



Rewarding Learning

General Certificate of Secondary Education
2024

Centre Number

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Candidate Number

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Double Award Science Biology

Unit B2

Higher Tier

[GDW42]

GDW42

TUESDAY 11 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 eleven** 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(b)**.



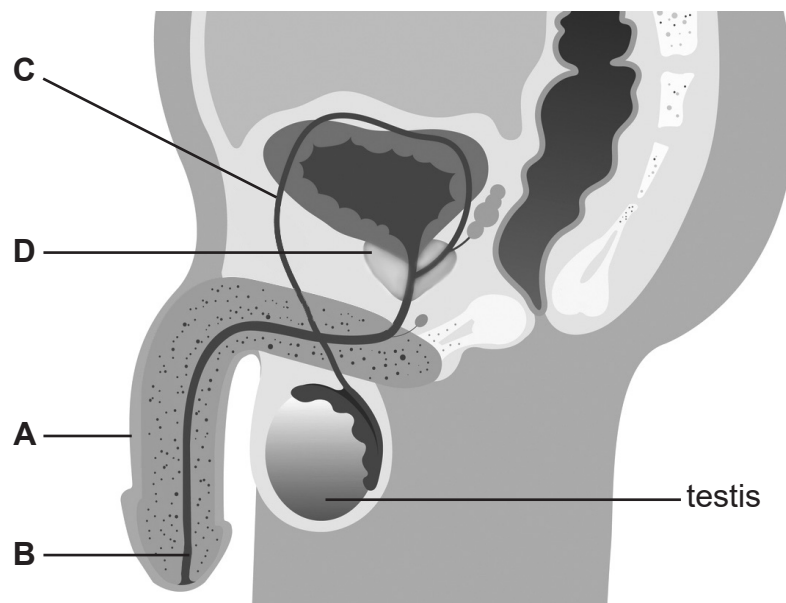
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1 The diagram shows a side view of the male reproductive system.



(a) Name the structures labelled **A** and **B**.

A _____

B _____

[2]

(b) Give the **functions** of structures **C** and **D**.

C _____

D _____

[2]

The testes produce sperm cells.

(c) Give the function of the flagellum in a sperm cell.

[1]

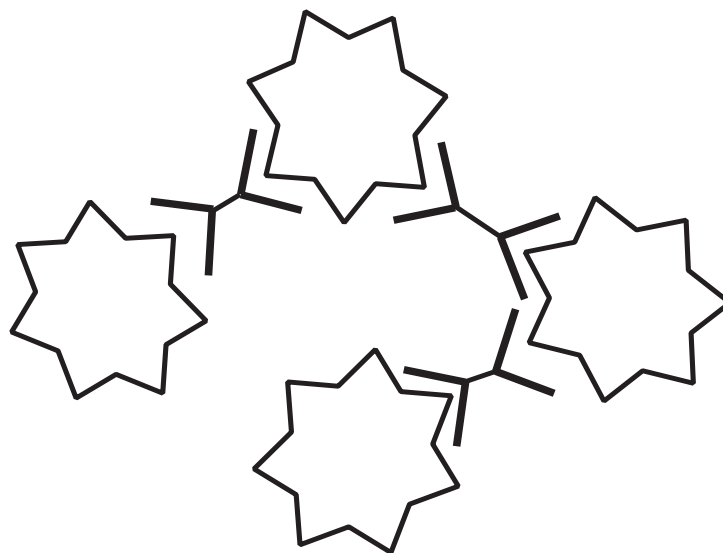
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- 2 When a microorganism infects the body, white blood cells produce specific antibodies.

These antibodies cause the microorganisms to clump together.

The diagram shows how antibodies clump one type of microorganism.



- (a) On the diagram, draw a line labelled **A** to **one** antibody. [1]

- (b) Explain why **only** these antibodies can produce a clump with this type of microorganism.

[2]



When a clump of microorganisms is formed, the microorganisms become immobilised.

(c) Suggest how immobilising microorganisms helps the body to defend itself.

[1]

After the microorganisms have been immobilised, a different type of white blood cell destroys the clump.

(d) Name this type of white blood cell and describe how the clump of microorganisms is destroyed.

