

Please check the examination details below before entering your candidate information

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| Candidate surname    |                      |                      |                      |                      | Other names          |                      |                      |                      |  |
| Centre Number        |                      |                      |                      |                      | Candidate Number     |                      |                      |                      |  |
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**Pearson Edexcel International Advanced Level**

**Friday 10 October 2025**

Afternoon (Time: 1 hour 30 minutes) **Paper reference** **WBI11/01**

**Biology**

**International Advanced Subsidiary/Advanced Level**

**UNIT 1: Molecules, Diet, Transport and Health**

**You must have:**  
Scientific calculator, ruler, HB pencil

Total Marks

### Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- Calculators may be used.
- You must **show all your working out** with **your answer clearly identified** at the **end of your solution**.

### Information

- The total mark for this paper is 80.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*
- In questions marked with an **asterisk (\*)**, marks will be awarded for your ability to structure your answer logically, showing how the points you make are related or follow on from each other where appropriate.

### Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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**Answer ALL questions. Write your answers in the spaces provided.**

**Some questions must be answered with a cross ☐. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☐.**

- 1** Two types of polynucleotide, DNA and RNA, are found in the body.

- (a) Read through the following description of DNA.

Complete the description by writing the most appropriate word or words on the dotted lines.

(3)

The mononucleotides that join together to form DNA consist of a base, a

..... and a ..... sugar.

The mononucleotides are joined together by ..... bonds  
to form a strand of DNA.

- (b) Two types of RNA are messenger RNA (mRNA) and transfer RNA (tRNA).

The table shows some features of RNA.

For each feature, put **one** cross ☐ in the appropriate box, in each row, to show the features that are present in these types of RNA.

(2)

| Feature         | Types of RNA             |                          |                          |                          |
|-----------------|--------------------------|--------------------------|--------------------------|--------------------------|
|                 | both mRNA and tRNA       | mRNA only                | tRNA only                | neither mRNA nor tRNA    |
| single-stranded | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| folded          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

**(Total for Question 1 = 5 marks)**

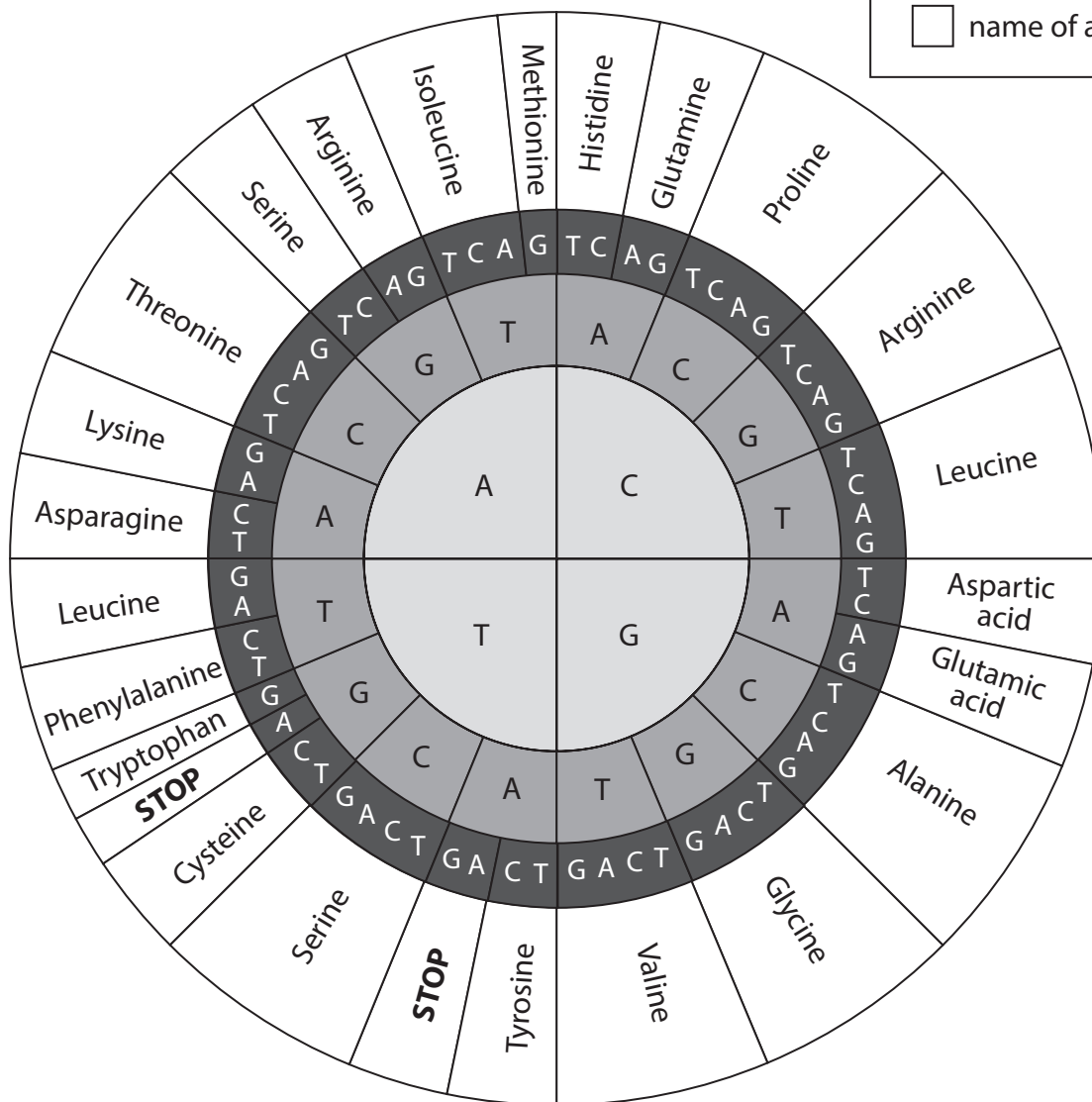


- 2 The nature of the genetic code is important in determining the sequence of amino acids in a polypeptide chain.

