Please check the examination details below before entering your candidate information

| Candidate surname | Other names |
|---|---|

**Pearson Edexcel**
**International Advanced Level**

Centre Number | | | | | |

Candidate Number | | | | |

# Tuesday 7 January 2020

Morning (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 **black** 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.*
- **Show all your working in calculations and include units where appropriate.**

## 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 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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Pearson

**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 ☒.**

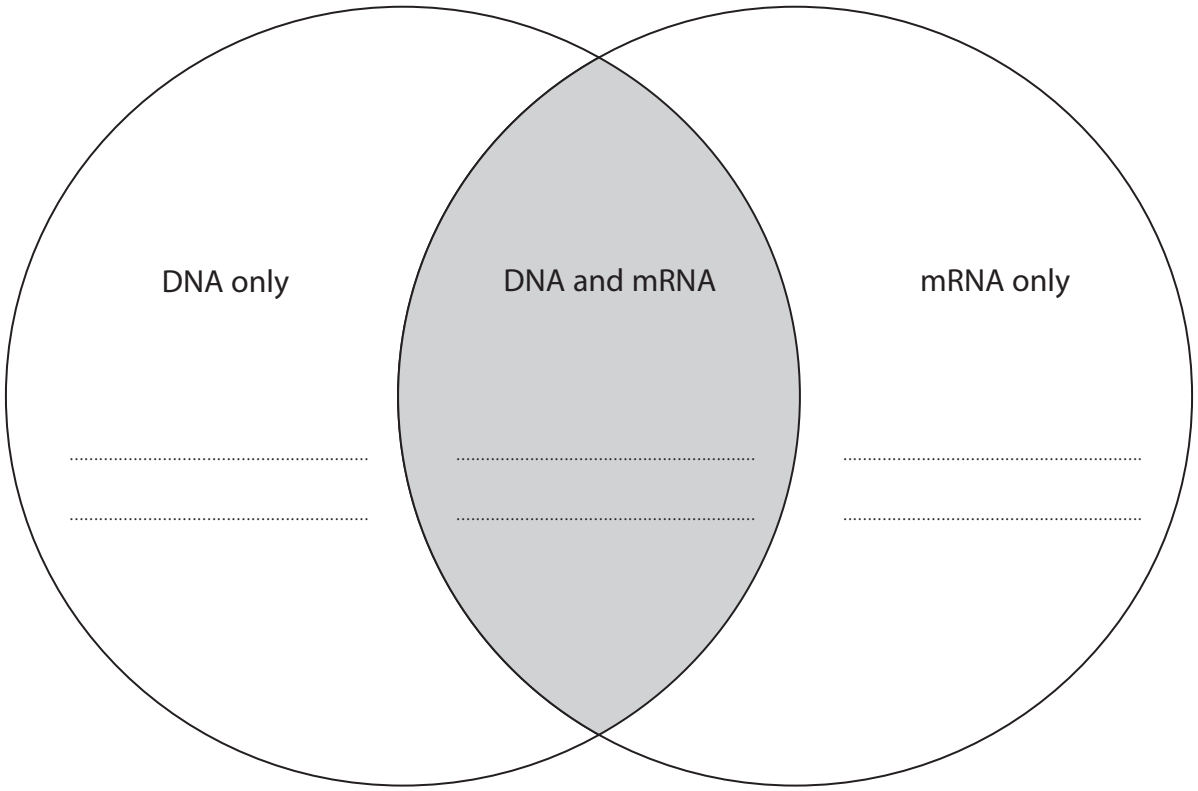
**1** Polynucleotides include DNA and messenger RNA (mRNA).

Some components of polynucleotides are found in both DNA and mRNA.
Other components are found only in DNA or in mRNA.

A Venn diagram can be drawn to represent this information. Components found in both DNA and mRNA are written in the part of the diagram where the circles overlap.

Complete the Venn diagram by writing the name of **two** components in each part of the diagram.

**(6)**




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

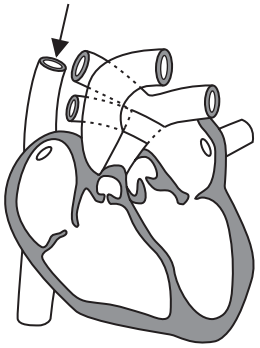
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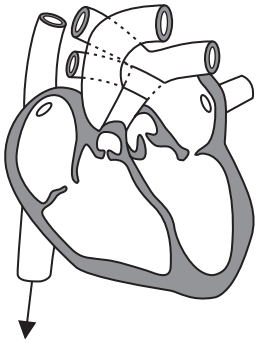
**2** Blood flows through the heart during the cardiac cycle.

(a) Which diagram shows the direction of blood flow through the vena cava?

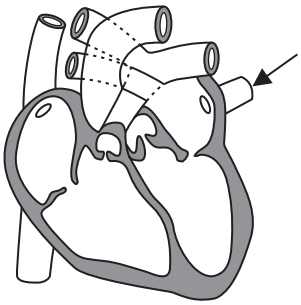
**(1)**



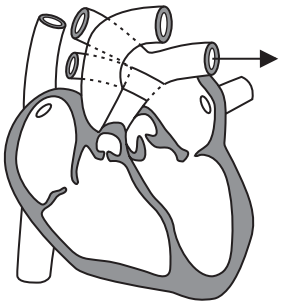
☒ **A**



☒ **C**



☒ **B**



☒ **D**

(b) Which row in the table describes the blood flow through the pulmonary artery and the pulmonary vein?