[3]

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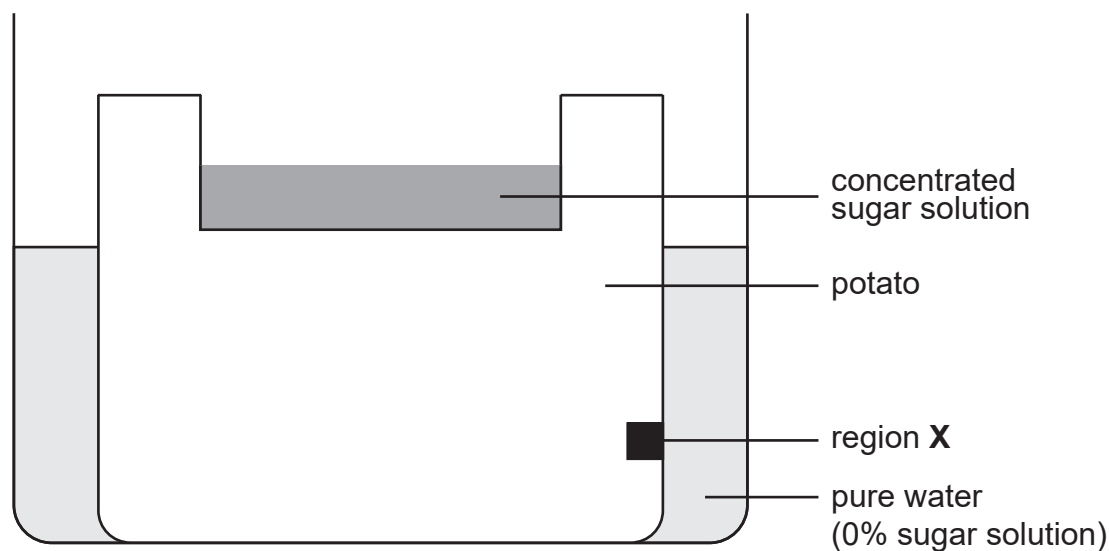


- 3 (a) A student carried out an experiment to investigate osmosis using a potato.

The student cut a piece out of the potato and partially filled the space with concentrated sugar solution.

The student then placed the potato into a beaker containing pure water (0% sugar solution).

The diagram shows the set-up of the student's experiment.



- (i) Describe and explain what happened to the cells in region X when the student placed the potato into the beaker of pure water.

Circle the letter of the correct statement in **list 1** and the letter of the correct statement in **list 2**.



List 1

Statement	Description
A	water moved out of the cells in region X into the pure water
B	water moved into the cells in region X from the pure water
C	there is no movement of water between the cells in region X and the other potato cells

List 2

Statement	Explanation
D	because osmosis is the movement of water from a more concentrated solution to a dilute solution
E	because osmosis is the movement of water from a dilute solution to a more concentrated solution
F	because osmosis is the movement of water between two solutions with the same concentration

[2]

The student left the potato in the pure water for several hours.

- (ii) Describe and explain what happened to the level of the **concentrated sugar solution** after several hours.

Description _____

Explanation _____

_____ [2]

[Turn over



(b) When plant cells lose a large amount of water they become **plasmolysed**.

(i) What change, if any, occurs in the **size** of the following structures when a plant cell becomes plasmolysed?

vacuole _____

cytoplasm _____

[2]

(ii) Describe what happens to the cell membrane when a plant cell becomes plasmolysed.

[1]





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4 (a) Cancer is a disease of cells.

(i) Name the process in the body that produces cancer cells.