The diagram shows the genetic codes for each amino acid and the stop codons found in human DNA.

**Key:**

- 1st base in code
- 2nd base in code
- 3rd base in code
- name of amino acid



- (b) The diagram shows the sequence of bases in part of a DNA template (antisense) strand for serine and arginine.

DNA template strand

|   |   |   |   |   |   |
|---|---|---|---|---|---|
| T | C | T | A | G | A |
|---|---|---|---|---|---|

mRNA

|  |  |  |  |  |  |
|--|--|--|--|--|--|
|  |  |  |  |  |  |
|--|--|--|--|--|--|

- (i) Complete the diagram to show the sequence of bases in the mRNA molecule formed during protein synthesis.
- (ii) Give the sequence of bases that would be found on the anticodon of a **tRNA** molecule that would bind to the first codon in this mRNA molecule.

(1)

(1)

- (c) Explain why each amino acid is coded for by **three** bases.

(2)



(d) The table shows the amino acid sequences of three peptides, A, B and C.

| Peptide | Position of amino acid in the peptide |     |     |     |     |     |     |     |     |
|---------|---------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|
|         | 1                                     | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   |
| A       | cys                                   | tyr | ile | gln | asn | cys | pro | arg | gly |
| B       | cys                                   | tyr | phe | gln | asn | cys | pro | arg | gly |
| C       | cys                                   | tyr | phe | gln | asn | cys | pro | lys | gly |

Compare and contrast the amino acid sequences in these three peptides.

(3)

(Total for Question 2 = 8 marks)



**3** Enzymes are biological catalysts that increase the rate of chemical reactions in the body.

(a) Which of the following statements are true for enzymes?

(1)

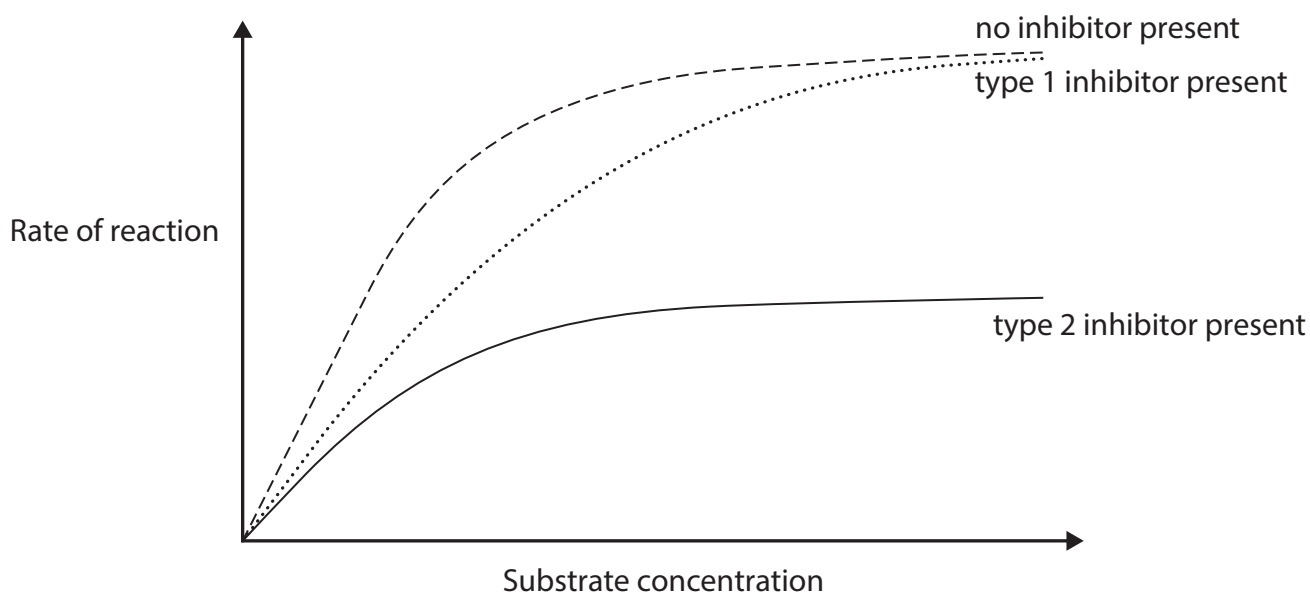
1. Only found inside cells
2. Lower the activation energy of a chemical reaction
3. Consist of carbon, hydrogen and oxygen atoms only

- ☐ **A** 2 only
- ☐ **B** 3 only
- ☐ **C** 1 and 2 only
- ☐ **D** 1 and 3 only

(b) Some chemicals inhibit enzyme reactions.

The graph shows the effect of substrate concentration on the rate of reaction of an enzyme.

It also shows the effect of two types of inhibitor on the rate of this reaction.



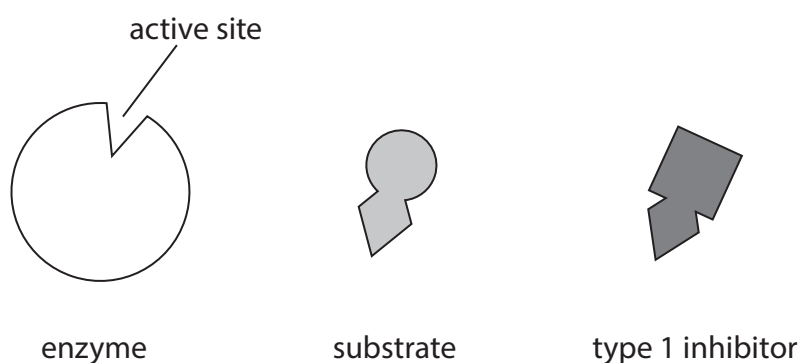
- (i) Describe **two** differences in the effects of these two types of inhibitor on the rate of this reaction.

(2)

1 .....

2 .....

