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 13 May 2024

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.*
- 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 4 4 7 2 A 0 1 3 2

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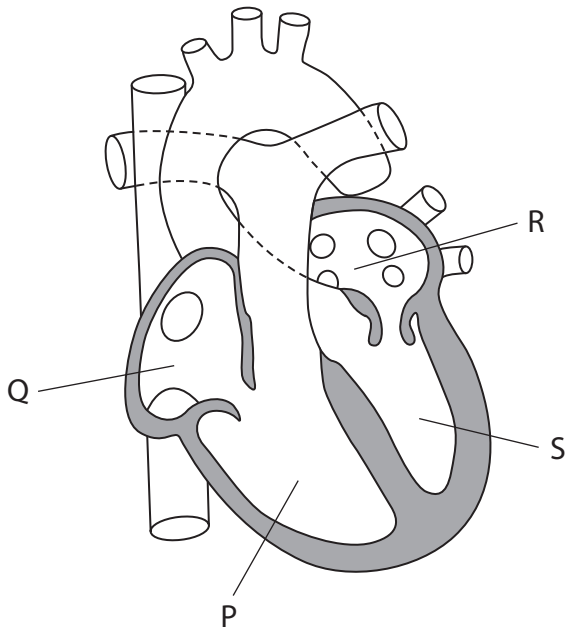
Answer ALL questions. Write your answers in the spaces provided.

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 part of the internal structure of a human heart.



(a) (i) How many of the following statements about the human heart are correct?

- structures P and S fill with deoxygenated blood when structures Q and R contract
- structure R receives blood from the pulmonary vein
- when the cardiac muscle walls of P and S undergo diastole, blood leaves the heart and enters the aorta and pulmonary artery

(1)

☒ **A** none

☒ **B** one

☒ **C** two

☒ **D** three

(ii) Complete the diagram to show the location of the semilunar valve in the pulmonary artery.

(1)

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(iii) Describe the role of this semilunar valve in the cardiac cycle.

(3)

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(b) The diagrams show a cross-section of an aorta and a vena cava.

aorta vena cava

(i) Complete the diagrams to show the relative sizes of the lumens.

(1)

(ii) Which of the following would be in contact with the blood in an undamaged vena cava?

(1)

☒ **A** collagen

☒ **B** endothelial cells

☒ **C** epithelial cells

☒ **D** smooth muscle cells

(Total for Question 1 = 7 marks)

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2 The photograph shows red, white and pink snapdragon flowers.

Plants with genotype F^RF^R have flowers with red petals.

Plants with genotype F^WF^W have flowers with white petals.

(Source: © Irina Kryvasheina/Alamy Stock Photo)

(a) Deduce why heterozygous snapdragon plants produce flowers with pink petals.

(3)

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(b) (i) Two snapdragon plants with genotype F^RF^W were crossed.

Determine the probability of each petal colour in the offspring of this cross, using a genetic diagram.

(3)

Petal colour	Probability
Pink	
Red	
White	

(ii) There were 416 plants produced from this cross.

Predict how many of these plants will have flowers with white petals.

(1)

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(Total for Question 2 = 7 marks)

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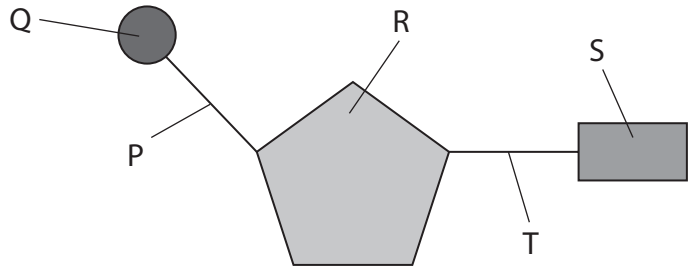
3 Nucleic acids are involved in protein synthesis.

(a) The diagram shows the structure of a nucleotide.



(i) Which labelled structure would contain the element phosphorus?

(1)

☒ **A** P

☒ **B** Q

☒ **C** R

☒ **D** S

(ii) Structure R is different in a DNA nucleotide compared with an RNA nucleotide.

Name structure R in a DNA nucleotide and in an mRNA nucleotide.

(1)

DNA nucleotide .....

mRNA nucleotide .....

