Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel Level 3 GCE

Monday 15 May 2023

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 1 9 2 2 A 0 1 3 2

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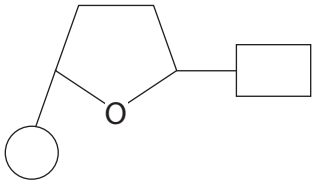
Answer ALL questions.

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 The diagram shows a DNA nucleotide.



(a) (i) Complete the diagram to show how a complementary pair of nucleotides would appear in a DNA molecule.

(2)

(ii) Name two bonds formed between nucleotides in the process of DNA replication.

(2)

1 .....

2 .....

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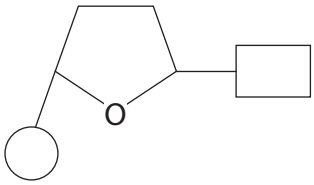
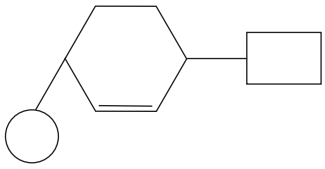
(b) The diagram shows the structure of a DNA nucleotide and a modified nucleotide called CeNA.



DNA nucleotide



CeNA nucleotide

Give **one** difference in the structure of these two molecules.

(1)

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(Total for Question 1 = 5 marks)

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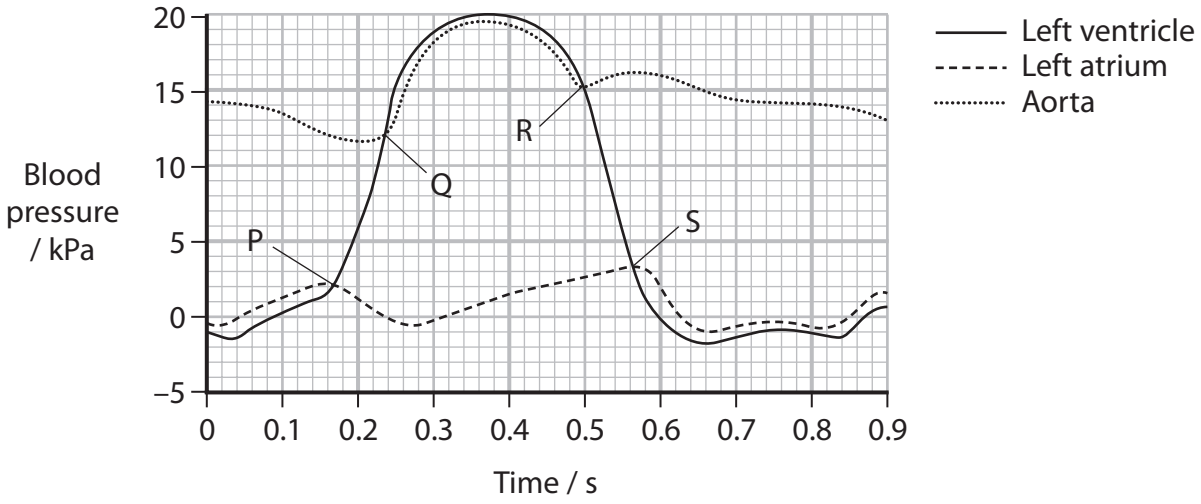
2 The human circulatory system is composed of the heart and blood vessels.

(a) The graph shows pressure changes in the aorta, left atrium and left ventricle during the cardiac cycle.



(i) At which part of the graph is the left atrioventricular valve starting to close?

(1)

☒ **A** P

☒ **B** Q

☒ **C** R

☒ **D** S

(ii) At which part of the graph is a semilunar valve opening?

(1)

☒ **A** P

☒ **B** Q

☒ **C** R

☒ **D** S

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(iii) Describe what happens during diastole.

(2)

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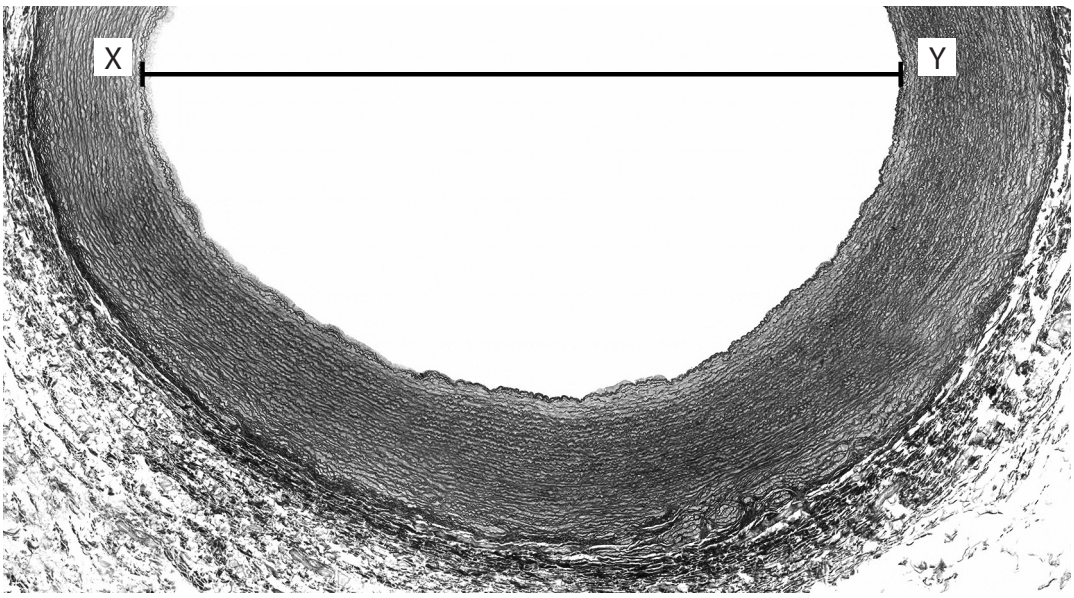
(b) The photograph shows a cross-section of part of a human aorta, as viewed under a light microscope.