- (ii) The diagram shows the enzyme, its substrate and a type 1 inhibitor.



Explain how a type 1 inhibitor affects the rate of this reaction.

Use the information in the diagram to support your answer.

(3)

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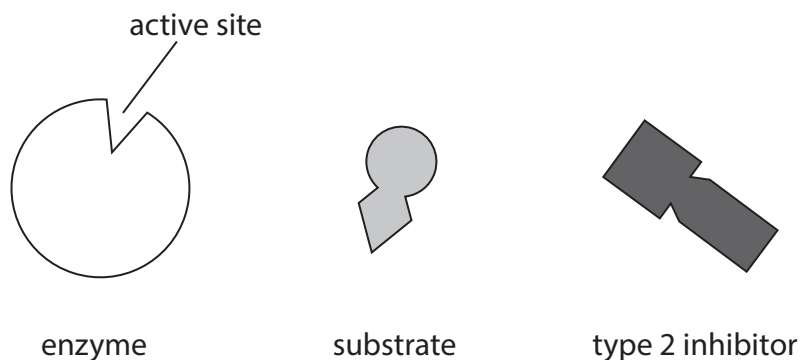
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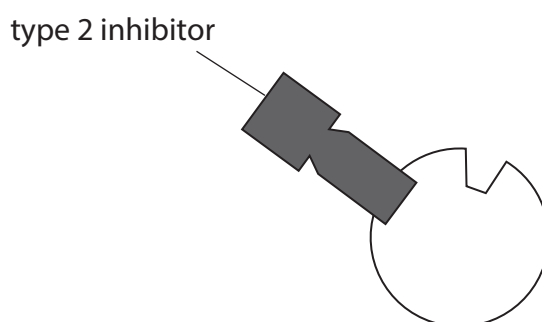
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(iii) The first diagram shows the enzyme, its substrate and a type 2 inhibitor.



The second diagram shows the type 2 inhibitor attached to this enzyme.



Explain how a type 2 inhibitor affects the rate of this reaction.

Use the information in both of these diagrams to support your answer.

(2)

**(Total for Question 3 = 8 marks)**



4 One role of haemoglobin is to transport oxygen in the blood.

(a) Haemoglobin is a protein.

- (i) The table shows some features of the secondary and tertiary (three-dimensional) structures of proteins.

For each feature, put **one** cross ☐ in the appropriate box, in each row, to show whether these features **can be present in** these structures of proteins.

(2)

| Feature                          | Structures of proteins      |                          |                          |                                |
|----------------------------------|-----------------------------|--------------------------|--------------------------|--------------------------------|
|                                  | both secondary and tertiary | secondary only           | tertiary only            | neither secondary nor tertiary |
| peptide bonds                    | <input type="checkbox"/>    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>       |
| beta ( $\beta$ ) pleated folding | <input type="checkbox"/>    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>       |

- (ii) Explain **two** ways in which the structure of haemoglobin enables it to transport oxygen in the blood.

(2)

1 .....

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2 .....

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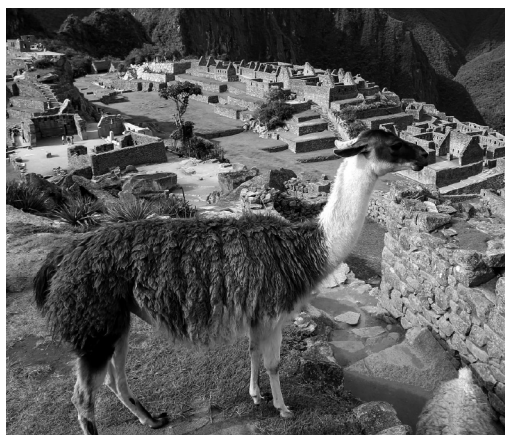


- (b) The tops of the Andes mountains in Peru are between 4 800 m and 5 400 m above sea level.

Llamas are adapted for living at these high altitudes.

Camels live at lower altitudes than llamas.

The photographs show a llama and a camel.



(Source: © Don Mammoser / Alamy Stock Photo)

