Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel International Advanced Level

Monday 9 October 2023

Morning (Time: 1 hour 30 minutes)

Paper reference **WBI11/01**

Biology

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.*
- **Show all your working out 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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P 7 5 6 1 5 A 0 1 2 8

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 Nucleic acids include DNA and RNA.

(a) Read through the following passage about DNA.

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

(5)

A strand of DNA is composed of mononucleotides linked

by ..... bonds formed during ..... reactions.

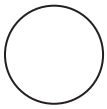
During this type of reaction a molecule of ..... is also formed.

One DNA molecule has two strands of DNA joined together

by ..... bonds between complementary base pairs.

The DNA molecule then twists to form a ..... .

(b) The table shows some components of DNA mononucleotides and RNA mononucleotides and shapes that can be used to represent them.

Component	Shapes
bond	
thymine	
uracil	
deoxyribose	
ribose	
phosphate	

Draw **one** DNA mononucleotide, using shapes selected from those shown in the table.

(3)

(Total for Question 1 = 8 marks)

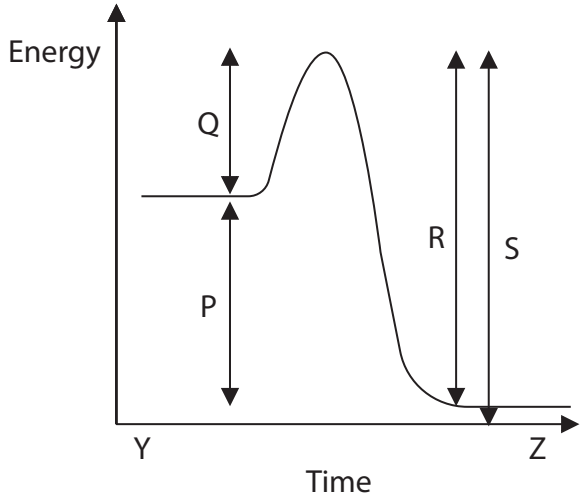
2 Polyphenol oxidase is an enzyme found in avocados.

This enzyme causes green avocados to go brown when they are cut open.

The equation shows the reaction catalysed by this enzyme.

monophenol ⟶ *o*-diphenol

(a) The graph shows the energy changes during this reaction, when the enzyme is not present.



(i) Which arrow shows the activation energy for this reaction?

(1)

☒ **A** P

☒ **B** Q

☒ **C** R

☒ **D** S

(ii) Which row of the table shows the molecule present at time Y and time Z on this graph?

(1)

		Time Y		Time Z	
☒	**A**	product	monophenol	reactant	*o*-diphenol
☒	**B**	product	*o*-diphenol	reactant	monophenol
☒	**C**	reactant	monophenol	product	*o*-diphenol
☒	**D**	reactant	*o*-diphenol	product	monophenol

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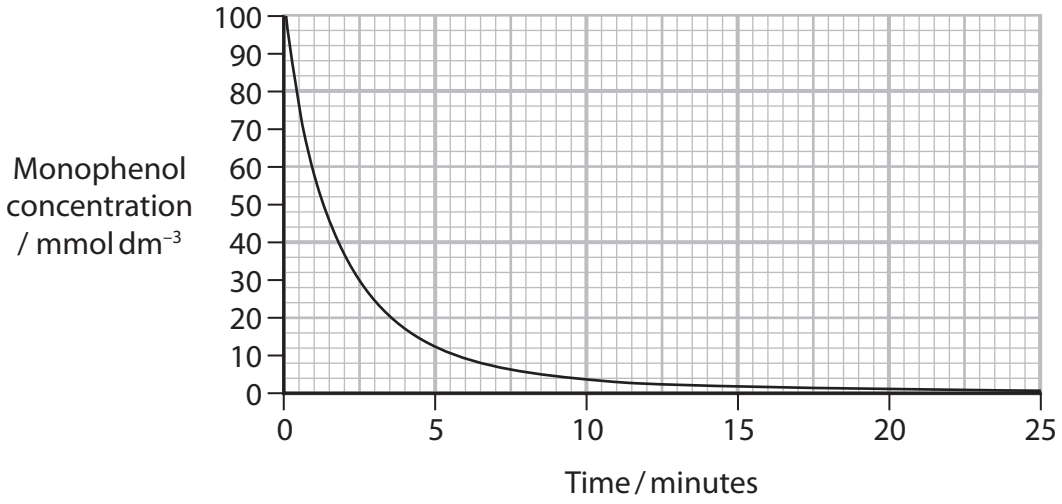
(iii) Which row of the table shows how the length of the arrows P and Q on this graph would change when polyphenol oxidase is present?