(iii) Which of the following bases would be found in a DNA nucleotide, but not in an RNA nucleotide?

(1)

☒ **A** Adenine

☒ **B** Cytosine

☒ **C** Guanine

☒ **D** Thymine

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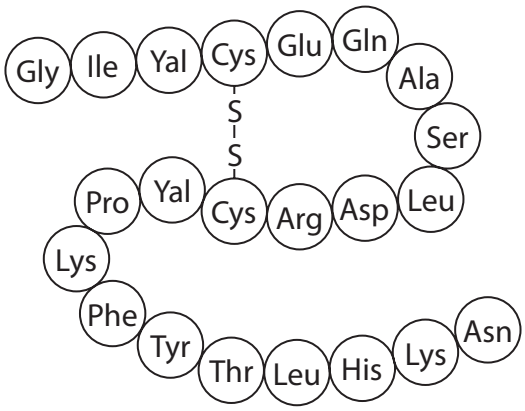
(b) The diagram shows a polypeptide chain.



(i) Which row shows the correct type of monomer and the type of reaction that joins the monomers together?

(1)

		Monomer	Type of reaction
☒	**A**	amino acid	condensation
☒	**B**	amino acid	hydrolysis
☒	**C**	fatty acid	condensation
☒	**D**	fatty acid	hydrolysis

(ii) Which of the following types of bond are involved in forming the tertiary structure of a protein?

(1)

☒ **A** disulfide bridge, ester bond and ionic bond

☒ **B** disulfide bridge, hydrogen bond and ionic bond

☒ **C** disulfide bridge, ester bond and hydrogen bond

☒ **D** disulfide bridge, glycosidic bond and hydrogen bond

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(iii) Describe the role of RNA in the formation of this polypeptide chain.

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(Total for Question 3 = 9 marks)

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4 Red blood cells contain haemoglobin.

(a) Oxygen molecules enter red blood cells and bind to haemoglobin.

Glucose molecules can also enter red blood cells.

The table gives some information about these molecules.

Molecule	Properties
Glucose	large, polar molecule
Oxygen	small, non-polar molecule

Describe how oxygen and glucose molecules can enter red blood cells.

(2)

Oxygen .....

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Glucose .....

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(b) Collagen and haemoglobin are proteins associated with the cardiovascular system.

Give **three** differences between the structures of collagen and haemoglobin.

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(c) Haemolysis is the breaking open of a red blood cell, causing the release of haemoglobin.

The effect of concentration of three different alcohols on the haemolysis of red blood cells was investigated.

Samples of red blood cells were treated with different concentrations of three alcohols.

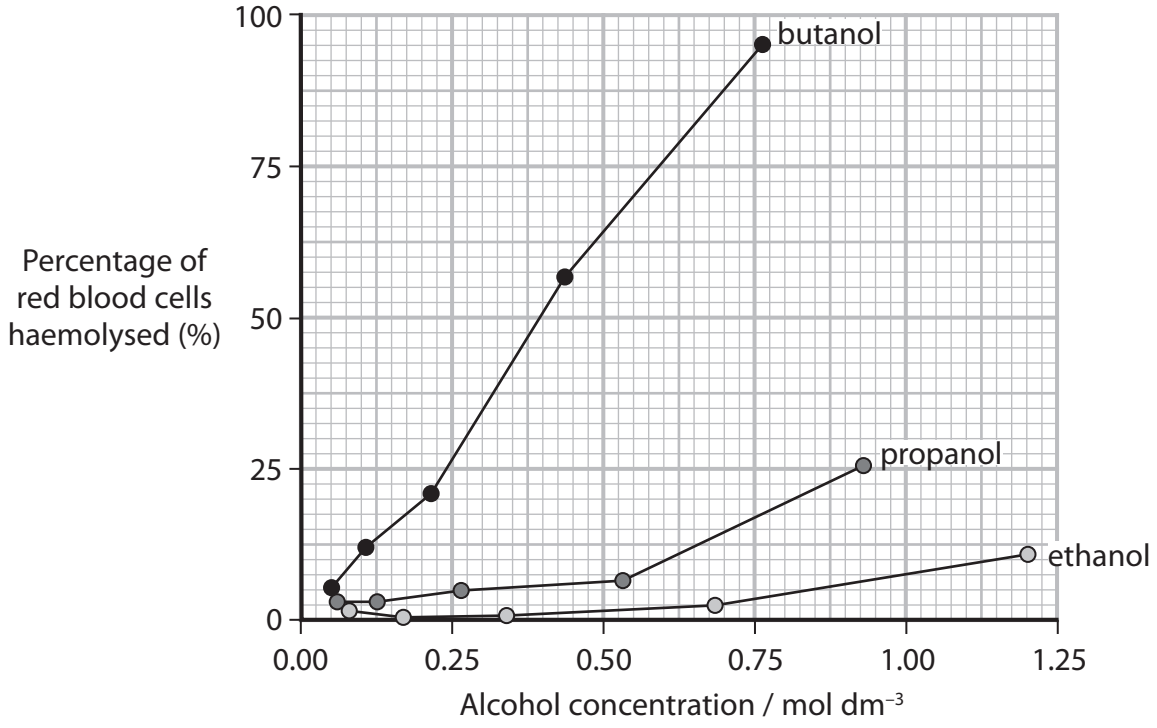
The table shows the formulae of the alcohols.

