PEARSON EDEXCEL A-LEVEL BIOLOGY A · 9BN0

BIOLOGY



EXAM QUESTION PACK

TOPIC 1: LIFESTYLE, HEALTH AND RISK

SCORE	PERCENTAGE
/236	%

STEMUP

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Q1.

A study was carried out to determine the incidence of VTE in people of different ages. Those who developed VTE were then tested for the factor V gene mutation.

The results of this study are shown in the table.

Age range	Percentage incidence of VTE in the study group (%)	Percentage of VTE patients with factor V mutation in the study group (%)
less than 20 years of age	1.3	49.3
over 70 years of age	34.0	20.9

Deduce the relative impact of the genotype and environmental factors on the development of VTE.

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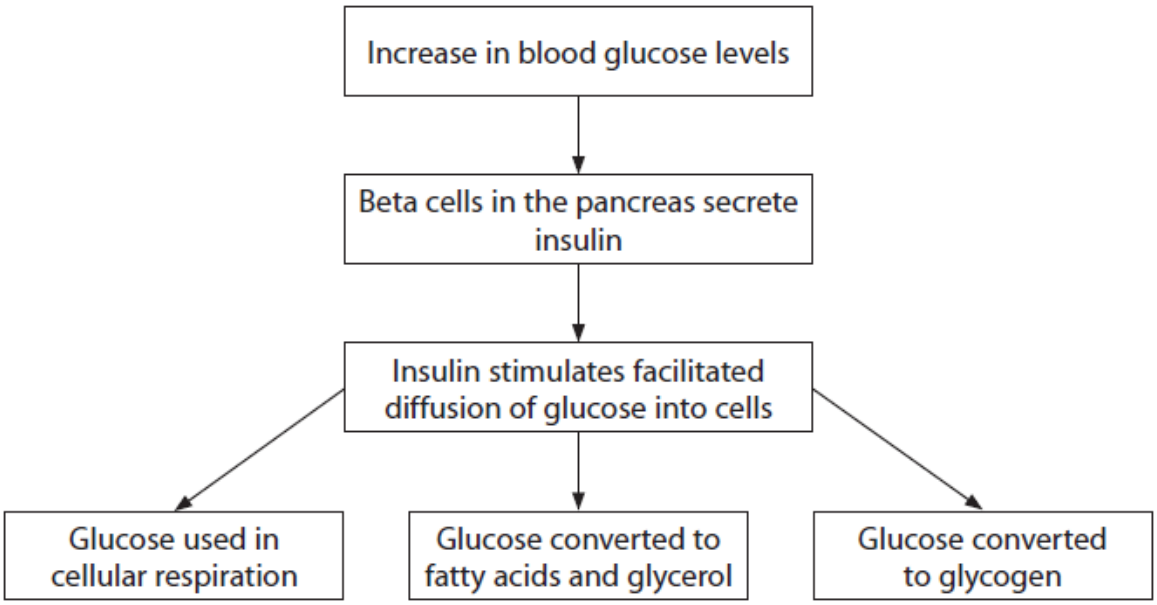
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(Total for question = 4 marks)

Q2.

The internal conditions within the body are maintained by homeostatic mechanisms. The regulation of blood glucose involves homeostatic mechanisms.

The diagram shows part of the sequence of events when there is an increase in blood glucose levels.



(i) Describe how glucose moves into cells by facilitated diffusion.

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(ii) Explain how the structure of glycogen allows it to be an energy store.

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(Total for question = 5 marks)

Q3.

Cardiovascular disease (CVD) is a major cause of death and disability in the UK.

It has been suggested that magnesium ions are involved in regulating the ratio of HDL to LDL in the blood.

(i) Describe the role of LDLs in the development of atherosclerosis.

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(ii) Explain how atherosclerosis can result in damage to heart muscle.

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(Total for question = 6 marks)

Q4.

Thrombophilia is a condition that increases the risk of blood clots forming.

This condition increases the risk of venous thromboembolism (VTE), a condition where a blood clot forms in a vein. Thrombophilia due to the production of overactive factor V can be inherited.

Factor V is involved in the conversion of prothrombin to thrombin.

(i) Describe the role of thrombin in blood clotting.

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(ii) Explain why a mutation in the gene coding for the protein factor V may increase the risk of VTE.

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(Total for question = 6 marks)

Q5.

Sweating is a thermoregulatory mechanism.

A student stated that loss of heat when sweating is related to the dipole nature of water molecules.

Justify this statement.

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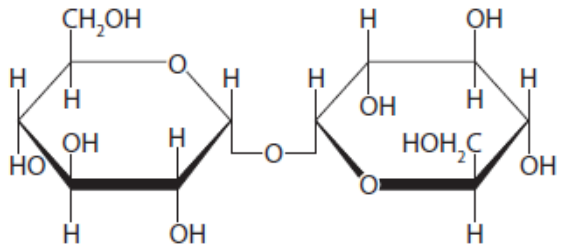
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(Total for question = 3 marks)

Q6.

Maltose and trehalose are disaccharides. Trehalose is formed from two molecules of α-glucose.

The diagram shows a molecule of trehalose.



(i) Describe the reaction that joins two α-glucose molecules to form a disaccharide.

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(ii) Compare and contrast the structures of trehalose and maltose.

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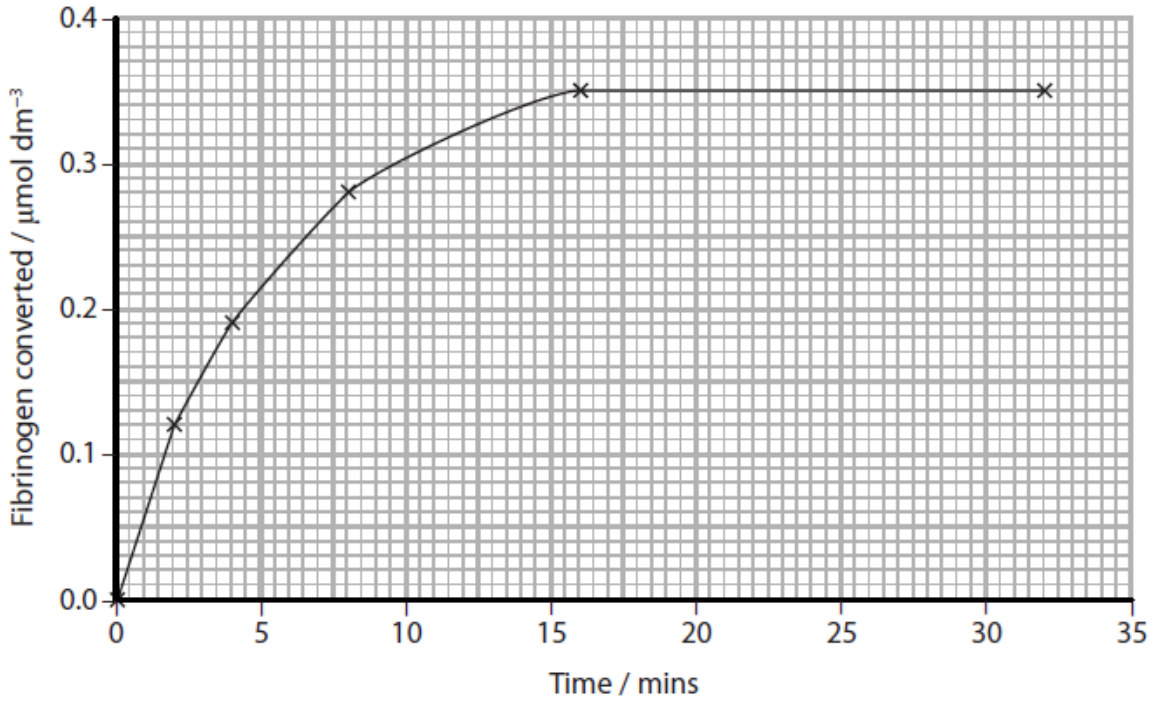
(Total for question = 4 marks)

Q7.

Fibrin is involved in the formation of blood clots.

Thrombin is an enzyme that converts fibrinogen to fibrin.

The graph shows the effect of one concentration of thrombin on the conversion of fibrinogen to fibrin.



(i) Calculate the initial rate of reaction.

(2)

Answer .....

(ii) On the graph, draw a line to show the effect of halving the concentration of thrombin.

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(iii) Explain the effect of changes in the initial rate of reaction on the time taken for a blood clot to form.

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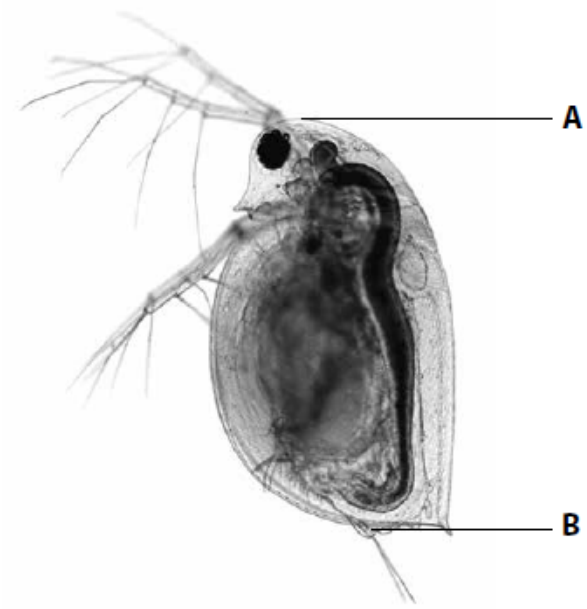
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(Total for question = 5 marks)

Q8.

A student investigated the effect of temperature on the heart rate of *Daphnia*.



