Please check the examination details below before entering your candidate information

| Candidate surname | Other names |
|---|---|
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Centre Number | Candidate Number

# Pearson Edexcel Level 3 GCE

## Monday 12 May 2025

Morning (Time: 1 hour 30 minutes)

Paper reference **8BN0/01**

# Biology A (Salters Nuffield)

## Advanced Subsidiary

## PAPER 1: Lifestyle, Transport, Genes and Health

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

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.
- **Show all your working out** in calculations and **include units** where appropriate.
- Answer the questions in the spaces provided – *there may be more space than you need.*

## 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.*
- You may use a scientific calculator.
- In questions marked with an **asterisk** (*), marks will be awarded for your ability to structure your answer logically, showing how the points that 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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P 7 8 6 8 7 A 0 1 2 8

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

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

**1** DNA and RNA are nucleic acids.

(a) (i) Which base is present in RNA but absent from DNA?

**(1)**

☐ **A** adenine

☐ **B** guanine

☐ **C** thymine

☐ **D** uracil

(ii) Which row shows the correct structure of these two molecules?

**(1)**

| | DNA | Messenger RNA |
|---|---|---|
| ☐ **A** | double-stranded | double-stranded |
| ☐ **B** | double-stranded | single-stranded |
| ☐ **C** | single-stranded | double-stranded |
| ☐ **D** | single-stranded | single-stranded |

(b) DNA acts as a template for the synthesis of messenger RNA.

(i) Which bond joins together mononucleotides in a strand of DNA and RNA?

**(1)**

☐ **A** disulfide

☐ **B** glycosidic

☐ **C** peptide

☐ **D** phosphodiester

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(ii) Give **three** differences between the process of DNA replication and the process of DNA transcription.

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**(Total for Question 1 = 6 marks)**

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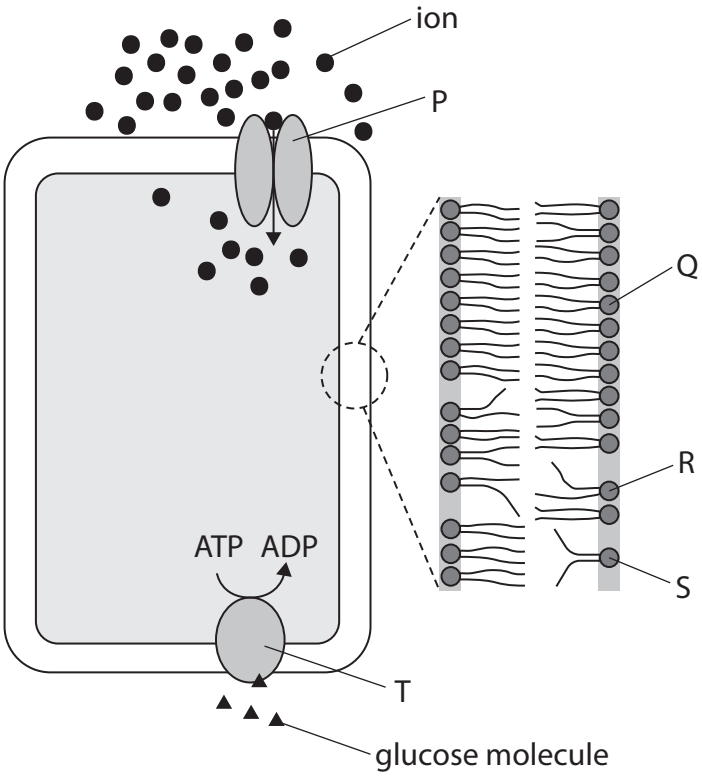
**2** The diagram shows some components of a cell membrane.




(a) The components labelled P and T are proteins.

(i) State **one** role of ATP in the movement of molecules through the component labelled T.

**(1)**

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(ii) Describe how ions enter the cell through the component labelled P.

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(b) The components labelled Q, R and S are phospholipids.

(i) Water molecules can pass between phospholipids to enter or leave a cell.

Name this process.

**(1)**

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(ii) Explain why the phospholipids labelled Q and R have different shapes.

**(2)**

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(iii) Predict the effect of increasing the proportion of the phospholipid labelled S on **one** of the properties of this cell membrane.

