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Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel
International Advanced Level

Centre Number | | | | | |

Candidate Number | | | | |

Thursday 7 January 2021

Morning (Time: 1 hour 30 minutes) | Paper Reference **WBI11/01**

Biology

Advanced Subsidiary

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 sho wn in brackets – *use this as a guide as to how much time to spend on each question.*
- Any diagrams may **NOT** be accurately drawn, unless otherwise indicated.
- 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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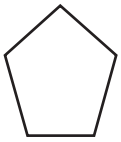
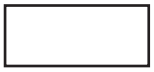
Answer ALL questions. Write your answers in the spaces provided.

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 Both DNA and RNA are polynucleotides.

(a) The table shows how the components of polynucleotides can be represented.

Component	Representation
sugar	
phosphate group	
cytosine or thymine	
adenine or guanine	
covalent bond	
hydrogen bond	

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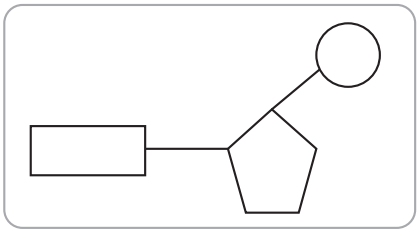
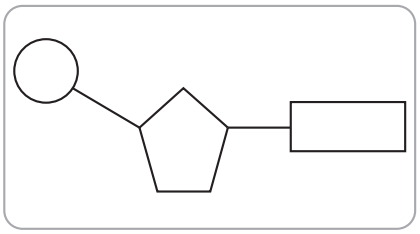
(i) Which diagram shows a mononucleotide?

(1)

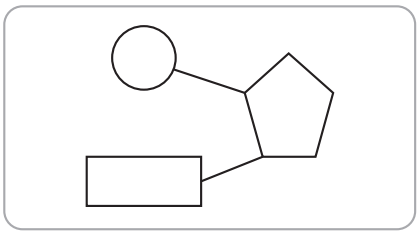
☒ **A**



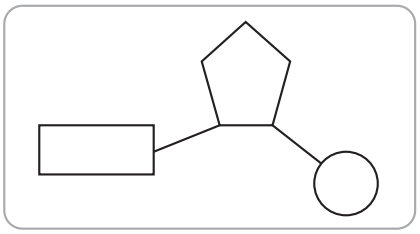
☒ **B**



☒ **C**



☒ **D**



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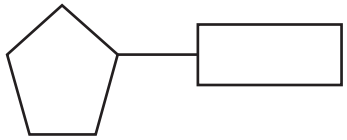
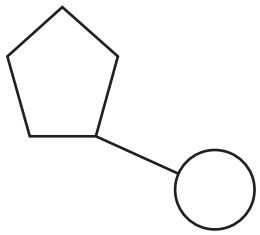
(ii) Which diagram shows two components joined by a phosphodiester bond?

(1)

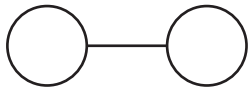
☒ **A**



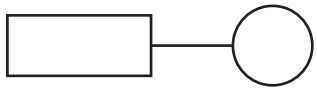
☒ **B**



☒ **C**



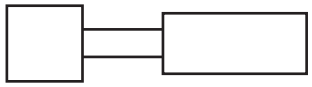
☒ **D**



(iii) Which diagram shows complementary base pairing?

(1)

☒ **A**



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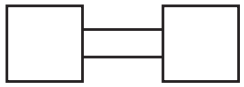
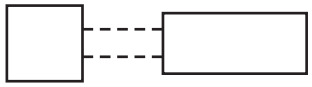
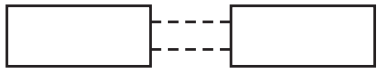


☒ **C**



☒ **D**



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(b) The diagram shows a sequence of bases in a DNA template (antisense) strand.

A	**T**	**T**	**G**	**G**	**C**	**G**	**A**	**G**	**A**	**A**	**C**

(i) The table shows some statements about the new complementary DNA strand and the mRNA strand synthesised using this sequence of bases.

For each statement, put **one** cross ☒ in the appropriate box, in each row, to show the correct statement about these strands.

(3)

Statement	both the new complementary DNA strand and the mRNA strand	only the new complementary DNA strand	only the mRNA strand	neither strand
The number of guanines will be the same as in the template strand	☒	☒	☒	☒
The number of thymines will be the same as the number of adenines in the template strand	☒	☒	☒	☒
There will be no adenine present	☒	☒	☒	☒

(ii) Name the process that synthesises a mRNA strand using the DNA template strand.

(1)

.....

(Total for Question 1 = 7 marks)

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2 Many animals have a heart and circulatory system.

(a) Five litres of blood can pass through a human heart each minute.

Calculate the volume of blood that passes through this heart in 24 hours.

Give your answer in standard form.

(2)

Answer ..... litres

(b) Blood leaves the heart through the arteries.

Compare and contrast the structure of the aorta with the structure of the pulmonary artery.