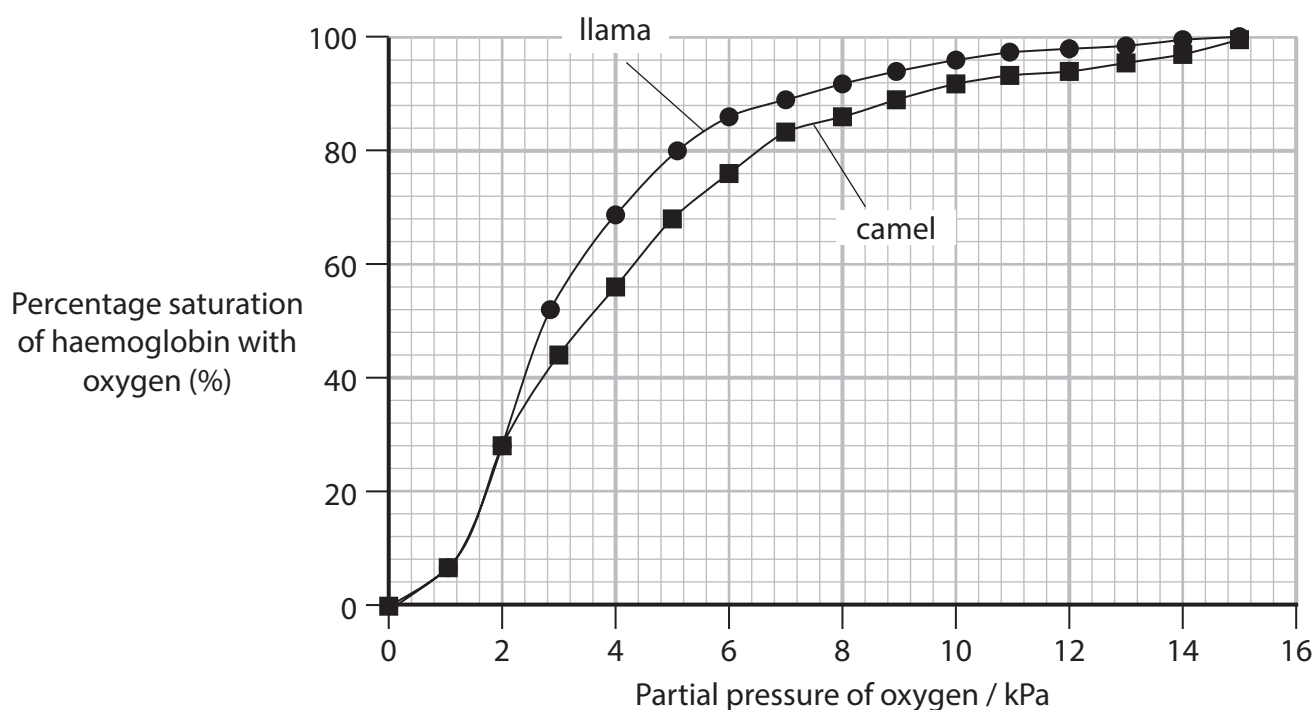
Llama



(Source: © Itsik Marom / Alamy Stock Photo)

Camel

The graph shows the oxygen dissociation curves of haemoglobin of a llama and a camel.



The table shows the partial pressure of oxygen in the atmosphere at different altitudes.

| Altitude<br>/ metres above sea level | Partial pressure of oxygen in<br>the atmosphere / kPa |
|--------------------------------------|-------------------------------------------------------|
| 2 000                                | 16.8                                                  |
| 3 000                                | 14.7                                                  |
| 4 000                                | 13.1                                                  |
| 5 000                                | 11.3                                                  |
| 6 000                                | 9.9                                                   |

Deduce why llamas are able to live at higher altitudes than camels.

Use the information in the graph and the table to support your answer.

(4)

(Total for Question 4 = 8 marks)

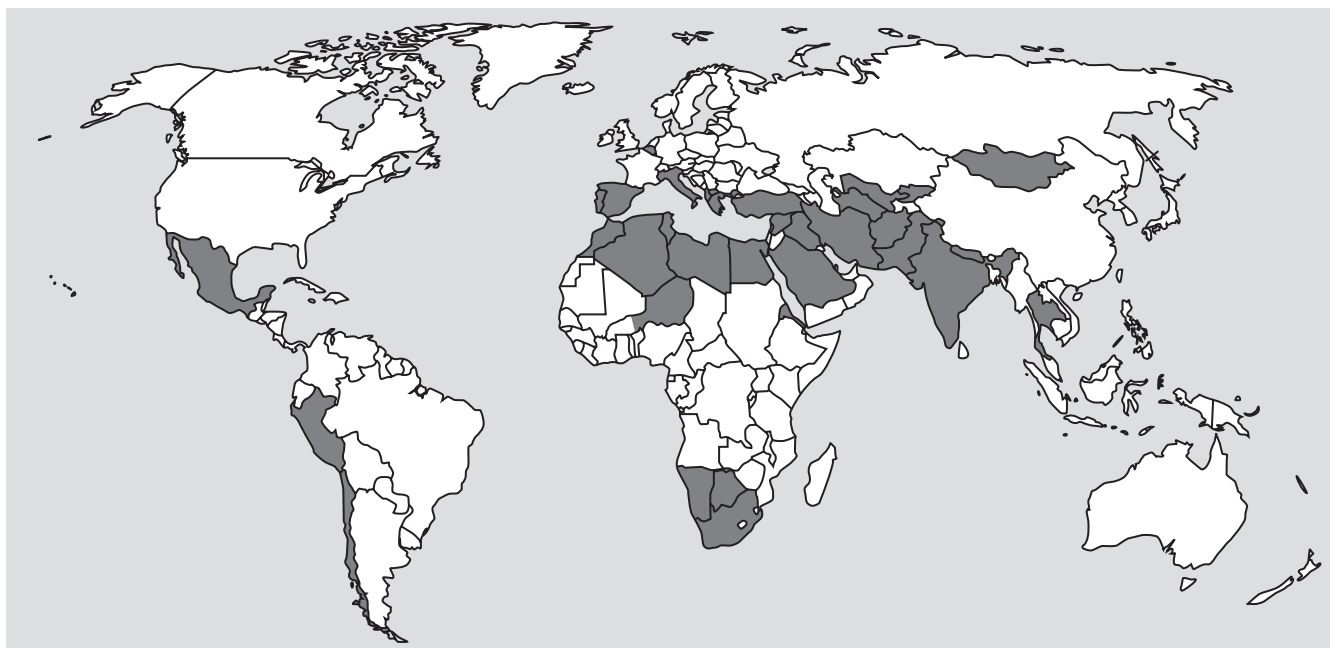


- 5 There are many water-stressed countries in the world, mostly in the Middle East, North Africa and South Asia.

Water-stressed countries have a shortage of fresh water needed for humans, animals and crops.

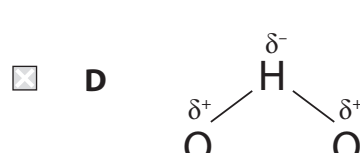
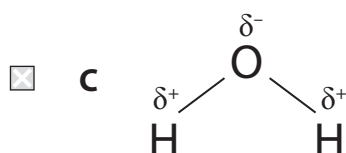
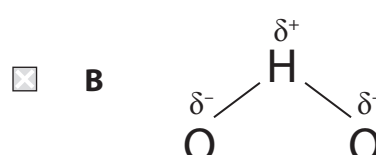
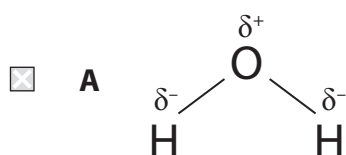
Fresh water can be produced from sea water by desalination processes.

The map shows the most water-stressed countries (shaded) in the world.