(1)

		Change in length of arrow	
		P	**Q**
☒	**A**	increase	decrease
☒	**B**	increase	no change
☒	**C**	no change	decrease
☒	**D**	no change	no change

(b) The graph shows the change in monophenol concentration in the presence of polyphenol oxidase, at a temperature of 25 °C.



(i) Calculate the rate of reaction at 3 minutes.

Draw a tangent to help with your calculation.

(2)

Answer ..... mmol dm^{-3} min^{-1}

(ii) This reaction was carried out below the optimum temperature for the enzyme.

Explain what would happen to the shape of this curve if the temperature was increased to the optimum temperature for this enzyme.

(2)

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(Total for Question 2 = 7 marks)

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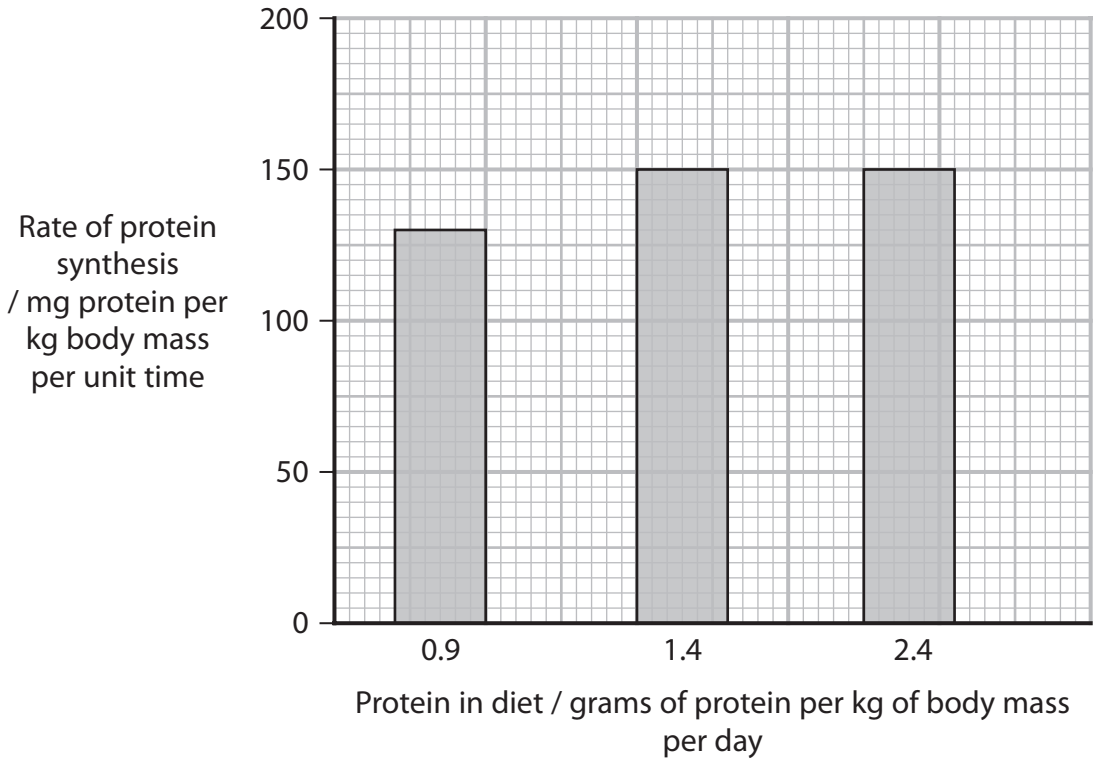
3 Amino acids in the diet of animals are used to synthesise proteins.

