

Please check the examination details below before entering your candidate information

Candidate surname

Other names

Centre Number

Candidate Number

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Pearson Edexcel International Advanced Level**Monday 8 May 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.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed – you should take particular care on these questions with your spelling, punctuation and grammar, as well as the clarity of expression.

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 ☐. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☐.

1 Messenger RNA (mRNA) and transfer RNA (tRNA) are involved in protein synthesis.

(a) The diagram shows the sequence of bases in part of a DNA template (antisense) strand and the mRNA molecule formed during protein synthesis.

DNA template strand	A	T	G	C	C	G	T	T
mRNA								

(i) Complete the diagram to show the sequence of bases in this mRNA.

(1)

(ii) Name this stage of protein synthesis.

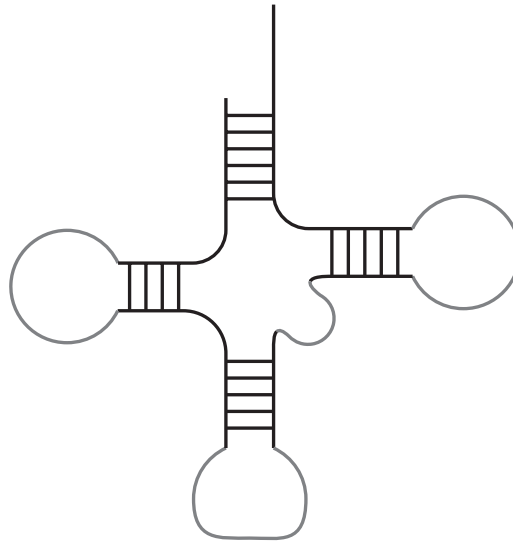
(1)

(iii) Name the enzyme used in this stage of protein synthesis.

(1)



(b) The diagram shows part of a tRNA molecule.