The diameter of the lumen can be reduced to maintain blood pressure in the aorta.



Magnification ×18

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(i) Calculate the diameter of the lumen along the line XY. Give your answer to **two** significant figures.

(2)

Answer ..... mm

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(ii) State the feature of the wall of the aorta that causes a reduction in the diameter of the lumen.

(1)

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(Total for Question 2 = 7 marks)

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3 Starch and amylase are molecules found in some cells.

(a) Amylase is a biological catalyst.

State what is meant by the term biological catalyst.

(2)

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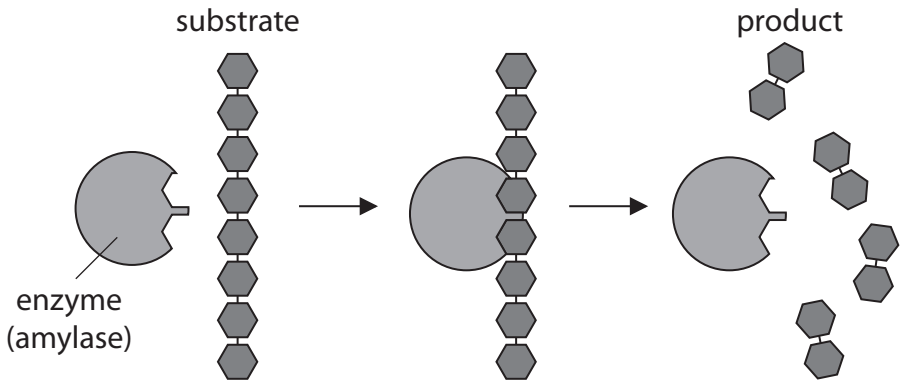
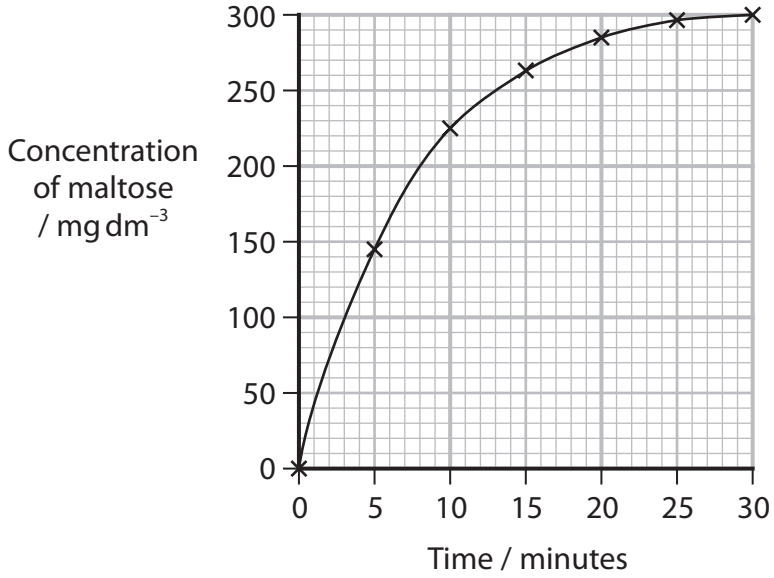
(b) The hydrolysis of starch by amylase was investigated.

The diagram shows the hydrolysis of starch into maltose.



The concentration of maltose in the solution was measured at regular intervals.

The graph shows the results of this investigation.



(i) Which of the following shows the type of molecules in this reaction?

(1)

		Substrate	Product
☒	**A**	Polypeptide	Disaccharide
☒	**B**	Polysaccharide	Disaccharide
☒	**C**	Polypeptide	Monosaccharide
☒	**D**	Polysaccharide	Monosaccharide

(ii) Which of the following is the type of bond that is broken when starch is hydrolysed by amylase?

(1)

☒ **A** glycosidic

☒ **B** hydrogen

☒ **C** ionic

☒ **D** peptide

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(iii) Which of the following shows the correct unit for the rate of this reaction?