(a) The rate of protein synthesis is dependent on a number of factors.

The graph shows the effect of the mass of protein in the diet on the rate of protein synthesis.



Calculate the minimum mass of protein a person with a mass of 70 kg should eat in one week if they want a rate of protein synthesis of 150 mg protein per kg body mass per unit time.

(2)

Answer ..... g

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(b) (i) Name the **two** stages in protein synthesis, in the order that they occur.

(1)

Stage 1

Stage 2

(ii) Describe the roles of messenger RNA (mRNA) and transfer RNA (tRNA) in protein synthesis.

(4)

(Total for Question 3 = 7 marks)

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4 Red-green colour blindness is an inherited condition.

The table shows some statistics on red-green colour blindness in some countries.

Country	Population size in millions	Number of people who are red-green colour blind in millions	Percentage of population who are red-green colour blind (%)
India	1380		5.2
Japan	126	3.024	2.4
Malaysia	32	1.024	
Philippines	108	3.024	2.8

(a) Complete the table to show the number of people who are red-green colour blind in India and the percentage of people who are red-green colour blind in Malaysia.

(2)

(b) The percentage of males in Malaysia who are red-green colour blind is 6.7% and the percentage of females who are red-green colour blind is 0.4%.

(i) Calculate the ratio of red-green colour blind males to red-green colour blind females in Malaysia.

(1)

Answer .....

(ii) Explain why the percentage of red-green colour blind males is greater than the percentage of red-green colour blind females.

(4)

(Total for Question 4 = 7 marks)

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5 Many animals have a heart and circulation.

(a) Molecules such as glucose move by mass transport to overcome the limitations of diffusion in meeting the requirements of an animal.

(i) State what is meant by the term **mass transport**.

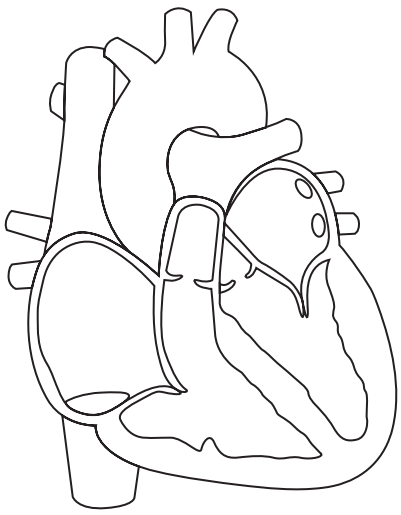
(1)

(ii) All the cells in an animal require glucose.

Explain the limitations of diffusion in providing cells with glucose.

(2)

(b) The diagram shows a mammalian heart.



Draw arrows on the diagram to show the flow of deoxygenated blood (oxygen-depleted blood) into, through and out of the heart.

(2)

(c) The tunica media is the middle layer in the wall of an artery.

The table shows the percentages of some components in the tunica media of arteries of different sizes.

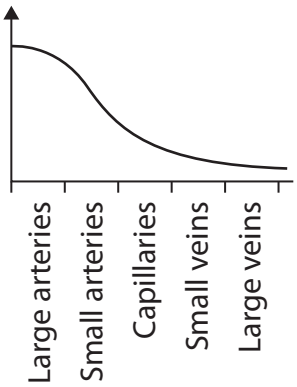
Component	Percentages of some components in tunica media (%)		
	Large artery	Medium-sized artery	Small artery
Smooth muscle cells	33.5%		60.5%
Collagen	37.0%		12.0%
Elastin	24.5%		1.5%

Explain why the percentages of the components in these arteries are different.