**(1)**

| | Blood flow through pulmonary artery | Blood flow through pulmonary vein |
|---|---|---|
| ☒ **A** | deoxygenated blood flowing away from the heart | oxygenated blood flowing towards the heart |
| ☒ **B** | deoxygenated blood flowing towards the heart | oxygenated blood flowing away from the heart |
| ☒ **C** | oxygenated blood flowing away from the heart | deoxygenated blood flowing towards the heart |
| ☒ **D** | oxygenated blood flowing towards the heart | deoxygenated blood flowing away from the heart |

(c) The table describes the atrioventricular (AV) valves and the semilunar (SL) valves during the cardiac cycle.

Which description is true for each stage of the cardiac cycle?

**(3)**

| Stage of the cardiac cycle | AV valves open and SL valves open | AV valves open and SL valves closed | AV valves closed and SL valves open | AV valves closed and SL valves closed |
|---|---|---|---|---|
| atrial systole | ☒ | ☒ | ☒ | ☒ |
| ventricular systole | ☒ | ☒ | ☒ | ☒ |
| diastole | ☒ | ☒ | ☒ | ☒ |

(d) Describe how the events of the cardiac cycle change when the demand of body cells for oxygen increases.

**(2)**

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

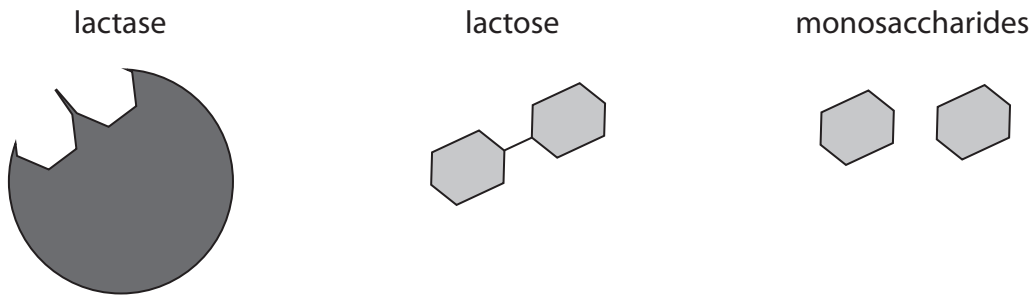
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**3** Lactase is an enzyme that catalyses the hydrolysis of lactose.

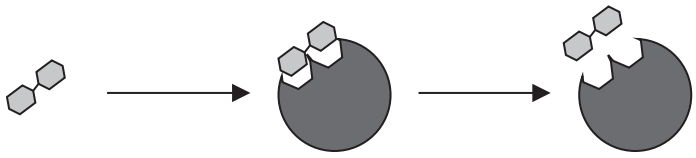
(a) (i) The diagrams show symbols for lactase, lactose and the monosaccharides of lactose.



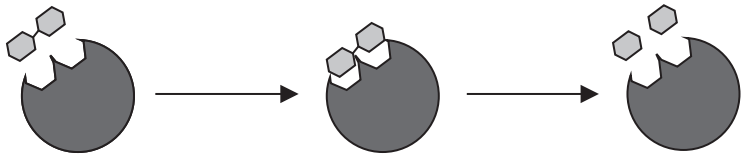

Which diagram shows the sequence of events for the hydrolysis of lactose?

**(1)**

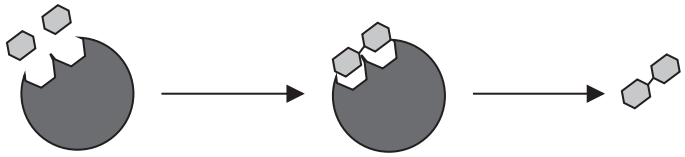
☒ **A**



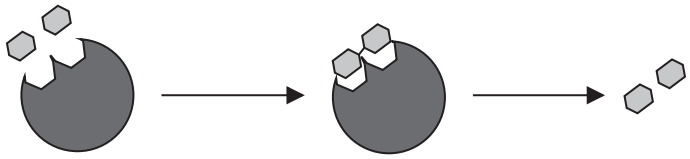
☒ **B**



☒ **C**



☒ **D**



(ii) Which of the following are the monosaccharides present in lactose?

**(1)**

☒ **A** fructose and sucrose

☒ **B** galactose and glucose

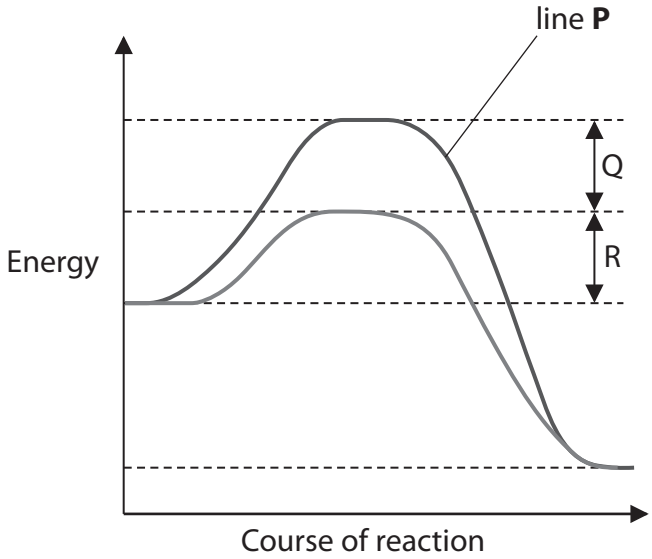
☒ **C** glucose and fructose

☒ **D** sucrose and galactose

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(b) The graph shows the energy changes for the hydrolysis of lactose, with and without lactase.