(2)

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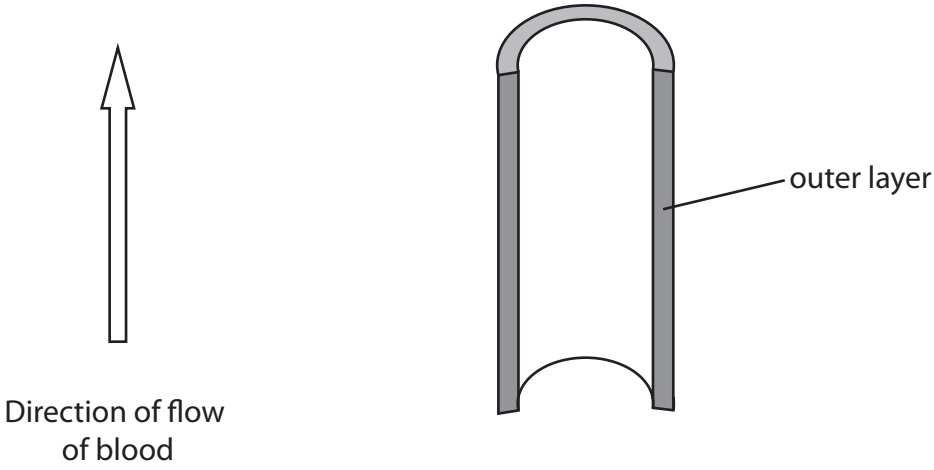
(c) Blood returns to the heart through the veins.

The diagram shows the outline of a vein. The direction of flow of blood is also shown.

Complete and label the diagram to show the structures present in a vein.

(3)



(Total for Question 2 = 7 marks)

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3 Humans store energy as glycogen.

(a) (i) Which is the correct statement about the formation of glycogen?

(1)

- ☒ **A** α glucose molecules join together by a condensation reaction
- ☒ **B** α glucose molecules join together by a hydrolysis reaction
- ☒ **C** β glucose molecules join together by a condensation reaction
- ☒ **D** β glucose molecules join together by a hydrolysis reaction

(ii) Name the bond that joins two glucose molecules together.

(1)

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(iii) Explain how the structure of glycogen relates to its role as an energy storage molecule.

(3)

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(b) Von Gierke disease is one type of glycogen storage disease (GSD).

(i) Between one in 20 000 and one in 25 000 babies are born with GSD.

About 25% of patients with GSD are thought to have Von Gierke disease.

In one country, 3.8 million babies were born in one year.

Estimate the number of babies born each year with Von Glerke disease in this country.

(2)

Answer .....

(ii) Von Gierke disease is an inherited disease.

Suggest why the majority of these babies are born to parents who are not affected by Von Gierke disease.

(2)

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(Total for Question 3 = 9 marks)

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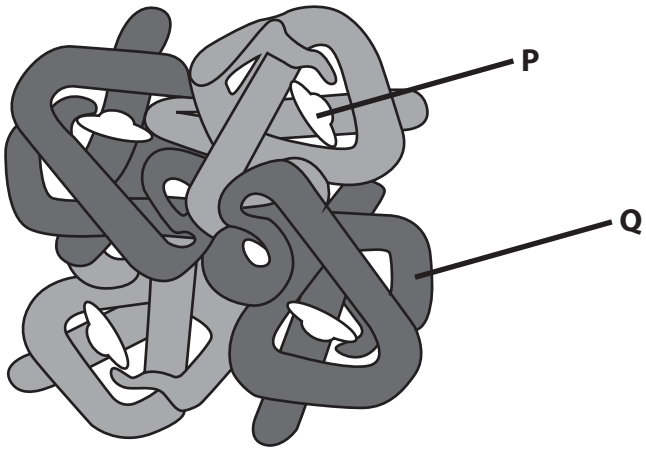
4 The role of haemoglobin is to transport oxygen and carbon dioxide in the blood.

The diagram shows the structure of adult haemoglobin



(a) (i) State the role of the structure labelled **P**.

(1)

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(ii) Explain the properties of amino acids located on the outer surface of the haemoglobin, for example at position **Q**.

(2)

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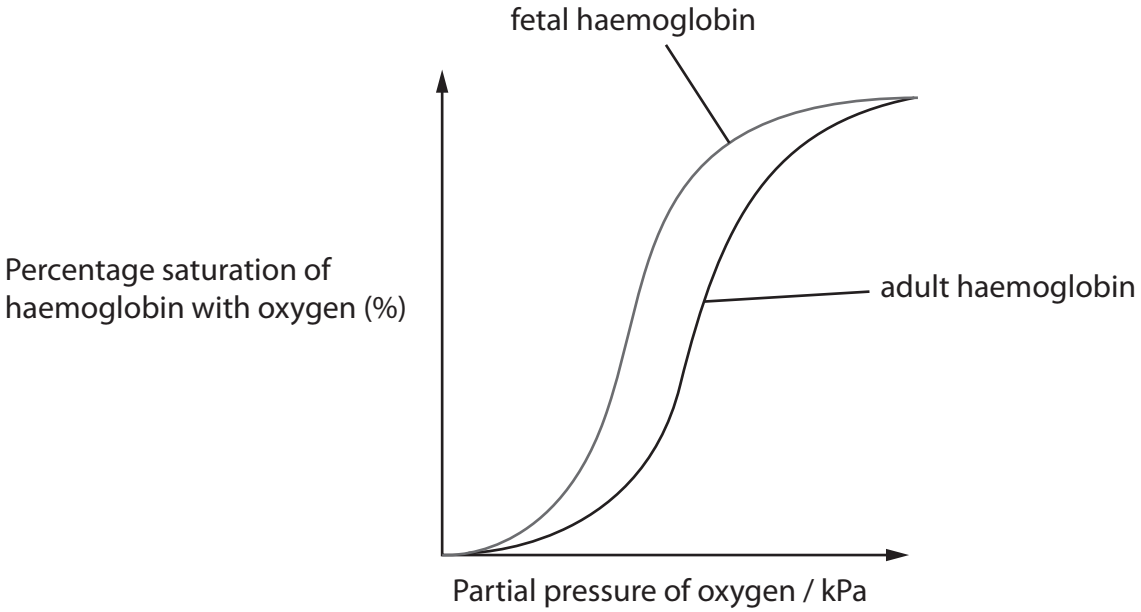
(b) The graph shows the oxygen dissociation curves of adult and fetal haemoglobin.



