Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel International Advanced Level

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 shown 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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Q:1/1/1/

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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 Water is an important biological molecule.

Read through the following description of water.

Complete the description by writing the most appropriate word on the dotted lines.

Water has an uneven charge distribution so it is described as a

..... molecule. The hydrogen ends of the molecule

have a very slightly ..... charge.

Water is involved in the transport of substances so it is an important

..... in living organisms.

Water is needed in chemical reactions called .....

reactions that break down disaccharides such as

..... into glucose and galactose.

(Total for Question 1 = 5 marks)

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2 The blood clotting process has to be fast to prevent loss of blood from wounds.

(a) Which molecule traps red blood cells and platelets in the formation of a blood clot at a wound?

(1)

- ☒ **A** cholesterol
- ☒ **B** collagen
- ☒ **C** fibrin
- ☒ **D** fibrinogen

(b) How many of the following are converted into an active enzyme during blood clotting?

- fibrin
- fibrinogen
- prothrombin
- thrombin

(1)

- ☒ **A** 1
- ☒ **B** 2
- ☒ **C** 3
- ☒ **D** 4

(c) How many of the following are soluble in blood plasma?

- fibrin
- fibrinogen
- prothrombin
- thrombin

(1)

- ☒ **A** 1
- ☒ **B** 2
- ☒ **C** 3
- ☒ **D** 4

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(d) Thromboplastin is stored inside platelets.

Explain the advantages of storing thromboplastin inside platelets.

(3)

(Total for Question 2 = 6 marks)

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3 Pectinase is an enzyme that breaks down pectin. Pectin is present in the cell walls of fruits.

(a) What type of molecule is pectinase?

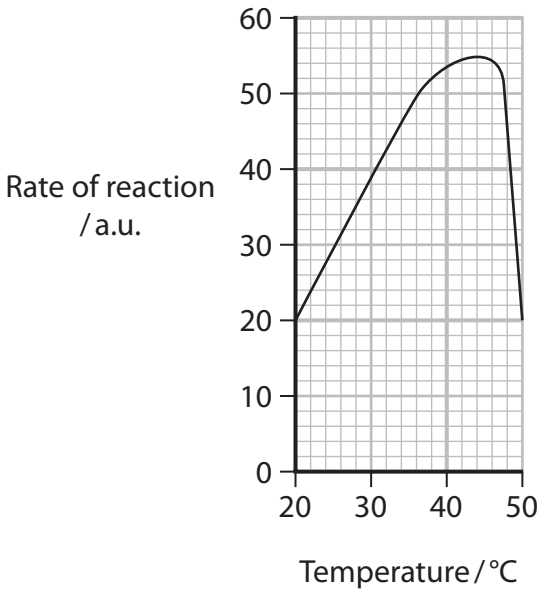
(1)

- ☒ **A** disaccharide
- ☒ **B** polysaccharide
- ☒ **C** protein
- ☒ **D** triglyceride

(b) Explain why enzymes are described as biological catalysts.

(2)

(c) The graph shows the effect of temperature on the rate of reaction of pectinase.



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(i) Calculate the effect on the rate of reaction of each degree increase in temperature between 46 °C and 50 °C.

Give your answer to two significant figures.

(1)

Answer ..... a.u. per °C

(ii) State why there is a decrease in the rate of reaction above the optimum temperature.

(1)

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(Total for Question 3 = 5 marks)

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4 The structures of blood vessels relate to their functions.

The table gives information about some blood vessels in a dog.

Blood vessel	Number in body	Diameter / cm	Length of vessel / cm	Total surface area / cm^2	Velocity of blood flow / $cm\ s^{-1}$
aorta	1	1.0	40.0	1.3×10^2	28.0
large arteries	40	0.3	20.0	7.5×10^2	7.8
capillaries	1.2×10^9	8.0×10^{-4}	0.1	3.0×10^5	3.6×10^{-2}
large veins	40	0.6	20.0		1.9
vena cava	1	1.25		1.6×10^2	18.0

(a) Complete the table.

Use the formula:

surface area = $2\pi rl$

where r is the radius of the blood vessel and l is the length of the vessel.

(3)

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(b) Explain why the velocity of blood flow in the large arteries is slower than the velocity of blood flow in the aorta.

