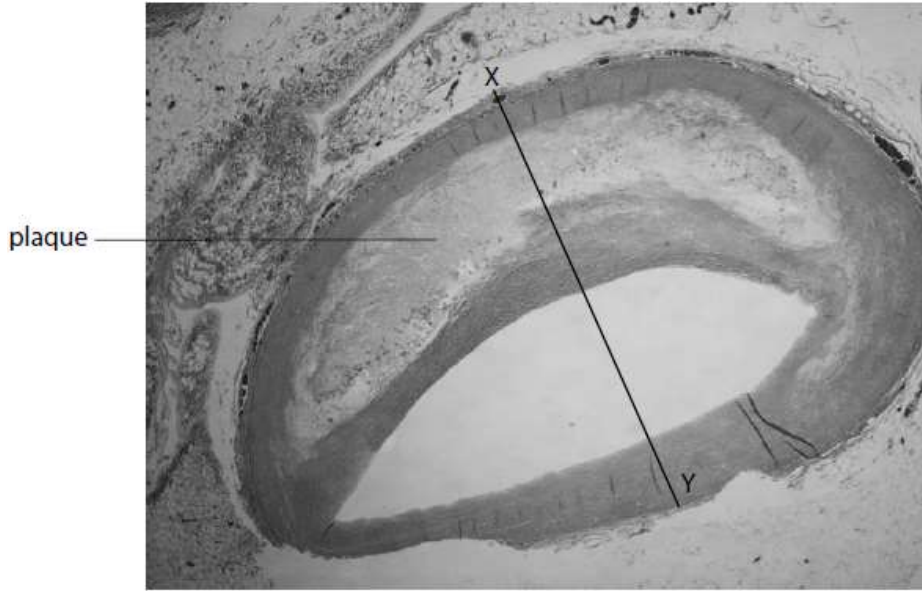


Molecules, Transport and Health - Questions by Topic

Q1.

Many studies have linked the development of atherosclerosis with cardiovascular disease (CVD).

(a) The photograph shows a section through an artery with a plaque (atheroma) from a patient with atherosclerosis.



© Ogphoto/iStock

Calculate the percentage increase in the thickness of the artery wall where the plaque is located.

Take your measurements along the line labelled X-Y.

(3)

Answer %

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

(4)

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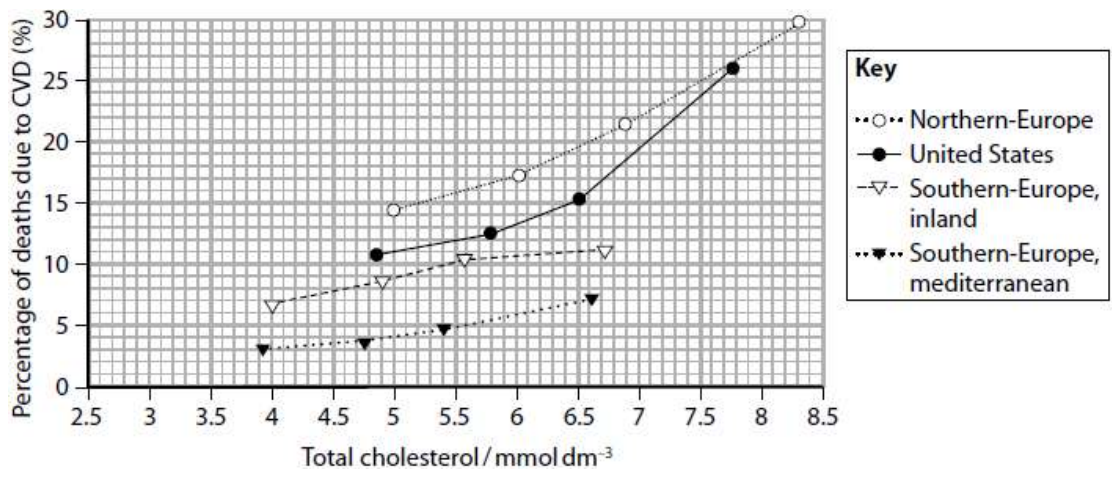
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*(c) Cholesterol is transported in the blood as lipoproteins LDL and HDL.

In one study, the relationship between total blood cholesterol and the risk of death from CVD was investigated.

The results are shown in the graph.



Graph 1

In another study, the effect of the size of LDL and the ratio of total blood cholesterol to HDL on the relative risk of CVD was investigated.

