

Lifestyle, Health and Risk Part -1

Name: _____

Class: _____

Date: _____

Time:

Total Marks Available:

Total Marks Archived:

Level: Edexcel A level Biology

Subject: Biology

Exam Board: Pearson Edexcel Level 3 GCE AS and A level Biology A (Salters-Nuffield) and also Pearsons Edexcel AS and A Level Biology B (9BI0) - Is however suitable for use by AS and A level Biology Students of other Boards

Topic: Lifestyle, Health and Risk Part -1

Type: Topic Questions

To be used by all students preparing for Edexcel AS and A level Biology A and Biology B - Students of other Boards may also find this useful

Questions

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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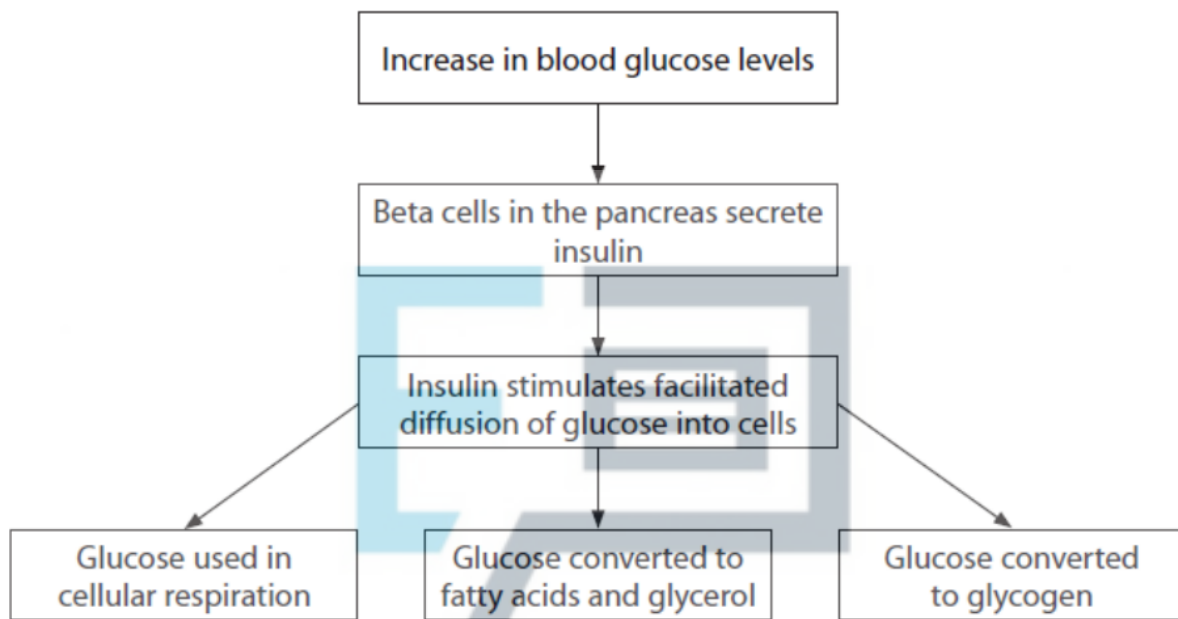
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(Total for question = 4 marks)

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)



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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.

(3)



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

(3)

(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.

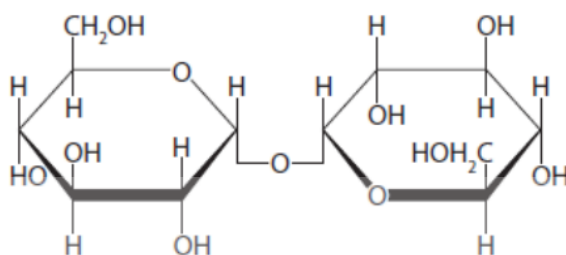
(3)

