	large	small
Length of shell	short	long

(a) Use the information and **both** tables to suggest how the adaptations of dog whelks help them to survive on **exposed shores**.

[3]



Crabs feed on dog whelks by pulling their bodies out of their shells.

In dog whelks with long shells, the body of the dog whelk can move further away from the opening of the shell.

- (b) Suggest how **this** adaptation helps dog whelks with long shells survive on **sheltered** shores.

[2]

Dog whelks usually have white shells, but some have brown shells and others have yellow shells.

- (c) What type of variation is shown by shell colour in dog whelks?

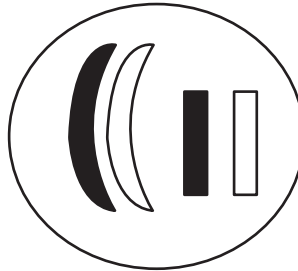
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9 Mitosis and meiosis are types of cell division.

The diagram represents a cell with four chromosomes.



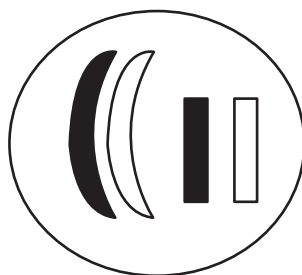
(a) In the space below, draw the cells that would be produced when this cell divides by **mitosis**.

[3]



(b) The other type of cell division is meiosis.

The diagram represents a cell with four chromosomes.



(i) In the space below, draw the cells that would be produced when this cell divides by **meiosis**.

[4]

(ii) What is the role of independent assortment in meiosis?

[1]

(c) Sperm cells are produced by meiosis in the testes from cells called “germ cells”. All germ cells contain the sex chromosomes.

(i) Name the sex chromosomes.

[1]

(ii) How do **sperm cells** differ from **germ cells** with respect to the sex chromosomes?

[2]

[Turn over]



10 A protein is formed from amino acids joined together in a particular order.

Each amino acid is coded for by bases in a DNA molecule.

A hypothesis states that a sequence of three bases codes for each amino acid.

(a) Name this hypothesis.

_____ [1]

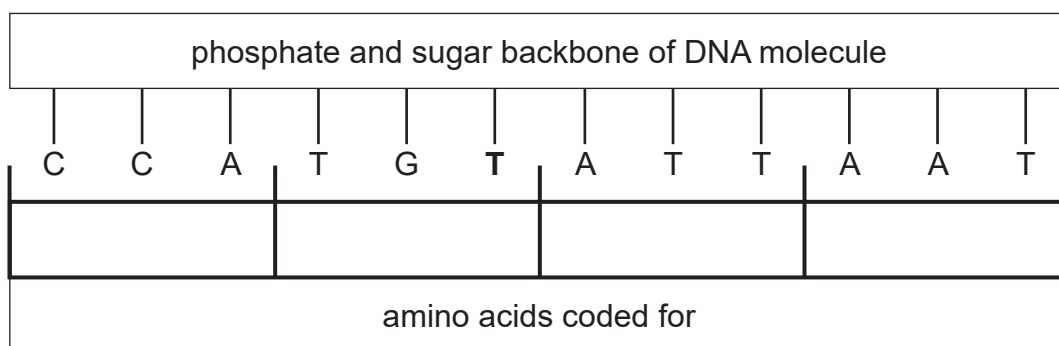
(b) The table gives five base sequences in DNA and the amino acid that each base sequence codes for.

Base sequence in DNA	Amino acid coded for
AAT	asparagine
ATT	isoleucine
CCA	proline
TGT	cysteine
TGG	tryptophan

The diagram below represents part of a DNA molecule.

(i) Use the information in the table to name the amino acid that each base sequence codes for.

Write the names of the amino acids in the empty boxes.



[2]



Changes can occur in the base sequence of DNA. These are called mutations.

One of the bases, the second **T** in the diagram, is replaced by the base **G**.

(ii) What different amino acid would be coded for?

[1]

(iii) What would be the result of this new amino acid sequence?

[1]

(c) Some mutations can result in genetic conditions.

Cystic fibrosis and Huntington's disease are two examples.

(i) Circle the correct description of the alleles, in the list below, for a person with cystic fibrosis.

homozygous
dominant

sex-linked

heterozygous

homozygous
recessive

[1]

(ii) Circle the correct descriptions of the alleles, in the list below, that a person with Huntington's disease could have.

homozygous
dominant

sex-linked

heterozygous

homozygous
recessive

[2]

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Question Number	Marks
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