(a) Which is the structure of a water molecule?

(1)



- (b) The estimate of the volume of water on Earth is  $1.4 \times 10^{12} \text{ km}^3$ .

Fresh water makes up 2.5% of this volume.

90% of this fresh water is not available as it is frozen in ice caps and glaciers.

Calculate the volume of **available** fresh water on Earth.

Give your answer in standard form.

(2)

Answer .....  $\text{km}^3$

- (c) The global demand for water is expected to rise to about  $6000 \text{ km}^3$  by 2050.

Suggest **one** reason for an increase in the global demand for water.

(1)

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- (d) Sea water is a salt solution.

Salt has positively-charged sodium ions ( $\text{Na}^+$ ) and negatively-charged chloride ions ( $\text{Cl}^-$ ).

Explain why salt can dissolve in water.

(2)

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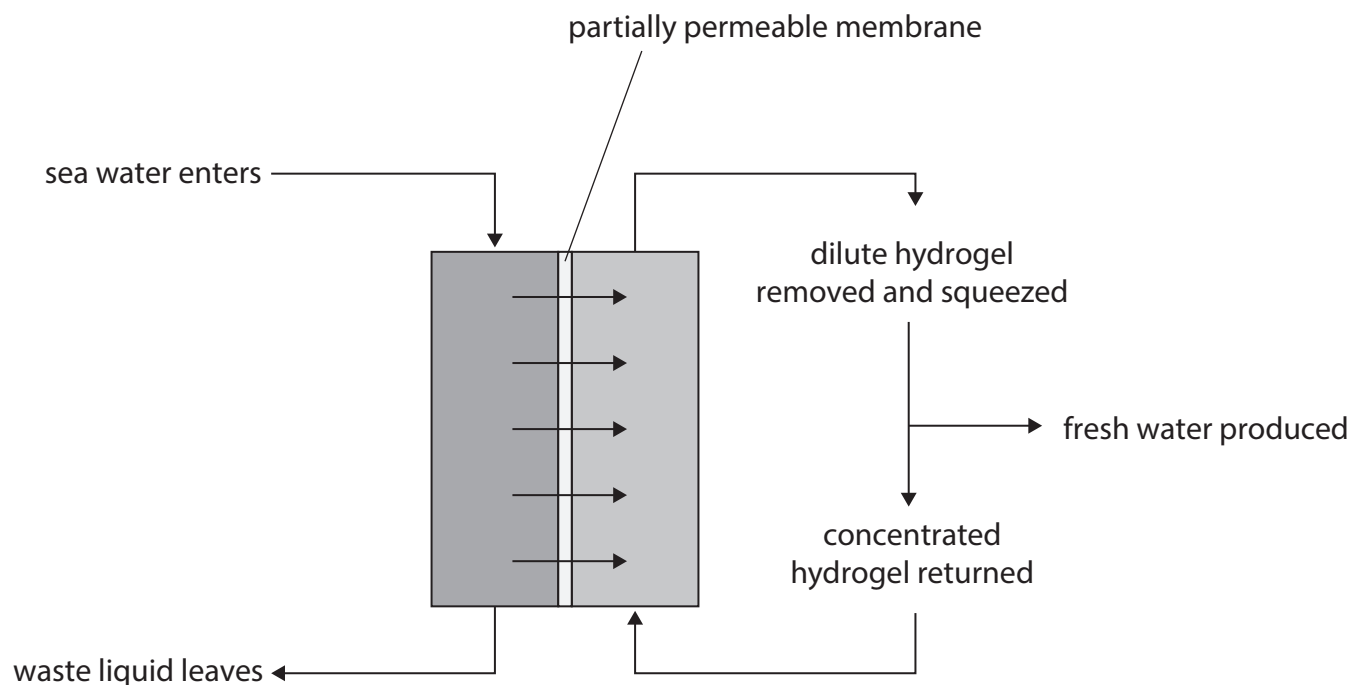
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(e) One method of desalination is forward osmosis desalination using a hydrogel.

Hydrogels are made of large molecules that can absorb water because they have a low water potential.

The diagram shows the process of forward osmosis desalination.



Explain how forward osmosis desalination produces fresh water.

Use the information in the diagram to support your answer.

(4)

(Total for Question 5 = 10 marks)

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- 6 The structures of polysaccharides, disaccharides and monosaccharides relate to their roles in living organisms. They are all types of carbohydrate.

(a) The table shows the main type of carbohydrate present in some foods.

| Food                  | Main type of carbohydrate present |
|-----------------------|-----------------------------------|
| jackfruit             | glucose                           |
| rice                  | starch                            |
| sugar cane            | sucrose                           |
| sweet potato (cooked) | maltose                           |
| watermelon            | fructose                          |

- (i) Which row of the table shows an example of a polysaccharide, a disaccharide and a monosaccharide?

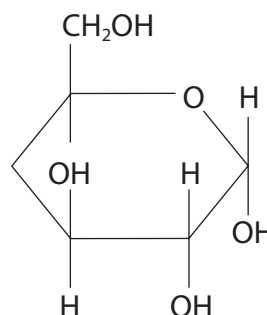
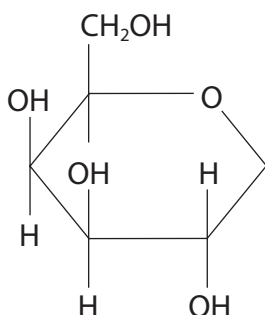
(1)

|                            | Polysaccharide | Disaccharide | Monosaccharide |
|----------------------------|----------------|--------------|----------------|
| <input type="checkbox"/> A | fructose       | maltose      | sucrose        |
| <input type="checkbox"/> B | maltose        | sucrose      | fructose       |
| <input type="checkbox"/> C | starch         | maltose      | sucrose        |
| <input type="checkbox"/> D | starch         | sucrose      | fructose       |

- (ii) Lactose is a disaccharide composed of galactose and glucose.