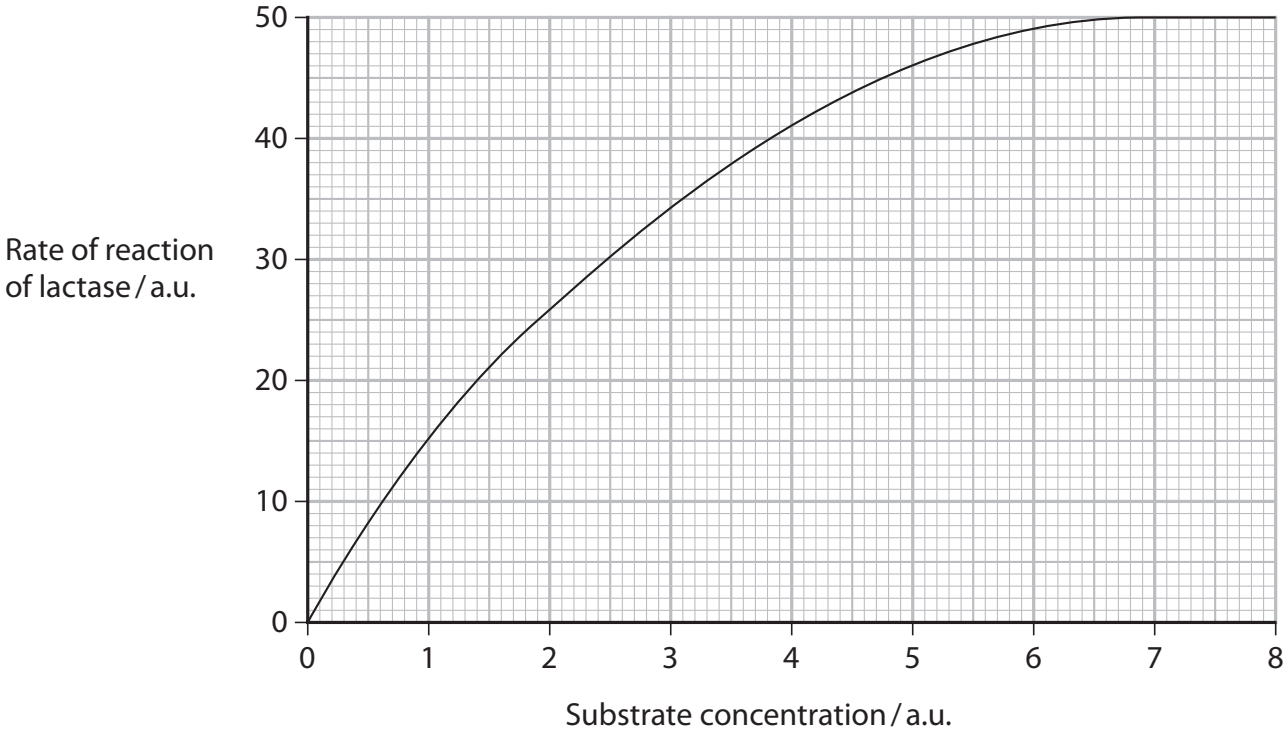



Which row in the table describes line **P** and identifies the letter that shows the decrease in activation energy due to lactase?

**(1)**

| | Line P | Decrease in activation energy due to lactase |
|---|---|---|
| ☒ **A** | reaction with enzyme | Q |
| ☒ **B** | reaction with enzyme | R |
| ☒ **C** | reaction without enzyme | Q |
| ☒ **D** | reaction without enzyme | R |

(c) The graph shows the relationship between substrate concentration and the rate of reaction of lactase.




(i) Explain why substrate concentration affects the rate of reaction.

**(2)**

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(ii) The reaction rate (V) at each substrate concentration can be calculated using the formula

$$V = \frac{V_{max} \times S}{K + S}$$

$V_{max}$ is the maximum rate of reaction

K is the substrate concentration when the rate of reaction is half the rate of $V_{max}$

S is the substrate concentration.

Calculate the reaction rate (V) at a substrate concentration of 4 a.u.