(Total for question = 6 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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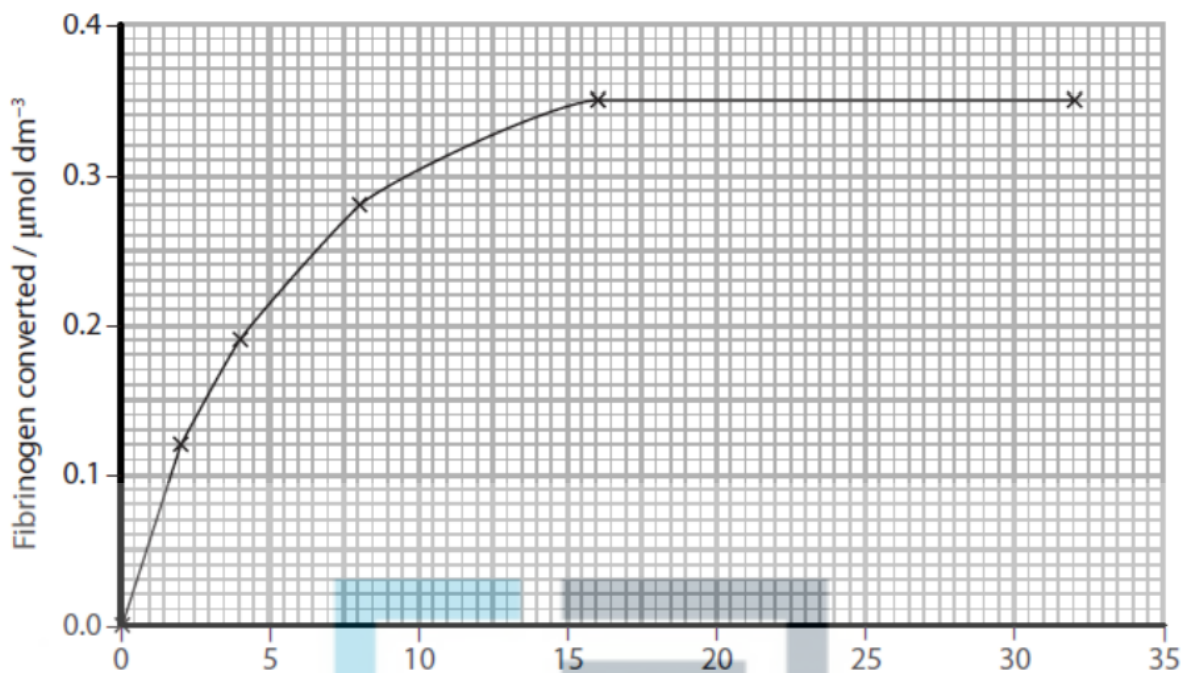
(Total for question = 3 marks)

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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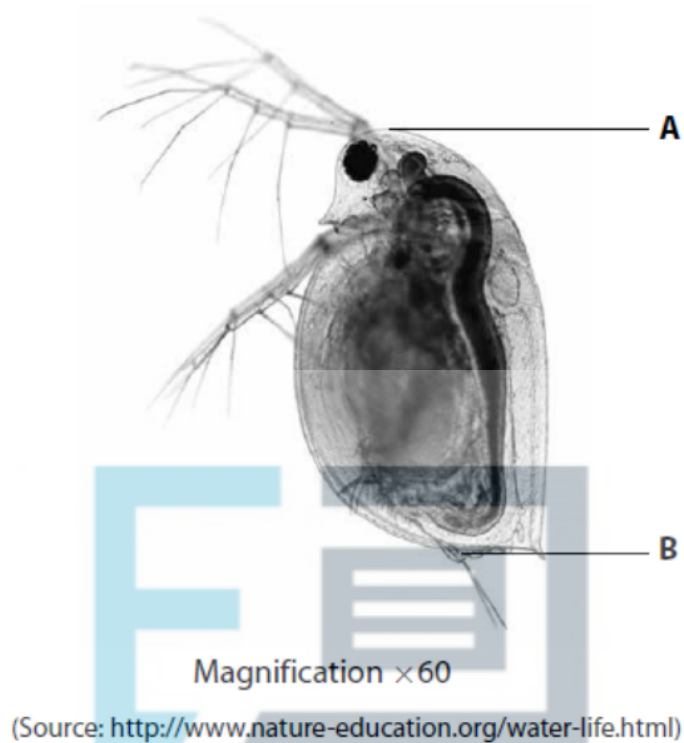
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(Total for question = 5 marks)

Q8.
A student investigated the effect of temperature on the heart rate of *Daphnia*.



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

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(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.

<i>Daphnia</i>	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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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 marks)

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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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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(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).

(5)



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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.