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**(Total for Question 2 = 7 marks)**

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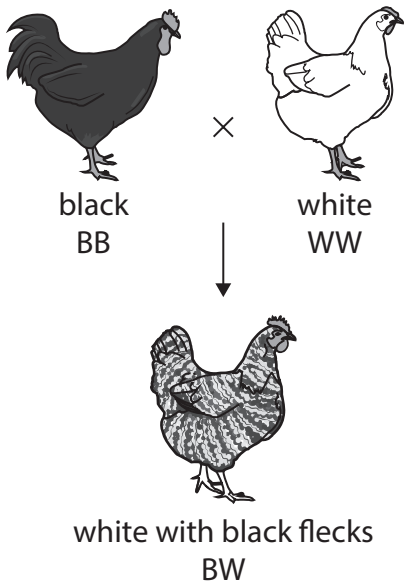
**3** The phenotype of an organism is affected by its genotype.

Chickens have different patterns and colours in their feathers as a result of their genotypes.

The image shows the genotypes and phenotypes of two chickens used in a breeding programme and one of their offspring.

A gene has the alleles B and W.




(a) (i) State what is meant by the following terms.

**(2)**

Genotype

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Phenotype

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(ii) Explain the type of inheritance shown in this example.

**(2)**

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(b) Two chickens, both white with black flecks, were used in a further breeding programme.

(i) Draw a genetic diagram to find the expected ratio of the phenotypes of the offspring.

**(3)**

Ratio of named phenotypes:

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(ii) A statistical test can be used to compare observed and expected frequencies of the different phenotypes.

Which statistical test is used to compare observed and expected frequencies of the different phenotypes?

**(1)**

☒ **A** chi-squared test

☒ **B** correlation coefficient

☒ **C** standard deviation

☒ **D** Student's t-test

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

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**4** Vitamin C can be found in many fruits and vegetables, including broccoli.

The table shows the vitamin C content of two types of broccoli.

| Type of broccoli | Mean vitamin C content / μg per $cm^3$ extract |
|---|---|
| Green broccoli | 30 |
| Purple-sprouting broccoli | 25 |

(a) It is recommended that a pregnant woman consumes 85 mg of vitamin C a day.

Calculate the volume of purple-sprouting broccoli extract that would provide 85 mg of vitamin C.

Give your answer in $dm^3$.

**(3)**

..... $dm^3$

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(b) The photograph shows green broccoli being cooked in a steamer.

(Source: © Art Directors & TRIP / Alamy Stock Photo)

Broccoli can also be cooked by boiling in water.

A student investigated the following hypothesis:

'The broccoli will lose less vitamin C if it is steamed than if it is boiled'.

Devise an investigation the student could use to test this hypothesis and collect valid data.

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(c) Vitamin C is an antioxidant.

Some studies have discovered a negative correlation between vitamin C intake and the risk of coronary heart disease.

State what is meant by a negative correlation between vitamin C intake and the risk of coronary heart disease.

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**(Total for Question 4 = 9 marks)**