(i) Explain why the oxygen dissociation curve of adult haemoglobin is different from that of fetal haemoglobin.

(2)

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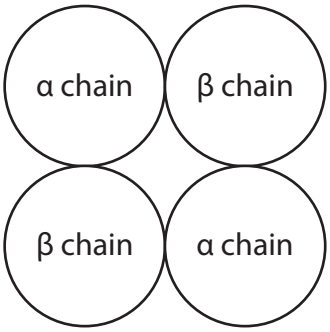
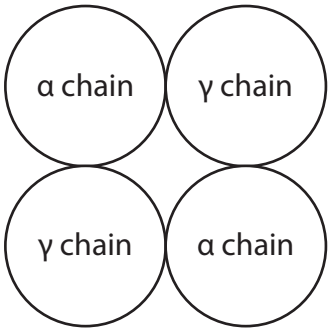
(ii) The structures of adult and fetal haemoglobin are different.

The diagram shows the structure of adult and fetal haemoglobin.



Adult haemoglobin



Fetal haemoglobin

The table shows the number of amino acids in each type of chain.

Type of chain	Number of amino acids
α	141
β	146
γ	146

The amino acids in the α chains are the same in adult and fetal haemoglobin.
The β and γ chains differ in 39 of their amino acids.

Calculate the percentage of amino acids that are different in adult and fetal haemoglobin.

(2)

Answer ..... %

(Total for Question 4 = 7 marks)

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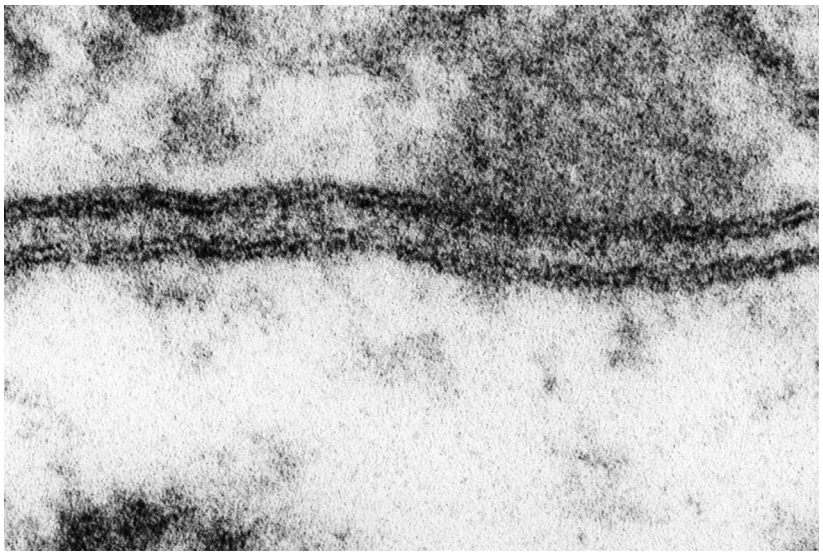
5 The structure and properties of the cell membrane are important in controlling which molecules can enter and leave a cell.

(a) The photograph shows part of a cell membrane, as seen using an electron microscope.



(Source: © Dennis Kunkel Microscopy / Science Photo Library)

The width of this cell membrane is 5.00 nm.

A phosphate head of a phospholipid is between 0.8 and 0.9 nm in diameter and the fatty acid tails are between 1.25 and 1.75 nm long.

Explain how this electron micrograph provides evidence for the structure of the cell membrane.

Use the information given to support your answer.