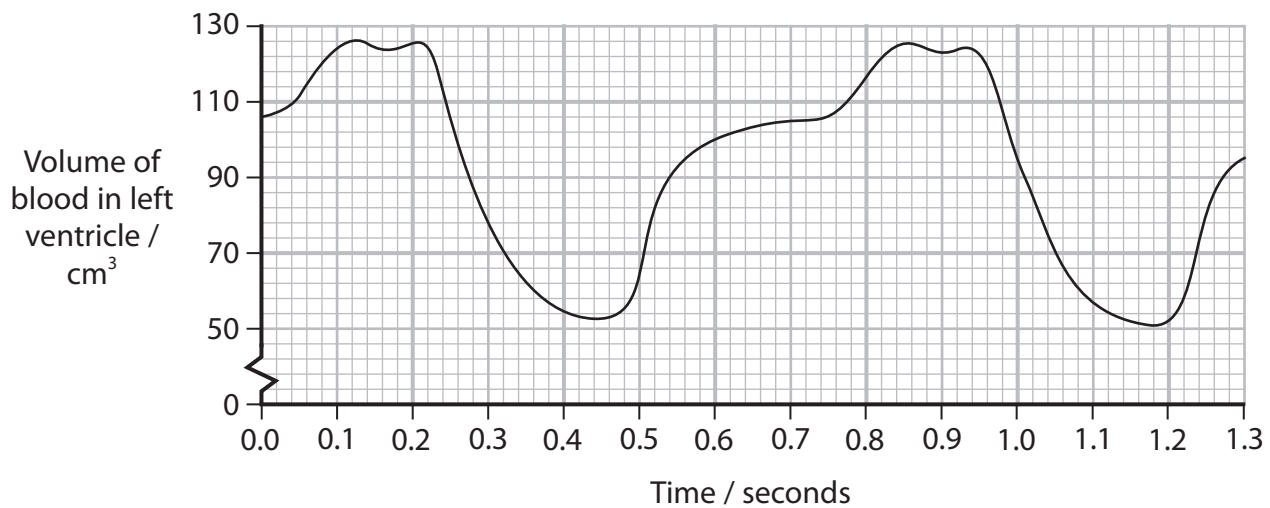
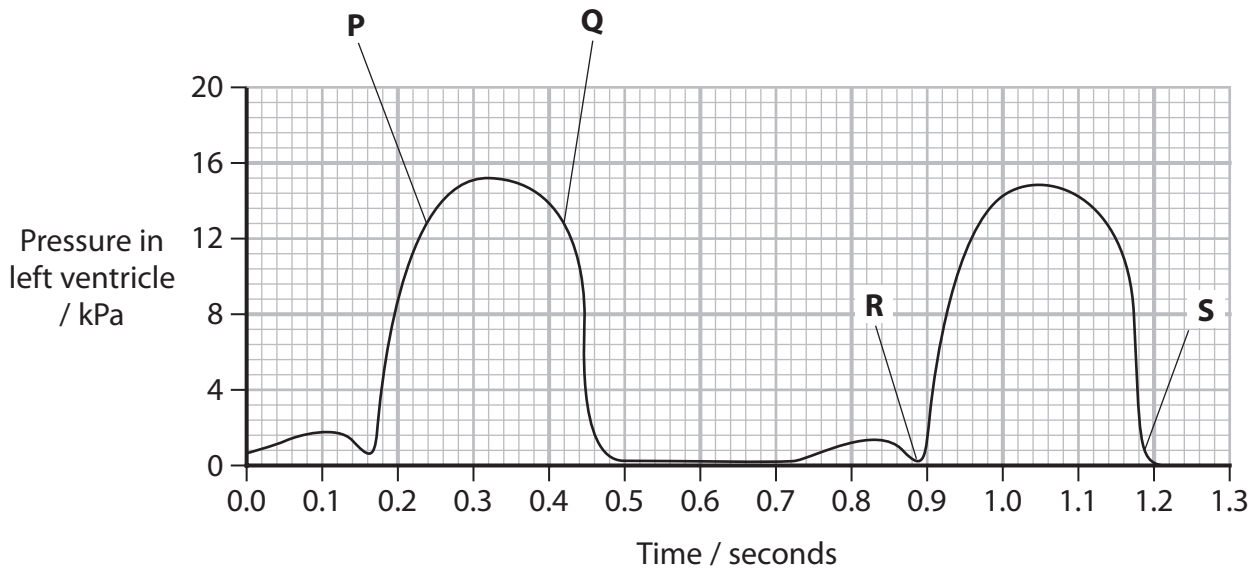
Compare and contrast the structure of an mRNA molecule with that of a tRNA molecule.

(3)

(Total for Question 1 = 6 marks)



- 2 The graphs show how the pressure and volume of blood in the left ventricle change during the cardiac cycle.



- (a) Which letter indicates when the atrioventricular (mitral) valves close?

(1)

- ☐ **A** P
- ☐ **B** Q
- ☐ **C** R
- ☐ **D** S

- (b) Calculate the time for one cardiac cycle.

(1)

Answer seconds



(c) The volume of blood in the left ventricle changes during the cardiac cycle.

Explain these changes.

(3)

(Total for Question 2 = 5 marks)

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3 Sucrose is a disaccharide made from glucose and fructose.

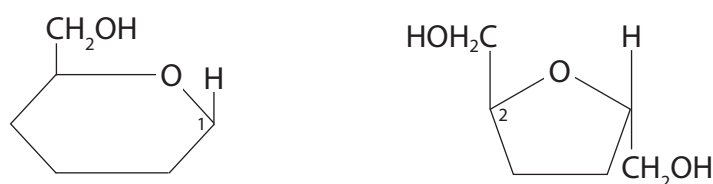
Glucose is joined to fructose by a 1–2 glycosidic bond.

(a) (i) The diagram shows a molecule of glucose and a molecule of fructose.

Carbon 1 on the glucose and carbon 2 on the fructose are numbered.

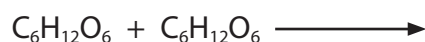
Complete the diagram to show a glycosidic bond between the glucose molecule and the fructose molecule.