(1)

☒ **A** $mg\,dm^{3}\,min^{1}$

☒ **B** $mg\,dm^{-3}\,min^{1}$

☒ **C** $mg\,dm^{3}\,min^{-1}$

☒ **D** $mg\,dm^{-3}\,min^{-1}$

(c) Explain how the structure of starch makes it a good storage molecule.

(2)

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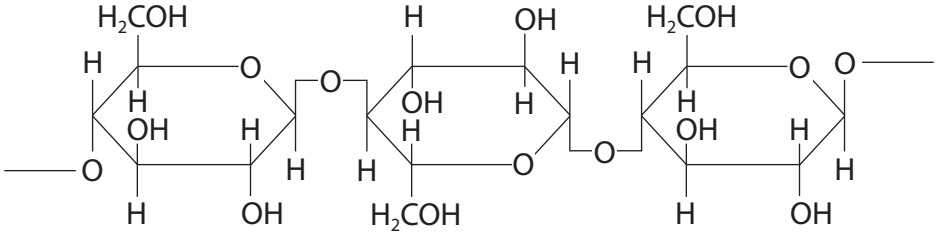
(d) The diagram shows part of another molecule.



The enzyme amylase cannot hydrolyse this molecule.

Deduce why amylase **cannot** hydrolyse this molecule.

(2)

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(Total for Question 3 = 9 marks)

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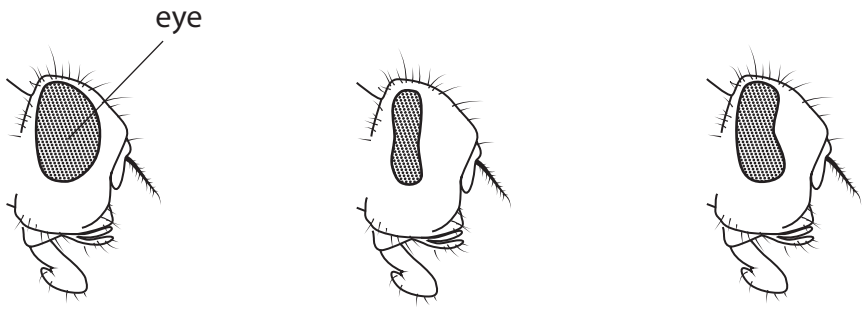
4 The phenotype of an organism is affected by its genotype.

(a) The shape of the eye in fruit flies is controlled by a single gene.

Fruit flies that are homozygous for the allele R have round eyes.

Fruit flies that are homozygous for the allele B have bar eyes.

The diagram shows the eyes on the heads of the fruit flies.



round-eyed fruit fly bar-eyed fruit fly wide bar-eyed fruit fly

(i) State what is meant by the term allele.

(2)

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(ii) When a round-eyed fruit fly is crossed with a bar-eyed fruit fly, offspring are produced that have wide bar eyes.

Explain why offspring are produced with the **wide** bar eye shape.

(3)

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(b) Tay-Sachs disease is a genetic condition.

Individuals who are homozygous recessive for this condition usually survive for up to four years.

(i) Determine the probability of two individuals who are heterozygous for the Tay-Sachs gene having a child with this condition.

Use a genetic diagram, and the alleles **T** and **t**.

(2)

Probability .....

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(ii) An embryo, created by IVF, can be screened for Tay-Sachs disease before being placed in the mother's uterus.

Name this type of genetic screening.

(1)

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(iii) Explain why the mother may prefer this type of prenatal screening to amniocentesis.

(2)

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(Total for Question 4 = 10 marks)

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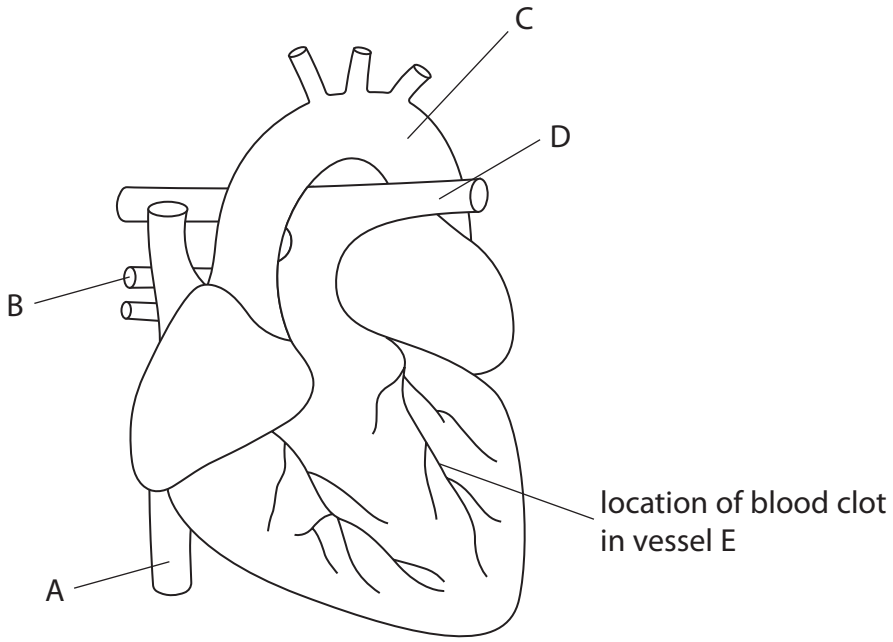
5 Cardiovascular disease (CVD) can occur in the blood vessels of organs such as the brain and the heart.