(3)

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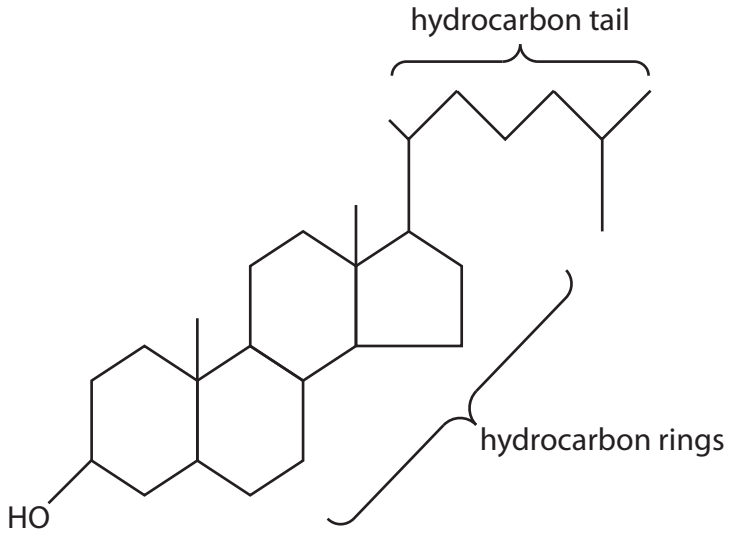
(b) Cell membranes contain cholesterol.

The molecular formula of cholesterol is $C_{27}H_{46}O$.

The diagram shows a cholesterol molecule.



Explain the location of cholesterol in cell membranes.

Use the information in the diagram to support your answer.

(3)

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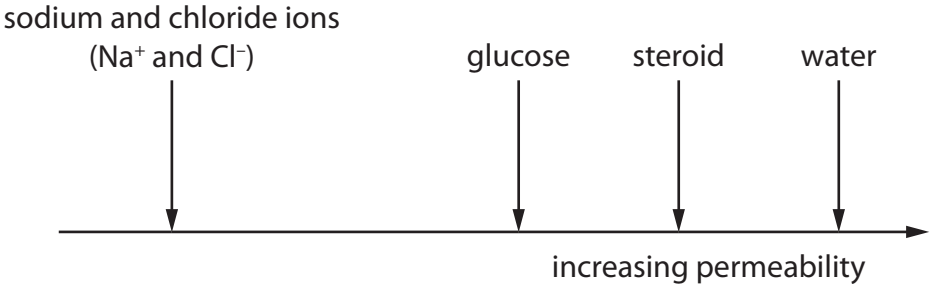
(c) The diagram shows the permeability of cell membranes to some chemicals.



The sodium and chloride ions, glucose and water are polar chemicals.

A steroid is a non-polar chemical.

(i) Describe the dipolar nature of water.

(2)

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(ii) Explain the permeability of cell membranes to each chemical shown in the diagram.

(4)

(Total for Question 5 = 12 marks)

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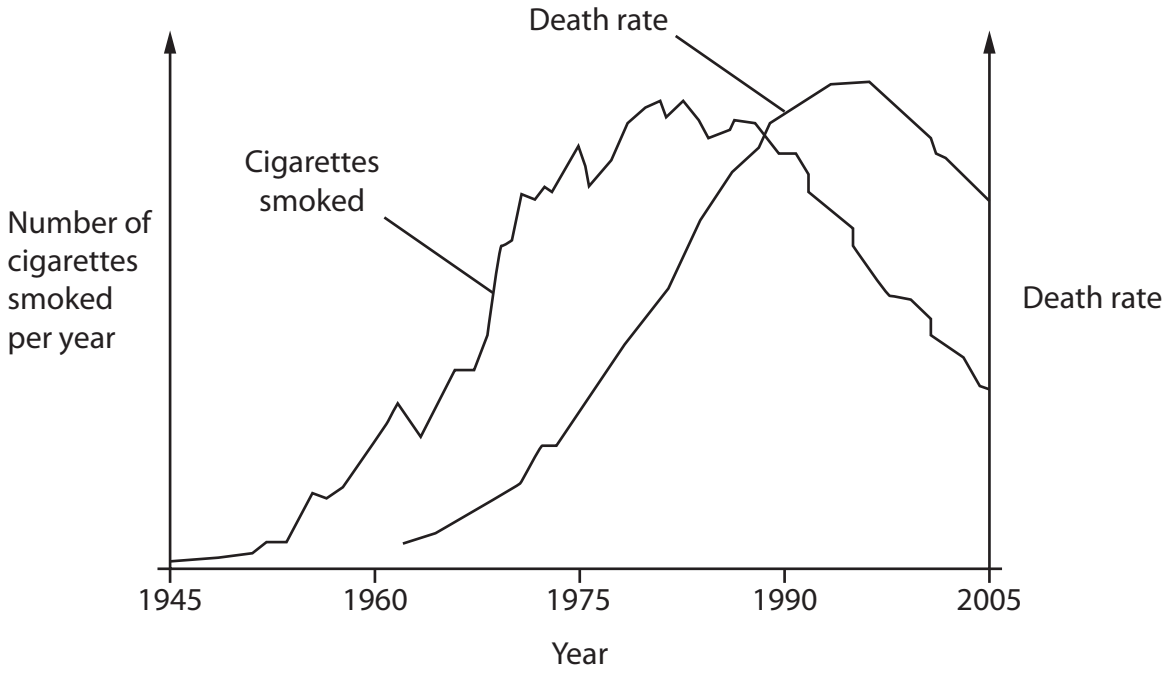
6 Gas exchange surfaces have specific adaptations.

(a) Lungs contain the gas exchange surfaces of humans.

Smoking causes lung damage.

(i) The graph shows that there is a correlation between smoking and death rate from lung cancer in men.



Explain how this graph shows that there is a correlation between smoking and death rate from lung cancer in men.