(1)



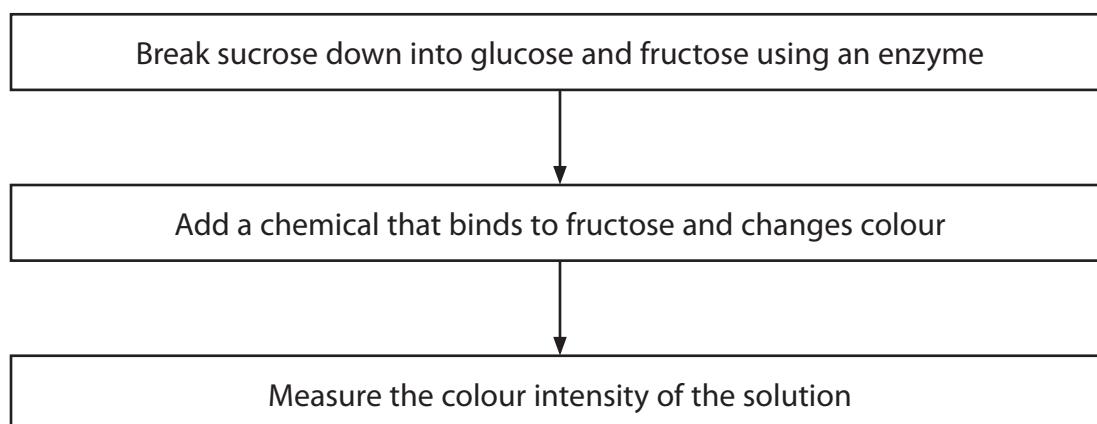
(ii) Complete the formula equation for the reaction that makes sucrose from glucose and fructose.

(2)



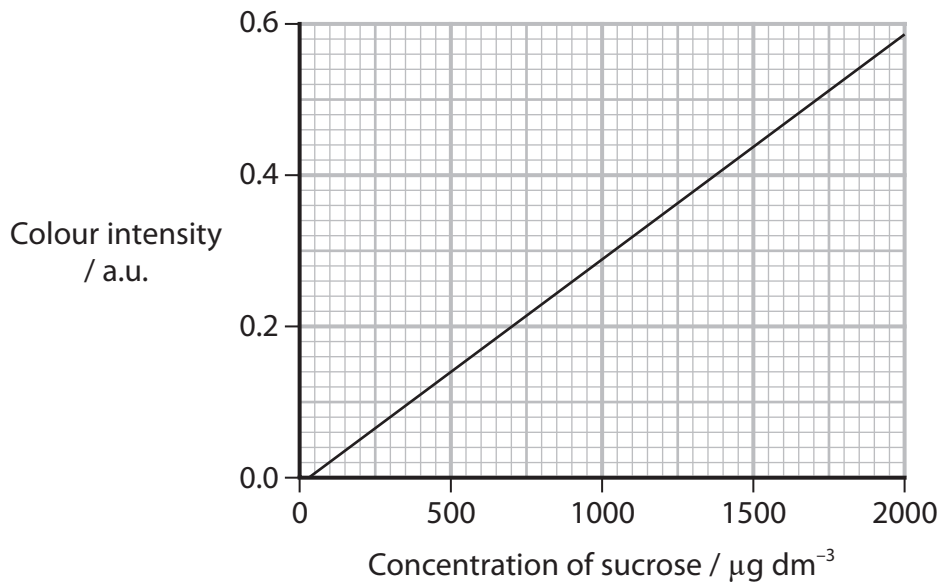
(b) The concentration of sucrose in a solution can be determined by a test.

The chart shows the steps involved in this test.



The colour intensity is directly proportional to the concentration of sucrose.

The graph shows this relationship.



- (i) Give a reason why the colour intensity is directly proportional to the concentration of sucrose.

(1)

- (ii) Suggest why the line does not start at the origin of the graph.

(1)

- (iii) State why the concentration of maltose and lactose cannot be measured using this test.