Alcohol	**Formula**
Ethanol	CH_3CH_2OH
Propanol	$CH_3CH_2CH_2OH$
Butanol	$CH_3CH_2CH_2CH_2OH$

A microscope was used to count the number of intact red blood cells.

The investigation was repeated twice.

The mean percentage of red blood cells that had haemolysed was calculated, and the results are shown in the graph.



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(i) State and justify a suitable control for this investigation.

(2)

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(ii) Evaluate the effect of concentration of the three alcohols on the haemolysis of red blood cells.

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(Total for Question 4 = 11 marks)

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5 Scientists have investigated the functions of DNA polymerase.

(a) (i) Describe the function of DNA polymerase in producing a polynucleotide.

(2)

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(ii) Scientists have discovered a property of DNA polymerase that detects and corrects errors in DNA replication.

Discuss the possible benefits of this property of DNA polymerase.

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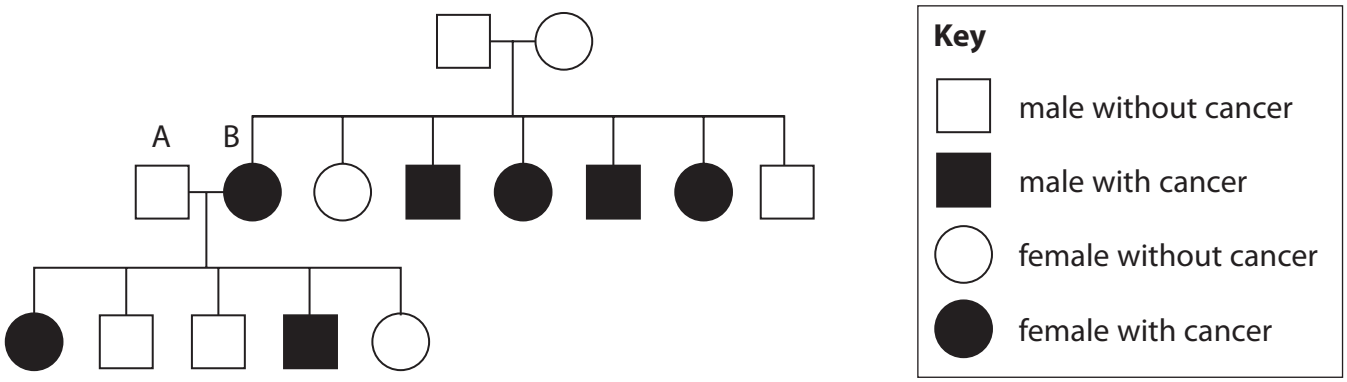
(b) Some people have DNA polymerase that cannot detect and correct errors in DNA replication.

These people have an increased risk of developing cancer.

The increased risk of cancer occurs when a person inherits two faulty recessive alleles of the DNA polymerase gene.

The pedigree diagram shows the development of cancer in one family.



Individuals A and B wish to have another child.

Explain why they may choose pre-implantation genetic diagnosis (PGD).

(2)

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(Total for Question 5 = 8 marks)

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6 The effect of enzyme concentration on the rate of reaction was investigated.