Magnification ×60

(Source: http://www.nature-education.org/water-life.html)

(a) Use the lines A to B to calculate the actual length of this *Daphnia*.

(2)

Answer .....

(b) The student used five *Daphnia* in the investigation.

The *Daphnia's* heartbeats were counted over a 20-second period.

A stopwatch was used and a pencil mark made on a piece of paper while observing the *Daphnia* through a low powered microscope.

The number of heartbeats was counted three times for each *Daphnia*.

This was repeated at five different temperatures using the same *Daphnia* each time.

This was then repeated using the four other *Daphnia*.

The results obtained are shown in the table below.

Daphnia	Heart rate / beats in 20 seconds														
	5 °C			10 °C			15 °C			20 °C			25 °C		
1	20	18	19	30	26	29	36	35	36	42	45	44	53	47	53
2	22	23	19	36	32	29	36	39	34	42	46	42	50	51	63
3	16	18	20	26	30	27	35	33	36	39	41	40	58	52	50
4	19	22	21	30	32	35	38	36	37	45	46	42	62	62	58
5	20	25	21	35	32	34	36	39	38	44	48	42	52	55	59

(i) Explain why the number of heartbeats was measured in 20 seconds rather than in one minute.

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(ii) The mean heart rate at 5 °C is 20.2 beats in 20 seconds. Calculate how many times faster the mean heart rate is at 25 °C than at 5°C.

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Answer .....

(iii) The student concluded that temperature increased the heart rate of *Daphnia*.

Analyse the data to explain how this investigation could be modified to improve the validity of this conclusion.

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(c) Discuss the ethical issues that might arise from the use of invertebrates in investigations.

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(Total for question = 13 marks)

Q9.

An investigation was carried out to study the effect of alcohol concentration on heart rate in *Daphnia*.

Give one reason why some people believe that there are fewer ethical issues when using *Daphnia* for this investigation rather than using a species of mammal.

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(Total for question = 1 mark)

Q10.

The scientific article you have studied is adapted from articles from Nature, Scientific American and the ScienceDaily website.

Use the information from the scientific article and your own knowledge to answer the following questions.

(a) Give the name of the 'simpler molecules' produced by the breakdown of glucose that can enter the mitochondria (paragraph 3).

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(b) (i) Describe the role of oxygen in the 'last reaction' involved in aerobic respiration in the mitochondria (paragraph 3).

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(ii) Explain how carbon monoxide reduces the production of ATP in the electron transport chain (paragraphs 3 and 4).

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(c) Explain how nitric oxide (NO) released by nerve endings could result in vasoconstriction of blood vessels (paragraphs 7 and 9).

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(d) Explain how free radicals may be involved in the production of P53 in the cell (paragraph 17).

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(e) Describe **three** structural differences between the inner mitochondrial membrane and the outer mitochondrial membrane (paragraphs 18 and 19).

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(f) Long wavelengths of light, in the near infrared (NIR) spectrum, appear to be able to modulate cell respiration by affecting cytochrome oxidase (paragraph 30).

Deduce how this may explain why NIR phototherapy has 'shown promise' in reducing cell death caused by myocardial infarction (paragraph 34).

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(g) (i) Describe how scientists could have produced 'genetically modified neurons' described in paragraphs 38 and 39.

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(ii) A light sensitive protein is channelrhodopsin-2. This is a channel protein that spans membranes. When exposed to blue light these channel proteins open and allow sodium ions to flow through.

Explain how a brief flash of light could cause neurotransmitter to be released by 'the genetically modified neurons' (paragraphs 38 and 39).

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(h) Explain how fMRI allowed Vandewalle to make the observations described in paragraph 50.

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(Total for question = 30 marks)

Q11.

Nandrolone is an anabolic steroid, it is a molecule with a similar shape to testosterone. Nandrolone has been used as a performance-enhancing substance by athletes in the past.

A number of investigations with mice have been carried out to study the effect of nandrolone on the structure and function of the aorta.

In these investigations, all the mice were of one type and were all supplied with the same amount of food and water. These mice were placed into four groups.

Each group was treated differently for eight weeks. The treatments are shown in the table.

Group	Treatment	
	Allowed to exercise	Given nandrolone
P	No	No
Q	No	Yes
R	Yes	No
S	Yes	Yes

After eight weeks, the aorta of each mouse was studied.

(i) In investigation 1, samples of aorta were put under tension to test elastic recoil.

The tension was removed and the mean maximum percentage recoil for each group was found.

The results are shown in the table.

Group	Mean maximum percentage recoil (%)
P	57
Q	38
R	80
S	53

The use of nandrolone has been linked to a variety of cardiovascular conditions.

Explain how the use of nandrolone could lead to atherosclerosis.

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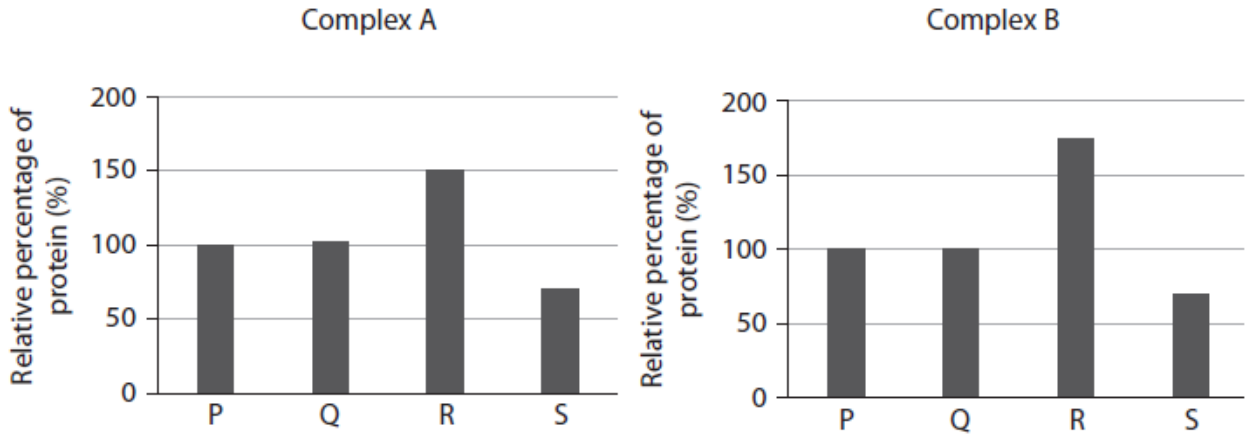
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(ii) In investigation 2, some of the cells from the middle layer of the aortas of the

mice were removed.

Two protein complexes, A and B, are found in the cells of the middle layer.
These protein complexes are involved in the electron transport chain.

The graphs show the relative percentage of these two protein complexes in each group of mice.



Comment on the effects of nandrolone on the production of ATP.

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(iii) The transcription factor Tfam is involved in the production of mitochondria.

In investigation 3, some of the cells from the middle layer of the aortas of the mice were removed. The quantity of mRNA per cell coding for Tfam was measured.

The results are shown in the table.

Group	Quantity of mRNA per cell coding for Tfam / a.u.
P	100 ± 20
Q	75 ± 10
R	170 ± 25
S	85 ± 15

A student concluded that nandrolone affects the quantity of mRNA per cell coding for Tfam.

Explain why this conclusion is not valid for all the mice.

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(Total for question = 8 marks)

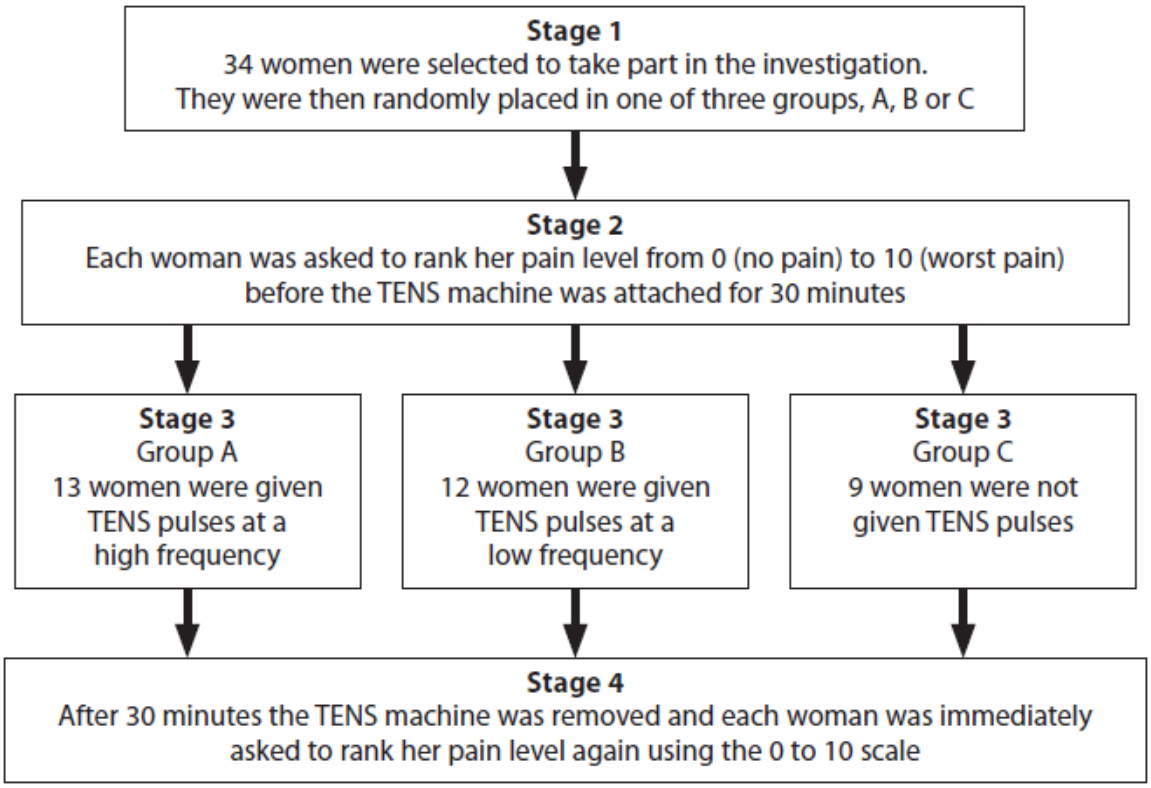
Q12.