(1)

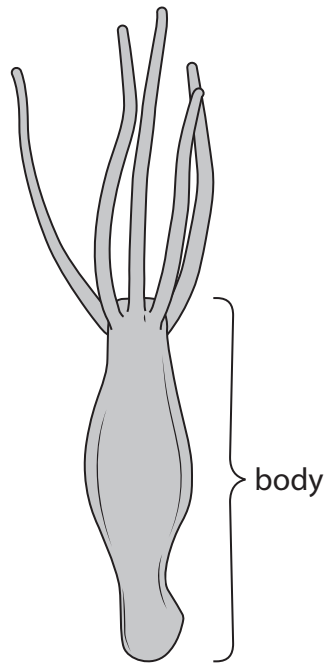
(Total for Question 3 = 6 marks)



4 Hydra are small animals that live in water.

They have a cylindrical body.

The drawing shows a hydra.



(a) This hydra has a body length of 1.8 mm and a diameter of 1 mm.

(i) Which is the magnification of this drawing?

(1)

- ☐ **A** 3.75×10^{-2}
- ☐ **B** 3.75×10^{-1}
- ☐ **C** 2.67×10^0
- ☐ **D** 2.67×10^1

(ii) Which is the surface area, in mm^2 , of this hydra?

Use the formula:

$$\text{surface area} = 2\pi rl$$

(1)

- ☐ **A** 0.9π
- ☐ **B** 1.8π
- ☐ **C** 3.6π
- ☐ **D** 5.4π



- (iii) Another hydra has a surface area of $2.3\pi \text{ mm}^2$, a body length of 1.8 mm and a diameter of 1.2 mm.

Calculate the surface area to volume ratio of this hydra.

Use the formula:

$$\text{volume} = \pi r^2 l$$

(2)

Answer

- (b) A hydra has a hollow body that is made up of two layers of cells.

Explain how a hydra is adapted for gas exchange.

(3)

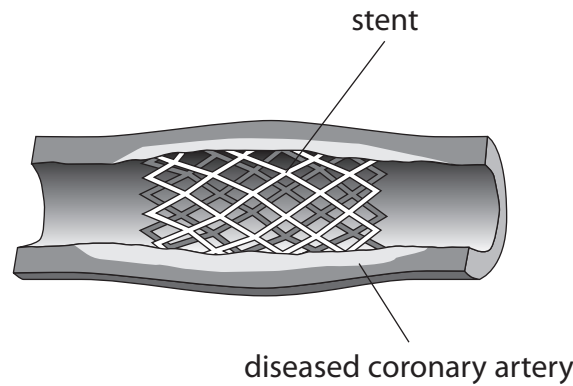
(Total for Question 4 = 7 marks)



5 Stents are used in the treatment of atherosclerosis.

Stents widen the diseased coronary artery so that blood can flow through to the heart muscle.

The diagram shows a stent.



Stents can damage the endothelial cells lining the artery and trigger the formation of a blood clot.

Patients who have a stent fitted are given anticoagulants.

(a) Explain how damage to the endothelial cells results in the formation of thrombin.

(2)

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(b) Give **one** risk of treating patients with anticoagulants.

(1)

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(c) The photograph shows a tropical bont tick.



(Source: © Phanie/Alamy Stock Photo)

This bont tick produces a peptide called variegain.

Variegain binds to the active site of thrombin and prevents blood clotting.

(i) Variegain is a peptide consisting of 32 amino acids.

Which is the minimum number of bases in the gene that codes for this peptide?

(1)

- ☐ A 32
- ☐ B 33
- ☐ C 96
- ☐ D 99

(ii) Explain how variegain prevents blood clotting.

(2)

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(iii) Thrombin slowly splits variegain into two molecules.

Explain how thrombin splits variegain.