(3)

(c) Explain why the total surface area of the capillaries needs to be so high.

(2)

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(d) (i) The diagrams show the relative proportions of components found in blood vessel walls.

Which diagram represents the wall of a large artery?

(1)

☒ **A**



☒ **B**

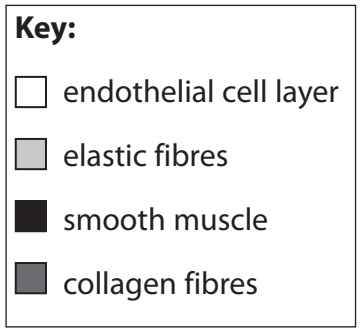


☒ **C**



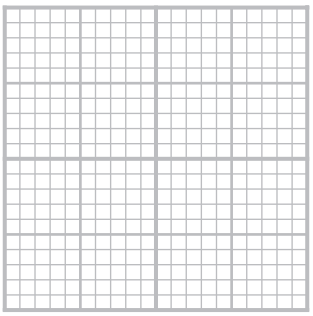
☒ **D**





(ii) Draw a diagram, using the style above, to represent the wall of a capillary.

(1)



(Total for Question 4 = 10 marks)

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5 Hair straightening, or rebonding, is a hair styling technique used to straighten hair using either heat or chemicals.

(a) Hair is made from an insoluble fibrous protein called keratin.

(i) Describe **two** structural features of insoluble fibrous proteins.

(2)

1 .....

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2 .....

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(ii) Keratin contains a high proportion of the amino acid, cysteine.

Disulfide bridges form between the R groups of two cysteines.

The diagram shows the R group of cysteine.



Draw the complete structure of the amino acid, cysteine.

(3)

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(b) The effect of two different temperatures on the lengths of the primary structure and secondary structure of a polypeptide was investigated.

The table shows the results of this investigation.

Structure of polypeptide	Length of structure / nm	
	at 25 °C	at 55 °C
primary	505	505
secondary	48	70

(i) Describe the secondary structure of a polypeptide.

(2)

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(ii) Explain the results of this investigation.

(4)

(Total for Question 5 = 11 marks)

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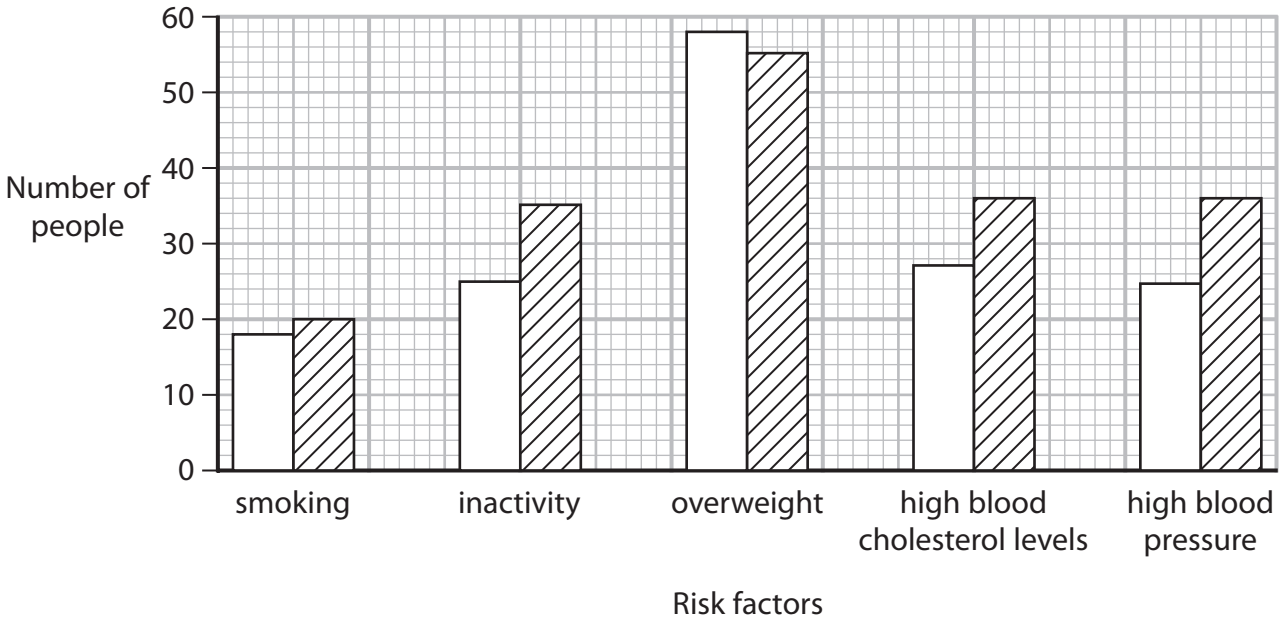
6 The risk of developing cardiovascular disease (CVD) is dependent on a number of factors.