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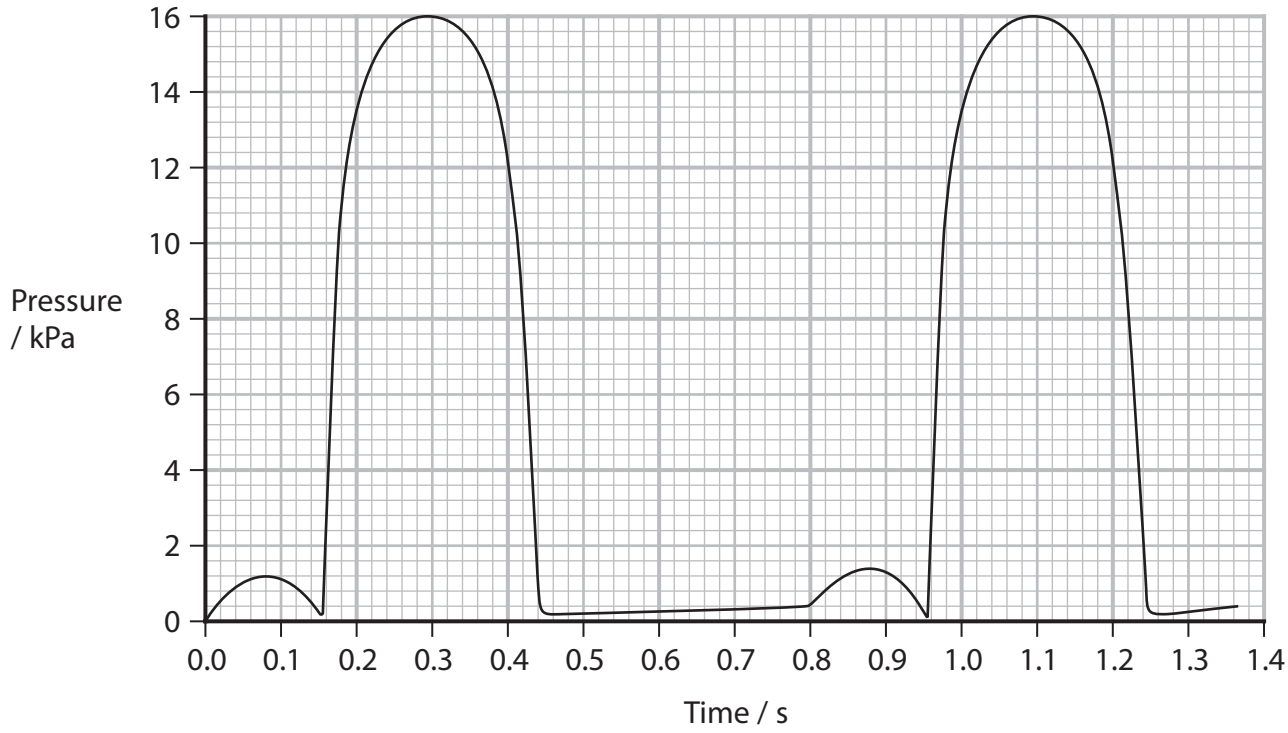
**5** The graph shows the pressure changes in the left ventricle of a human heart.




(a) (i) Draw a line on the graph to show the pressure changes in the **right** ventricle from 0.16 to 0.44 seconds.

**(1)**

(ii) Calculate the heart rate shown in the graph.

**(1)**

..... beats $min^{-1}$

(iii) Which correctly describes the blood as it moves out of the left ventricle?

**(1)**

☒ **A** deoxygenated and pumped into the aorta

☒ **B** deoxygenated and pumped into the pulmonary artery

☒ **C** oxygenated and pumped into the aorta

☒ **D** oxygenated and pumped into the pulmonary artery

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(iv) Explain what is causing the change in pressure in the left ventricle during the following time periods:

**(4)**

0.0 to 0.08 seconds

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0.16 to 0.3 seconds

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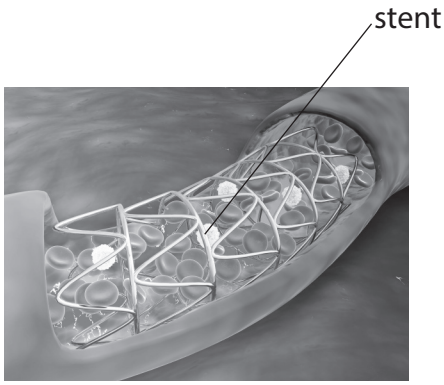
(b) The lumen of a coronary artery can be widened by a technique called angioplasty.

A stent can be used to maintain the lumen width of the coronary artery after angioplasty has occurred.

The image shows a stent in a coronary artery.




(Source: © Stocktrek Images, Inc. / Alamy Stock Photo)

(i) Explain why a patient might need this treatment.