(2)

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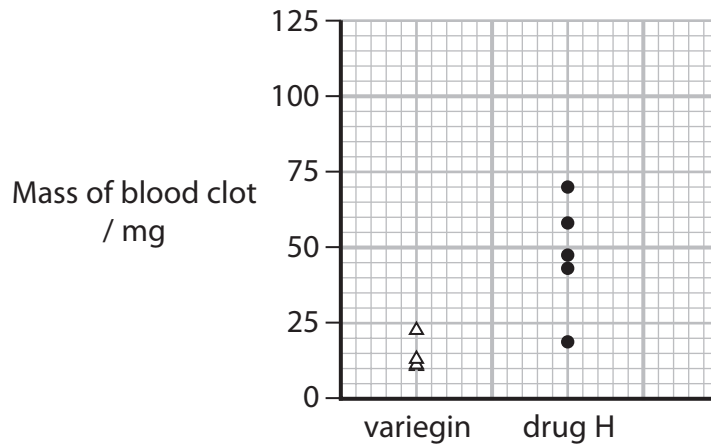


- (iv) The effect of variegatin on the mass of blood clots forming inside a stent was investigated.

The masses were compared with another anticoagulant, drug H.

The graph shows the results of this investigation.

Each plotted point represents the mass of blood clot in one stent.



Comment on the results of this investigation.

(2)

(Total for Question 5 = 10 marks)

- 6 Insects and other invertebrates are a good source of protein, unsaturated fatty acids, iron and other nutrients.

Recent research has shown that some insects and other invertebrates have a high antioxidant content.

(a) How many of the following statements are true for proteins?