(a) People's perception of these risks are often very different from the actual risks.

A study was designed to compare perceived risks with actual risks.

A group of people were asked if they thought they were at risk (perceived risk) of CVD. The same group of people were then examined to determine their actual risks of CVD.

The graph shows the results of this study.



(i) Describe **two** conclusions that can be drawn from this study.

(2)

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2 .....

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(ii) Explain how this study should have been designed to allow valid conclusions to be made.

(3)

(iii) Explain why it is important that a person's perception of a risk is close to the actual risk.

(3)

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(b) The 10-year risk of a person developing CVD can be estimated in a number of ways.

The Framingham Risk Score uses a point scoring system to estimate the 10-year risk of developing CVD.

Table 1 shows the point scores for different risk factors in women.

Table 1

Risk factor	Points per age group			
	35 to 39	**40 to 44**	**45 to 49**	**50 to 54**
age	−3	0	+3	+6
total cholesterol level / mg dm^{-3}				
<160	0	0	0	0
160 to 199	+4	+3	+3	+2
200 to 239	+8	+6	+6	+4
240 to 279	+11	+8	+8	+5
smoker	+9	+7	+7	+4
systolic blood pressure / mm Hg				
<120	0	0	0	0
120 to 129	+1	+1	+1	+1
130 to 139	+2	+2	+2	+2

Table 2 shows the 10-year risk for the total points scored, calculated using the information in Table 1.

Table 2

Total points scored	10-year risk of developing CVD (%)
16	4
17	5
18	6
19	8
20	11
21	14
22	17

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(i) Calculate the 10-year risk of CVD for a 35-year-old woman who:

- has a total cholesterol level of 242 mg dm^{-3}
- is a smoker
- has a systolic blood pressure of 132 mm Hg.

(2)

Answer ..... %

(ii) Explain the lifestyle changes this woman could make to reduce her 10-year risk of CVD.

Use the information in the table to support your answer.

(2)

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(iii) Which pair of drugs may reduce the 10-year risk of CVD for this woman?

(1)

☒ **A** anticoagulants and statins

☒ **B** anticoagulants and antihypertensives

☒ **C** antihypertensives and platelet inhibitors

☒ **D** antihypertensives and statins

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(iv) Suggest why this method of determining the 10-year risk of CVD may not be accurate.

(2)

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(Total for Question 6 = 15 marks)

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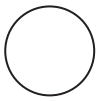
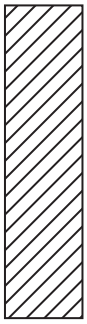
7 The components of a cell membrane determine its properties.

The membrane is a phospholipid bilayer.

(a) The table shows one way that the components of phospholipids can be drawn.

Component	Way of drawing the component
phosphate group	
glycerol	
fatty acid	
bond	

(i) Draw a diagram of a phospholipid, using the information in the table.

(2)

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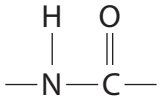
(ii) One of the bonds present in phospholipids is an ester bond.

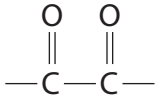
Which diagram shows an ester bond?

(1)

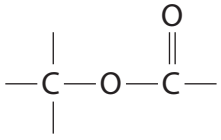
☒ **A**



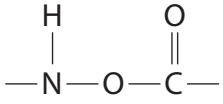
☒ **B**



☒ **C**



☒ **D**



(b) The fluidity of a membrane is increased by a number of factors:

- increase in temperature
- increase in the proportion of unsaturated fatty acids
- decrease in cholesterol
- fatty acids with shorter side chains.