_____ [1]

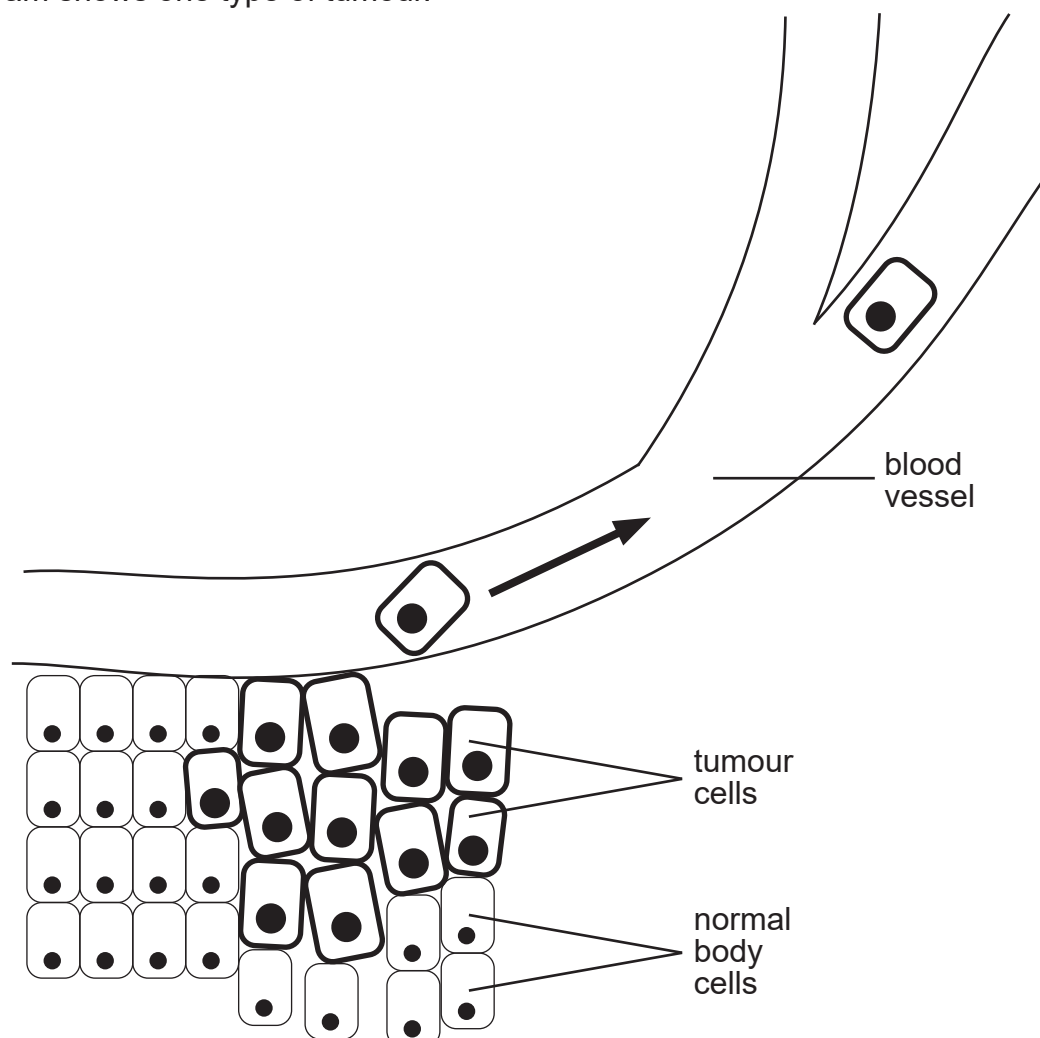
One type of cancer is skin cancer.

(ii) Give the environmental factor that causes skin cancer.

_____ [1]

Cancer cells can form tumours.

The diagram shows one type of tumour.



- (b)** Give differences, **shown in the diagram**, between tumour cells and normal body cells.

Name the type of tumour shown in the diagram and explain how you can identify this type of tumour.

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

Differences between tumour cells and normal body cells _____

[illegible]

Type of tumour and explanation _____

[6]

[Turn over

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- 5 The Government recommends that the maximum amount of alcohol that should be consumed in one week is 14 units.

One pint of beer contains **2** units of alcohol.

One measure of gin contains **1** unit of alcohol.

The table gives information about the alcoholic drinks consumed by three people, **A**, **B** and **C**, over one weekend.

These people **did not** consume any alcoholic drinks from Monday to Thursday.

Day	Alcoholic drinks consumed over one weekend		
	person A	person B	person C
Friday	2 gins	8 pints of beer	4 gins
Saturday	2 gins	none	3 pints of beer
Sunday	none	none	2 gins

- (a) Which person, **A**, **B** or **C**, had the most unhealthy drinking habits over the weekend?

Give **two** reasons for your answer.

Person _____

Reason 1 _____

Reason 2 _____

_____ [3]

[Turn over



A study into the number of deaths linked to drinking alcohol in middle-aged men and middle-aged women was carried out.

The graphs show the trends of the results.



(b) Complete the table using **only** information from the graphs.

Place a tick [✓] in **one** empty box for each statement.

Statement	True	False	Can't tell
For men only, the total deaths from all causes is lowest for men who drink one unit of alcohol per day.			
Fewer men than women died from cardiovascular diseases .			
Women who drink one unit of alcohol per day have less risk of dying from cardiovascular diseases than women who drink no units of alcohol per day.			
The trend for deaths from cardiovascular diseases for young women would be the same as for these middle-aged women.			