- Proteins contain only the elements carbon, hydrogen and nitrogen.
- Proteins can be made of more than one polypeptide chain.
- Proteins contain hydrogen bonds.

(1)

- ☐ **A** 0
- ☐ **B** 1
- ☐ **C** 2
- ☐ **D** 3

(b) Which row of the table is correct for an unsaturated fatty acid?

(1)

	Contains carbon–carbon double bonds	Carbon : hydrogen ratio compared with a saturated fatty acid is
☐ A	no	lower
☐ B	no	higher
☐ C	yes	lower
☐ D	yes	higher

(c) Name **one** organic molecule that contains iron.

(1)

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(d) Explain why dietary antioxidants are important.

(4)

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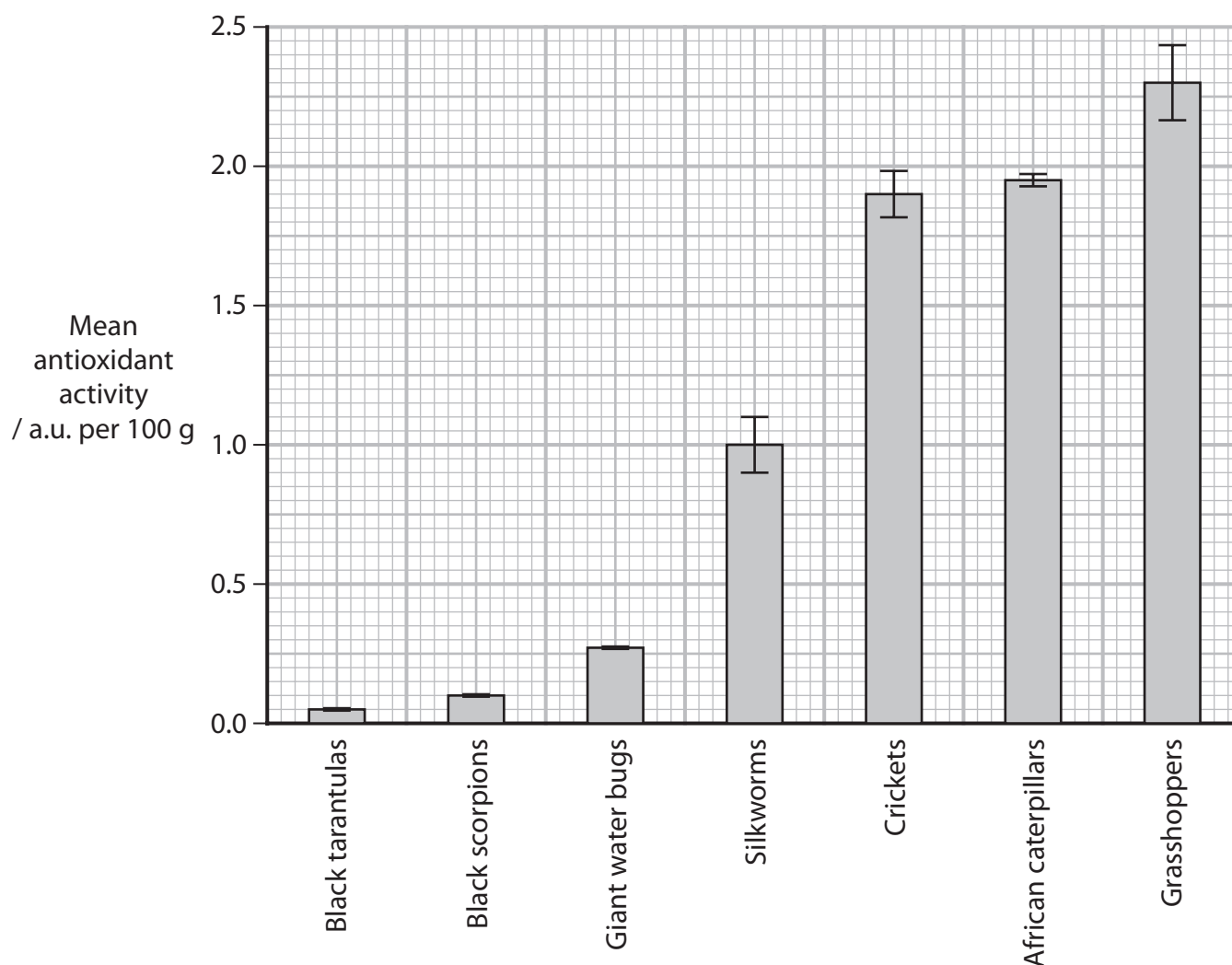