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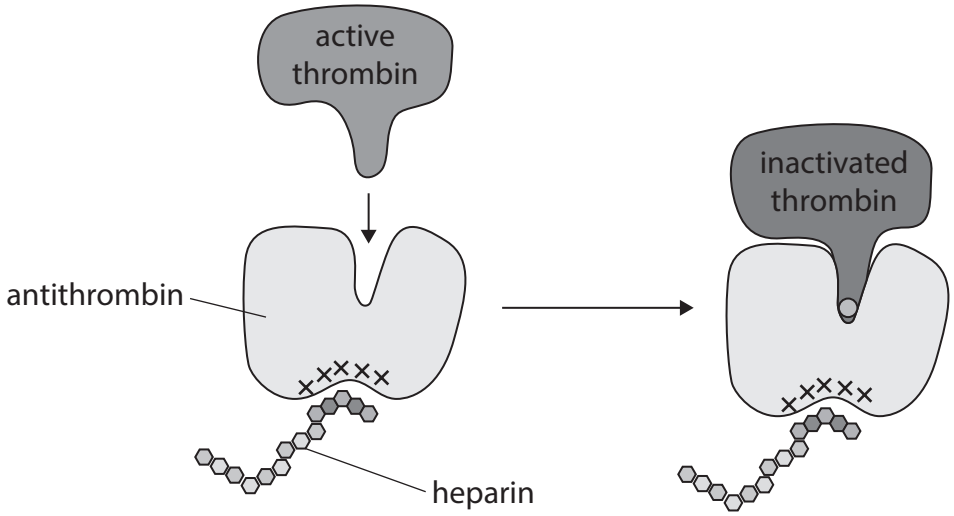
(ii) Anticoagulant drugs, such as heparin, are given to patients who have been fitted with a stent.

Heparin binds to antithrombin in the blood to form an antithrombin-heparin complex.

The diagram shows the effect of an antithrombin-heparin complex binding to active thrombin.




Explain how an antithrombin-heparin complex will prevent blood clots forming in a coronary artery.

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**(Total for Question 5 = 13 marks)**



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**6** Collagen is a protein found in the walls of some blood vessels.

(a) (i) Which of the blood vessels aorta and vena cava have collagen in their walls?

**(1)**

☒ **A** aorta only

☒ **B** aorta and vena cava

☒ **C** neither the aorta nor the vena cava

☒ **D** vena cava only

(ii) Describe the structure of collagen.

**(2)**

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(b) Collagen has low solubility in water.

(i) Give **one** other property of collagen.

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(ii) Explain why collagen has a low solubility in water.

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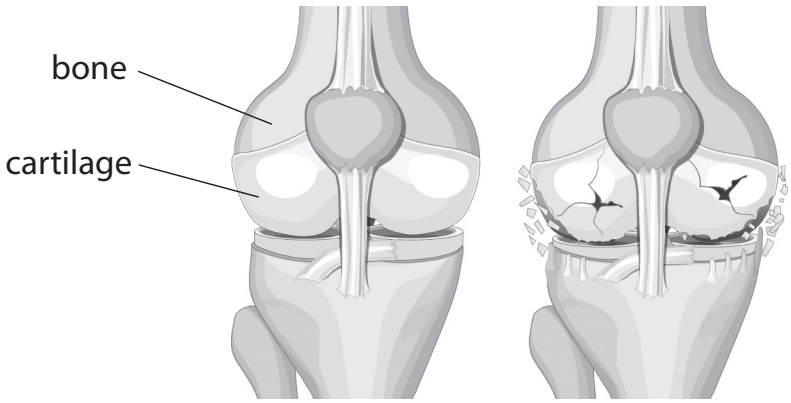
(c) Collagen is a component of cartilage in joints.

The diagram shows damage inside a knee joint of a person with osteoarthritis.




(Source: © Tetiana Zhabska/Alamy Stock Vector)

The collagen is broken down by collagenase enzymes made by cells in the joint.

These enzymes can be intracellular or extracellular.

Give **one** similarity and **one** difference between the action of an **intracellular** enzyme and an **extracellular** enzyme.