The diagram shows a human heart and the location of a blood clot in one of the blood vessels in this heart.



(a) (i) Which labelled blood vessel carries oxygenated blood under lower pressure than the aorta?

(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(ii) Which labelled blood vessel carries blood from the right ventricle?

(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**

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(b) The endothelium of vessel E was damaged and collagen fibres in the vessel wall were exposed. This resulted in the formation of a blood clot.

The blood clot blocked vessel E. This caused a heart attack.

(i) Sketch an outline on the diagram to show the area of heart muscle that would receive a **reduced** blood supply.

(1)

(ii) Describe how this blood clot could have been formed.

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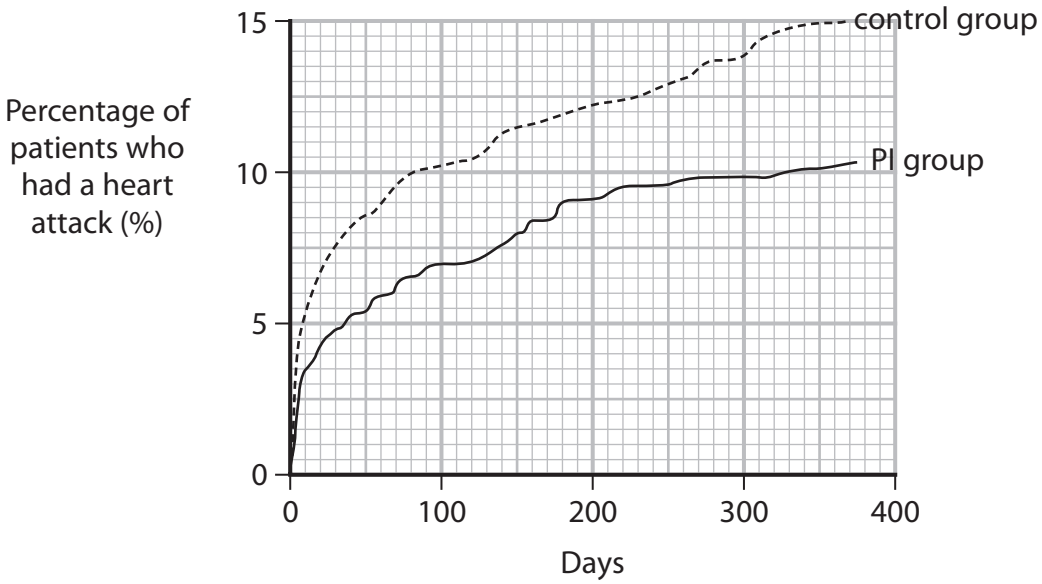
(c) The risk of a heart attack in humans can be reduced by treatment with platelet inhibitors.

The effectiveness of a platelet inhibitor (PI) drug was investigated.

One group of patients took a new platelet inhibitor (PI) drug whereas the control group were given no treatment.

The graph shows the percentage of these patients who had a heart attack.



Explain the results of this investigation.

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(Total for Question 5 = 10 marks)

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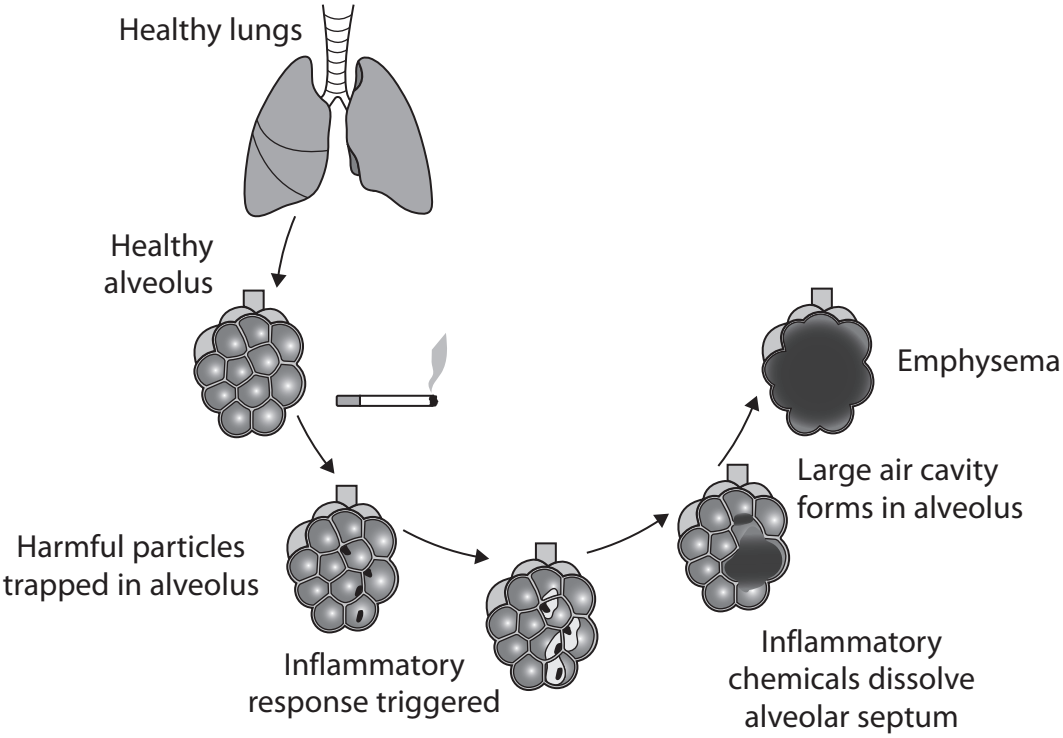
6 Smoking cigarettes can result in a lung disease called emphysema.