Some women need to have surgery to aid childbirth. This can lead to pain after surgery.

A TENS (transcutaneous electrical nerve stimulation) machine releases regular pulses of electricity onto the skin surface and can be used in pain relief.

An investigation was carried out to study whether the frequency of the pulses from a TENS machine could help these women with their pain relief.

The diagram shows how the investigation was carried out.



Explain why group C was included in this investigation.

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(Total for question = 2 marks)

Q13.

Sepsis is a bacterial infection in the bloodstream. Sepsis can cause tissue death in limbs. This may require parts of a limb to be removed (amputation).

Sepsis can cause blood clots to form and block the supply of blood to tissues in the limbs.

Explain why blood clot formation in capillaries could cause tissues to die.

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(Total for question = 2 marks)

Q14.

The largest blood vessels in the body are the aorta and the vena cava.

The wall of the aorta is thicker than the wall of the vena cava.

Explain why there is a difference in the thickness of the walls of the aorta and the vena cava.

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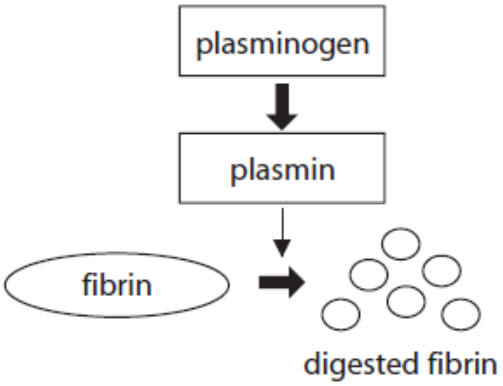
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(Total for question = 2 marks)

Q15.

Plasmin is an enzyme that digests fibrin.

Plasmin is produced, in the blood, from an inactive form of the enzyme called plasminogen.



Pharmaceutical companies have developed drugs that inhibit the activity of plasmin.

One of these drugs, tranexamic acid, is used in surgery to reduce blood loss.

(a) Explain why tranexamic acid will result in reduced blood loss during surgery.

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(Total for question = 3 marks)

Q16.

Fibrin is involved in the formation of blood clots.

Thrombin is an enzyme that converts fibrinogen to fibrin.

The table shows the results of an investigation into the fibrinogen concentrations in the blood of males and females with and without cardiovascular disease (CVD).

	Mean fibrinogen concentration / mg 100 cm^{-3}	
	With CVD	**Without CVD**
Males	333 ± 5.16	322 ± 2.00
Females	336 ± 7.25	319 ± 1.89

(i) Explain how the results of this investigation could be used to identify individuals at risk of CVD.

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(ii) Explain how changes in fibrinogen concentration might be a risk factor for CVD.

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(Total for question = 6 marks)

Q17.

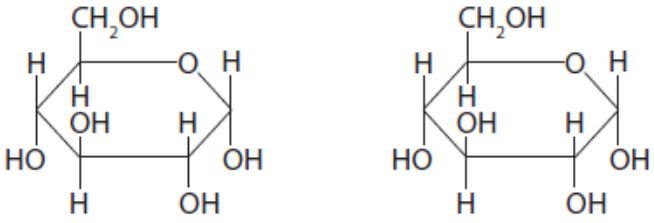
There are a number of reactions that regularly occur in cells.

Condensation reactions can be used to join a number of molecules together.

(i) The diagram shows two substrate molecules.

Draw the products when a condensation reaction occurs between the two substrate molecules.

(2)



(ii) Name the larger product formed in this reaction.

(1)

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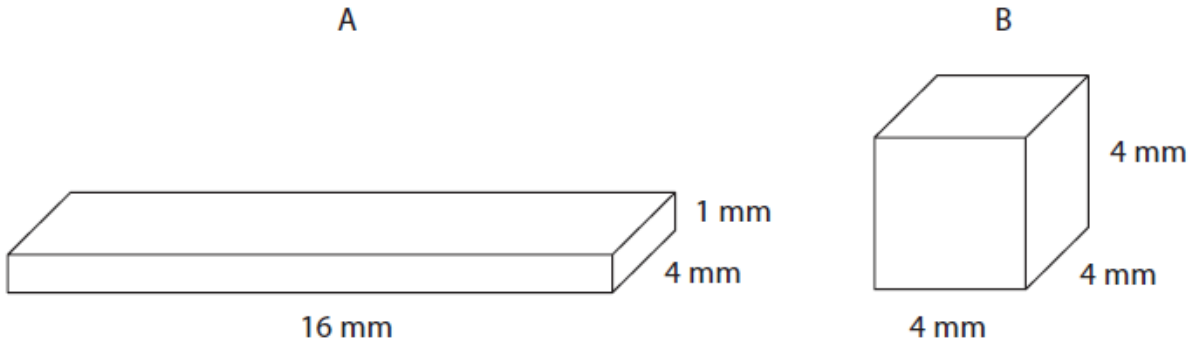
Q18.

Scientists can use models to explain the need for a circulation system in animals.

The shapes in the diagram represent two different animals that live in water.
The figures represent the height, width and breadth of the animals.

Determine why animal A does not need a circulation system but animal B does.

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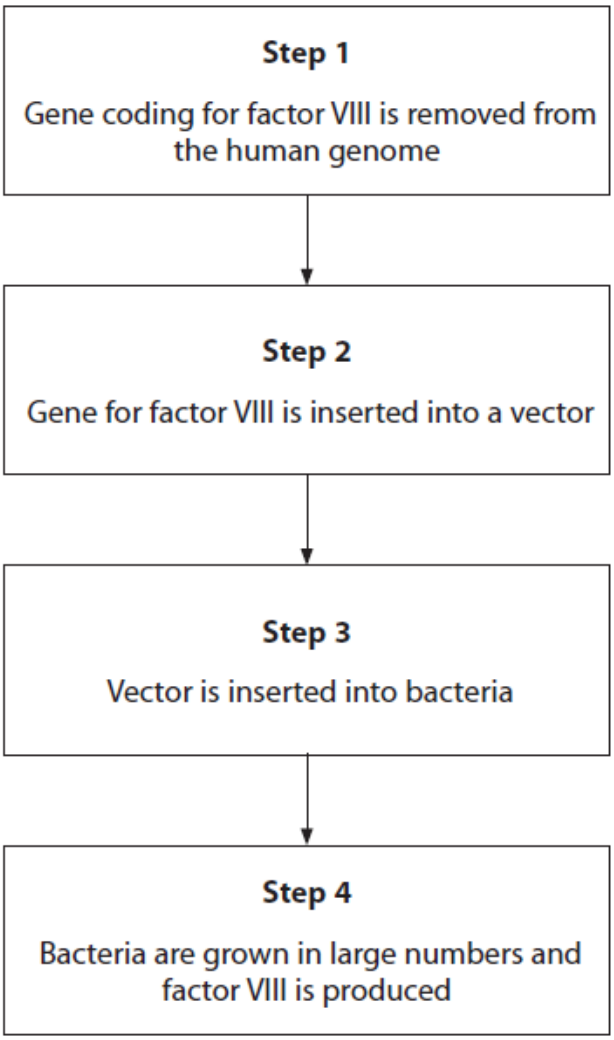
Q19.

Haemophilia is a genetic disorder where blood does not clot normally.

It can be treated by injecting factor VIII, a protein involved in the blood-clotting process that is not produced by people with haemophilia type A.

Bacteria can be genetically modified to produce factor VIII.

(a) The diagram shows some of the steps involved in genetically modifying bacteria to produce factor VIII.



(i) Describe the difference between a gene and the genome

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(ii) Give the name of the type of enzyme that would be used to insert the gene into the DNA of the vector at Step 2.

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(iii) Give an example of a suitable vector that would be used in Step 2 or 3.

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(iv) Describe how the genetically modified bacteria would use the gene from the human genome to produced factor VIII in Step 4.

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(b) Factor VIII is required for the activation of prothrombin.

Explain why the blood-clotting process does not take place normally when a person with haemophilia type A cuts their hand.

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(Total for question = 9 marks)

Q20.

The scientific article you have studied is adapted from several sources.

Use the information from the scientific article and your own knowledge to answer the following questions.

Give two reasons why doctors want to prevent people gaining excess weight (paragraph 28).

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(Total for question = 1 mark)

Q21.

Some people have a disorder that reduces their ability to produce an enzyme required to break down glycogen. This enzyme is glycogen phosphorylase.

The symptoms of this disorder include muscle weakness and lack of stamina when exercising.

(i) Explain why a low concentration of this enzyme would cause the symptoms described.

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(ii) Devise an experiment to investigate the effect of glycogen phosphorylase concentration on the breakdown of glycogen.

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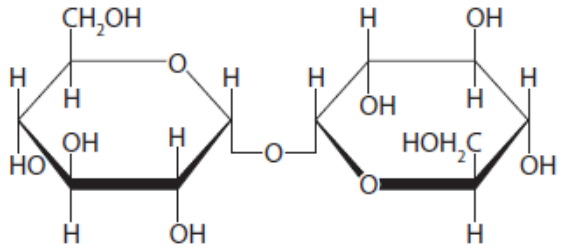
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Q22.