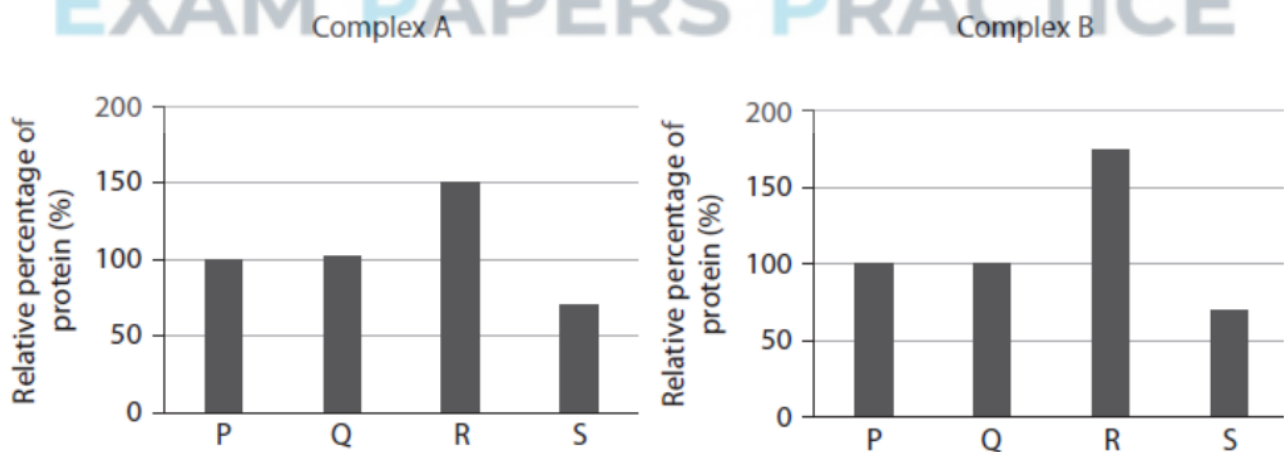
Explain how the use of nandrolone could lead to atherosclerosis.

(3)

(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.

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.

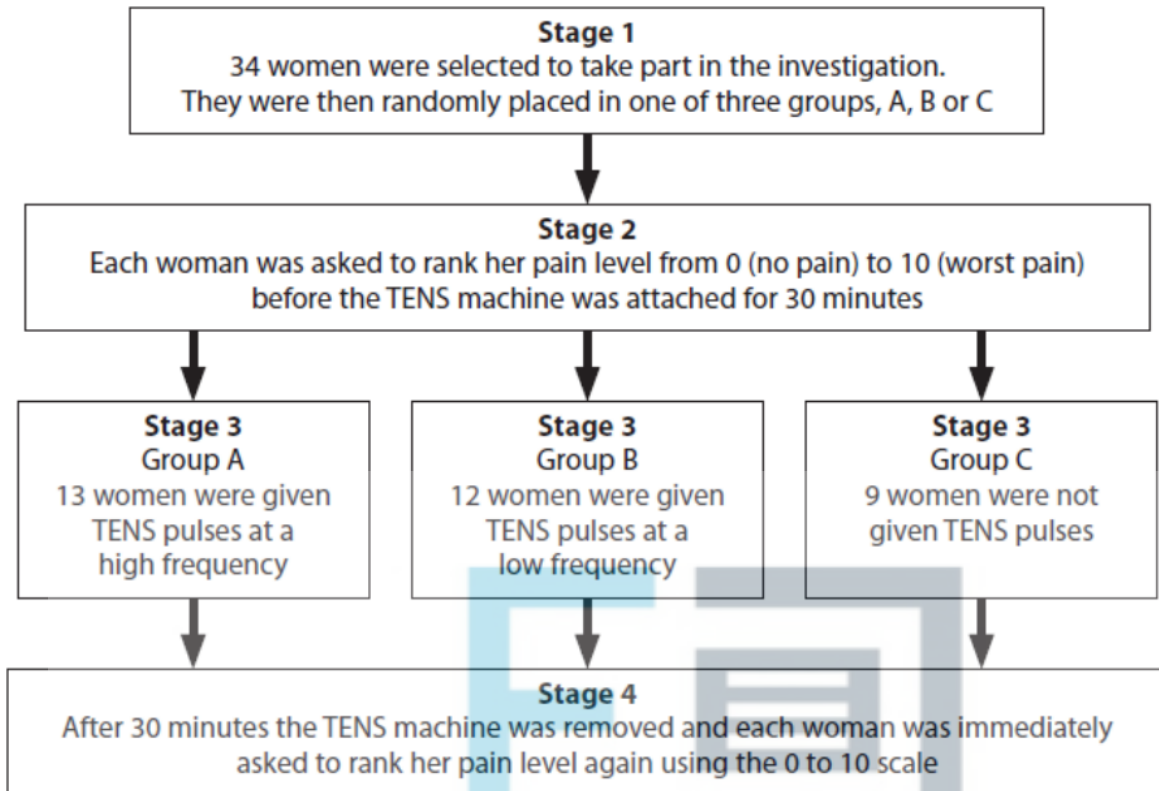
An investigation was carried out to study whether the frequency of the pulses from a TENS machine could help these women with their pain relief.