The diagram shows stages in the development of emphysema.



(a) Explain why emphysema affects the **rate** of gas exchange between the alveolus and the blood.

(4)

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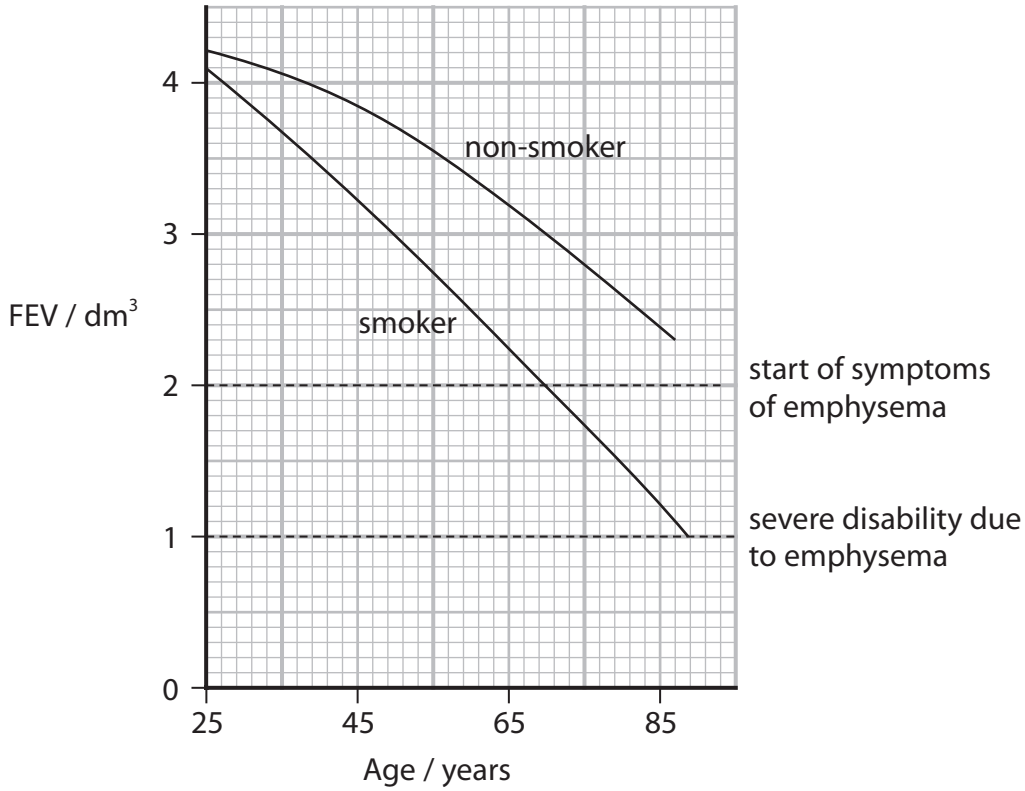
*(b) Forced expiration volume (FEV) is the maximum volume of air a person can breathe out in one second.

Emphysema reduces FEV.

The effects of ageing and long-term cigarette smoking on FEV and the development of emphysema have been investigated.

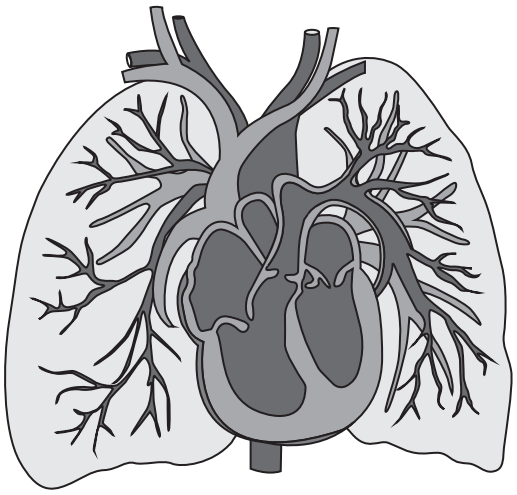
The graph shows the results of these investigations.