Maltose and trehalose are disaccharides. Trehalose is formed from two molecules of α-glucose.

The diagram shows a molecule of trehalose.



Some flying insects store trehalose and glycogen in their wing muscles.

(i) Trehalose is broken down to glucose by the enzyme trehalase.

Which of the following describes how glucose is produced from trehalose?

(1)

☒ **A** anabolism

☒ **B** catalysis

☒ **C** glycolysis

☒ **D** hydrolysis

(ii) Insect flight uses a lot of energy. Explain the advantage of insects storing both trehalose and glycogen.

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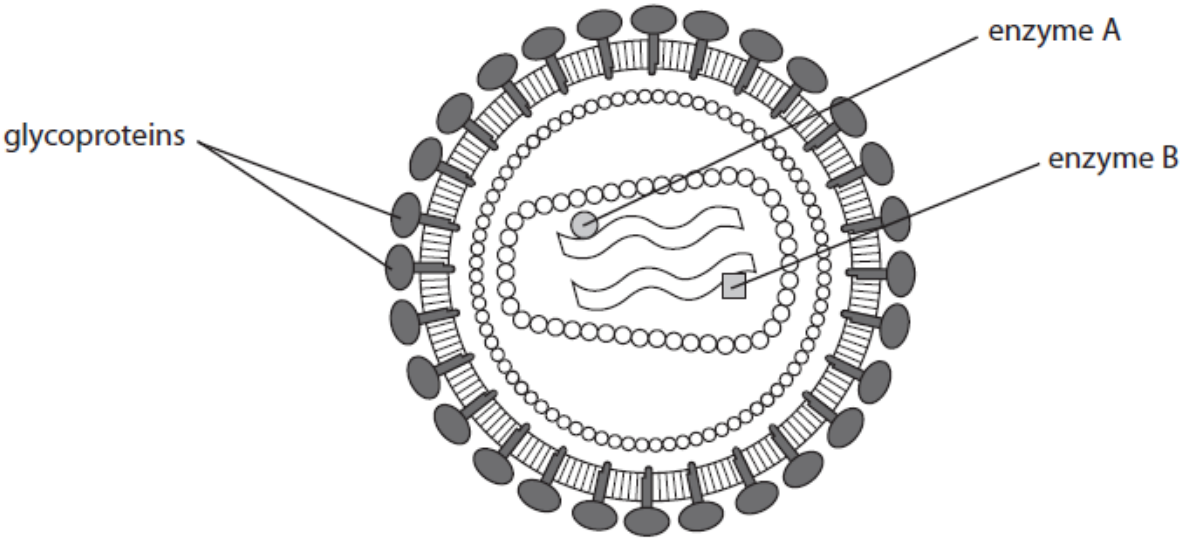
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(Total for question = 5 marks)

Q23.

Anti-viral drugs have been developed to treat patients infected with Human Immunodeficiency Virus (HIV).

The diagram below shows the structure of HIV.



(a) A glycoprotein has a carbohydrate attached to a protein molecule.
Describe the three-dimensional structure of a glycoprotein.

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(b) Some anti-viral drugs prevent HIV entering the host cells.

Suggest how these anti-viral drugs could prevent HIV entering the host cells.

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*(c) Describe how the enzymes shown in the diagram are involved in HIV infection.

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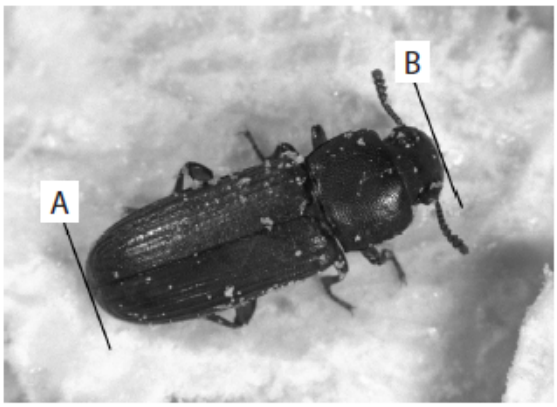
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(Total for question = 11 marks)

Q24.

The red flour beetle (*Tribolium castaneum*) is a food pest found in flour.

The photograph shows a red flour beetle.



(Source: © Nigel Cattlin/Alamy Stock Photo)

magnification ×15

The main food source for adult red flour beetles is starch.

Red flour beetles lay eggs that contain all the nutrients required for the development of the embryo.

The main food source in the eggs is glycogen.

Describe how starch can be used to make glycogen.

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(Total for question = 3 marks)

Q25.

Glucagon is a hormone that is usually released when the level of blood glucose falls too low.

Glucagon stimulates the liver to break down glycogen into glucose.

(i) Which of the following processes breaks down glycogen into glucose?

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☒ **A** condensation

☒ **B** hydrolysis

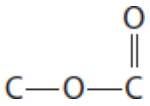
☒ **C** methylation

☒ **D** phosphorylation

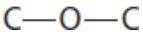
(ii) Which arrangement shows the structure of the bond that is broken in this process?

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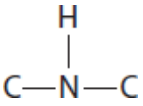
☒ **A**



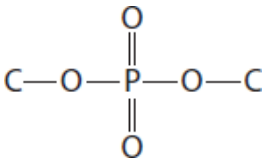
☒ **B**



☒ **C**



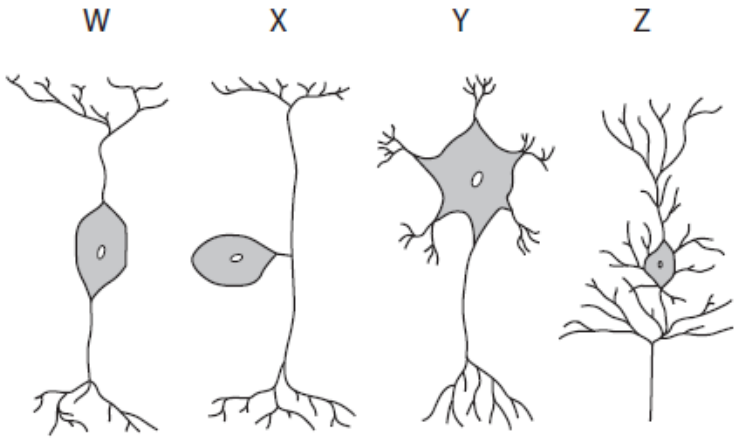
☒ **D**



Q1.

People with Guillain-Barré syndrome (GBS) suffer from a rapid onset of muscle weakness. It is thought that GBS is caused by damage to the peripheral nervous system.

The diagram shows some typical neurones.



(i) Which of these is a sensory neurone?

(1)

☒ **A** W

☒ **B** X

☒ **C** Y

☒ **D** Z

(ii) The axons of some neurones are surrounded by a myelin sheath.

The main component of myelin is a glycolipid.

Glycolipids are formed from lipids attached to a chain of

(1)

☒ **A** amino acids which are joined by glycosidic links

☒ **B** amino acids which are joined by peptide bonds

☒ **C** sugar molecules which are joined by ester bonds

☒ **D** sugar molecules which are joined by glycosidic links

(iii) Describe the role of the dendrites in a neurone.

(3)

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(Total for question = 5 marks)

Q2.

Obesity can be affected by both genetic and environmental factors. An indicator of obesity is the body mass index (BMI).

The effects of a gene called FTO, saturated fats and physical exercise on BMI were investigated.

There are two alleles (FTO^T and FTO^C) at the FTO locus.

(i) Which of the following describes what is meant by the term locus?

(1)

☒ **A** genetic code for a protein

☒ **B** holds together sister chromatids

☒ **C** location of a gene on a chromosome

☒ **D** paternal part of a genome

(ii) Compare and contrast the structures of a saturated fatty acid and an unsaturated fatty acid.

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(Total for question = 4 marks)

Q3.

An investigation was carried out to study the effect of alcohol concentration on heart rate in *Daphnia*.

In this investigation, *Daphnia* were placed into three groups of 10. Each group was placed in alcohol of a different concentration for five minutes.

After five minutes, each *Daphnia* was removed from the alcohol and its heart rate recorded every 15 seconds for one minute. A mean for each concentration was calculated.

The results are shown in the table.

Alcohol concentration / mol dm^{-3}	Mean *Daphnia* heart rate / beats per minute
0.00	221
0.17	176
0.34	97

(i) Give one reason why 10 *Daphnia* were used for each alcohol concentration.

(1)

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(ii) Explain why the *Daphnia* were left for five minutes in the alcohol before the heart rate was

recorded.

(2)

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(Total for question = 3 marks)

Q4.

An investigation was carried out to study the effect of alcohol concentration on heart rate in *Daphnia*.

Devise an investigation to find the lowest concentration of alcohol that has an effect on the heart rate of *Daphnia*.

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(Total for question = 5 marks)

Q5.

Devise a procedure that can be used to investigate the effect of cooking on the vitamin C content of cauliflower.

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(Total for question = 4 marks)

Q6.

Cells use ions in many different processes.

Explain why ions can dissolve in blood.

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(Total for question = 2 marks)

Q7.

Some lipoproteins may reduce fertility in mammals.

An investigation was carried out using mice of the same breed.

Female mice were divided into three groups, P, Q and R. Each group was given a different treatment.

The table shows the treatment given to the three groups of female mice.