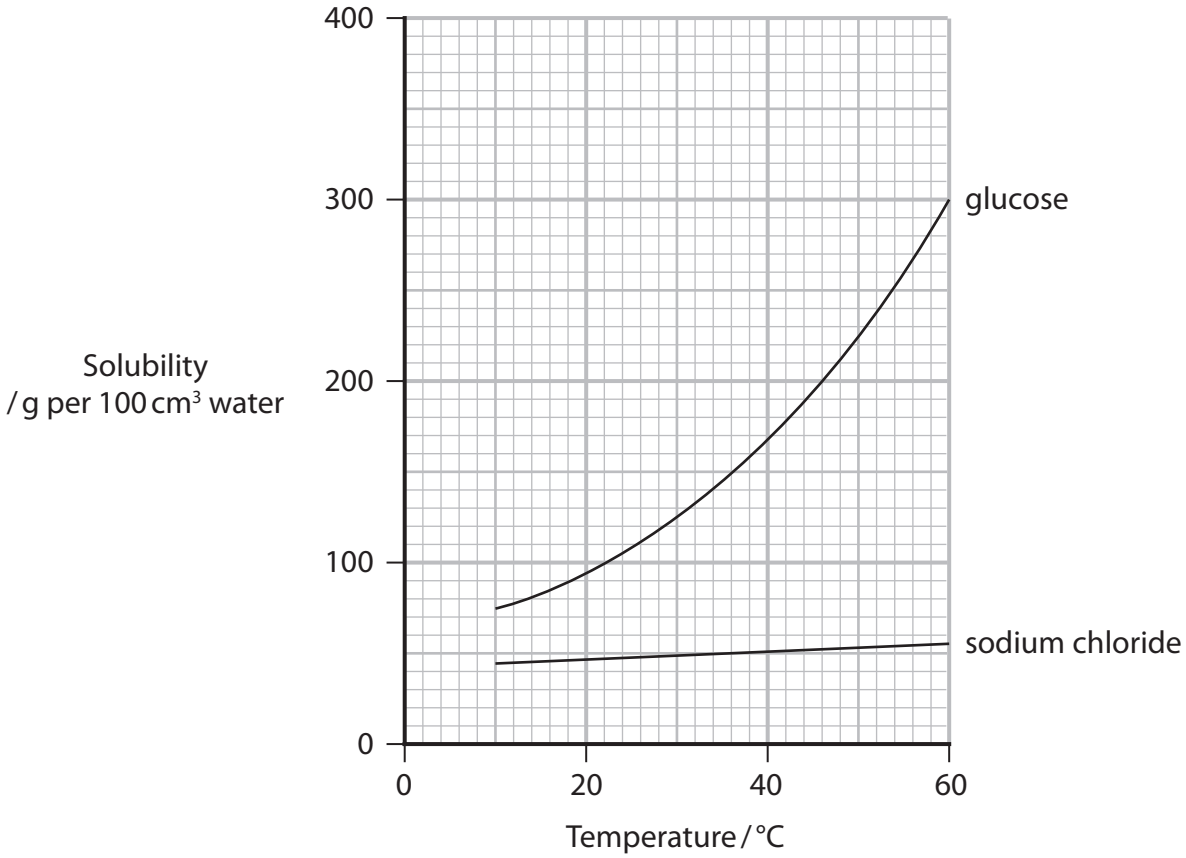
**(2)**

Answer .....

**(Total for Question 3 = 7 marks)**

**4** Water is the solvent for the transport of sodium chloride and glucose in the blood.

(a) The graph shows the effect of temperature on the solubility of sodium chloride and glucose in water.




(i) Compare and contrast the effect of temperature on the solubilities of sodium chloride and glucose in water.

**(3)**

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(ii) The formula mass of sodium chloride is 58.44.

Calculate the molecular mass of glucose, using the information in the table.

**(2)**

| Element | Atomic mass |
|---|---|
| carbon | 12 |
| hydrogen | 1 |
| oxygen | 16 |

Answer .....

(iii) Calculate how many times greater the molecular mass of glucose is than the formula mass of sodium chloride.

**(1)**

Answer .....

(iv) Suggest why there is a difference in the solubility of sodium chloride and glucose in water.

**(2)**

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(b) Explain why fatty acids are less soluble in blood than glucose and sodium chloride.

**(2)**

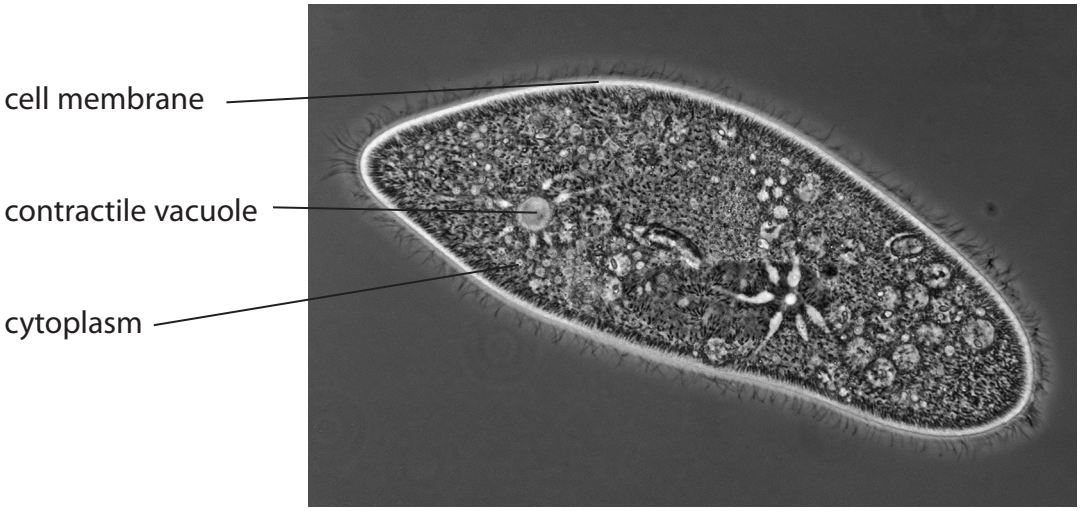
**(Total for Question 4 = 10 marks)**

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**5** Paramecia are single-celled organisms that live in pond water.

The photograph shows a single paramecium as seen using a light microscope.




magnification ×400

© M.I. WALKER/SCIENCE PHOTO LIBRARY

Water enters the paramecium. The contractile vacuole pumps water back out of the paramecium.

(a) (i) Explain why water enters the paramecium.

**(2)**

(ii) Explain the importance of the contractile vacuole in the paramecium.