[4]

[Turn over

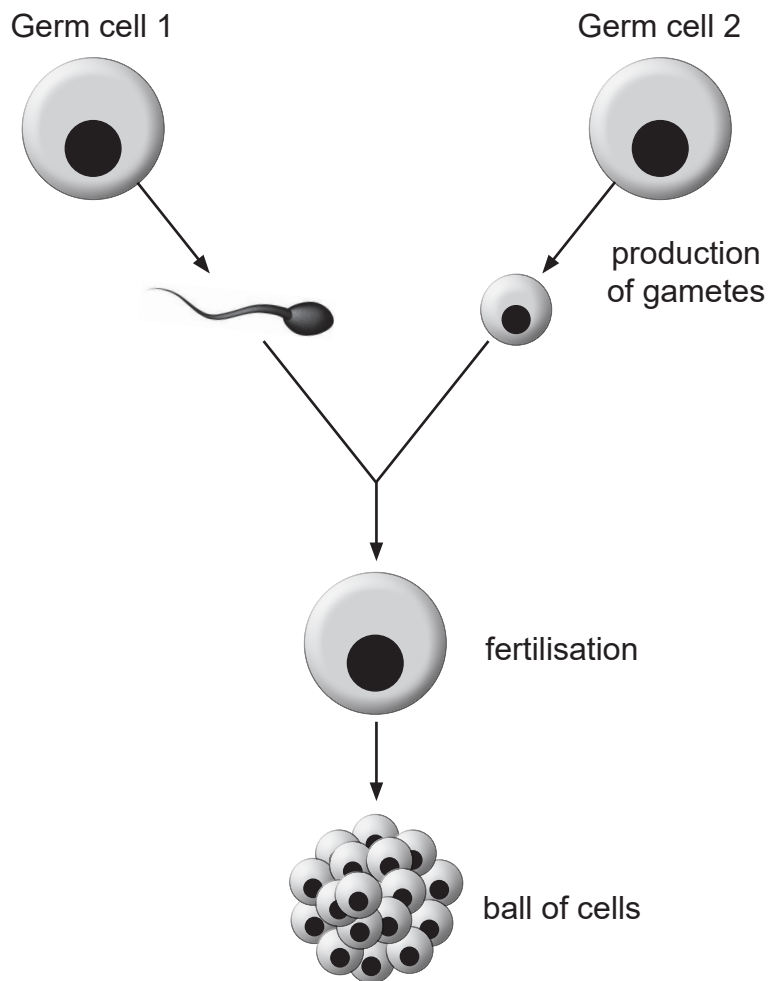


6 Gametes are produced by germ cells.

The diagram shows

- the production of gametes by germ cells
- fertilisation
- development of a ball of cells

During the process of **in vitro fertilisation (IVF)**, some of these stages occur inside the male or female body.



(a) Name the structure where germ cell 2 is found.

[1]



(b) During the process of **IVF**, where exactly does fertilisation take place?

[1]

During the formation of the ball of cells, each cell divides into two.

(c) (i) How many cells will be present after **four** cell divisions?

[1]

(ii) During the process of IVF, a ball of cells may **not** always be produced.

Suggest one reason why.

[1]

(d) In a successful IVF procedure, where exactly is the ball of cells implanted?

[1]

After implantation, the ball of cells undergoes differentiation.

(e) Describe what happens during differentiation.

[1]

(f) Sexually transmitted infections can cause infertility.

Suggest another cause of infertility:

- in men _____

- in women _____

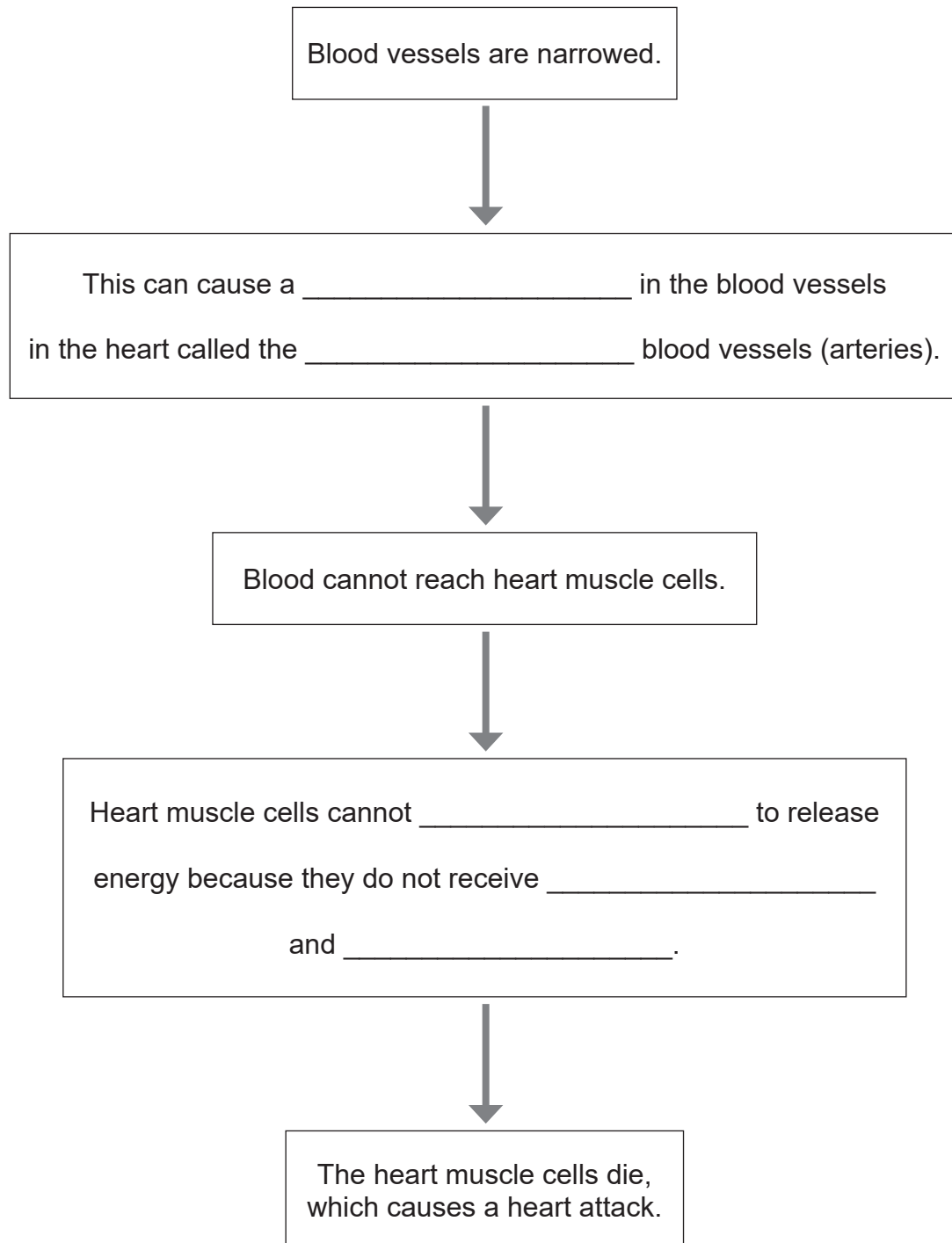
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7 Cardiovascular diseases include heart attacks and strokes.

- (a) Complete the diagram to explain how narrowed blood vessels in the heart can lead to a heart attack.



[5]



(Questions continue overleaf)

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- (b) High blood pressure is another condition that can lead to cardiovascular disease.

A study into the treatment of high blood pressure investigated how effective two **different combinations** of drugs were on reducing blood pressure.

Patients were either given drugs **A and B** or drugs **A and C**.

At the **start** of the study the average blood pressure of the patients was **145** arbitrary units.

The **target** was an average blood pressure of less than **140** arbitrary units.

The table gives some information about the study.

Group	Number of people	Drug combination	Number of people on target at end of study	Percentage (%) of people on target at end of study	Average blood pressure at end of study/ arbitrary units
1	5744	A and B	4331	75.4	131.6
2	5762	A and C		72.4	132.5

- (i) Calculate the number of people who were on target at the end of the study in **group 2**.

Show your working.

Give your answer to the nearest **whole** number.

_____ people [3]



Some of the scientists concluded that the combination of drugs **A and B** was more effective than the combination of drugs **A and C**.

(ii) Use information from the table to explain why they made this conclusion.

 [1]

Other scientists concluded that it **did not matter** which combination of drugs was used to lower blood pressure.

(iii) Use **different** information from the table to explain why they made this conclusion.

 [1]

(iv) Suggest why some patients could still be at risk of cardiovascular disease, even if their blood pressure has been lowered.

 [1]

[Turn over



(c) Other methods can be used in the treatment of cardiovascular disease. In one medical procedure, a structure can be inserted into an artery.

(i) Name this structure.

[1]

(ii) Name this medical procedure.

[1]