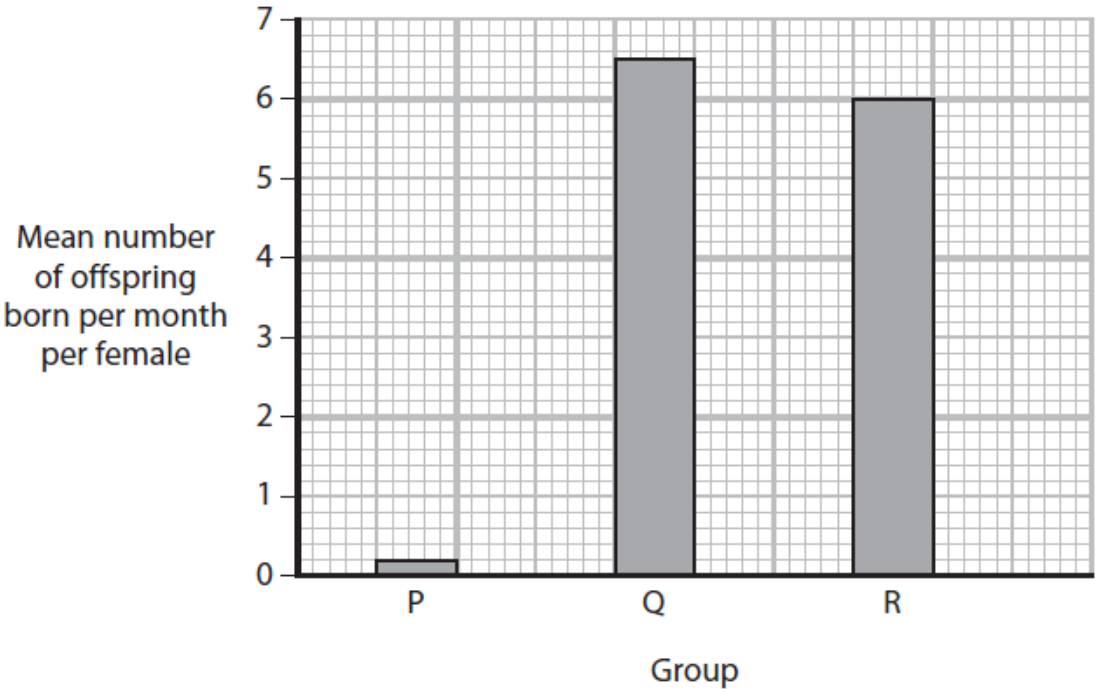
Group	Treatment
P	Genetically modified (GM) only
Q	Genetically modified and supplied with drug K
R	Supplied with drug K only

The GM mice have an increased concentration of high-density lipoproteins (HDLs) in their blood plasma.

Drug K was used to lower the blood plasma HDL levels.

The mice in each group were allowed to breed with non-genetically modified male mice and the number of offspring born was recorded.

The graph shows the results.



(i) The mice were all of one breed to improve data

(1)

☒ **A** accuracy

☒ **B** precision

☒ **C** quantity

☒ **D** validity

(ii) State a null hypothesis for this investigation.

(1)

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(iii) Comment on the effect of blood plasma HDL levels on the fertility of these female mice.

(4)

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(Total for question = 6 marks)

Q8.

As levels of activity increase, the heart can respond to the changing demand for oxygen.

During the cardiac cycle there are pressure changes in the chambers of the heart.

Explain how pressure differences in the heart ensure efficient pumping of the blood into the arteries.

(3)

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(Total for question = 3 marks)

Q9.

Studies have provided evidence for a link between heart rate when a person is at rest and various medical conditions.

In one study, the relationships between resting heart rate and the percentage incidence of coronary heart disease and cancer were investigated.

The results are shown in the table.

Range of resting heart rate / beats per min	Number of individuals in each range	Percentage incidence of condition (%)	
		Coronary heart disease	Cancer
< 59	961	4.2	1.0
60–69	2277	6.0	1.5
70–79	2120	7.5	2.0
80–89	1202	8.0	2.5
90–99	576	8.2	4.0
> 99	379	7.9	3.8

(i) Comment on the evidence for a link between resting heart rate and the percentage incidence of coronary heart disease and cancer.

(5)

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(ii) Give two reasons why there were different numbers of people in each resting heart rate group.

(2)

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(iii) Give two reasons why the number of people in each resting heart rate group did not affect the validity of this investigation.

(2)

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(Total for question = 9 marks)

Q10.

Trypsin is an enzyme found in many groups of living organisms.

Trypsin specifically acts on a polypeptide to form amino acids.

State the type of chemical reaction catalysed by trypsin.

(1)

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(Total for question = 1 mark)

Q11.

Doctors sometimes prescribe beta-blockers for their patients.

Beta-blockers are a type of drug with antihypertensive properties.

Explain why beta-blockers are prescribed for some people.

(2)

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(Total for question = 2 marks)

Q12.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

The cardiac cycle is the sequence of events in one heartbeat.
In humans, the cardiac cycle can be divided into three stages.

In the ventricular systole stage of the cardiac cycle, the

(1)

☐ **A** ventricles contract, atrioventricular valves close and semilunar valves open

☒ **B** ventricles contract, atrioventricular valves open and semilunar valves close

☒ **C** ventricles relax, atrioventricular valves close and semilunar valves open

☒ **D** ventricles relax, atrioventricular valves open and semilunar valves close

(Total for question = 1 mark)

Q13.

The cardiac output of the heart changes during exercise.

(a) During exercise, a person had a pulse rate of 140 beats per minute and a cardiac output of 17.0 dm^3 min^{-1}.

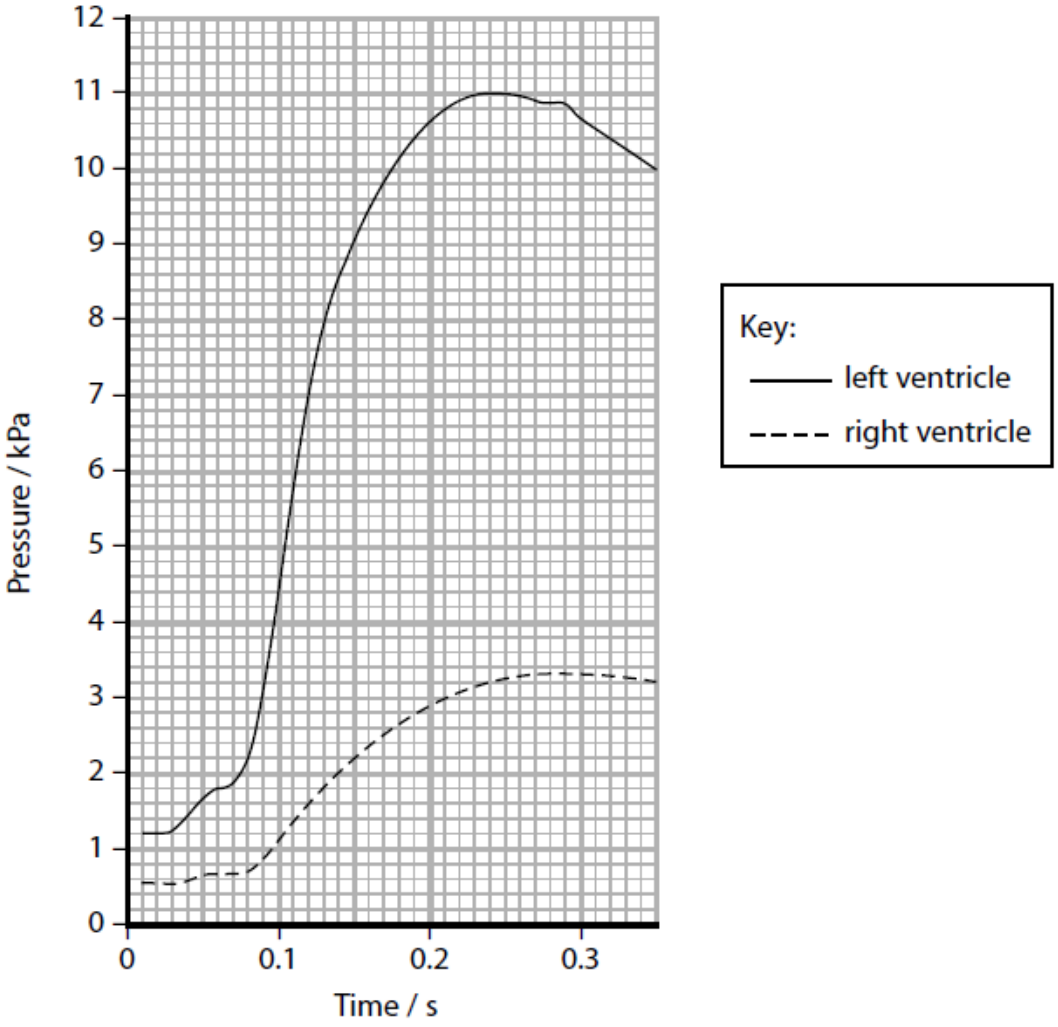
Calculate the stroke volume of the heart of this person.

(2)

Answer .....

(b) The maximum pressure in the left ventricle is 11.0 kPa and in the right ventricle 3.3 kPa.

The graph below shows the pressure changes in the two ventricles of the heart during part of the cardiac cycle.



(i) Explain why there is a difference in pressure in these two ventricles.

(3)

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(ii) Which row of the table shows the correct stage in the part of the cardiac cycle shown at 0.25 s in the graph?

(1)

		Stage in cardiac cycle	
		left ventricle	right ventricle
☒	A	diastole	diastole
☒	B	diastole	systole
☒	C	systole	diastole
☒	D	systole	systole

(Total for question = 6 marks)

Q14.

Nicotine is a drug found in the smoke of cigarettes.

The effect of inhaling nicotine on the circulatory system of rats was investigated.