(i) Explain why an increase in temperature increases the fluidity of the membrane.

(2)

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(ii) Which row in the table describes an unsaturated fatty acid compared with a saturated fatty acid with the same number of carbon atoms?

(1)

		Has double bonds between two carbons	Number of hydrogens
☒	**A**	no	fewer than the saturated fatty acid
☒	**B**	no	more than the saturated fatty acid
☒	**C**	yes	fewer than the saturated fatty acid
☒	**D**	yes	more than the saturated fatty acid

(iii) Explain why a decrease in cholesterol increases the fluidity of the membrane.

(2)

(iv) Suggest why a fatty acid with a shorter side chain will increase the fluidity of a membrane.

(1)

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(c) Studies have shown that when fish are moved into water at a lower temperature, the fatty acid content of their membranes changes.

(i) Suggest how the content of the fatty acids in these membranes may have changed.

(2)

(ii) Suggest why these changes are necessary for the survival of the fish.

(2)

(Total for Question 7 = 13 marks)

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8 Mutations can give rise to cancer or genetic disorders.

(a) Cancer is one of the main causes of death in the world.

In 2018, in the UK, there were 541 589 deaths in total and 166 800 of these were due to cancer.

Calculate the ratio of deaths caused by cancer to deaths not caused by cancer.

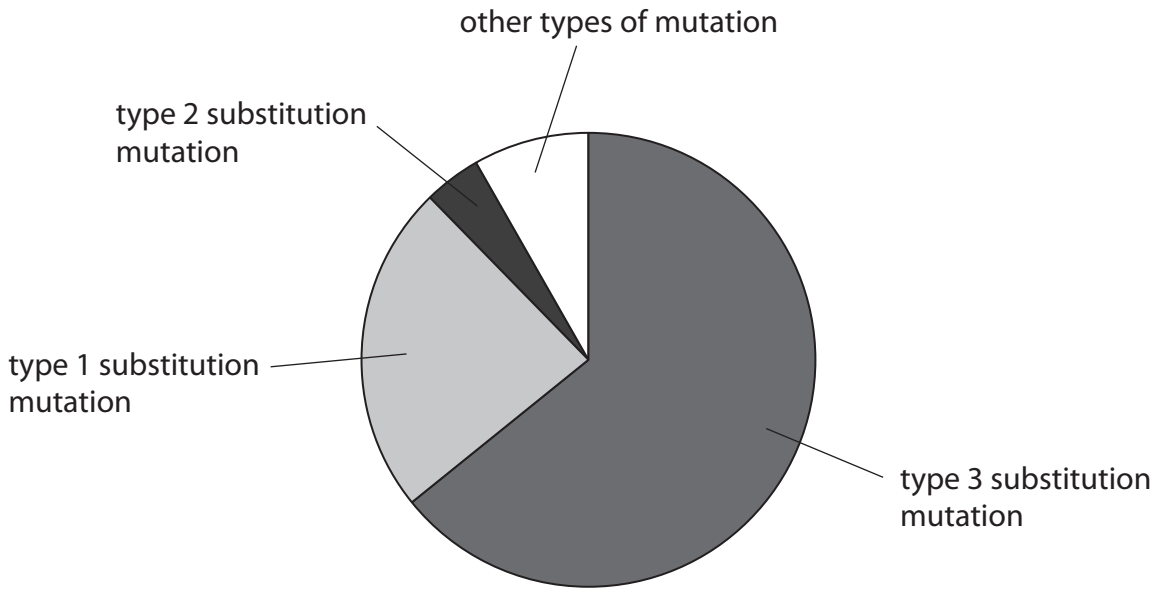
Give your answer to two decimal places.

(2)

Answer .....

(b) Scientists have identified many mutations in cancer cells and are trying to identify the mutations that are significant.

The chart shows the proportion of cancers caused by some types of mutation.



(i) Name **two** other types of mutation.

(1)

1 .....

2 .....

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(ii) Estimate the percentage of cancers caused by type 3 substitution mutations.

(1)

Answer ..... %

(iii) A type 1 substitution mutation in a gene alters the DNA and mRNA but does **not** affect the protein synthesised from the mutated gene.

Explain how a substitution mutation can alter the DNA and mRNA but **not** the protein.