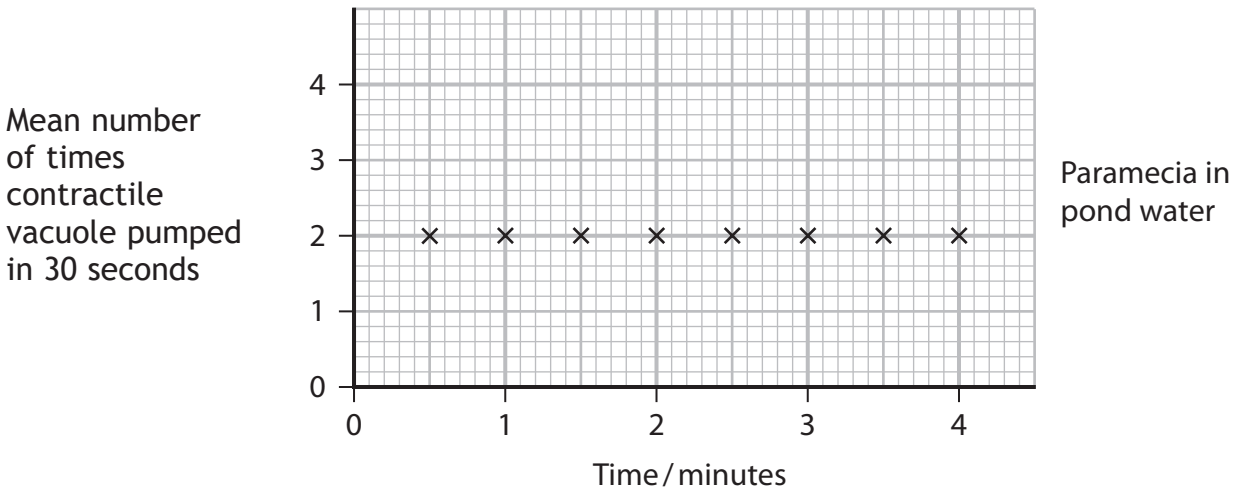
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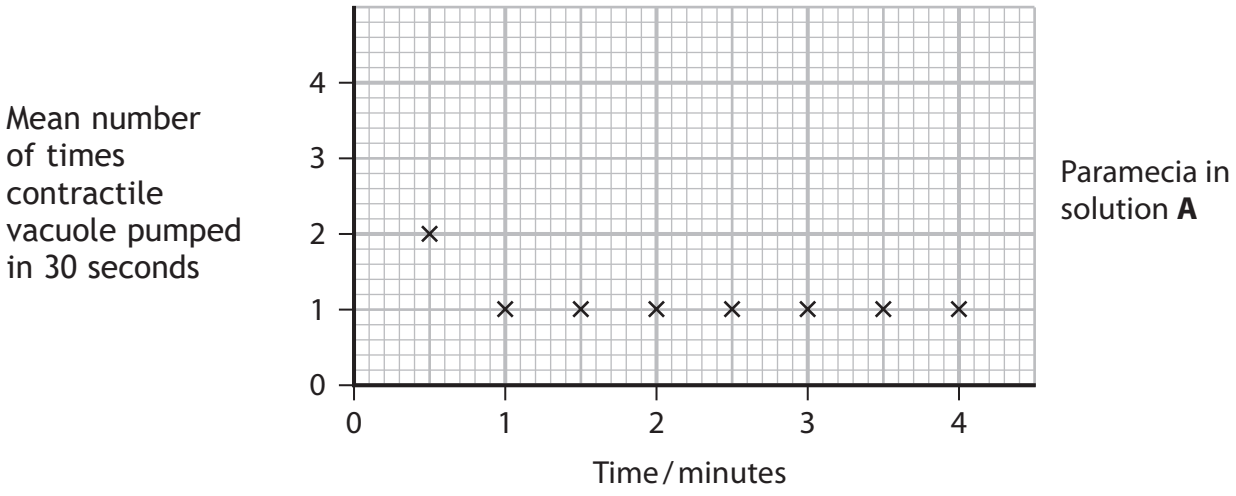
*(b) In an investigation, paramecia were placed in three separate solutions: pond water, solution **A** and solution **B**.

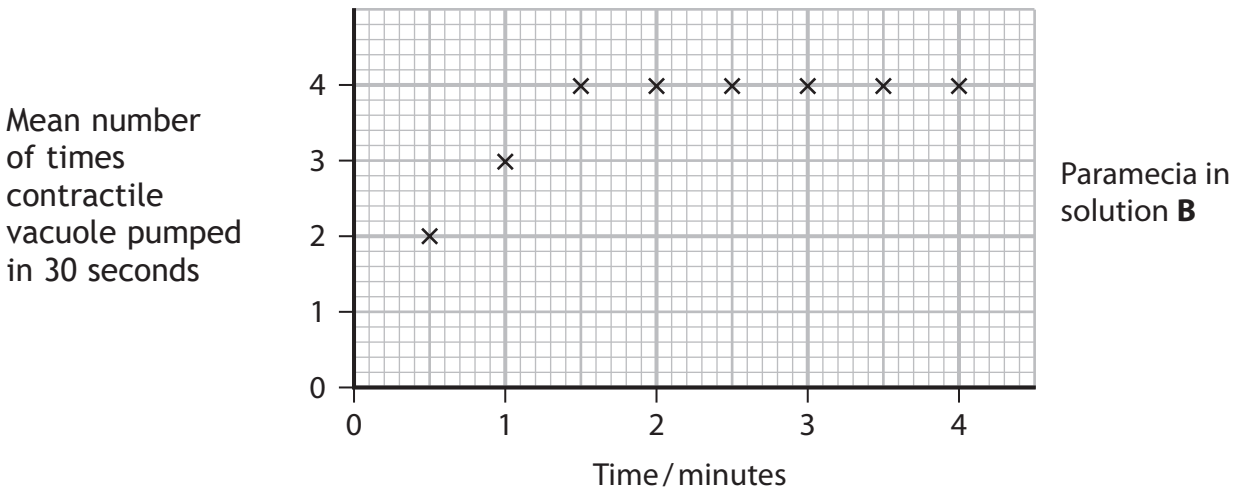
The paramecia were observed using a light microscope.

The number of times that the contractile vacuole pumped water out of the cell in 30-second intervals was recorded.