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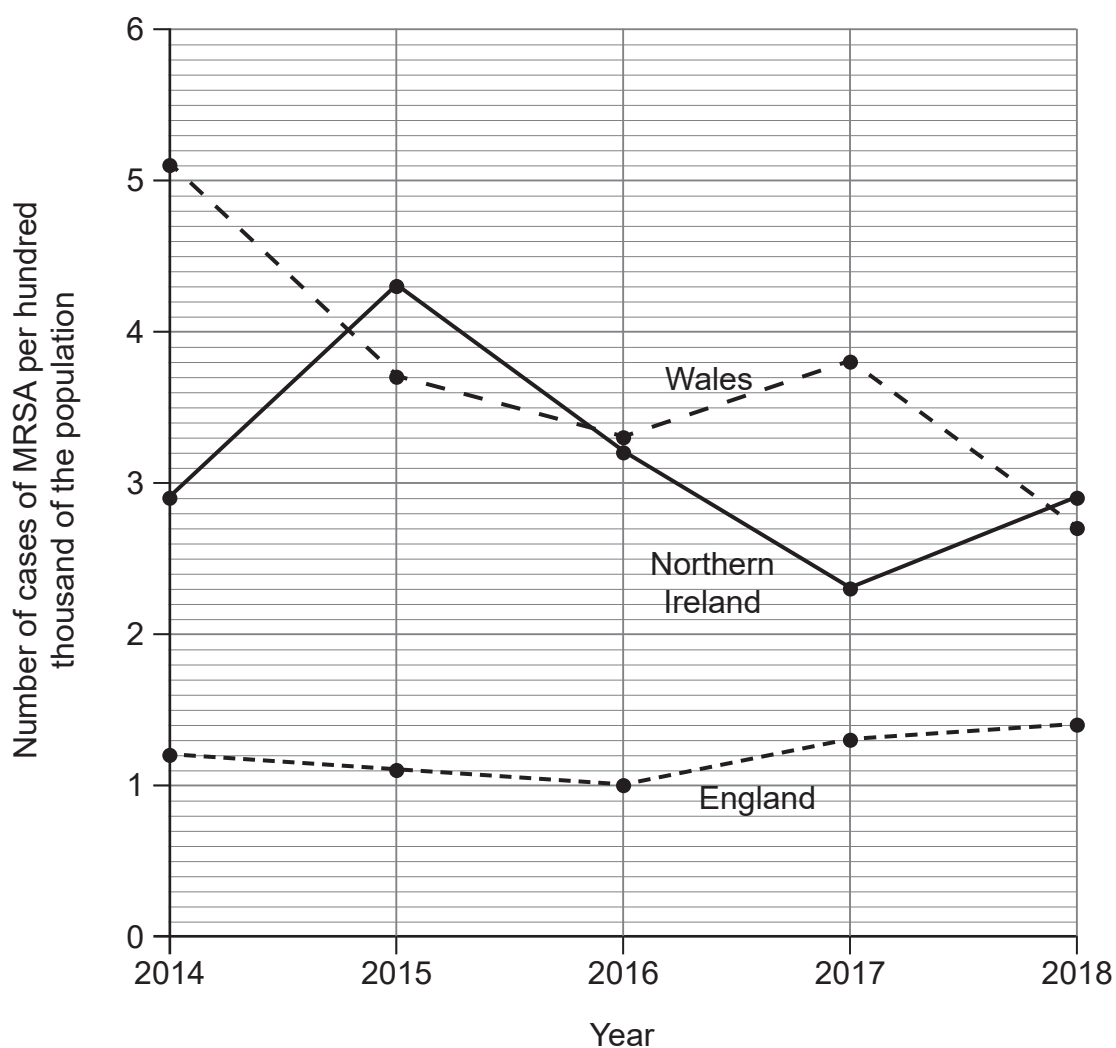
- 8 MRSA is a type of resistant bacteria that can cause dangerous infections, particularly in people with weakened immune systems.

(a) Name the type of chemical that MRSA bacteria are resistant to.

[1]

In a study, the number of cases of MRSA (per hundred thousand of the population) in Wales, Northern Ireland and England between 2014 and 2018 was recorded.

The graph shows the results of this study.



There were five increases in the number of cases of MRSA between two successive years:

Wales between 2016 and 2017

Northern Ireland between 2014 and 2015 and between 2017 and 2018

England between 2016 and 2017 and between 2017 and 2018.

(b) Use the information in the graph to give:

- (i) The country that showed the greatest **increase** in the number of cases of MRSA between two successive years.

_____ [1]

- (ii) The country that showed the greatest **change** in the number of cases of MRSA between the start of the study in 2014 and the end of the study in 2018.

_____ [1]

(c) Suggest why it is important to monitor the number of cases of MRSA.

_____ [1]

(d) Patients in hospital who have MRSA are isolated from other patients.

- (i) Explain how isolating patients with MRSA helps control the number of cases of MRSA in hospitals.

_____ [1]

- (ii) Suggest why it is **particularly** important that the number of cases of MRSA in patients in hospitals is controlled.

_____ [1]

[Turn over



- 9 The photographs show a garter snake and a rough-skinned newt, which are found in California.



Garter snake



Rough-skinned newt

Some information about **natural selection** in these organisms is given below.

- Garter snakes feed on rough-skinned newts.
- Rough-skinned newts produce a poison called TTX.
- TTX kills garter snakes when they feed on the newts.

Scientists in California noticed changes in the garter snakes over a number of years.