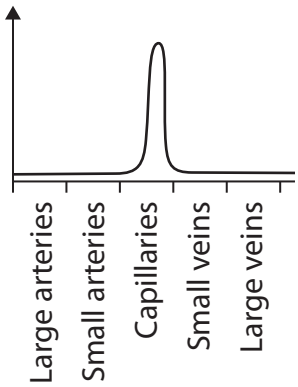
(4)

(d) The graphs show differences in some features of blood vessels.

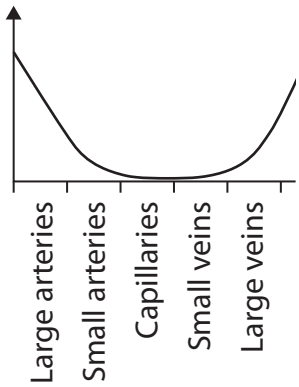
Graph 1



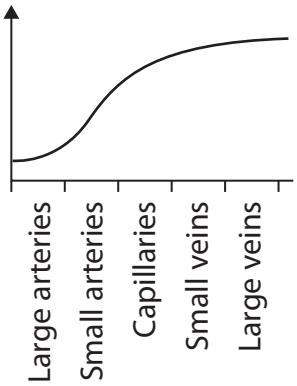
Graph 2



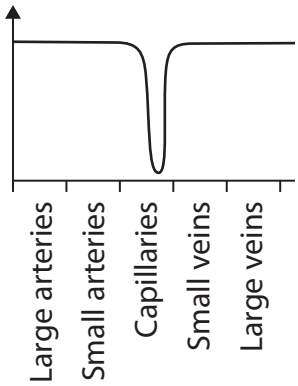
Graph 3



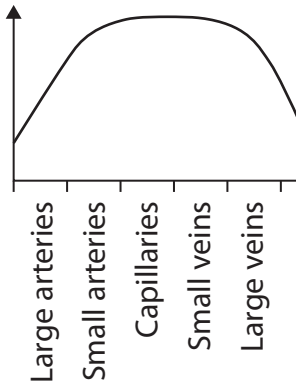
Graph 4



Graph 5



Graph 6



(i) Which graph shows the diameter of the blood vessels?

(1)

- ☒ **A** graph 1
- ☒ **B** graph 3
- ☒ **C** graph 4
- ☒ **D** graph 6

(ii) Which graph shows the permeability of the blood vessels?

(1)

- ☒ **A** graph 1
- ☒ **B** graph 2
- ☒ **C** graph 3
- ☒ **D** graph 6

(Total for Question 5 = 11 marks)

6 Starch from plants is used in the production of food, paper and building materials.

The structural and chemical properties of starch depend on its amylose and amylopectin content.

(a) The table shows some of the bonds found in amylose and amylopectin.