**(2)**

Similarity

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Difference

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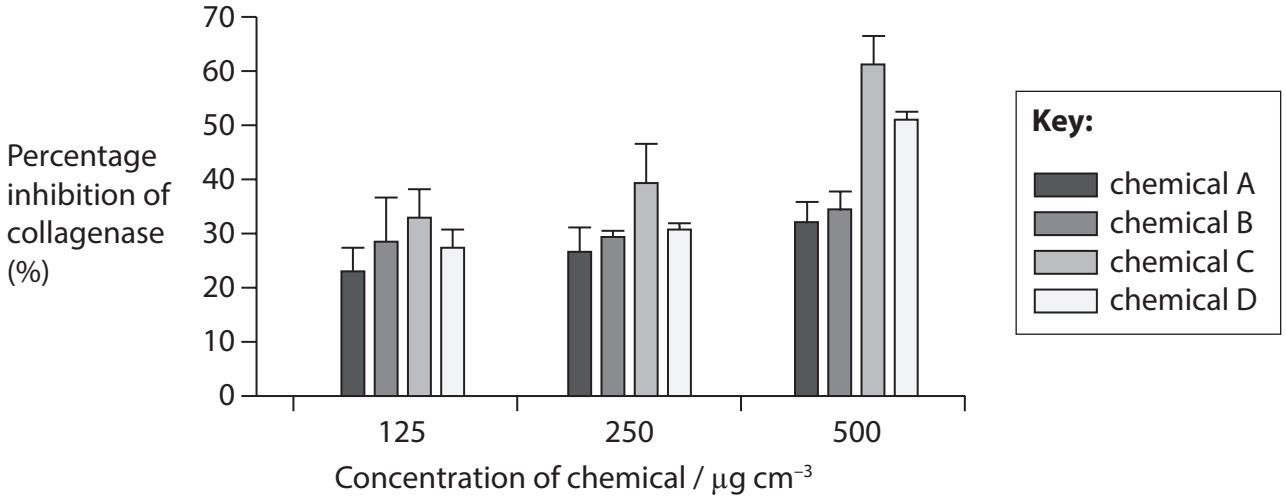
(d) The effect of the concentration of four chemicals, A, B, C and D, on the inhibition of a collagenase enzyme was investigated.

The graph shows the results of this investigation.




(i) Give **two** conclusions from the results of this investigation.

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(ii) Describe how the initial rate of reaction for collagenase could be calculated.

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**(Total for Question 6 = 12 marks)**

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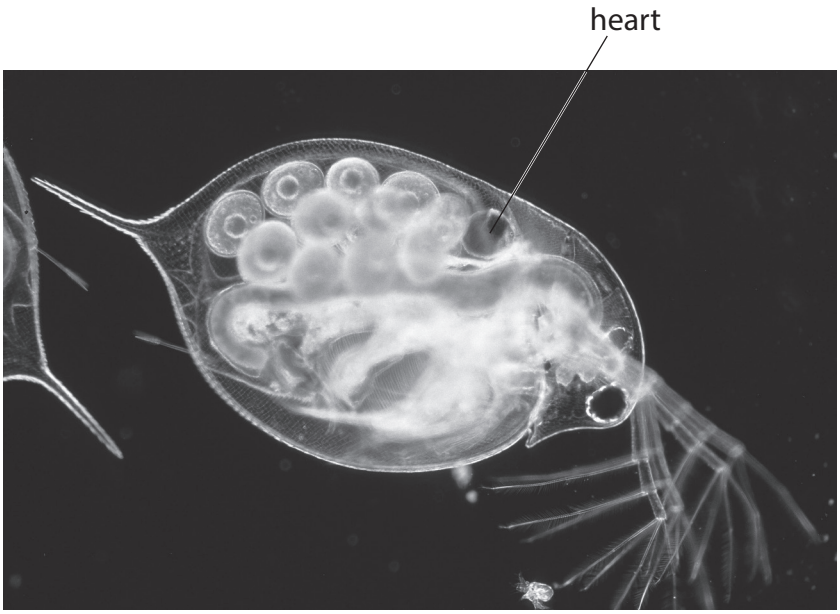
**7** The photograph shows a *Daphnia* that lives in ponds and streams.




(Source: © MELBA PHOTO AGENCY / Alamy Stock Photo)

magnification ×30

(a) Explain why the *Daphnia* needs a heart.