(2)

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(ii) Smoking is a cause of emphysema.

People with emphysema have weakened alveoli that can collapse, creating fewer but larger alveoli.

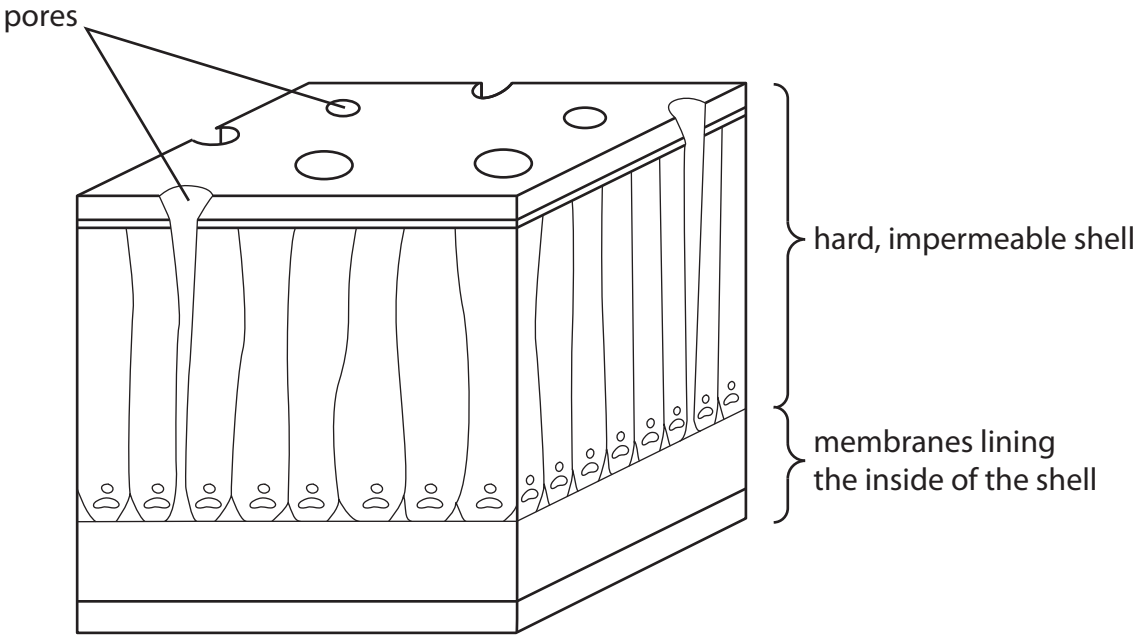
Explain how this will affect gas exchange in people with emphysema.

(2)

(b) Bird embryos develop inside hard-shelled eggs.

Gas exchange occurs across the shell of the egg. The oxygen diffuses into the bloodstream of the developing embryo and carbon dioxide diffuses back out.

The diagram shows a section through the shell of an egg.



The thickness of the egg shell is 0.5 mm. The density of the pores in the shell varies from 40 to 400 per cm^2.

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Explain the factors that would determine the rate of diffusion of gases between the air and the tissues of the embryo.

Use the information in the diagram, the question and your own knowledge to support your answer.

(6)

(Total for Question 6 = 10 marks)

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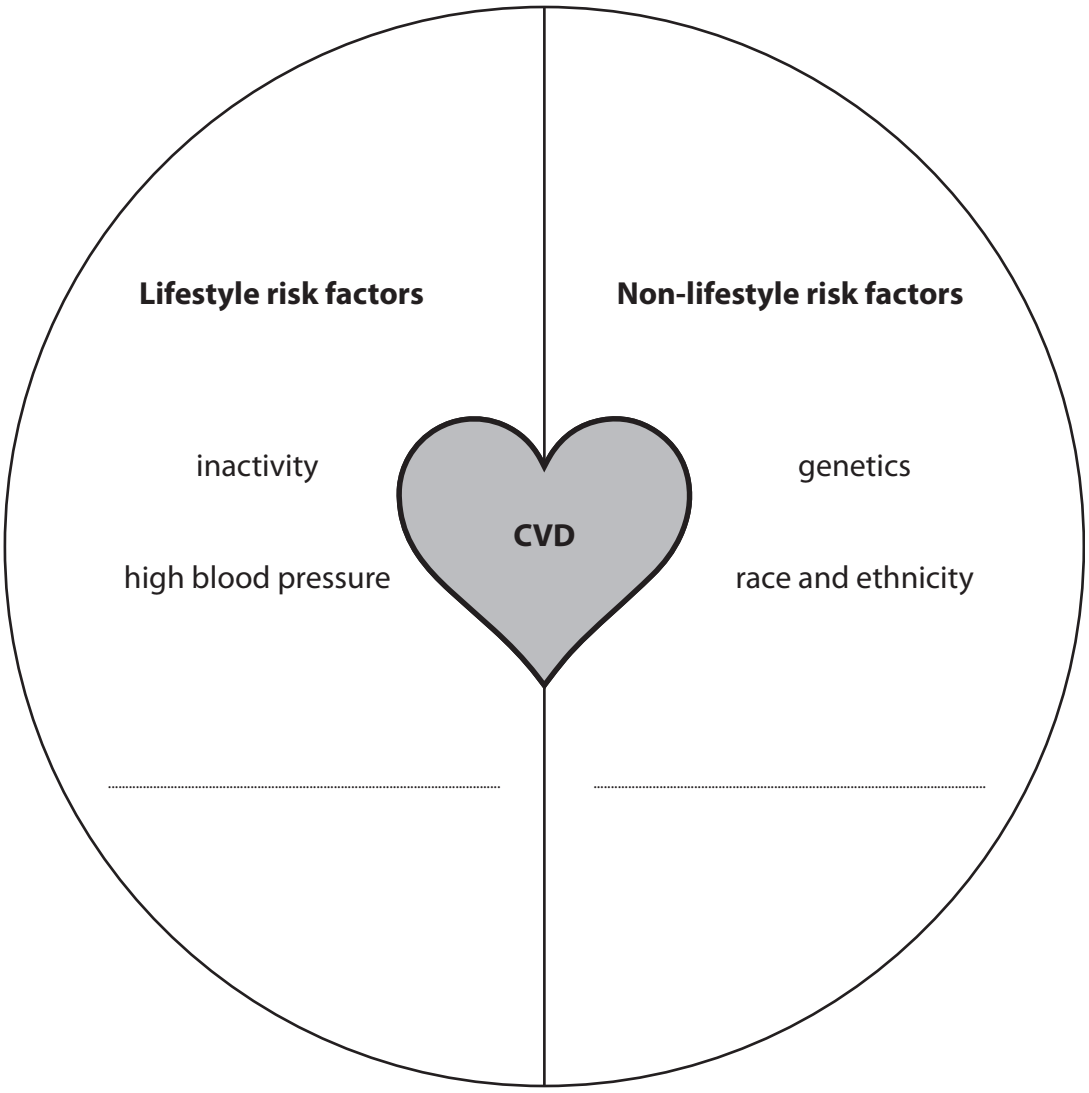
7 Several factors increase the risk of cardiovascular disease (CVD).