Starch is a polysaccharide.

(a) Which of the following statements about polysaccharides is correct?

(1)

☒ **A** starch contains amylose, a straight chain containing 1,6 glycosidic bonds

☒ **B** glycogen contains amylopectin, a branched chain containing both 1,4 and 1,6 glycosidic bonds

☒ **C** polysaccharides containing both 1,4 and 1,6 glycosidic bonds allow a rapid release of energy

☒ **D** starch and glycogen are both soluble in water

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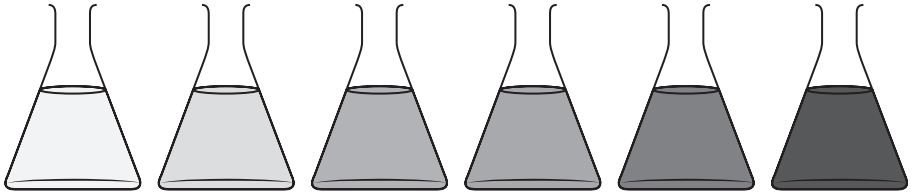
(b) Amylase breaks down starch into maltose.

The diagram shows the effect of adding iodine to flasks containing different concentrations of starch.



increasing concentration of starch present

no starch → high starch concentration

yellow-brown colour — blue-black colour

The effect of amylase concentration on the rate of reaction, at two different temperatures, was investigated.

The table shows the results of this investigation.

Enzyme concentration / mmol dm^{-3}	Rate of reaction at 30 °C / a.u.	Rate of reaction at 45 °C / a.u.
0	0	0
1	31	16
2	41	25
3	69	36
4	82	42
5	92	47
6	98	54
7	100	62
8	100	70

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*(i) Explain how to carry out a valid investigation to collect the data shown in the table.

(6)

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(ii) Comment on the effects of enzyme concentration and temperature in this investigation.

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(Total for Question 6 = 11 marks)

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7 Obesity indicators, such as body mass index (BMI), can be used to assess the risk of a person developing coronary heart disease (CHD).

(a) The table shows categories of BMI.

BMI	Classification
Less than 20	underweight
20–24.9	normal
25–29.9	overweight
30–40	obese
Greater than 40	severely obese

A man has a body mass of 65 kg.

He has a normal BMI.

Calculate the minimum and maximum possible heights for this man in metres.

Use the formula

$$\text{BMI} = \frac{\text{mass}}{(\text{height in m})^2}$$

(2)

minimum height ..... m

maximum height ..... m

(b) One risk factor for coronary heart disease (CHD) is obesity.

The table shows the incidence of CHD for people with a differing number of risk factors.

Number of risk factors	Incidence of CHD per 100 000 people
0	60
1	130
2	210
3	615

(i) Describe the relationship between the number of additional risk factors and the incidence of CHD.

(2)

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(ii) State **one** risk factor for CHD other than obesity.

(1)

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(c) The table shows the number of deaths due to CHD in three countries.

Country	Number of deaths per 100 000	
	Men	Women
England	240	110
France	100	20
Russia	700	200

Plot these data in a suitable graphical form.

(4)

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(d) Atherosclerosis is a type of cardiovascular disease (CVD) that causes the narrowing of coronary arteries.

(i) How many of the following types of medication would reduce the risk of CVD? **(1)**