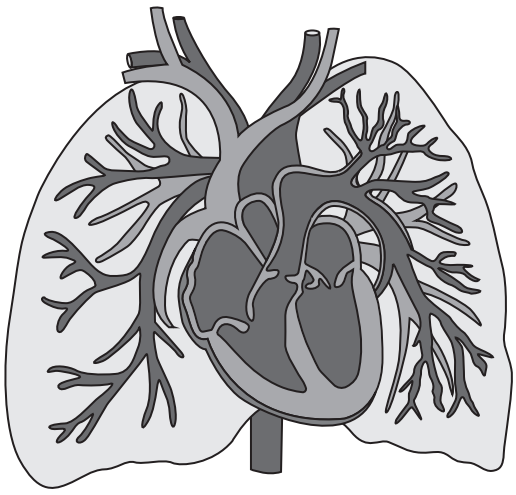
Scientists also investigated the changes in the heart and pulmonary blood vessels of patients with emphysema.

The diagrams show the heart and pulmonary blood vessels in a patient with emphysema and a patient without emphysema.

with emphysema



without emphysema



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Evaluate the effects of smoking on the respiratory system, heart and pulmonary circulation.

(6)

(Total for Question 6 = 10 marks)

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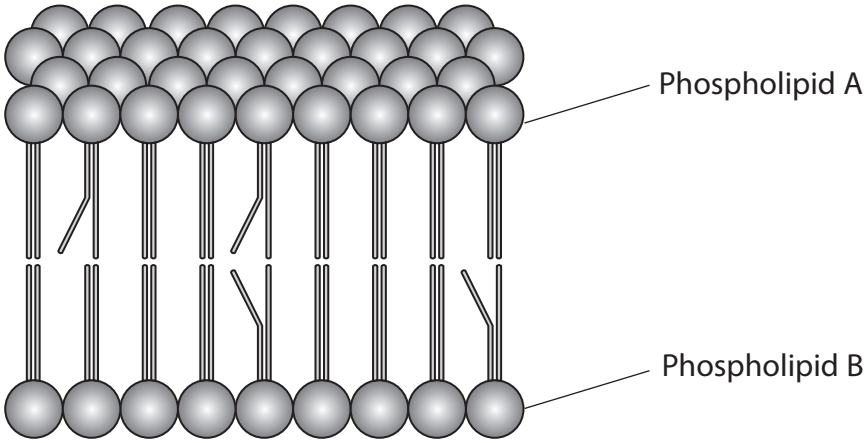
7 One component of the cell surface membrane is the phospholipid bilayer.

The diagram shows a phospholipid bilayer.



(i) A cell surface membrane also contains cholesterol molecules.

Name **two** other types of organic molecule that would be found in a cell surface membrane.

(2)

1 .....

2 .....

(ii) The diagram shows two types of phospholipid, A and B.

It is possible for phospholipid molecules to have different shapes.

Explain what causes these two phospholipids to have different shapes.

(2)

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(b) A phospholipid is a modified triglyceride.

Compare and contrast the structures of a phospholipid and a triglyceride.

(3)

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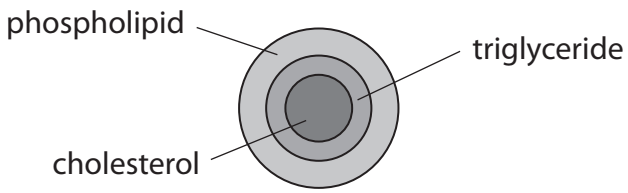
(c) The diagram shows a simplified low-density lipoprotein (LDL).



This spherical lipoprotein has a diameter of 27.50 nm.

Which of the following shows the circumference (C) of this lipoprotein?

Use the formula $C = 2\pi r$

(1)