(a) The diagram shows some factors that increase the risk of CVD.

Complete the diagram with **one** lifestyle risk factor and **one** non-lifestyle risk factor.

(1)



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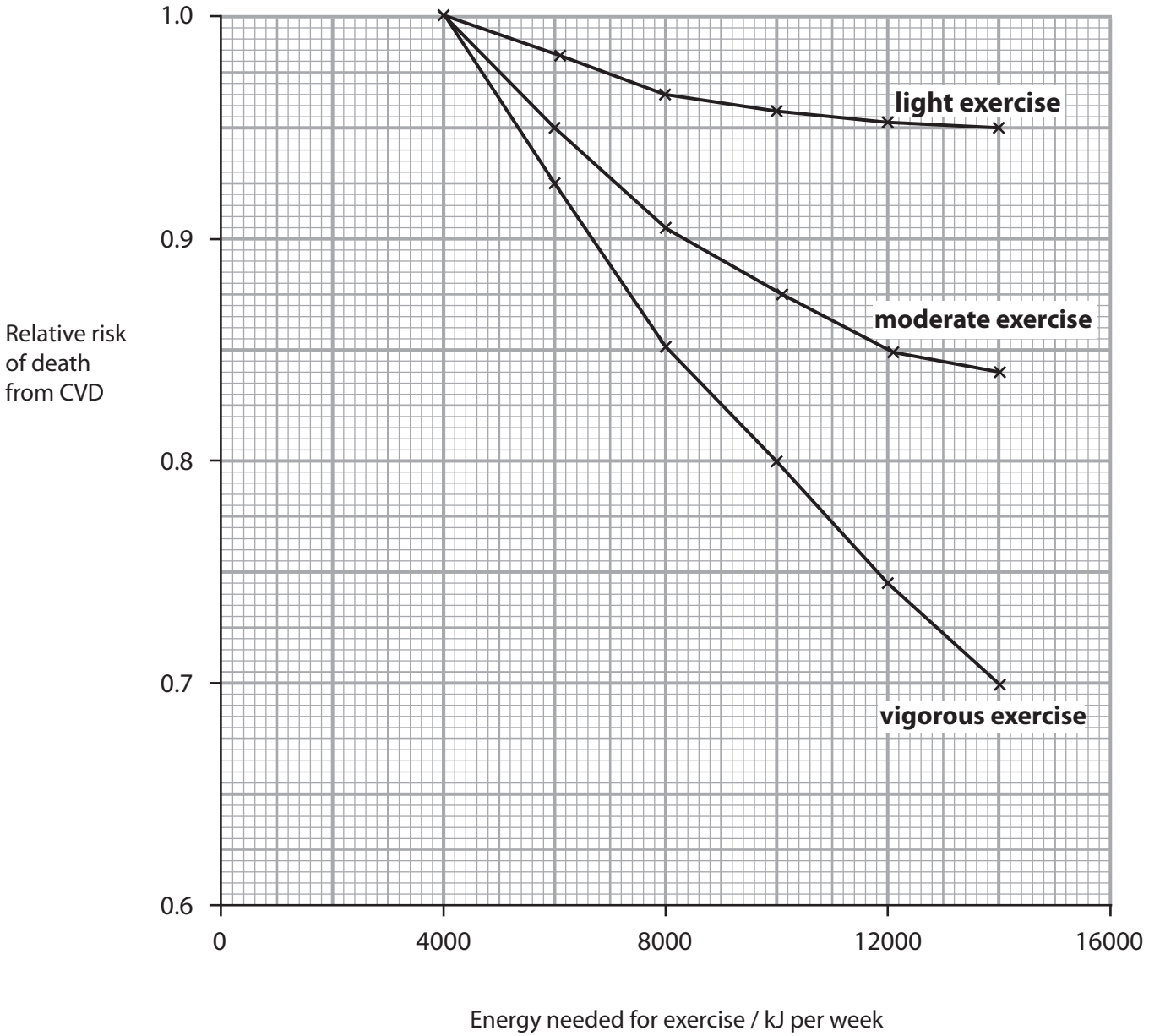
(b) The graph shows the effect of exercise on the relative risk of death from CVD.