The graphs show the results of this investigation.




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Explain the results of this investigation.

Use the information in the graphs to support your answer.

**(6)**

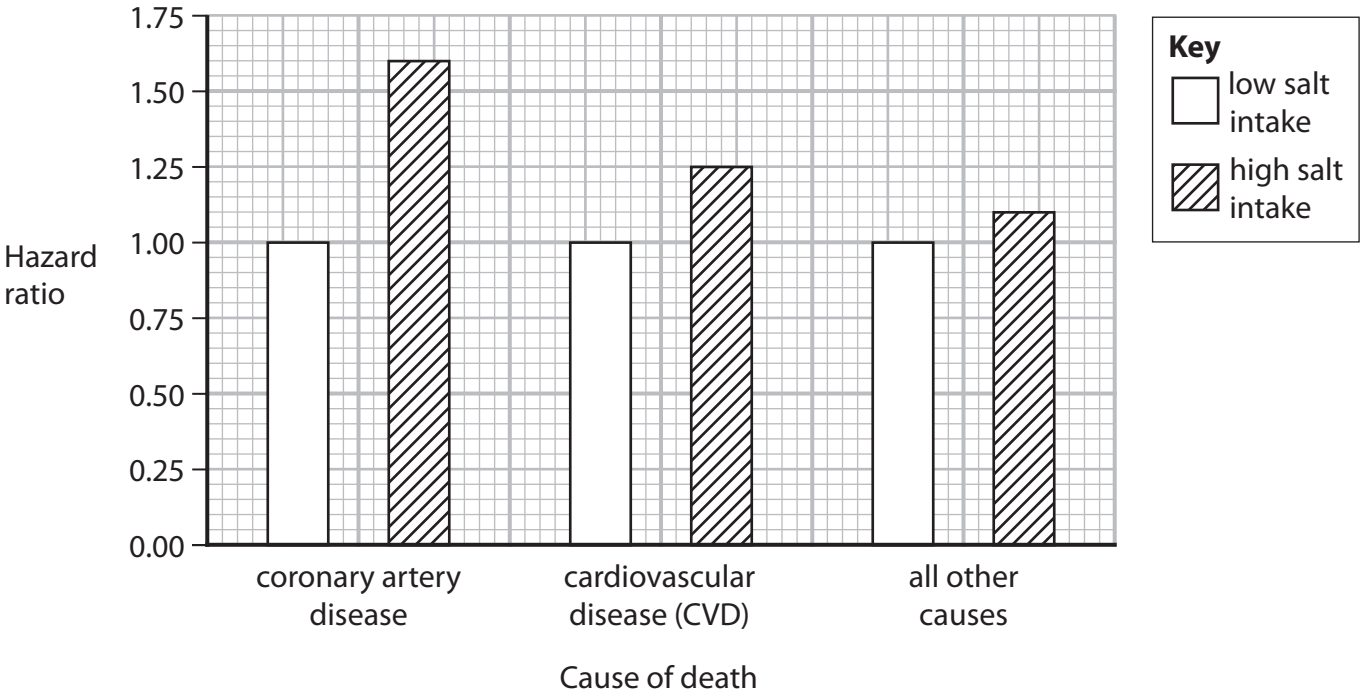
**(Total for Question 5 = 11 marks)**

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**6** A diet high in salt has been shown to increase the risk of some diseases.

The graph shows the results of one study into the increased risk of death related to a diet high in salt.

An increased risk of death is associated with a high hazard ratio.




(a) State **two** conclusions that can be drawn from these results.

**(2)**

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(b) The values for the hazard ratio were adjusted for a number of factors, including age and smoking.

(i) Explain why age and smoking were taken into account when determining the hazard ratio.

**(3)**

(ii) State **two** factors, other than age and smoking, that may have been considered when adjusting the values for the hazard ratio.

**(2)**

1

2

(c) Suggest why the hazard ratio for low salt intake was 1.00 for each cause of death.

**(2)**

(d) (i) The results of this study suggest that there is a correlation between salt intake and cause of death.

State the meaning of the term **correlation**.

**(1)**

(ii) Suggest why studies of this type are unreliable.