☒ **A** 86.39 nm

☒ **B** 172.79 nm

☒ **C** 593.96 nm

☒ **D** 2375.83 nm

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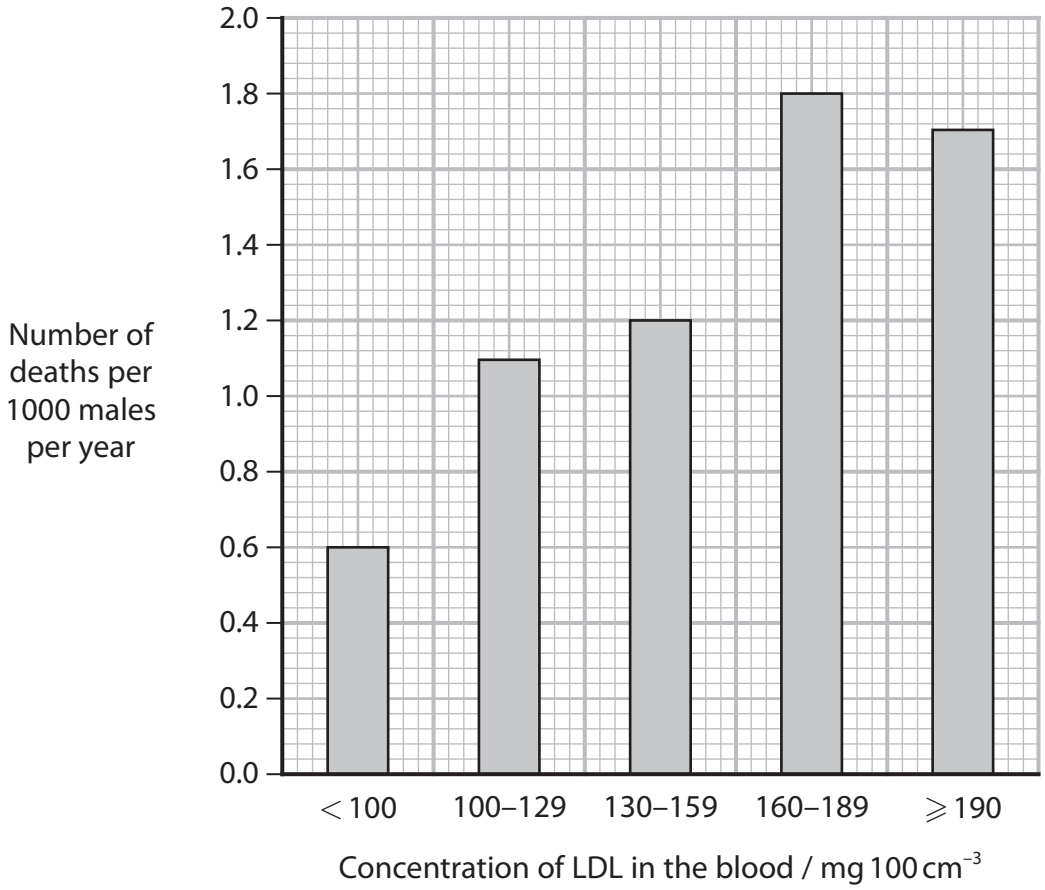
(d) The concentration of LDL in the blood is a risk factor for cardiovascular disease (CVD).

The effect of LDL concentration in the blood on the number of deaths from CVD, in males aged from 25 to 40, was investigated.

The graph shows the results of this investigation.



(i) Describe the relationship shown in the graph.

(2)

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(ii) The UK population in 2021 was 68 269 157.

A student concluded that 81 923 people with an LDL concentration in the blood of 130–159 mg per 100 cm^3 died from CVD in 2021.

Comment on the validity of this conclusion.

Use the information in the graph to support your answer.

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(Total for Question 7 = 14 marks)

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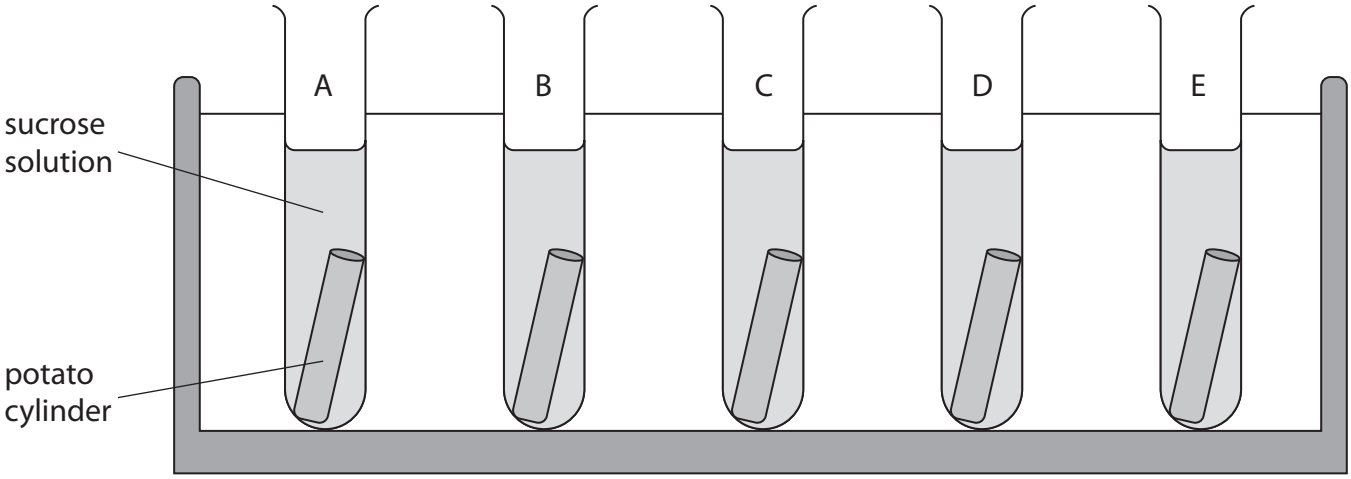
8 The effect of the concentration of sucrose solution on the mass of potato cylinders was investigated.

The cylinders were cut from the same potato and had the same volume. The initial mass of each cylinder was recorded.

The cylinders were left in the same volume of each solution for the same length of time. The final mass of each cylinder was recorded.