In this investigation, three variables were considered:

- the concentration of nicotine in blood plasma
- the diameter of the lumen of one artery
- blood pressure

Two groups of rats were treated as shown in the table.

Group	Number of rats in group	Nicotine dose / mg
A	6	1.0
B	6	0.1

(i) The concentration of nicotine in the blood plasma of the group A rats was recorded at different times and

the means calculated.

The means are shown in the table along with the range of data for each mean.

Time of sampling / minutes	Mean concentration of nicotine in blood plasma / ng cm^{-3}
0 (immediately after inhalation)	35.0 ± 9.3
30 (after inhalation)	24.1 ± 5.6

Determine the maximum rate of decrease in the concentration of nicotine in the blood plasma per minute after being given the nicotine.

(2)

Answer ..... ng cm^{-3} min^{-1}

(ii) The diameter of the lumen of one artery, in each of the 12 rats, was measured

when the rats were resting. The blood pressure of each rat was also measured and the mean blood pressure calculated.

The diameter of the lumen of the artery and the blood pressure of each rat were then recorded at intervals, for a total of 30 minutes. The rats inhaled nicotine for the first minute (0.0 to 1.0).

The table shows the results for the mean diameter of the lumen of the artery.

Time / minutes	Mean diameter of lumen / μm	
	Group A (1.0 mg nicotine)	Group B (0.1 mg nicotine)
0.0	48	48
0.5	44	44
1.0	49	45
2.0	52	48
5.0	57	52
10.0	55	48
15.0	49	48
30.0	49	48

Determine the effect of nicotine concentration on the percentage change in lumen diameter in the first minute.

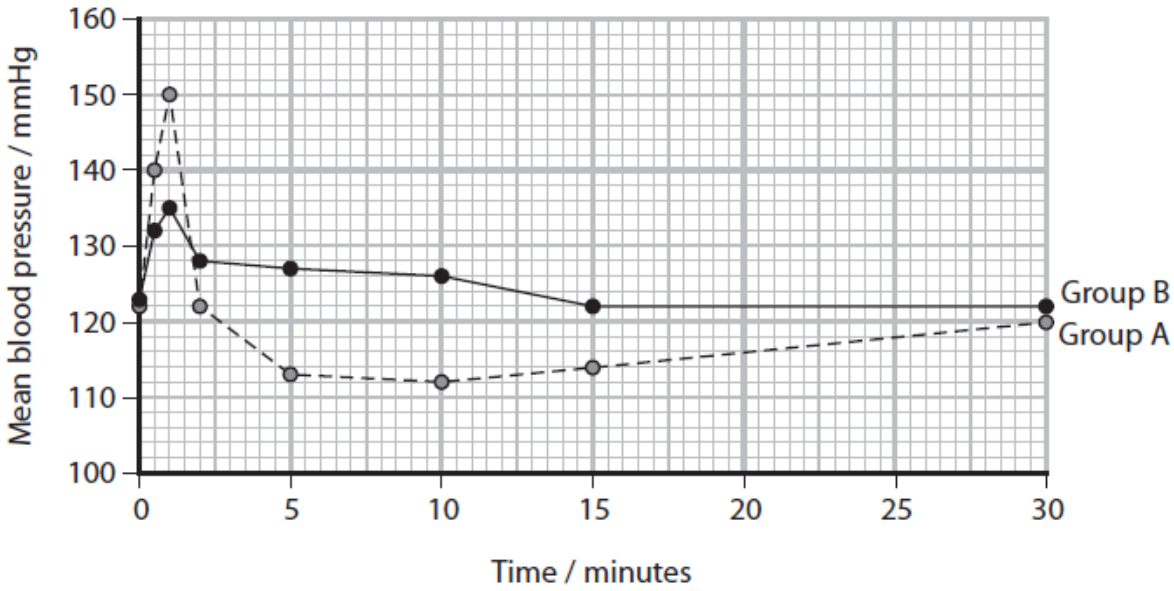
(2)

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*(iii) The graph shows the results for the mean blood pressure for the two groups

of rats. Nicotine was inhaled for the first minute.



It has been stated that:

'Nicotine gained from smoking cigarettes in humans causes an increase in blood pressure and a decrease in the lumen of arteries.'

Analyse all the data from this investigation using rats to evaluate the validity of this statement.

(6)

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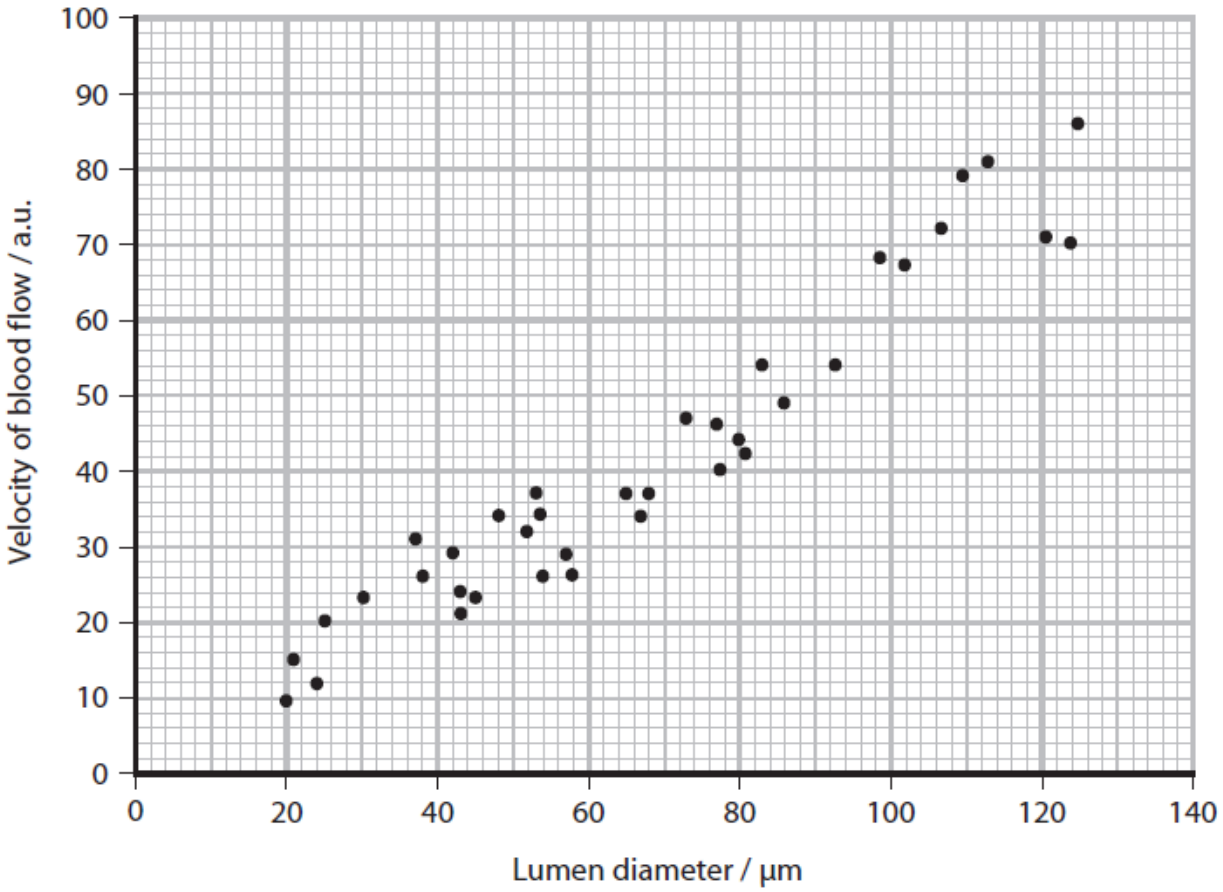
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(Total for question = 10 marks)

Q15.

The diameter of the inside of a blood vessel (lumen diameter) affects the speed of blood flow.

The graph shows the relationship between the lumen diameter of blood vessels and the velocity of blood flow.



State the relationship shown in the graph.

(1)

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(Total for question = 1 mark)

Q16.

Blood clotting is a process that is affected by genes.

Some people are at an increased risk of a condition called deep vein thrombosis (DVT). Blood clots form in the veins of people with DVT.

There are two alleles in a population, a wild type allele and G20210A.

The table shows the risk of DVT for people with different genotypes in this population.

Genotype	Risk of DVT / number of people with DVT per 1000 individuals
Homozygous wild type	1.0
Heterozygous for G20210A	2.5
Homozygous for G20210A	20.0

(i) Determine the effect of the allele G20210A on the risk of an individual developing DVT in this population.

(2)

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(ii) The frequency of the G20210A allele in a population of 10 000 individuals was investigated.

In this population, 50 individuals were homozygous for G20210A.

Calculate the number of individuals in the population who were heterozygous for the G20210A allele, using the Hardy-Weinberg equation:

$$p^2 + 2pq + q^2 = 1.0$$

(3)

Answer .....

(Total for question = 5 marks)

Q17.

Mucopolysaccharides are complex molecules found in the human body.

Mucopolysaccharides can be broken down by enzymes.

Describe how an enzyme could break down the polysaccharide component of mucopolysaccharides.

(2)

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(Total for question = 2 marks)

Q18.

Mucopolysaccharides are complex molecules found in the human body.

Mucopolysaccharides are large molecules containing unbranched polysaccharides.

Describe the structure of an unbranched polysaccharide.

(2)

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(Total for question = 2 marks)

Q19.

Blood from the lungs returns to the left side of the heart in the pulmonary vein. The pulmonary vein does not have valves.

(i) Describe how the atrioventricular (AV) valves work during one cardiac cycle.

(2)

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(ii) The structure of the pulmonary vein is different from the structure of the pulmonary artery.