**(2)**

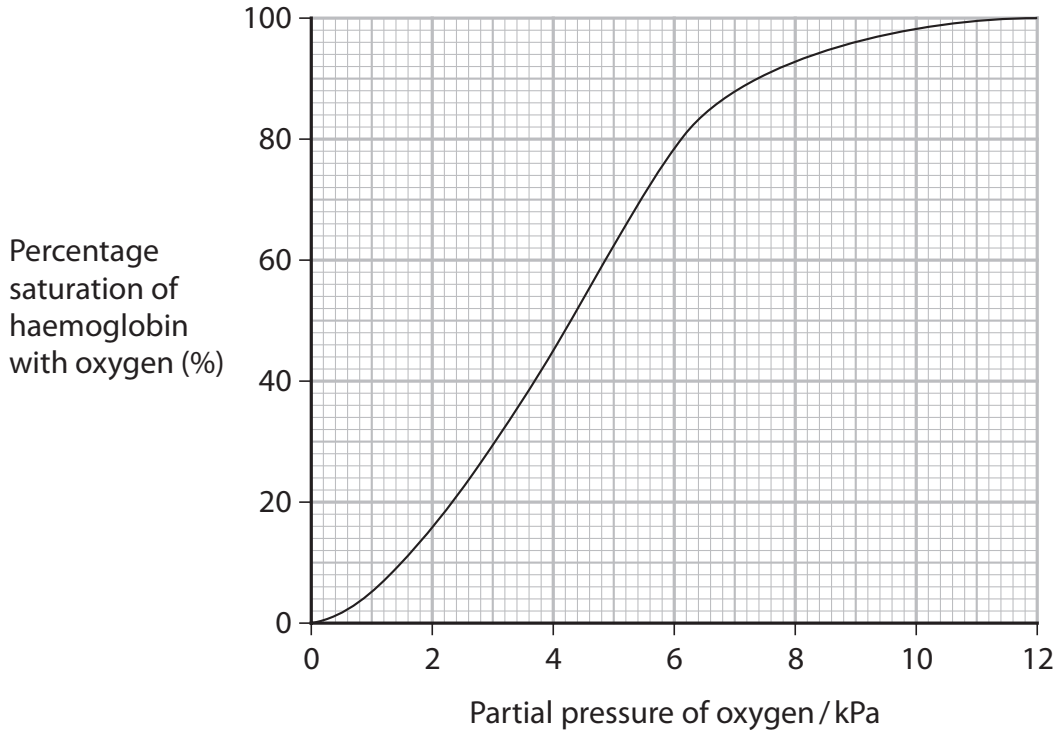
**(Total for Question 6 = 12 marks)**

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**7** One role of haemoglobin is to transport oxygen.

The graph shows an oxygen dissociation curve of haemoglobin.




(a) (i) State what is meant by the term partial pressure.

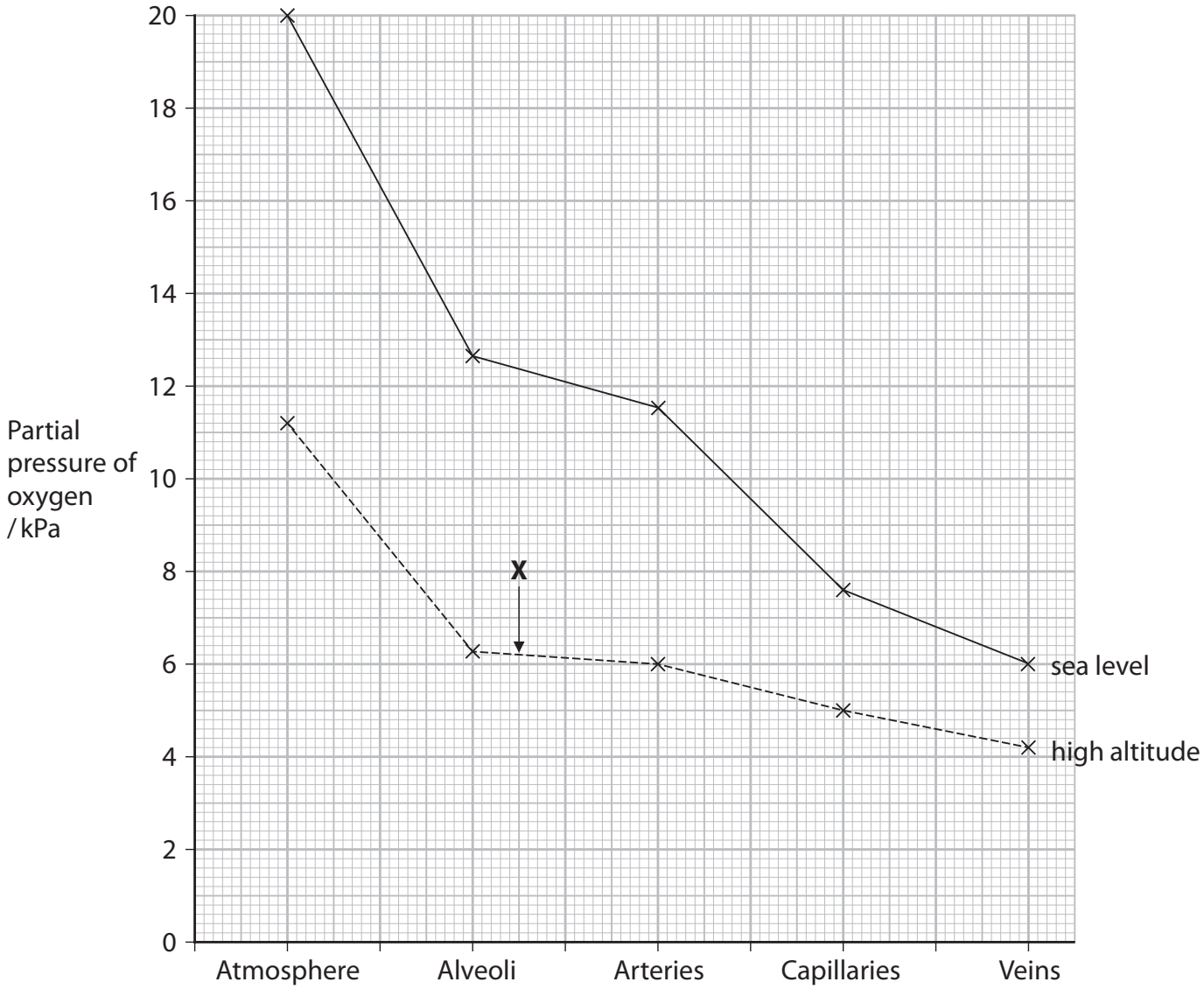
**(1)**

(ii) Explain how the structure of haemoglobin causes the oxygen dissociation curve of haemoglobin to be this sigmoidal (S) shape.

**(3)**

(b) The oxygen cascade describes the differences in the partial pressure of oxygen between different blood vessels and the external atmosphere.

The graph shows the partial pressures of oxygen for a person at sea level and a person at high altitude.




(i) Suggest why the partial pressure of oxygen in the air in the alveoli is lower than in the atmosphere.