The diagram shows the five test tubes, A, B, C, D and E, that were set up in this investigation.

The investigation was then repeated twice.



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(a) The table shows the results of this investigation.

Test tube	Concentration of sucrose solution / mol dm^{-3}	Mean initial mass of potato cylinder / g	Mean final mass of potato cylinder / g
A	0.0	2.79	3.82
B	0.4	2.75	2.67
C	0.6	2.68	2.31
D	0.8	2.71	2.21
E	1.0	2.79	2.01

(i) For test tube E the range of the initial mass was 2.79 ± 0.04 g and the range of the final mass was 2.01 ± 0.16 g.

Calculate the **largest** percentage change in mass for potato cylinders in 1.0 mol dm^{-3}.

(2)

Answer .....%

(ii) Explain the change in mass for potato cylinders in test tube E.

(2)

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(b) Describe how this investigation could be modified to determine the concentration of sucrose solution that does **not** change the mass of the potato cylinders.

(3)

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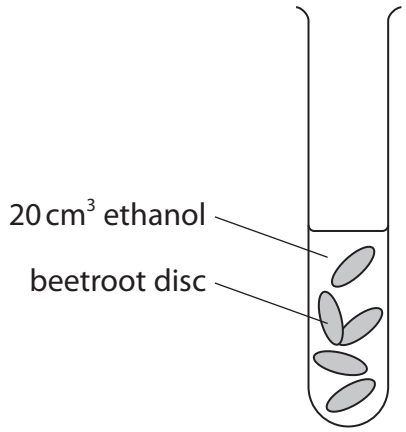
(c) Beetroot cell vacuoles contain a red pigment called betalain.

A student investigated the effect of ethanol on the permeability of beetroot membranes.

Test tubes were set up as shown in the diagram, each with a different concentration of ethanol.



The test tubes were placed in a thermostatically controlled water bath at 25 °C for 30 minutes.

The beetroot discs were removed from the ethanol.

(i) Calculate the volume of a beetroot disc with a diameter of 1 cm and a height of 5 mm to **one** decimal place.
Include the appropriate unit.

Use the formula $V = \pi r^2 h$

(2)

Answer .....

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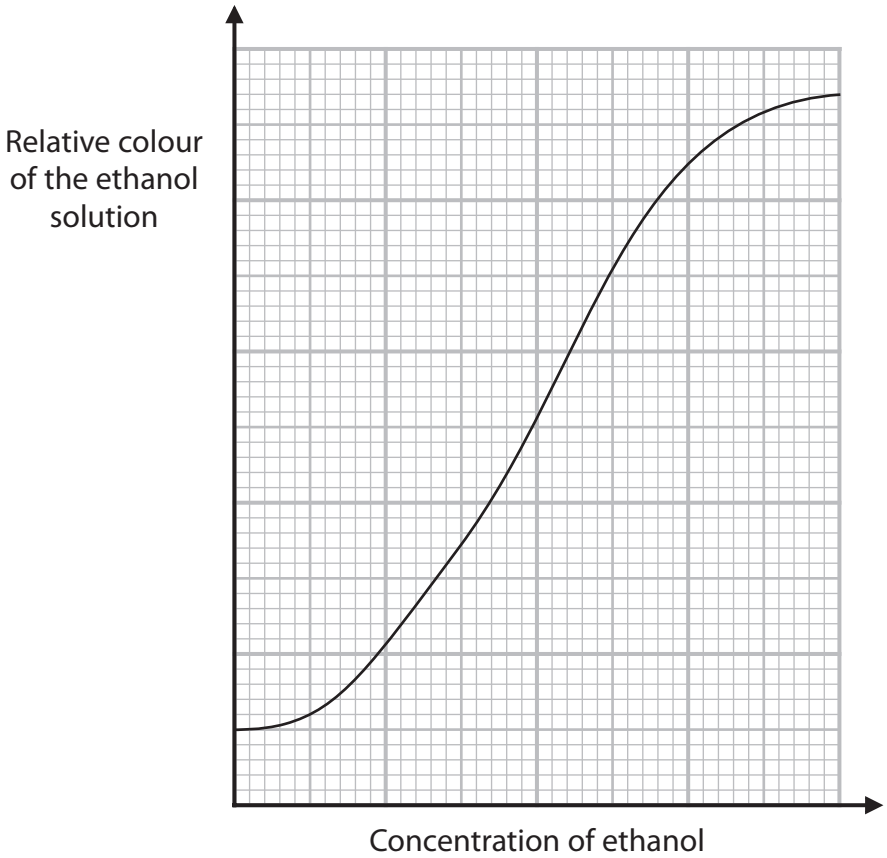
(ii) The relative colour of the ethanol after 30 minutes was measured using a colorimeter. The results of the investigation are shown in the graph.



Explain the results of this investigation.

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(iii) Devise a **valid** investigation to compare the effects of ethanol and propanol on the permeability of beetroot membranes.

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(Total for Question 8 = 15 marks)

TOTAL FOR PAPER = 80 MARKS

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