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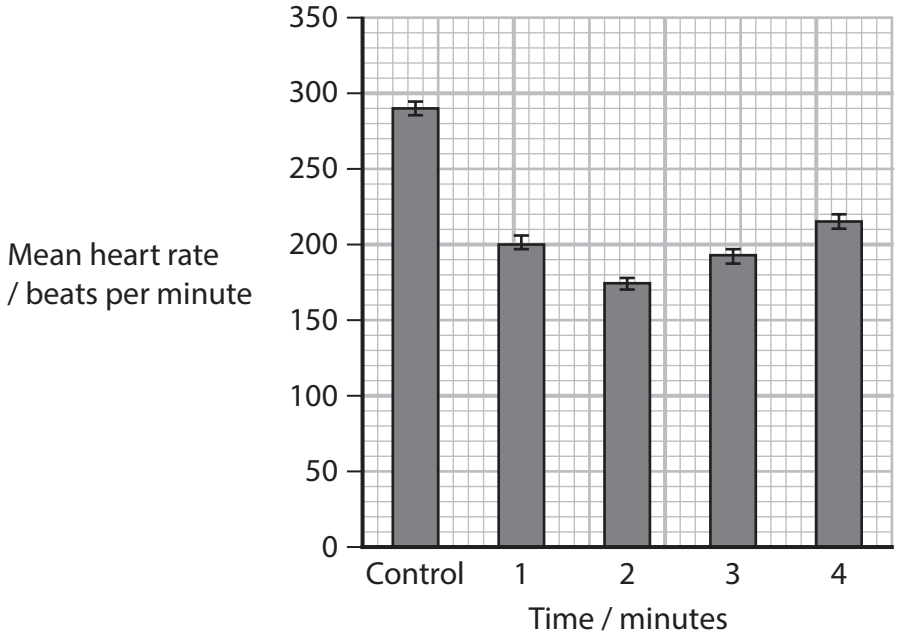
(b) The effect of alcohol on the heart rate of *Daphnia* was investigated.

The heart rates of several *Daphnia* in a control solution were measured.

The control solution was replaced with a solution of 2.5 % alcohol. The heart rates of these *Daphnia* were measured every minute, for four minutes.

The graph shows the results of this investigation.




(i) Explain why *Daphnia* is a suitable organism to use in this investigation.

**(2)**

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(ii) Give a suitable control solution.

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(iii) Describe how **valid** data could have been collected for this investigation.

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(iv) Comment on the effect of alcohol on the heart rate of *Daphnia*.

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**(Total for Question 7 = 12 marks)**

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**8** Fick's Law shows how three factors affect the rate of diffusion.

Part of the equation for Fick's Law is shown in the box.

$$\text{Rate of diffusion} \propto \frac{\text{surface area} \times \mathbf{Y}}{\mathbf{Z}}$$

(a) Oxygen diffuses from the air in the alveolus to the red blood cells in the blood.

(i) Which of the following is represented by **Y** in the equation in this context?

**(1)**

☒ **A** carbon dioxide concentration difference between alveoli and red blood cells

☒ **B** oxygen concentration difference between alveoli and red blood cells

☒ **C** volume of carbon dioxide in the alveoli

☒ **D** volume of oxygen in the alveoli

(ii) The diffusion distance is given by **Z** in the equation.

Which of the following would be included in this diffusion distance?

1. thickness of the epithelial cells
2. thickness of the endothelial cells
3. thickness of the red blood cell membrane

**(1)**

☒ **A** 1 and 2 only

☒ **B** 1, 2 and 3

☒ **C** 2 and 3 only

☒ **D** 3 only

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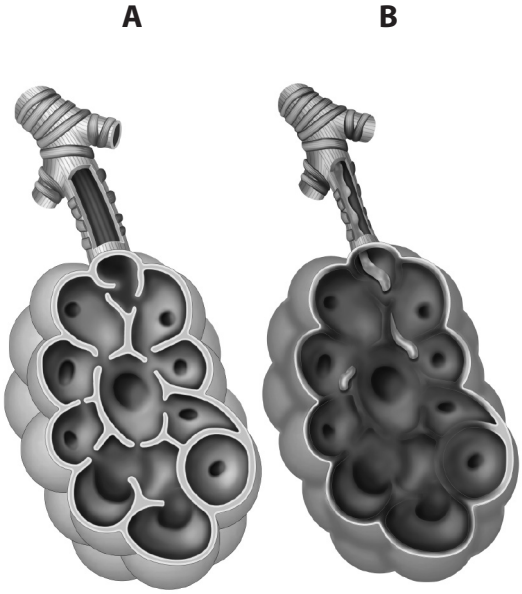
(iii) People with emphysema can develop hypoxia.

Hypoxia is a condition which results from low blood oxygen concentrations. This can be due to a low rate of oxygen diffusion from the alveoli into the blood.