Complete the diagram to show a molecule of lactose.

(2)

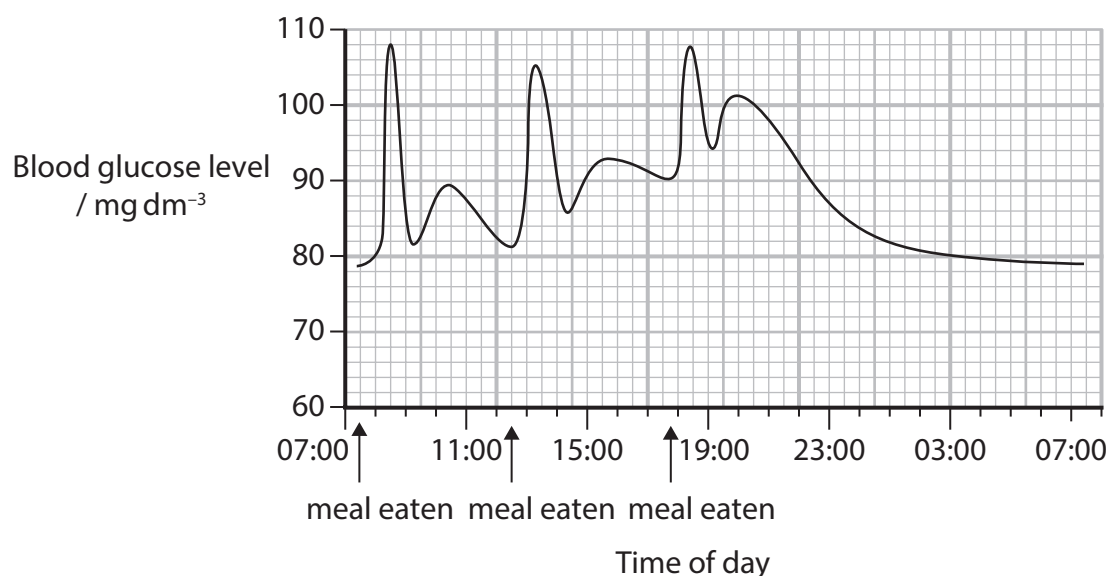


(iii) Glycogen is another carbohydrate.

Describe the structure of glycogen.

(2)

(b) The graph shows how the blood glucose level of a person changes during one day.



Calculate the maximum change in blood glucose level after the first meal is eaten.

Give your answer to **one** significant figure **with suitable units**.

(2)

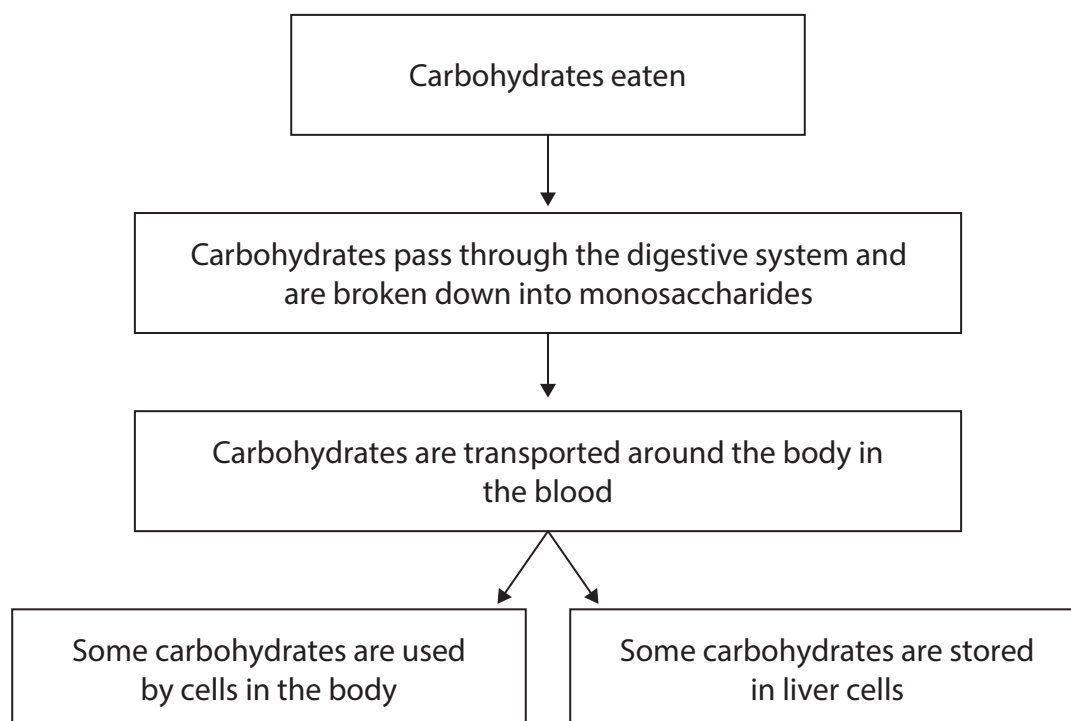
Answer ..... Units .....



\*(c) Carbohydrate metabolism includes the group of chemical reactions that break down carbohydrates.

Some of these reactions convert one type of carbohydrate into another type.

The flowchart shows what happens to some of the carbohydrates that we eat.



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Explain how carbohydrates are metabolised, transported and used in the cells of the body and stored in liver cells.

Use the information in the question and your own knowledge of the structures, roles and properties of carbohydrates and transport mechanisms.

(6)

(Total for Question 6 = 13 marks)



7 Cystic fibrosis (CF) is a recessive genetic disorder caused by mutations in the CFTR-gene.

(a) In 2022, there were approximately 70 000 people with CF in the world.

The world population was approximately  $8 \times 10^9$  people.

(i) Suggest **two** reasons why these values are only approximations.

(2)

1 .....

.....

.....

2 .....

.....

.....

(ii) Estimate the probability of a person in 2022 having CF.