Explain how this difference is related to the function of the pulmonary vein.

(2)

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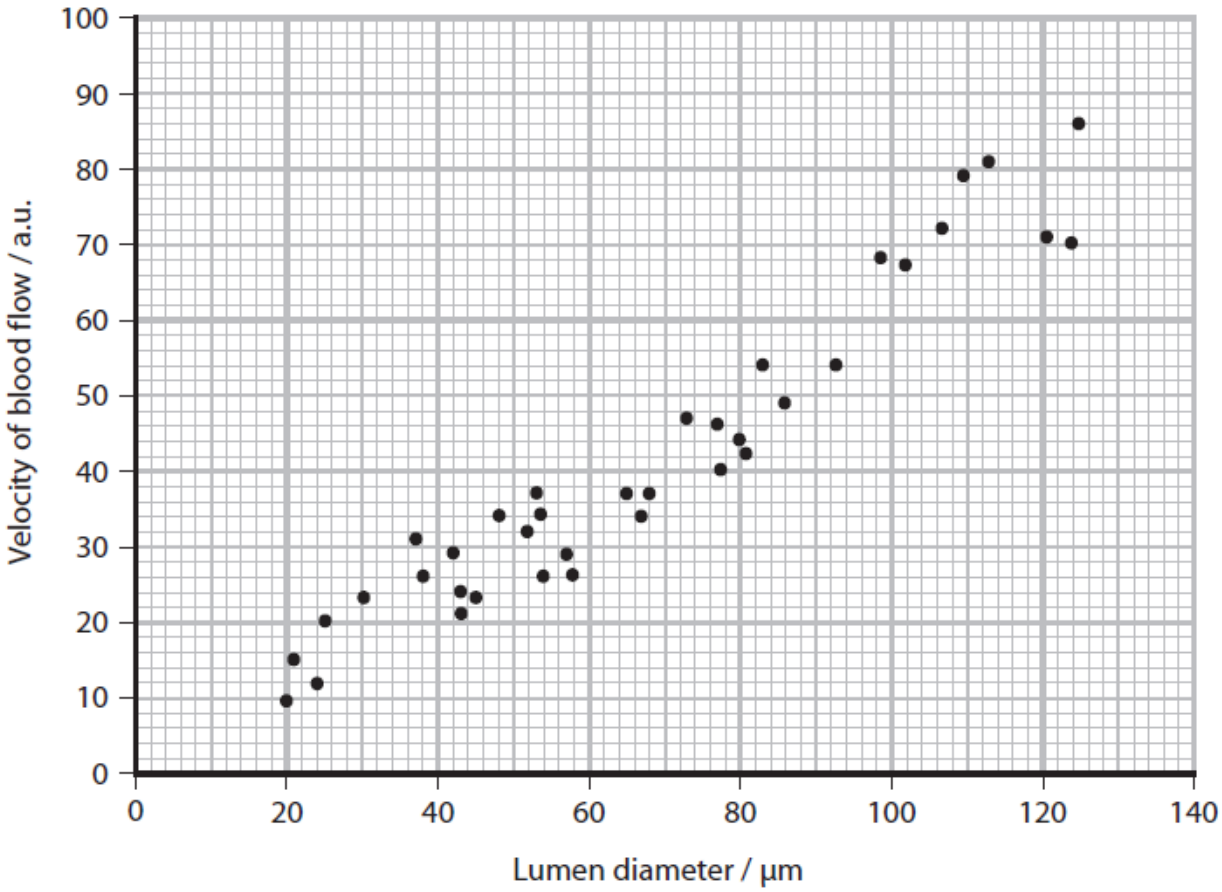
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(Total for question = 4 marks)

Q20.

The diameter of the inside of a blood vessel (lumen diameter) affects the speed of blood flow.

The graph shows the relationship between the lumen diameter of blood vessels and the velocity of blood flow.



(i) Explain how the development of cardiovascular disease (CVD) could affect the velocity of blood flow.

(2)

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(ii) Explain why a change in the velocity of blood flow will affect the function of the heart muscle.

(2)

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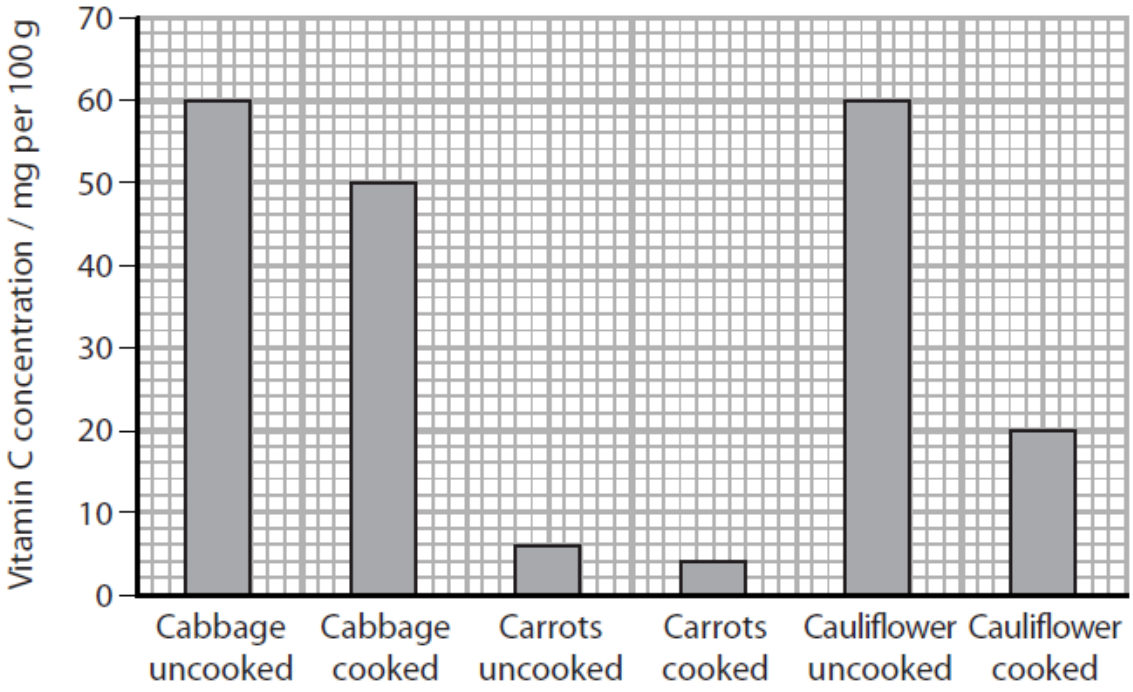
(Total for question = 4 marks)

Q21.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Vitamin C has antioxidant properties. The human body cannot make or store vitamin C.
A healthy diet must contain vitamin C.

The graph shows the concentration of vitamin C in a variety of cooked and uncooked vegetables.



(i) How many of the following conclusions are valid for these results?

- cooking destroys all of the vitamin C
- each vegetable contains less vitamin C when it is cooked than when it is uncooked
- cabbage contains the most vitamin C

(1)

☒ **A** 0

☒ **B** 1

☒ **C** 2

☒ **D** 3

(ii) The recommended daily value (DV) of vitamin C for men is 90 mg.

Calculate the mass of cooked cauliflower that would provide 90 mg of vitamin C.

(2)

Answer .....

(Total for question = 3 marks)

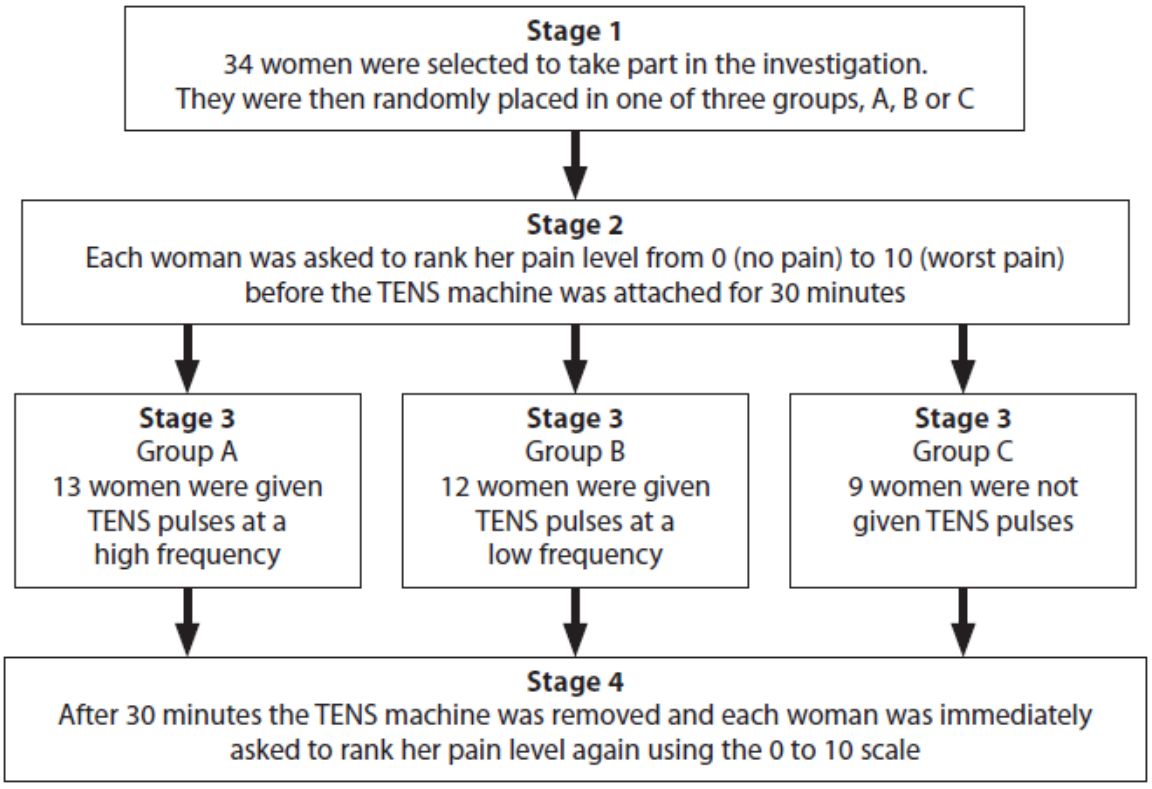
Q22.