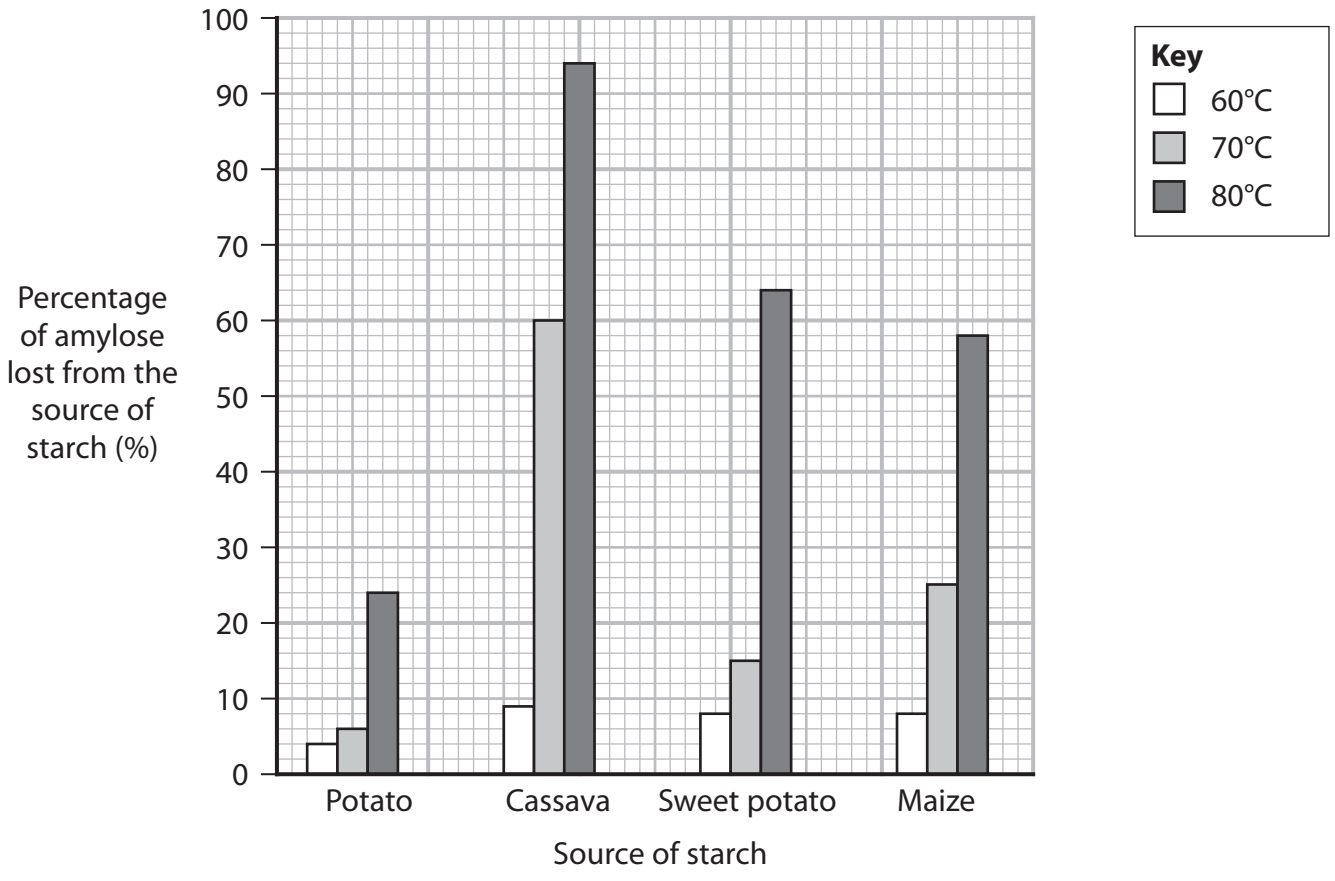
Put **one** cross ☒ in the appropriate box in each row to show whether the bond is present in these molecules.

(3)

Types of bond	Bonds found in			
	amylose only	amylopectin only	both amylose and amylopectin	neither amylose nor amylopectin
glycosidic bonds	☒	☒	☒	☒
1-6 α bonds	☒	☒	☒	☒
hydrogen bonds	☒	☒	☒	☒

(b) When sources of starch are heated in water, amylose moves into the water.

The graph shows the percentage of amylose that is lost from four sources of starch at three temperatures.



Describe **two** conclusions that can be made about the effects of temperature and source of starch on the loss of amylose.

(2)