(1)

Answer .....

(b) One mutation results in a CFTR protein that is missing a **single** amino acid.

The missing amino acid is phenylalanine.

(i) Explain how a mutation can result in a CFTR protein missing a single phenylalanine.

(2)

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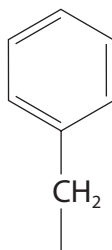
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(ii) The diagram shows the R group for phenylalanine.



Complete the diagram to show the amino acid phenylalanine.

(3)

(c) Cystic fibrosis can affect the functioning of the reproductive systems in both males and females, causing infertility.

(i) Some females with CF have thickened mucus in their reproductive tract.

Explain how a mutation in the CF-gene can result in infertility in these women.

(3)

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- (ii) Mutations in the CFTR-gene can result in the production of sperm cells that are not able to fertilise an egg cell.

In some male carriers of CF, only half the sperm cells are healthy and able to fertilise an egg cell.

Explain why male carriers of CF have a mixture of healthy sperm cells and sperm cells that are not able to fertilise an egg cell.

(3)

**(Total for Question 7 = 14 marks)**

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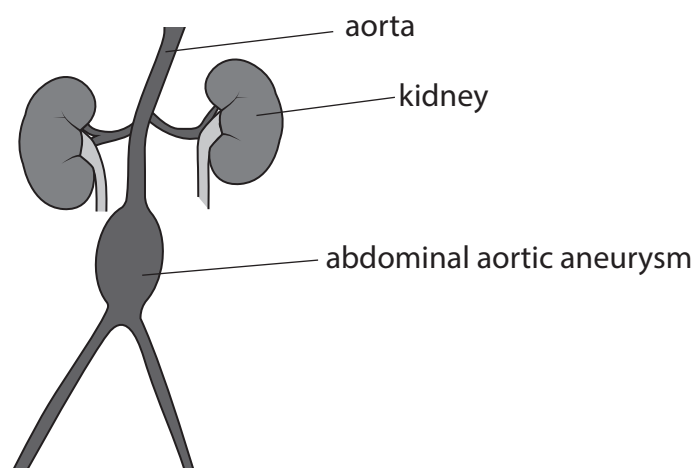


- 8 An abdominal aortic aneurysm (AAA) is a swelling of the aorta in the abdomen due to weakening of the wall of the aorta.

Patients with an AAA frequently have atherosclerosis.

An AAA can be fatal if the aorta bursts causing internal bleeding.

The diagram shows an AAA.



- (a) Explain how a healthy aorta is protected from bursting.

(2)

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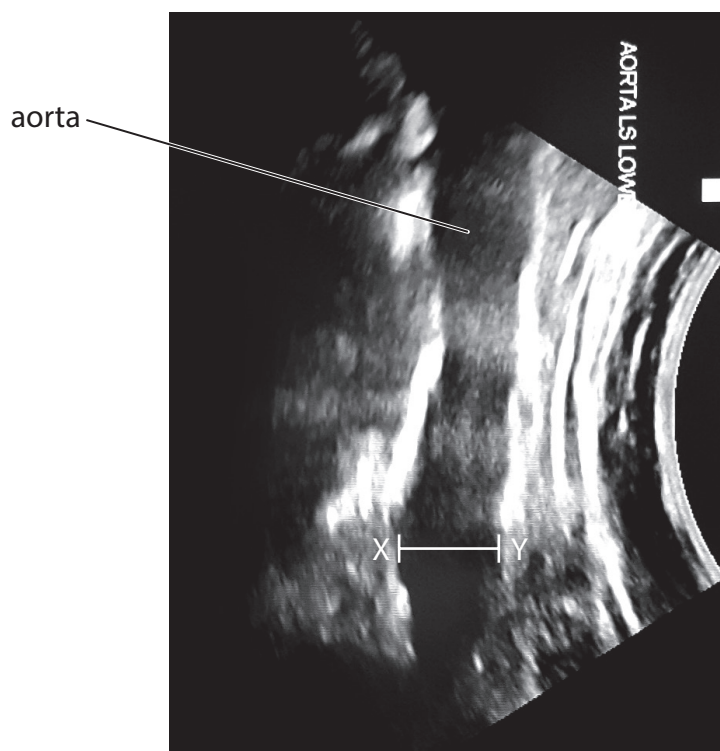
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- (b) The presence of an AAA can be detected by scanning the abdomen.

The image shows a scan of a healthy abdominal aorta.



- (i) The diameter of this aorta, between X and Y, is 17.3 mm.

Calculate the magnification of this image.

Give your answer to a suitable number of decimal places.

(2)

Answer .....

- (ii) An aorta with a diameter greater than 5.5 cm is classed as a large AAA.

Calculate how many times wider this large AAA is than the aorta with a diameter of 17.3 mm.

Give your answer to **three** significant figures.

(1)

Answer .....



- (iii) A screening programme found that 1 in 92 men had an AAA and 1 in 1 000 men had a large AAA.

Calculate the proportion of AAA that are large AAA.

(1)

Answer .....

- (c) The effect of drug D on AAA and atherosclerosis in mice was investigated by scientists.

- (i) Drug D is an antioxidant.

Suggest why the scientists thought that drug D might be effective against AAA.

(2)

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\*(ii) The scientists used four groups of mice in this investigation.