- A few garter snakes became resistant to the poison TTX.
- Over time most of the population of garter snakes became resistant to TTX.



- (a) Use this information and your knowledge of **natural selection** to explain how most of the population of **garter snakes** in California became resistant to TTX.

[4]

Some years later, the scientists noticed that:

When most of the population of garter snakes became resistant to TTX, a few rough-skinned newts began to produce a more poisonous form of TTX.

- (b) Suggest the advantage to the population of **rough-skinned newts** in California of producing a **more** poisonous form of TTX.

[1]

[Turn over]



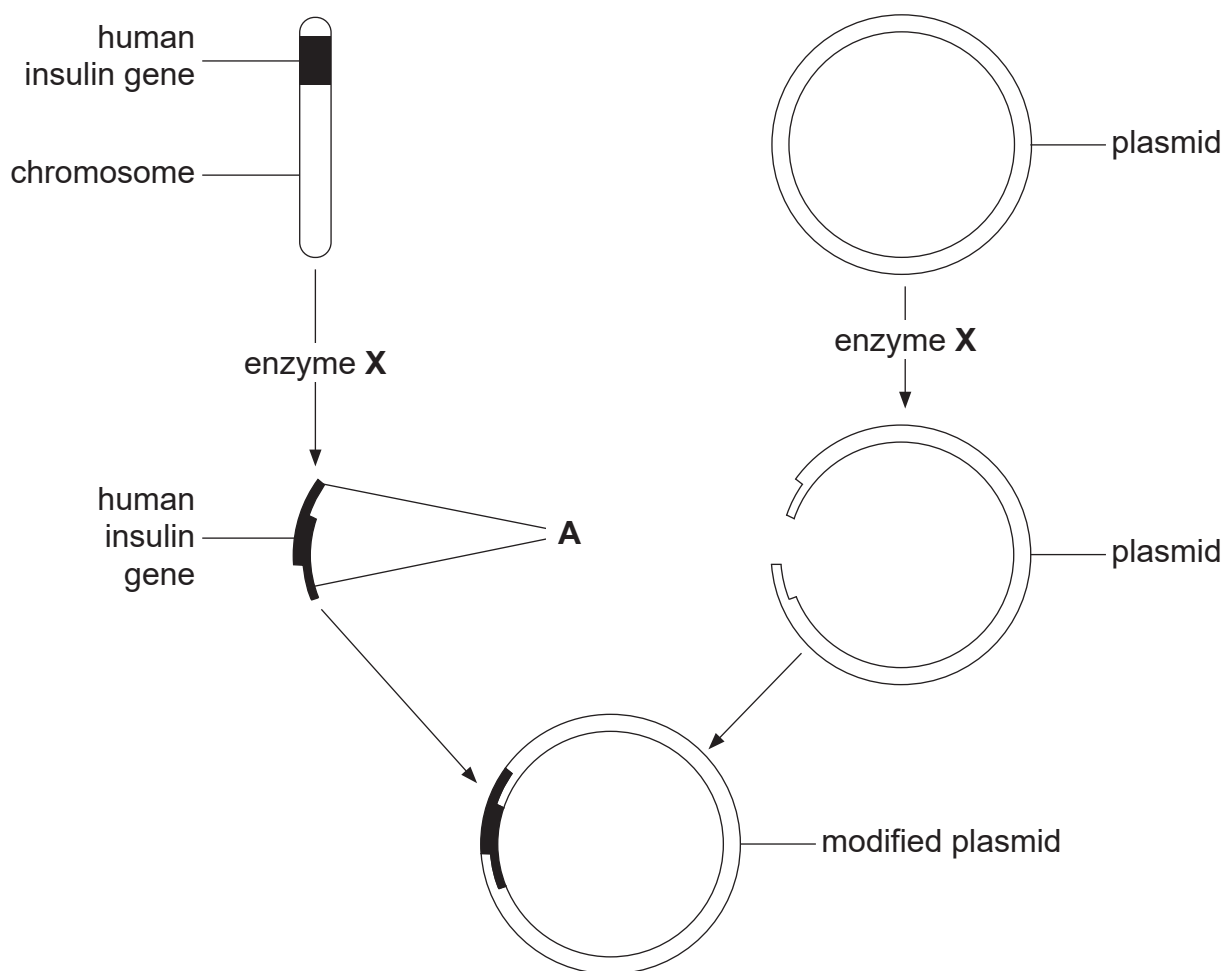
10 (a) Genetic engineering is a process that modifies the genome of an organism to introduce desirable characteristics.

(i) What is meant by the term genome?

[1]

One example of genetic engineering is the production of human insulin by bacteria.