- anticoagulants
- antihypertensives
- statins

☒ **A** none

☒ **B** one

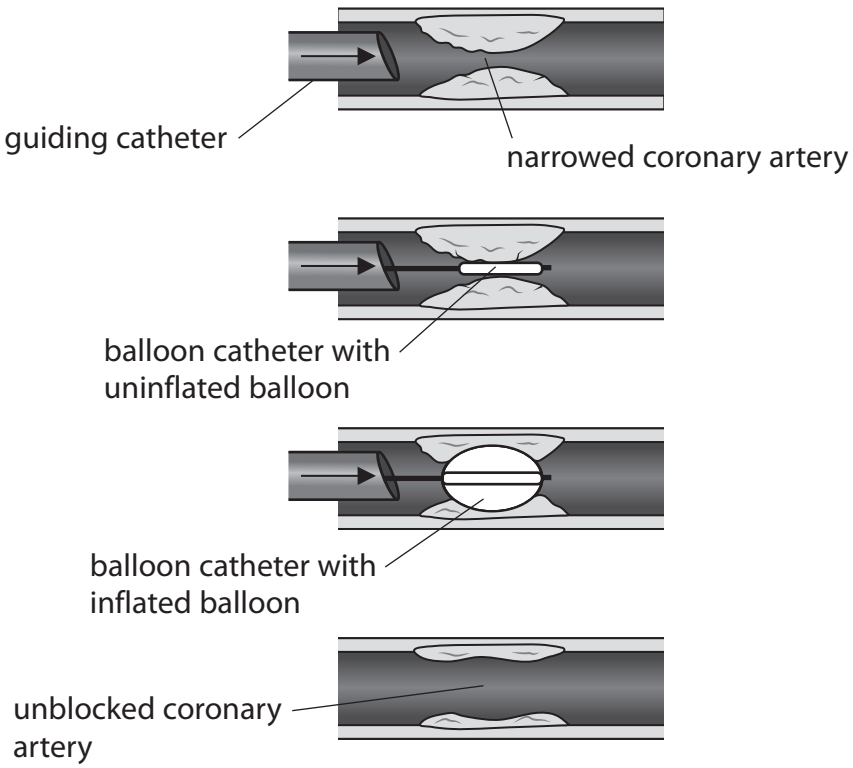
☒ **C** two

☒ **D** three

The diagram shows a procedure called balloon angioplasty.

Balloon angioplasty can reduce the immediate risk of a person having a heart attack.

It will not prevent further narrowing of coronary arteries due to atherosclerosis.



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(ii) Explain why balloon angioplasty could reduce the immediate risk of a person having a heart attack.

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(Total for Question 7 = 14 marks)

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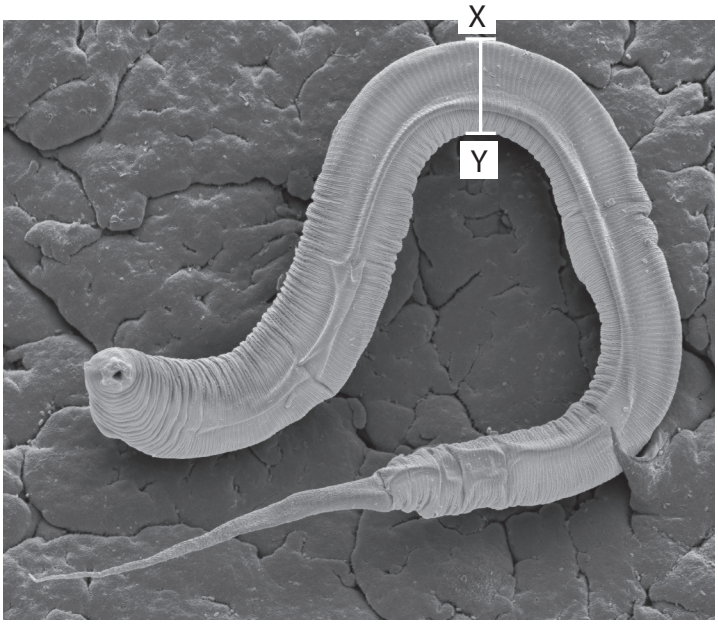
8 Some organisms do not have a circulatory system.

The photograph shows the nematode *Caenorhabditis elegans*, as seen using an electron microscope.



Magnification ×1300

(Source: © Science Photo Library/Alamy Stock Photo)

(a) (i) Calculate the actual width of the nematode from X to Y.

(2)

Answer ..... μm

(ii) Explain why this nematode does not need a circulatory system.