The diagrams show a healthy alveolus (A) and an alveolus from a person with severe emphysema (B).




(Source: © ilusmedical/Shutterstock)

Explain why severe emphysema could result in hypoxia.

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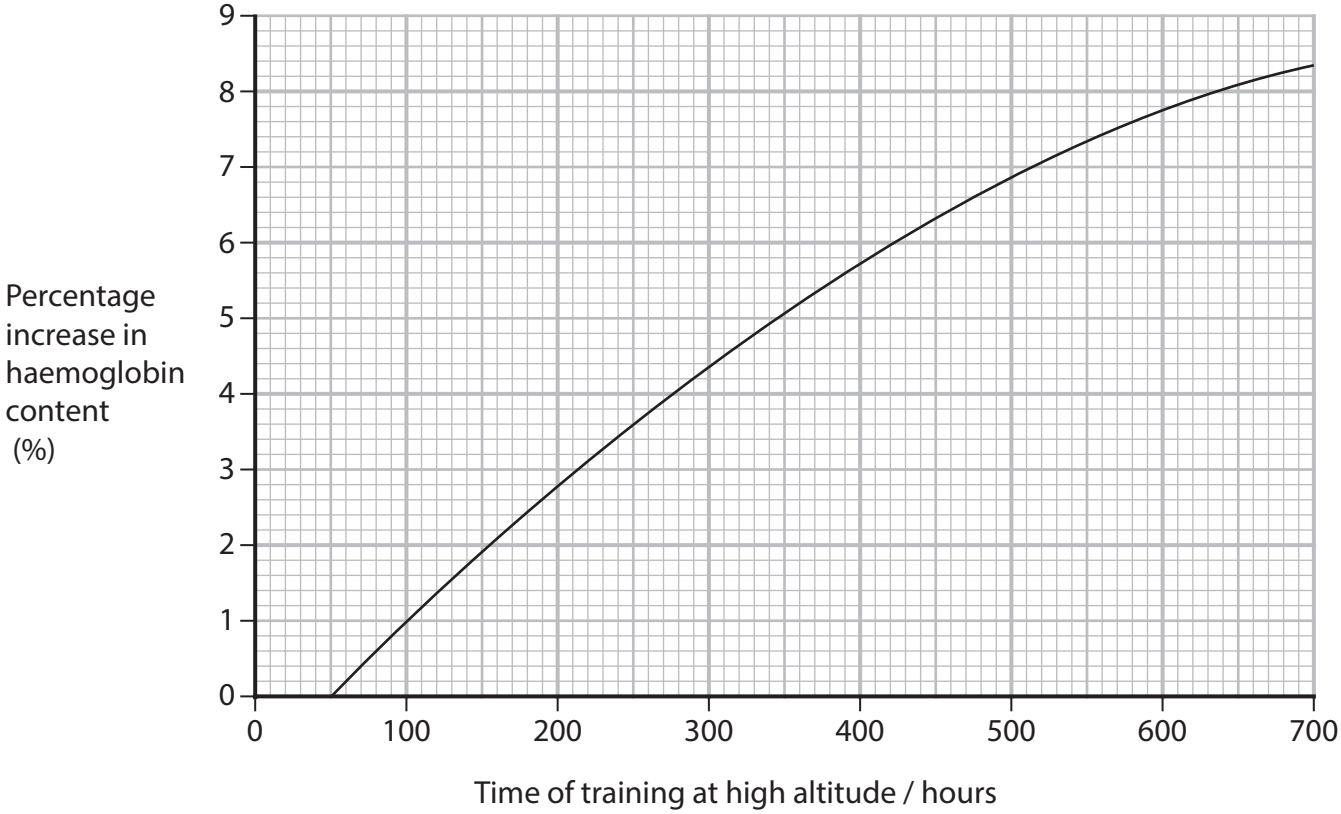
(b) The graph shows the effect of duration of training at a high altitude on the mass of haemoglobin in an athlete.




An athlete with a body mass of 70.8 kg had 13.1 g of haemoglobin per kg of body mass before training.

Calculate the total mass of haemoglobin in this athlete after 500 hours of training at high altitude.

Give your answer in kilogrammes to **two** significant figures.