Describe the conclusions that can be made from the information shown in this graph.

(2)

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(c) Dietary antioxidants may reduce the risk of CVD.

(i) Explain how dietary antioxidants reduce the risk of CVD.

(3)

(ii) Devise a study to confirm that antioxidants reduce the risk of CVD.

(3)

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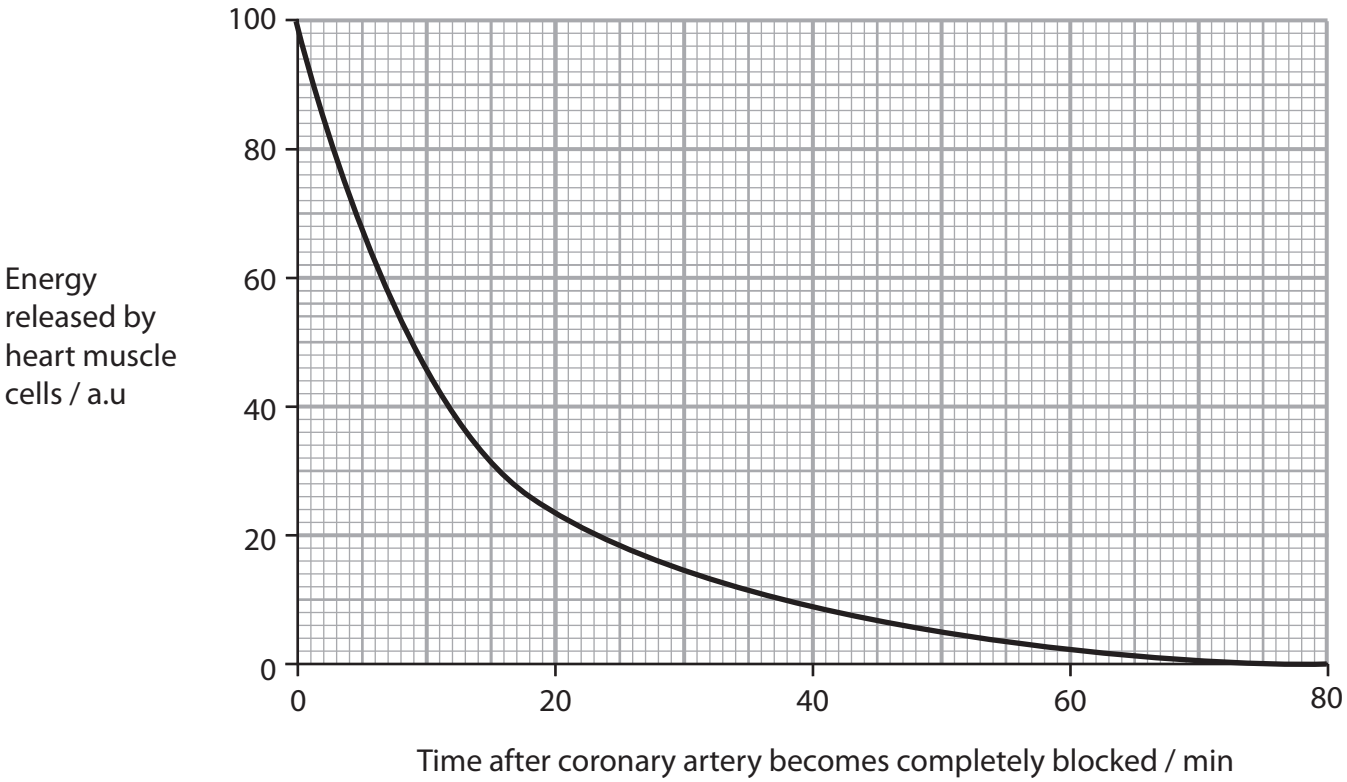
*(d) The coronary artery may become completely blocked in people with CVD.

The graph shows how the energy released by heart muscle cells changes after the coronary artery becomes completely blocked.



The heart muscle cells no longer contract 8 minutes after the coronary artery becomes completely blocked.

The heart muscle cells begin to die 20 minutes after the coronary artery becomes completely blocked.

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Explain the effects on the heart function after the coronary artery becomes completely blocked.

Use the information shown in the graph and your own knowledge to support your answer.