The diagram shows the start of this process.



(ii) What type of enzyme is enzyme **X**?

[1]

(iii) Name the parts labelled **A** on the human insulin gene.

[1]

(b) After the modified plasmid has been placed into a bacterium, the bacterium is placed into a fermenter.

(i) What happens in the fermenter to **both** the modified plasmid **and** the bacterium?

[1]

(ii) Why do the bacteria, containing the modified plasmid, make **human** insulin?

[1]

(c) (i) What type of biological molecule is the hormone insulin?

[1]

(ii) What biological molecules do the bacteria use to make the hormone insulin in the fermenter?

[1]

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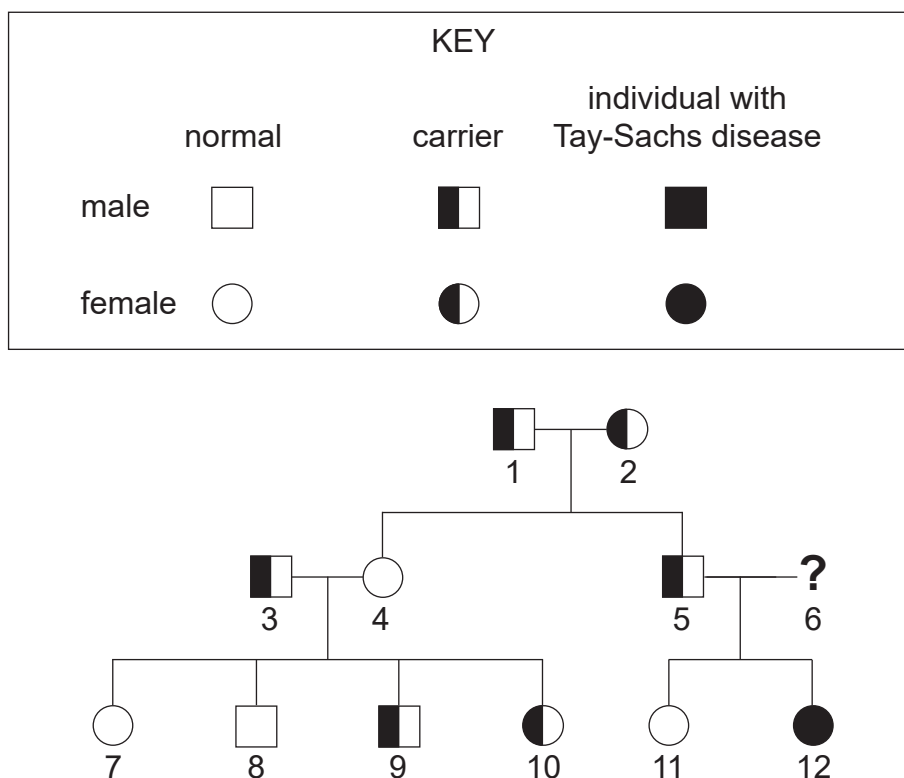


11 Tay-Sachs disease is a condition that stops nerves working properly.

It is inherited from parents who are carriers of the disease but do not have the disease themselves.

Tay-Sachs disease is **not** sex-linked.

The pedigree diagram shows how the allele for Tay-Sachs disease has passed down through one family.



(a) (i) What is the relationship of individual 1 to individual 4?

[1]



Let **T** represent the normal allele.

Let **t** represent the allele for Tay-Sachs disease.

- (ii) Use the **key** to give the genotype of individual 4.

[1]

- (iii) If individuals 3 and 4 have another child, what is the probability that the child will be a **carrier** for Tay-Sachs disease?

[1]

- (b) Individual 12 has the genotype **tt**.

- (i) Use the key and the pedigree diagram to give the **complete** phenotype of individual 12.

_____ [1]

- (ii) Tay-Sachs disease is **not** sex-linked.

Complete the Punnett square to show the alleles in the gametes of individuals 5 and 6 who are the parents of individuals 11 and 12.

On the Punnett square show **all** the **possible** genotypes of the children of individuals 5 and 6.

[3]



THIS IS THE END OF THE QUESTION PAPER

SOURCES

Question 1: © Getty Images

Question 2: Principal Examiner

Question 3: Principal Examiner

Question 4: Principal Examiner

Question 6: Principal Examiner

Question 7: *The New England Journal of Medicine*, 4 December 2008, Vol. 359 No. 23, Kenneth Jameson, Michael Weber

Question 8: Laboratory surveillance of *Staphylococcus aureus* bloodstream infections in England, Wales and Northern Ireland 2018.

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Question 9: © Getty Images

Question 10: Principal Examiner

Question 11: Principal Examiner

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