The diagram shows how the investigation was carried out.

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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)

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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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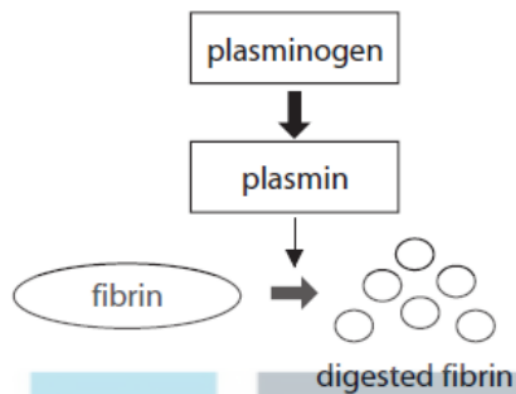
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(Total for question = 2 marks)

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 = 2 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.

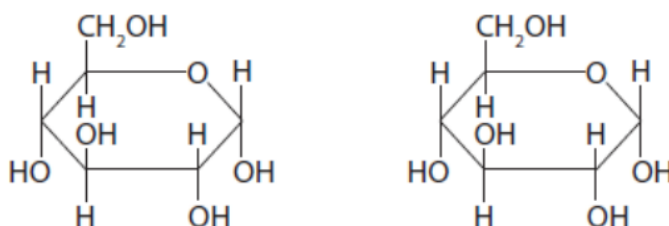
There are a number of reactions that regularly occur in cells.

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.

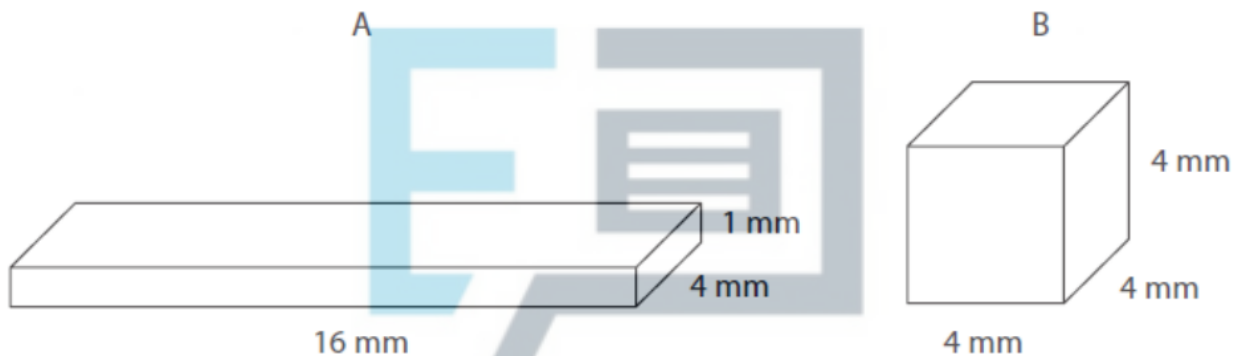
(1)

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.



(Total for question = 4 marks)

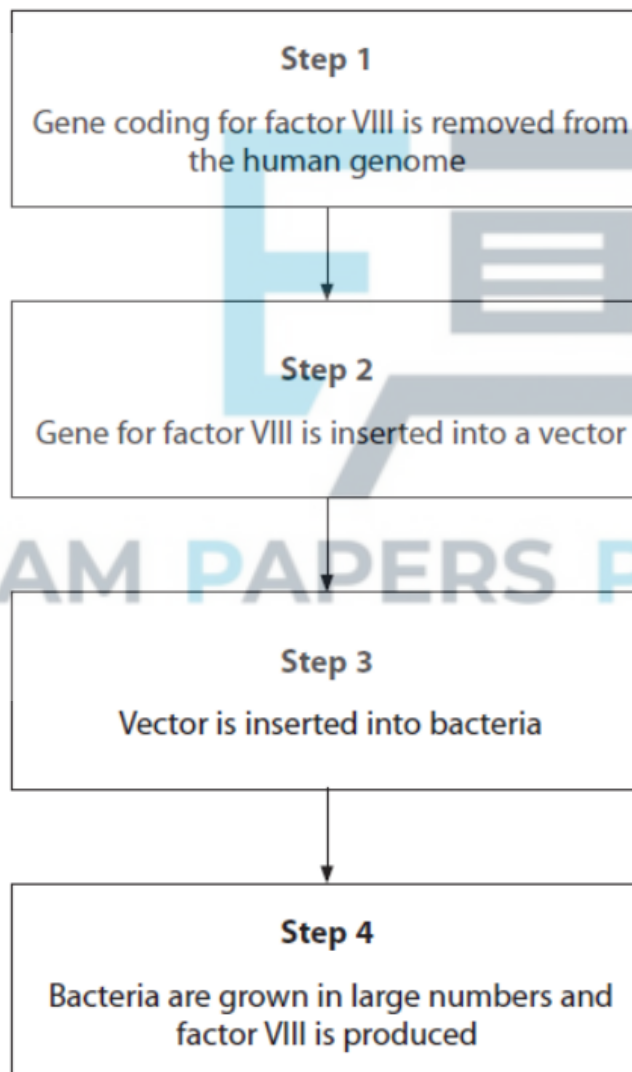
Q19.