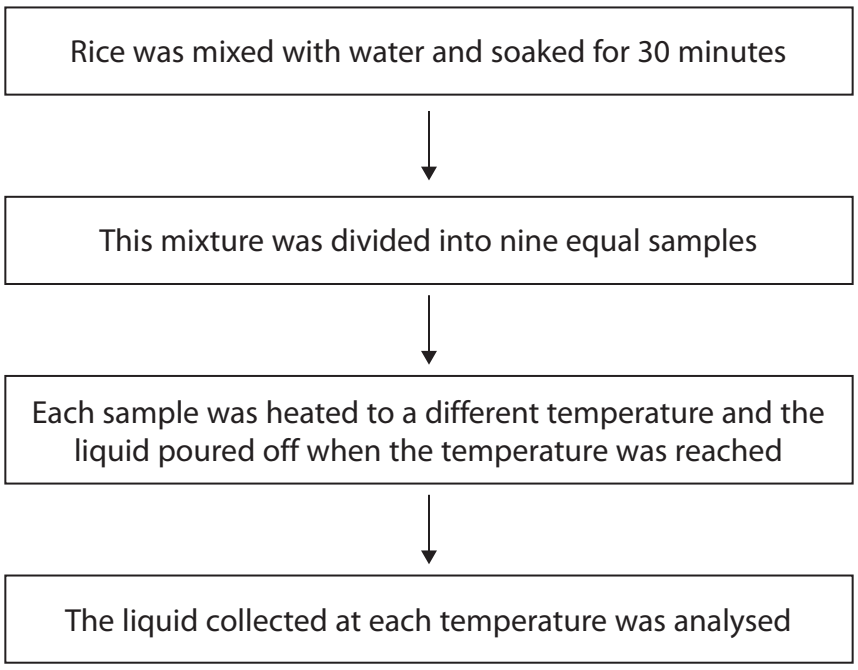
1 Effect of temperature

2 Effect of source of starch

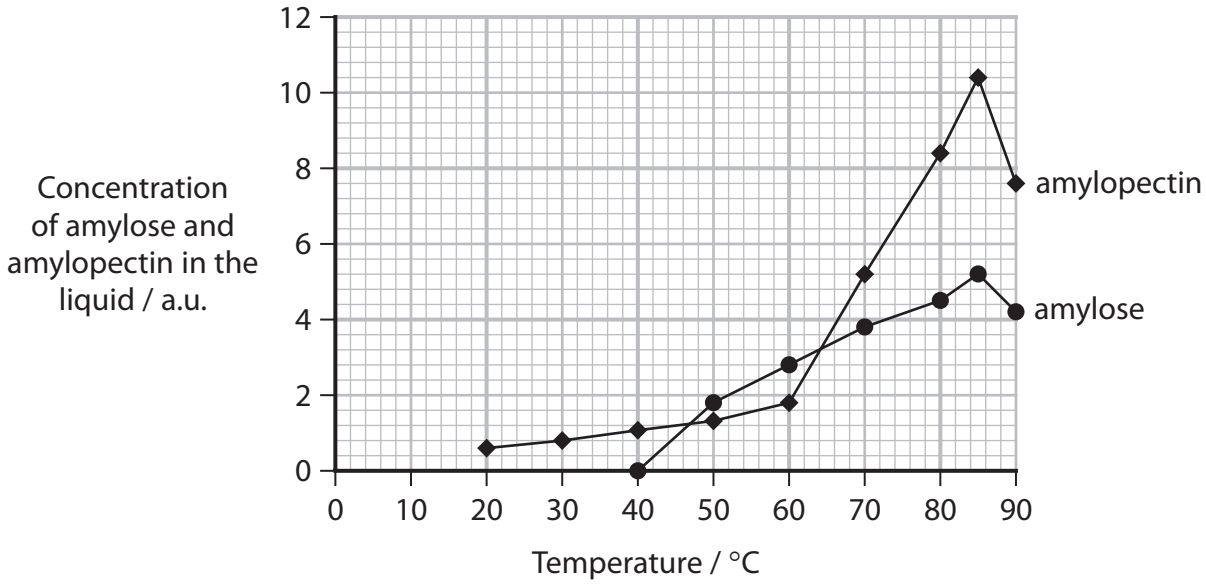
(c) The loss of amylose and amylopectin during the cooking of rice affects the hardness and stickiness of the cooked rice.

The effect of temperature on the loss of amylose and amylopectin was investigated.

The diagram shows part of the method used.



The graph shows the results of this investigation.



(i) Compare and contrast the effects of temperature on the loss of amylose and amylopectin from rice.

(3)

(ii) The investigation continued by adding a replacement liquid to finish cooking the rice.

The hardness and stickiness of the cooked rice was determined for each replacement liquid.