**(3)**

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*(c) At altitudes above 7000 m, most mountain climbers wear masks connected to an oxygen supply.

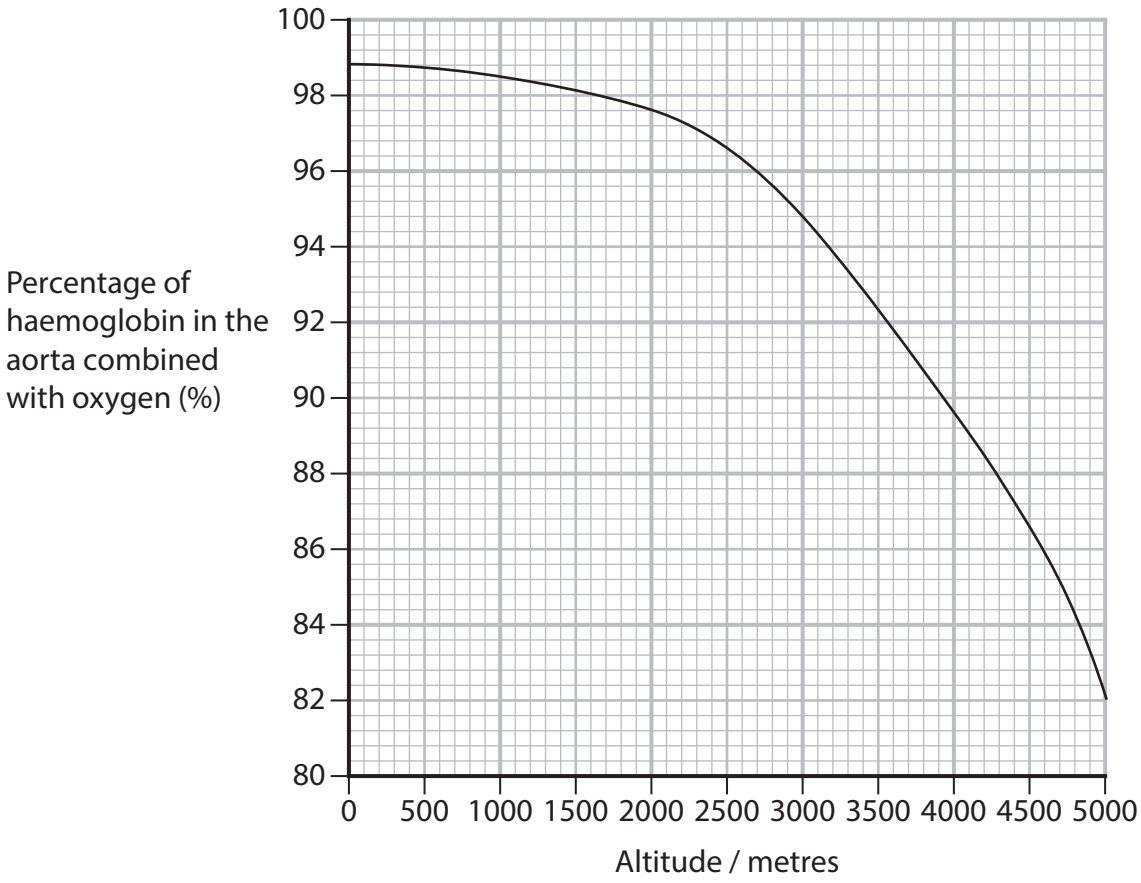
The oxygen supply apparatus can weigh from 3.5 to 7 kg.

The table gives some information about the partial pressure of oxygen in parts of the body, at different altitudes.

A higher partial pressure indicates a higher oxygen concentration.

| Location | Partial pressure of oxygen at sea level (0 m) / kPa | Partial pressure of oxygen at 5800 m / kPa |
|---|---|---|
| Alveoli | 12.5 | 6.0 |
| Arterial blood | 12.0 | 4.5 |

The graph gives some information about the percentage of haemoglobin in the aorta combined with oxygen at different altitudes.

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Explain the advantages and disadvantages for mountain climbers of carrying an oxygen supply.

Use all of the information in Question 8 and your own knowledge to support your answer.

**(6)**

**(Total for Question 8 = 13 marks)**

**TOTAL FOR PAPER = 80 MARKS**

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