(e) The antioxidant activity of some insects and arachnids was investigated.

The table shows the dietary habits of the organisms used in this investigation.

Name of organism	Type of organism	Dietary habits
Black tarantulas	arachnid	eat animals
Black scorpions	arachnid	eat animals
Giant water bugs	insect	eat animals
Silkworms	insect	eat plants
Crickets	insect	eat plants
African caterpillars	insect	eat plants
Grasshoppers	insect	eat plants

The graph shows the mean antioxidant activity of extracts made from these organisms.



- (i) The antioxidant activity of orange juice is 0.80 a.u. per 100 g.

Calculate how many times more antioxidant activity there is in 100 g of grasshopper extract.

Give your answer to two significant figures.

(1)

Answer

- (ii) Calculate the percentage difference between the antioxidant activity in black scorpions and crickets.

(1)

Answer%

- (iii) Comment on the results of this investigation.

Use the information in the table and the graph to support your answer.

(3)

(Total for Question 6 = 12 marks)

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7 Prenatal testing is used to screen for genetic disorders in developing embryos.

- (a) Phenylketonuria (PKU) is one genetic disorder that is screened for by prenatal testing.

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

Explain why a healthy couple might choose to have a prenatal test for PKU.

Draw a genetic diagram in your answer.

(4)

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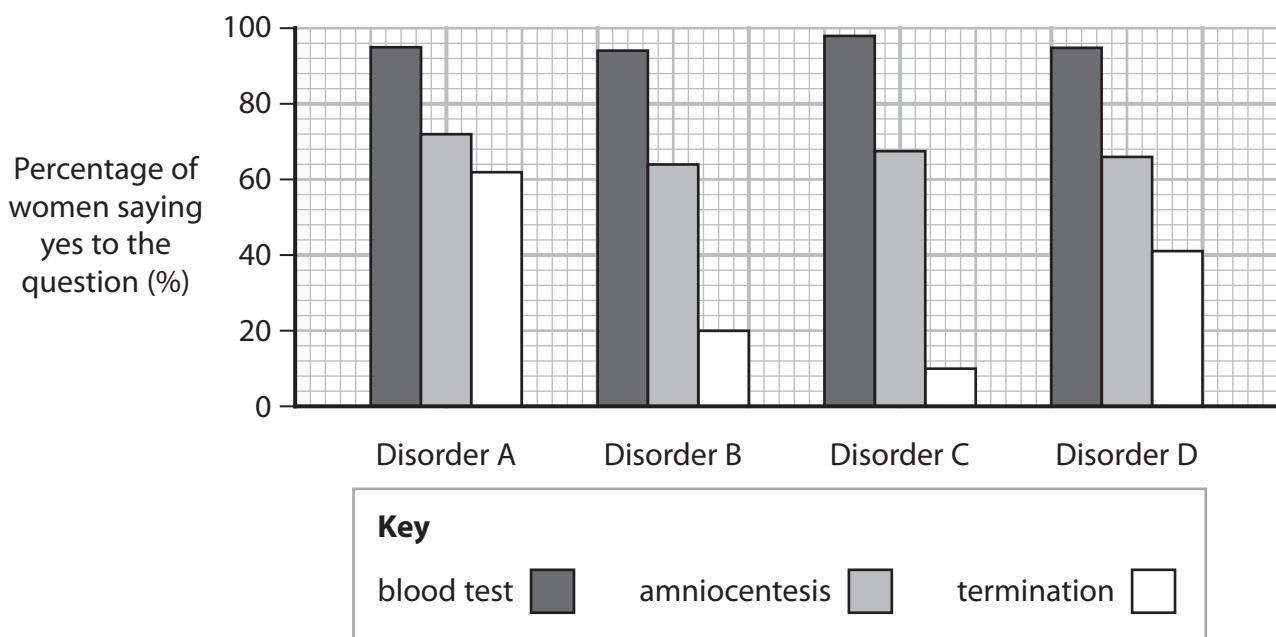


- *(b) A group of women, who had recently given birth to healthy babies, were asked about their opinions on screening for four different genetic disorders, A, B, C and D.

They were asked three questions about each disorder:

- 1 Would they be screened themselves with a blood test?
- 2 Would they have amniocentesis to screen for the genetic disorders?
- 3 Would they have a pregnancy termination (abortion) if an unborn child was found to have the genetic disorder?

The graph shows the percentage of women who said yes to each question for each disorder.



The table gives some information about each of these genetic disorders.

Genetic disorder	Information
A	muscles are weak and movement is difficult symptoms can be managed some types are lethal in childhood
B	treatable does not shorten life expectancy
C	treatable most individuals live into adulthood
D	intellectual disability medical care results in individuals leading healthy lives



Discuss the responses to the three questions.

(6)

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(Total for Question 7 = 10 marks)



- 8 The risk of developing cardiovascular disease (CVD) is influenced by a number of factors.

Risk assessment calculators allow a person to calculate their own risk of developing CVD.

The person completes a questionnaire about their health and lifestyle. This information is then used to calculate the risk of the person developing CVD within the next ten years.

The table shows the information required by two different risk assessment calculators, RAC-1 and RAC-2.

Information	Information required by the calculators	
	RAC-1	RAC-2
Age	✓	✓
Blood pressure	✓	✓
Smoking	✓	x
Total cholesterol	✓	✓
HDL cholesterol	x	✓

- (a) How many of the risk factors listed in the table are **not** influenced by lifestyle?

(1)

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



*(b) Explain the effectiveness of these two calculators in the assessment of risk and whether other factors should be considered.

(6)

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Area for writing the answer to question *(b). The area is ruled with horizontal dotted lines.



P 7 1 9 3 4 A 0 2 3 2 8

(c) The calculators work out the risk of a person developing CVD in the next 10 years.

- (i) Explain why the information entered by a person may lead to an underestimate of their 10-year risk of developing CVD.

(2)

- (ii) Suggest why these two risk calculators may not be suitable for everybody to use.

(2)

- (iii) Suggest why these risk calculators estimate the **10-year** risk of developing CVD.