The table shows the results of this investigation.

Replacement liquid	Hardness of cooked rice / a.u.	Stickiness of cooked rice / a.u.
Water	19.42	1.19
Water containing amylose	27.63	1.21
Water containing amylopectin	20.43	1.71
Water containing both amylose and amylopectin	27.65	1.70

Comment on the effect of the replacement liquids on the hardness and stickiness of cooked rice.

Use the information in the table to support your answer.

(3)

(iii) Suggest why rice should be cooked in a measured volume of water, with the lid on, until all the cooking liquid has been absorbed.

Use the information in the table to support your answer.

(2)

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(Total for Question 6 = 13 marks)

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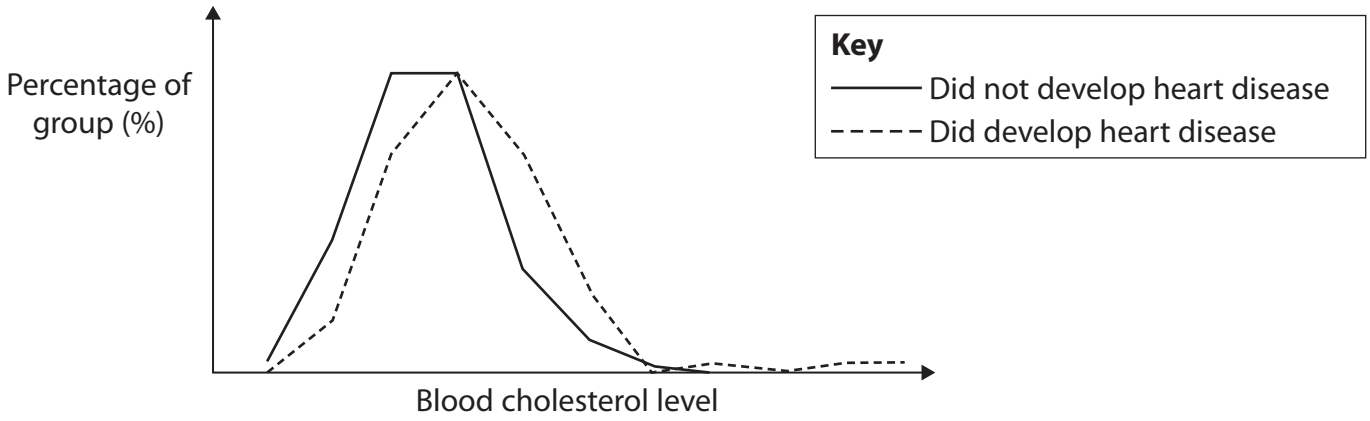
7 A number of factors increase the risk of cardiovascular disease (CVD), including blood cholesterol levels.

(a) In one investigation, scientists measured the blood cholesterol level in a group of people and monitored the development of heart disease in the following 10 years.

The graph shows the results of this investigation.



Some people interpreted the data as showing evidence for a relationship between blood cholesterol levels and heart disease.

Other people interpreted the data as not showing evidence for a relationship between blood cholesterol levels and heart disease.

Describe the evidence for and against a relationship between blood cholesterol levels and heart disease.

(2)