**(1)**

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(ii) Explain why the partial pressure of oxygen decreases as the blood flows through the arteries and into the veins.

**(3)**

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(iii) Determine the percentage saturation of haemoglobin in the blood as it leaves the lungs of the person at high altitude.

Use the point marked **X** on the graph and the oxygen dissociation curve of haemoglobin.

**(1)**

Answer ..... %

(iv) Explain why the percentage saturation of haemoglobin in a person at high altitude is much lower than in a person at sea level.

**(4)**

**(Total for Question 7 = 13 marks)**

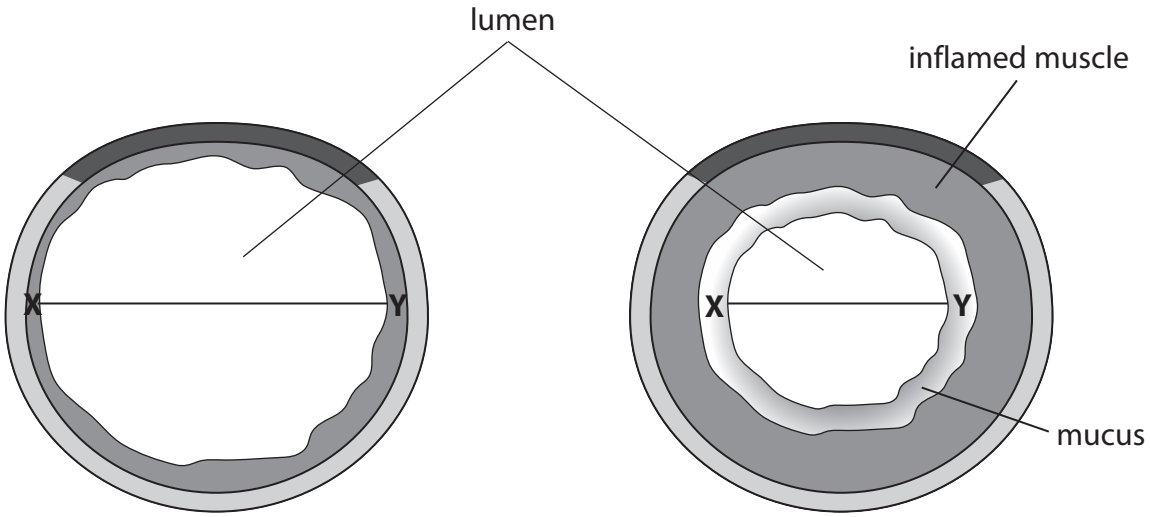
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**8** Cystic fibrosis is an inherited disorder.

(a) The diagrams show a cross section through a trachea from a person without cystic fibrosis and from a person with cystic fibrosis.




Person without cystic fibrosis

Person with cystic fibrosis

(i) Calculate the percentage decrease in the diameter of the lumen of the trachea from a person with cystic fibrosis.

Take your measurements between **X** and **Y** on each diagram.

**(2)**

Answer .....

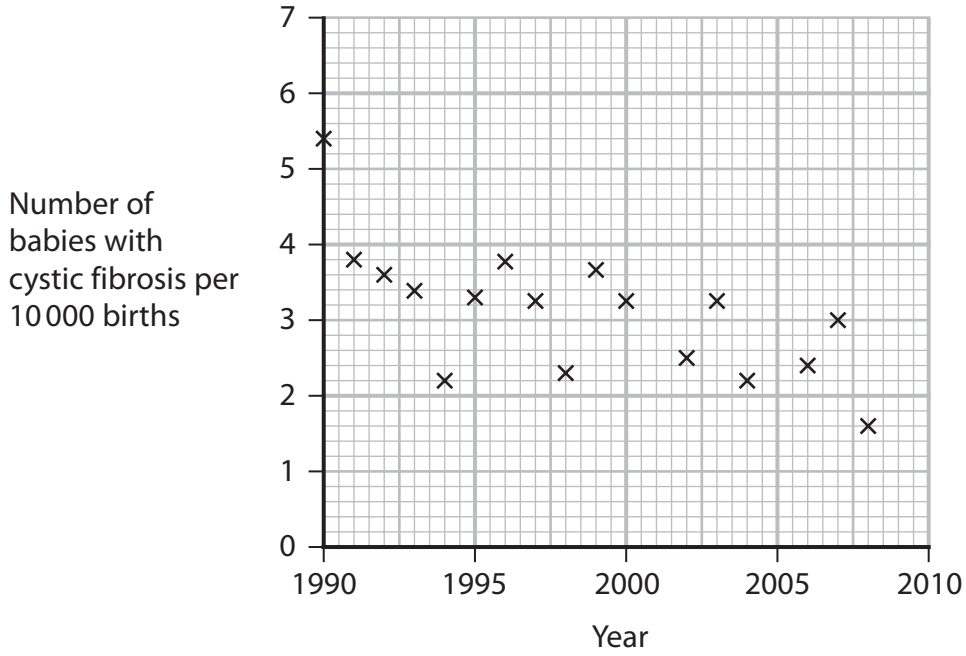
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*(ii) Explain why cystic fibrosis causes the differences shown in the diagrams.

**(6)**

(b) The graph shows the number of babies with cystic fibrosis per 10 000 births in one country, from 1990 to 2008.




(i) Explain how the identification of carriers, using genetic screening, could have contributed to the downward trend shown in this graph.

**(3)**

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(ii) Describe the ethical issues relating to genetic screening.

**(3)**

**(Total for Question 8 = 14 marks)**

**TOTAL FOR PAPER = 80 MARKS**

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