(1)

(Total for Question 8 = 12 marks)



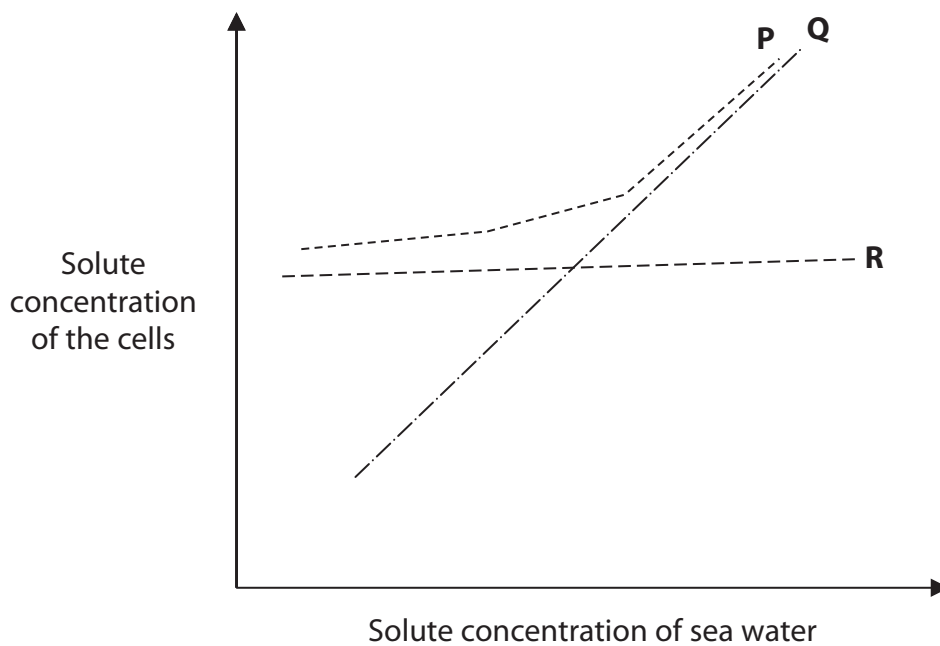
- 9 Some marine animals are osmoconformers and some are osmoregulators.

Strict osmoconformers have a cell solute concentration that matches the solute concentration of the sea water.

Partial osmoconformers have a cell solute concentration that varies with the solute concentration of the sea water.

Osmoregulators control the solute concentration of their cells when the solute concentration of sea water changes.

- (a) The graph shows the solute concentration of the cells of three marine animals, P, Q and R.



- (i) Which row in the table identifies the marine animals P, Q and R?

(1)

	P	Q	R
☒ A	partial osmoconformer	osmoregulator	strict osmoconformer
☒ B	partial osmoconformer	strict osmoconformer	osmoregulator
☒ C	osmoregulator	strict osmoconformer	partial osmoconformer
☒ D	strict osmoconformer	partial osmoconformer	osmoregulator



- (ii) Explain the advantages for osmoconformers of having cells with solute concentrations similar to that of the sea water they live in.

(3)

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- (b) The table shows the concentration of ions in sea water and in some osmoconformers.

Location		Ion concentration / a.u.				
		sodium	magnesium	calcium	potassium	chloride
Sea water		478	55	11	10	558
Cells of osmoconformers	jellyfish	474	53	10	11	
	sea urchin	474	54	11	10	557
	lobster	541	9	12	8	552

- (i) Estimate the chloride concentration of the cells of a jellyfish.

(1)

Answer a.u.



- (ii) Calculate the percentage difference in the concentration of magnesium ions in the lobster compared with the sea urchin.

Give your answer to two decimal places.

(2)

Answer%

- (iii) These three animals are osmoconformers even though they have different concentrations of each ion in their cells.

Explain why these three animals can be described as osmoconformers.

(2)

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- (iv) Suggest why osmoconformers do not have the same concentration of each ion in their cells.

(1)

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- (v) Energy is needed to maintain the concentration of ions inside the osmoconformers.

Explain what this energy is being used for.

(2)

(Total for Question 9 = 12 marks)

TOTAL FOR PAPER = 80 MARKS

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