Some women need to have surgery to aid childbirth. This can lead to pain after surgery.

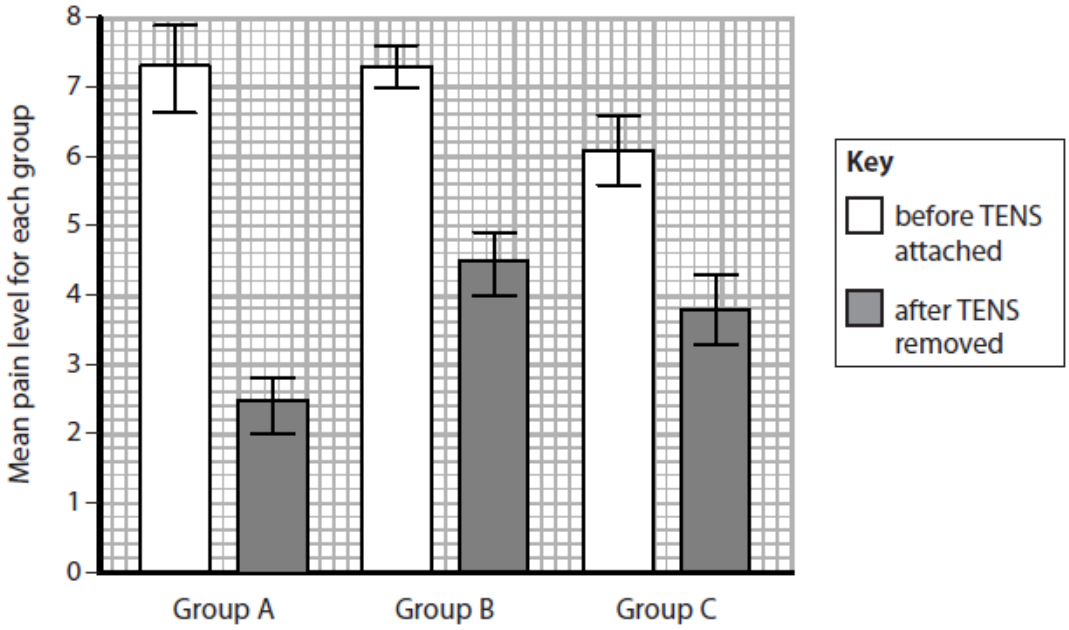
A TENS (transcutaneous electrical nerve stimulation) machine releases regular pulses of electricity onto the skin surface and can be used in pain relief.

An investigation was carried out to study whether the frequency of the pulses from a TENS machine could help these women with their pain relief.

The diagram shows how the investigation was carried out.



The results and range of data for the investigation are shown in the graph.



Determine the effectiveness of the use of a TENS machine in relieving pain following surgery.

(4)

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(Total for question = 4 marks)

Q23.

Changes in diet are affecting the health of people in the UK.

The table shows mean data for adult males in the UK in 1967 and 50 years later in 2017.

Year	Mean mass / kg	Mean height / cm	Mean BMI
1967	73	172	24.7
2017	84	178	

The National Health Service (NHS) states that BMI can be used to assess the weight category of an adult male. The table shows these categories.

Category	BMI range
Underweight	$\leqslant$18.4
Healthy weight	18.5 – 24.9
Overweight	25.0 – 29.9
Obese	$\geqslant$30.0

The mean BMI for adult males in 1967 indicates that they were in the healthy weight category.

Use the BMI formula to determine the mean weight category for adult males in 2017.

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

(2)

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(Total for question = 2 marks)

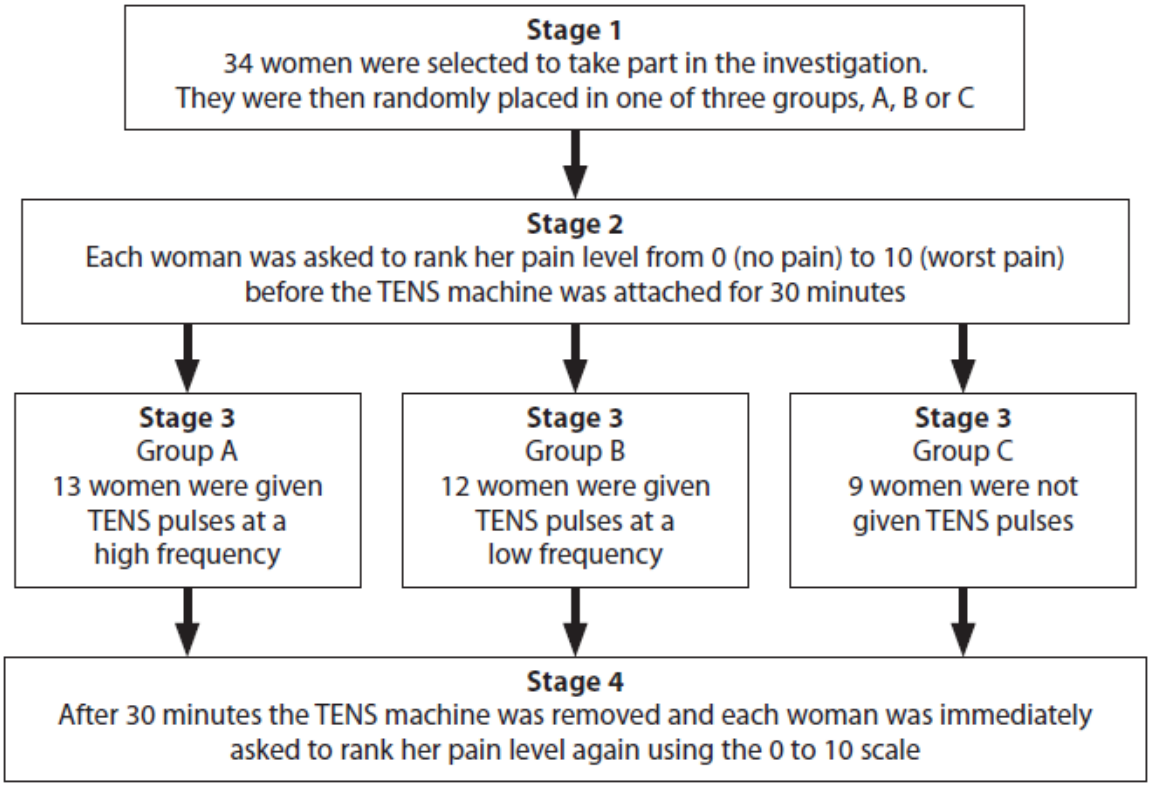
Q24.

Some women need to have surgery to aid childbirth. This can lead to pain after surgery.

A TENS (transcutaneous electrical nerve stimulation) machine releases regular pulses of electricity onto the skin surface and can be used in pain relief.

An investigation was carried out to study whether the frequency of the pulses from a TENS machine could help these women with their pain relief.

The diagram shows how the investigation was carried out.



Describe how the 34 women were selected in stage 1 to ensure that this investigation was valid.

(2)

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(Total for question = 2 marks)

Q25.

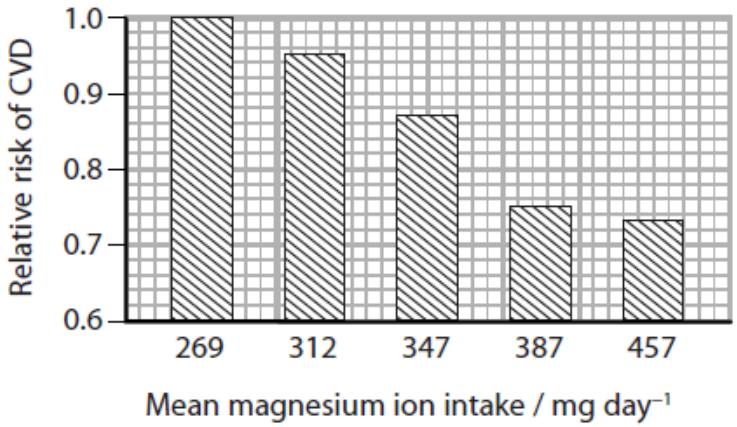
Cardiovascular disease (CVD) is a major cause of death and disability in the UK.

The relationship between magnesium ions in the diet and CVD has been studied.

In one study, magnesium ions were added to the diets of a group of men. The effect of this on the relative risk of CVD was recorded.

The mean normal dietary intake of magnesium ions is 269 mg day^{-1}.

The results of the study are shown in the graph.



(i) Which of the following statements can be made about the relationship between an increased magnesium ion intake and the risk of CVD in this study?

(1)

An increased magnesium ion intake

☒ **A** causes an increase in CVD

☒ **B** causes a reduction in CVD

☒ **C** is correlated with an increase in CVD

☒ **D** is correlated with a reduction in CVD

(ii) What is the daily increase in magnesium ion intake that reduces the relative risk of CVD by 0.13?

(1)

☒ **A** 43 mg day^{-1}

☒ **B** 78 mg day^{-1}

☒ **C** 118 mg day^{-1}

☒ **D** 347 mg day^{-1}

(Total for question = 2 marks)