(4)

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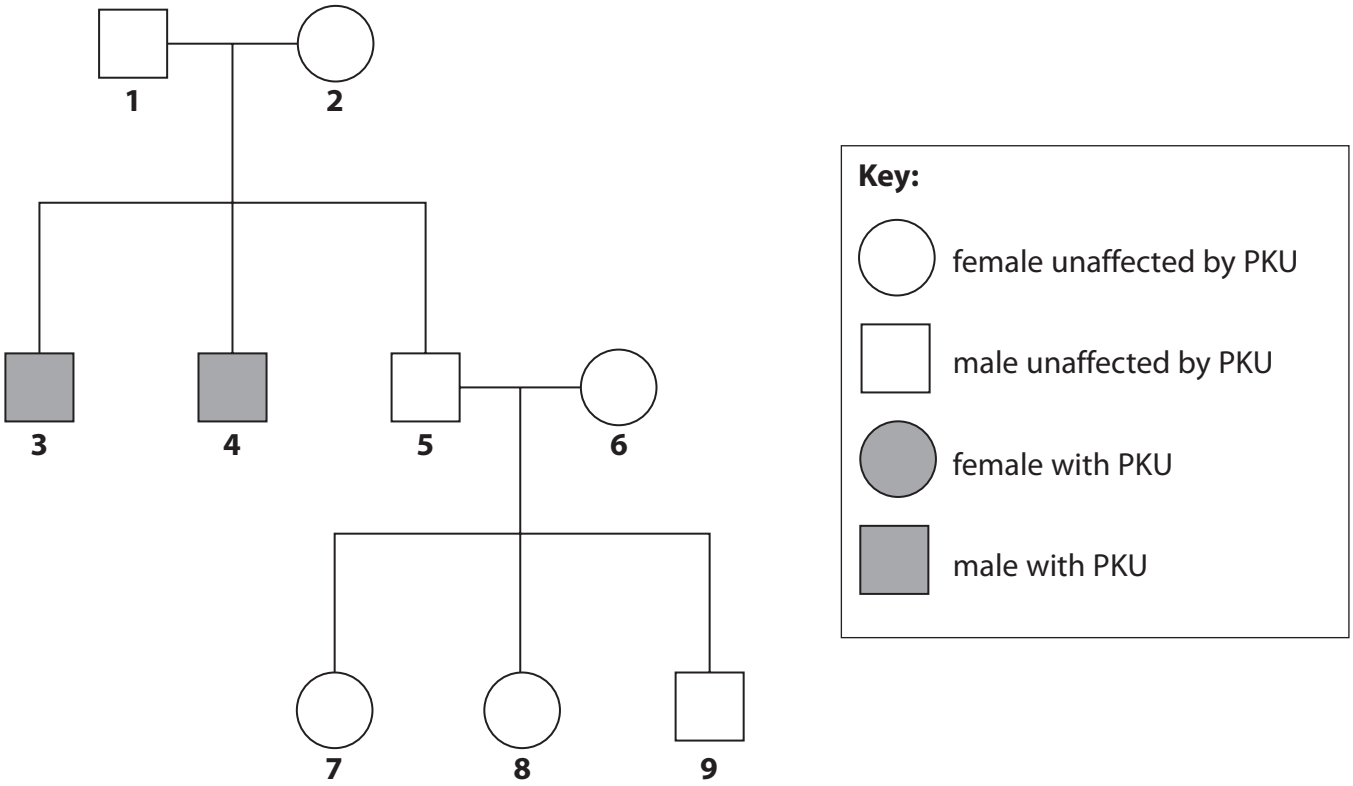
(c) Phenylketonuria (PKU) is a genetic disorder.

This disorder is inherited in a similar way to cystic fibrosis.

The pedigree diagram shows the phenotypes of individuals in one family affected by PKU.



(i) What is the probability of couple **1** and **2** having a fourth child that is a male affected by PKU?

(1)

- ☒ **A** 0.000
- ☒ **B** 0.125
- ☒ **C** 0.250
- ☒ **D** 0.500

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*(ii) Discuss the extent to which this pedigree diagram can be used to identify the genotypes of all the members of this family.

(6)

(Total for Question 8 = 15 marks)

TOTAL FOR PAPER = 80 MARKS

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