(2)

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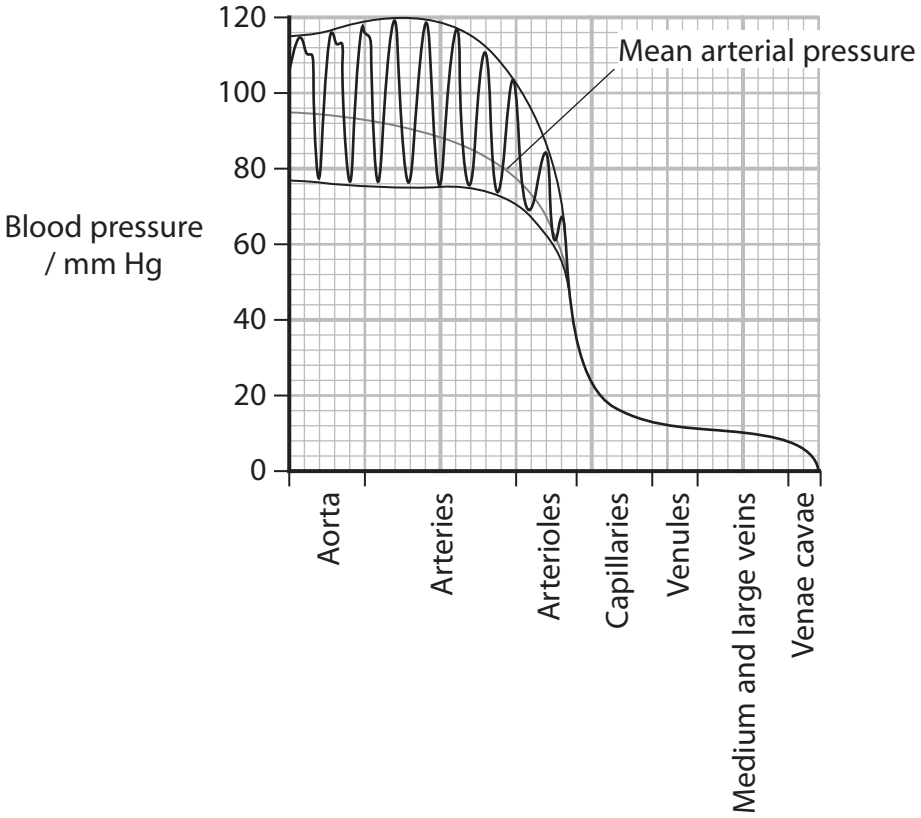
(b) Humans have a circulatory system.

The graph shows the change in blood pressure in different human blood vessels.



(i) Explain why the blood pressure increases and decreases in the aorta.

(2)

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(ii) Calculate the percentage decrease in blood pressure as blood travels through the capillaries.

Give your answer to two significant figures.

(2)

Answer ..... %

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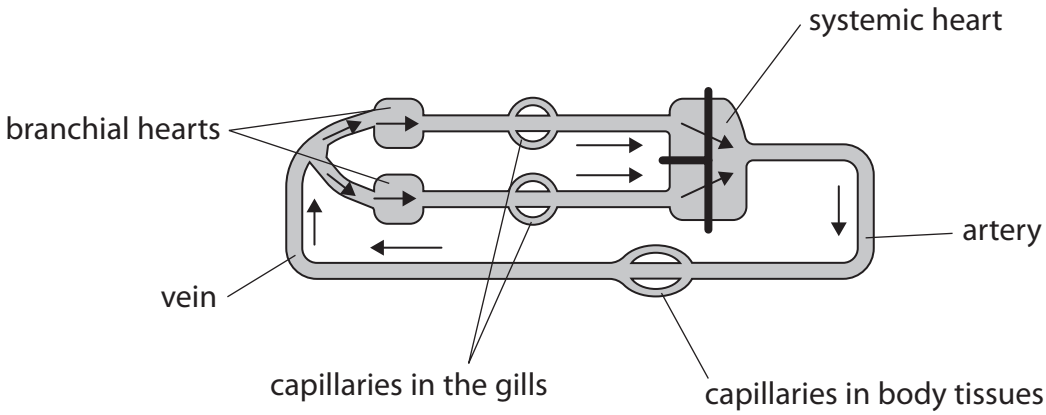
(c) The squid is an invertebrate animal that lives in the sea.

The photograph shows a squid.

(Source: © bonchan/Shutterstock)

The diagram shows the circulatory system of a squid.

The gills contain gas exchange surfaces.



(i) Compare and contrast the circulatory systems of a squid and a human.

(3)

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(ii) A student wished to investigate the effect of caffeine on the heart rate of some vertebrate and invertebrate organisms.

Describe two potential ethical issues which should be considered before the selection of organisms to include in this investigation.

(2)

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(Total for Question 8 = 13 marks)

TOTAL FOR PAPER = 80 MARKS

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