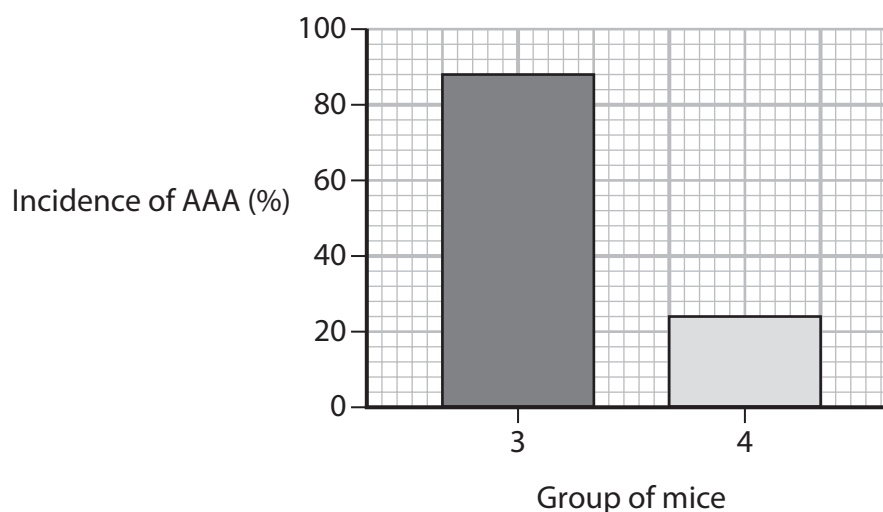
The table shows details of the injections and treatments given to these groups of mice.

| Group | Injection given to mice | Treatment with drug D |
|-------|-------------------------|-----------------------|
| 1     | salt solution           | no                    |
| 2     | salt solution           | yes                   |
| 3     | chemical C              | no                    |
| 4     | chemical C              | yes                   |

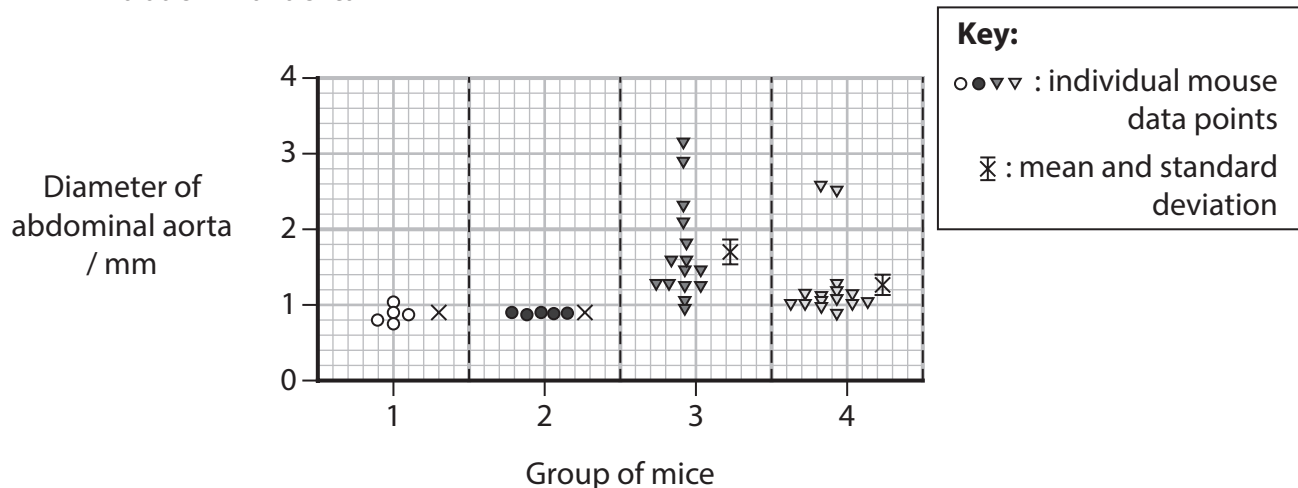
An injection of chemical C induces AAA and atherosclerosis in mice.

The graphs show some of the results from this investigation.

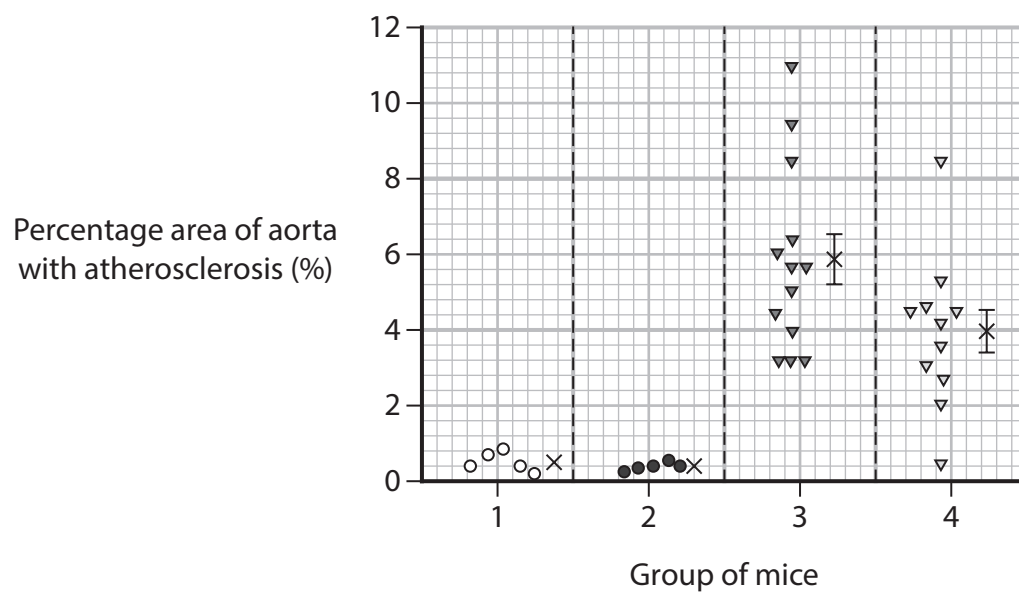
**Graph 1 : Effect of treatment with drug D on the incidence of AAA**



**Graph 2 : Effect of treatment with drug D on the diameter of the abdominal aorta**



**Graph 3 : Effect of treatment with drug D on the percentage area of aorta with atherosclerosis**



Comment on the effects of the injections and treatments used in this investigation.

(6)



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(Total for Question 8 = 14 marks)

**TOTAL FOR PAPER = 80 MARKS**