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 marks)

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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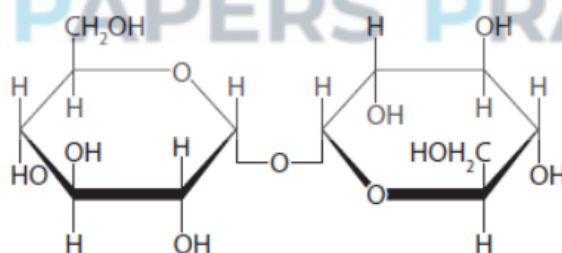
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Q22.

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.

(4)



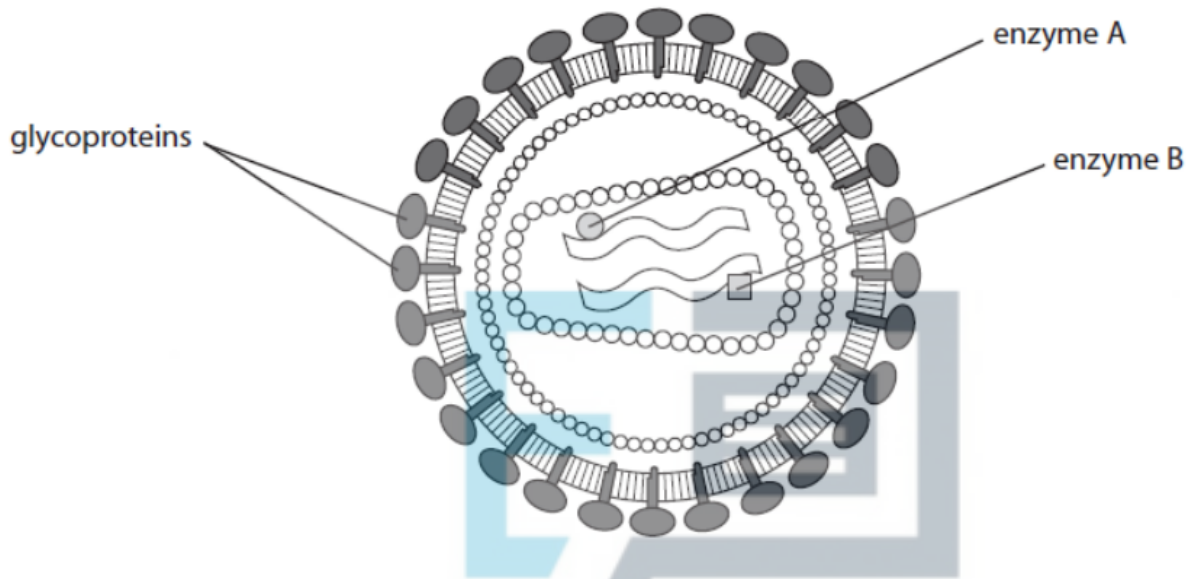
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(Total for question = 5 marks)

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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(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 $\times 15$

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?

(1)

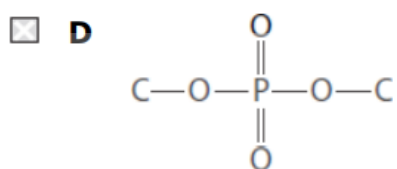
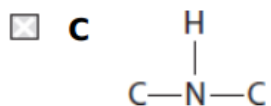
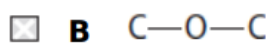
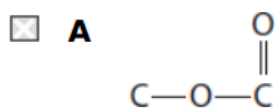
- ☐ A condensation
- ☐ B hydrolysis
- ☐ C methylation
- ☐ D phosphorylation

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

(1)



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