Evidence for

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Evidence against

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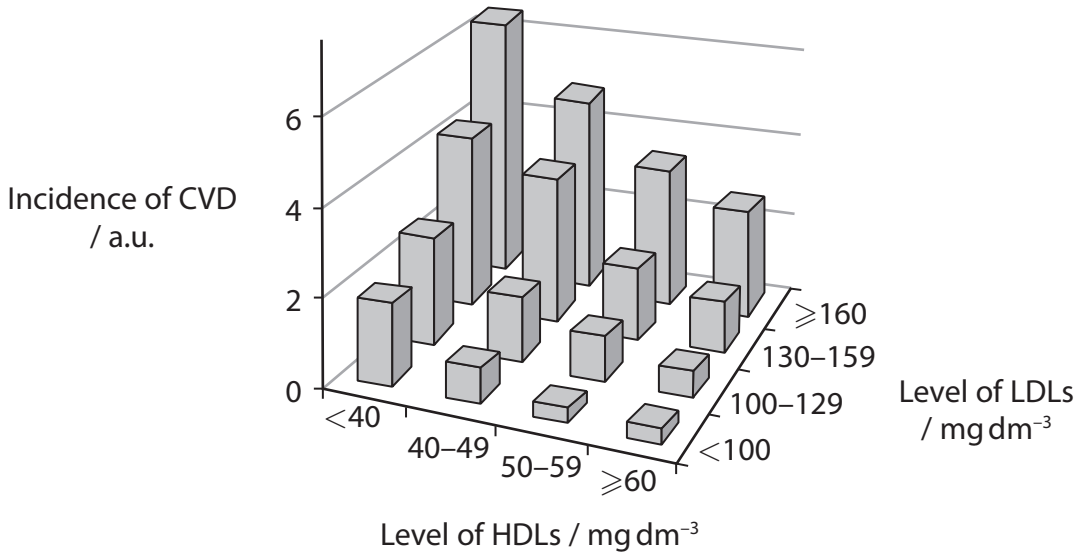
(b) Other investigations have shown that the levels of high-density lipoproteins (HDLs) and low-density lipoproteins (LDLs) are significant in determining the risk of CVD.

The graph shows the relationship between levels of HDLs and LDLs on the incidence of CVD.



The following conclusions can be made from this graph:

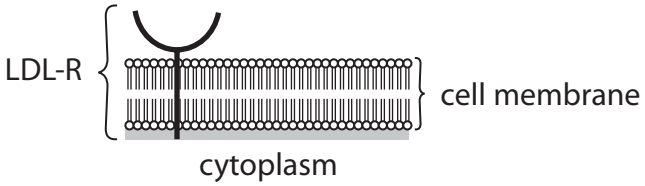
- as the levels of LDLs increases so does the incidence of CVD
- as the levels of HDLs increases the incidence of CVD decreases
- the higher the ratio of HDLs to LDLs the lower the incidence of CVD.

Describe the evidence shown in this graph that support these conclusions.

(3)

(c) The low-density lipoprotein receptor (LDL-R) is a protein on the surface of liver cells that is involved in the endocytosis of LDLs.

The diagram shows an LDL-R in a cell membrane.



(i) Explain how the LDL-R is involved in endocytosis of LDLs.

(3)

(ii) The lower pH inside the cell causes the LDL to separate from its receptor.

Suggest how a change in pH could cause this separation.

(2)

(iii) Mutations in the gene coding for the LDL-R can result in an increased risk of CVD.

Explain why mutations in this gene can increase the risk of CVD.

(3)

(Total for Question 7 = 13 marks)

8 In 2021, it was reported that cardiovascular diseases (CVDs) kill 17.9 million people per year. This is 31% of all global deaths.

(a) (i) Calculate how many global deaths there are in one year.

Express your answer in standard form.

(2)

Answer .....

(ii) It is predicted that by 2030 more than 22.2 million people will die each year from CVDs.

Suggest how this prediction was made.

(2)

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(b) The rhizomes of a ginger plant are used in cooking.

The photograph shows the rhizomes of a ginger plant.

(Source: © Helen Sessions / Alamy Stock Photo)

These rhizomes have high levels of antioxidants.

Some people believe that eating these rhizomes reduces the risk of CVD.

(i) Explain why eating these rhizomes may help to prevent CVD.

(3)

(ii) There is very little data available to show that these rhizomes reduce the risk of CVD.

Suggest why these rhizomes can be eaten to prevent CVD even though their effectiveness has not been thoroughly tested by scientists.

(1)

*(iii) Explain how a study should be designed to collect valid and repeatable data to show the effectiveness of using ginger in preventing CVD.

(6)

(Total for Question 8 = 14 marks)

TOTAL FOR PAPER = 80 MARKS

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