(6)

(Total for Question 7 = 15 marks)

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8 People with lactose intolerance cannot digest lactose.

Lactose intolerance is due to a lack of the enzyme lactase.

(a) (i) Which are the products of lactose digestion?

(1)

- ☒ **A** fructose and galactose
- ☒ **B** fructose and glucose
- ☒ **C** galactose and glucose
- ☒ **D** glucose and glucose

(ii) Explain how the three-dimensional structure of lactase affects the mechanism of action of this enzyme.

(3)

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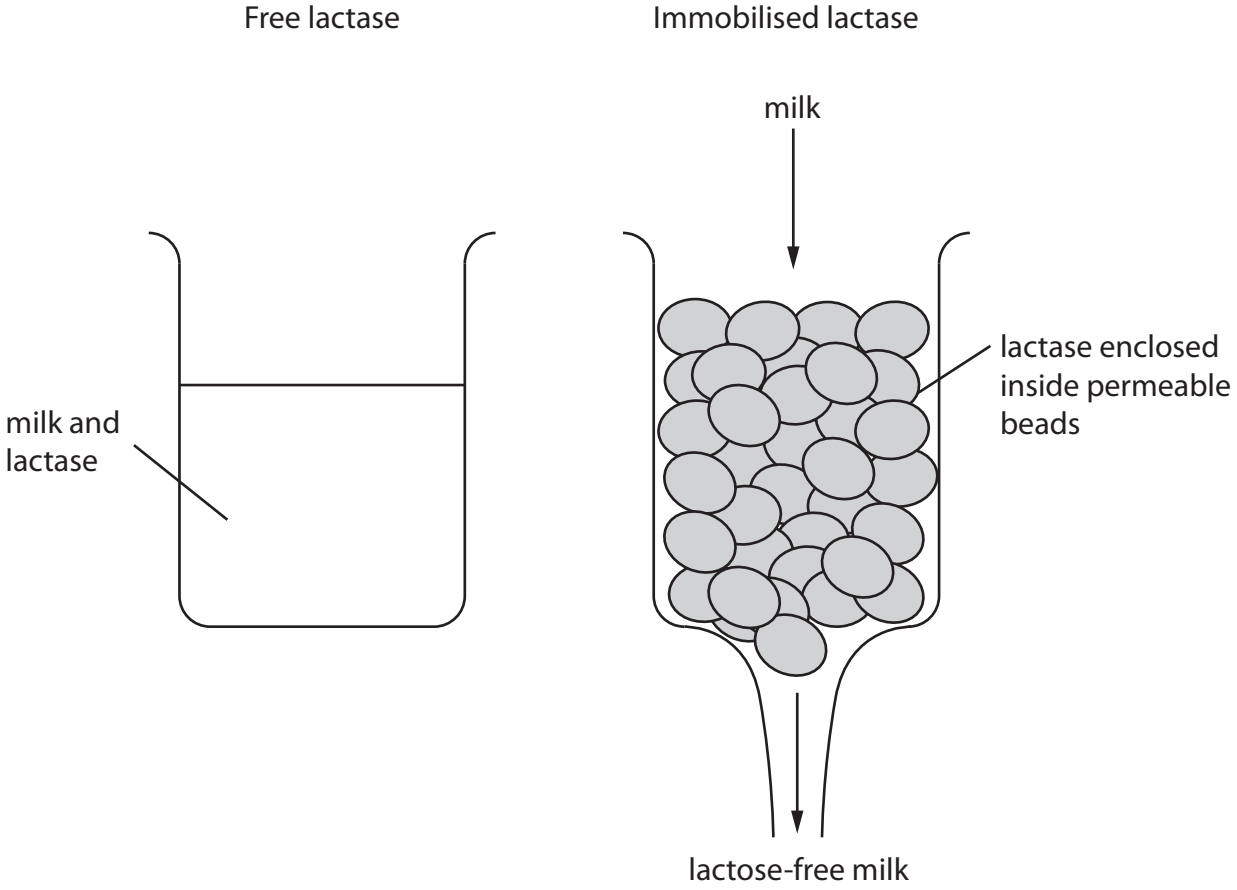
(b) People with lactose intolerance can drink lactose-free milk.

Lactose-free milk is produced by treating milk with lactase.

There are two ways of removing lactose from milk:

- mixing a solution of lactase with the milk (free lactase)
- enclosing the lactase inside permeable beads and pouring the milk over them (immobilised lactase).

The diagrams show these two methods.



(i) Suggest **one** advantage of using immobilised lactase.

(1)

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(ii) The table shows the effect of pH on the activity of free lactase and immobilised lactase.

pH	Activity of free lactase / a.u.	Activity of immobilised lactase / a.u.
2	0	0
3	0	38
4	75	75
5	94	98
6	63	76
7	56	63
8	28	35

Explain the effects of pH on the activity of these two enzymes.

(4)

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(iii) Suggest how the rate of activity of the lactase could be measured.

Include appropriate units in your answer.

(2)

(c) Congenital lactose intolerance (CLI) is an extremely rare genetic disorder.

Most people with CLI are found in one country.

Suggest why most people with CLI are found in one country.

(2)

(Total for Question 8 = 13 marks)

TOTAL FOR PAPER = 80 MARKS

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