The results are shown in the graph.

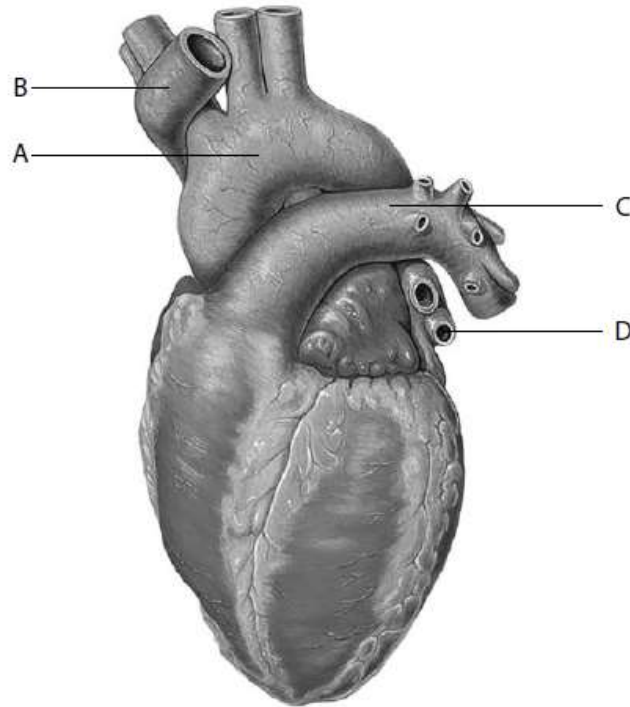
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(Total for question = 13 marks)

Q2.

Mammals have a heart that pumps blood through a network of blood vessels.

(a) The drawing shows a human heart.



Used under Creative Commons Attribution-ShareAlike License - Patrick J Lynch

(i) Which blood vessel takes blood from the heart to the body?

(1)

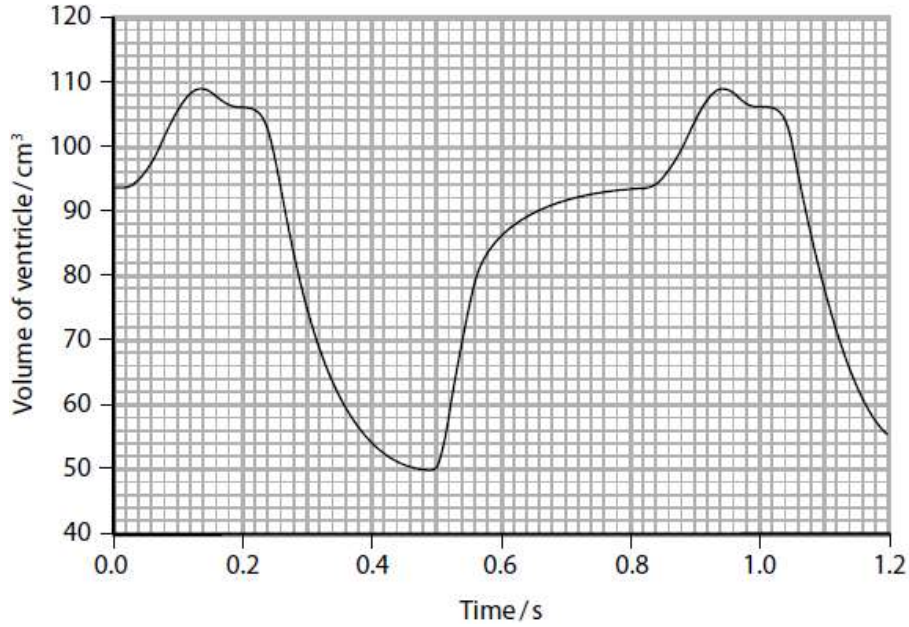
- A
- B
- C
- D

(ii) Which blood vessel has semilunar valves and contains blood with the highest concentration of carbon dioxide?

(1)

- A
- B
- C
- D

(b) The graph shows the change in volume of the left ventricle during the cardiac cycle.



(i) When is this heart in ventricular systole?

(1)

- A** at 0.1 seconds
- B** at 0.4 seconds
- C** at 0.6 seconds
- D** at 0.8 seconds

(ii) Calculate the volume of blood in dm^3 that will be pumped out of this heart by the left ventricle each minute.

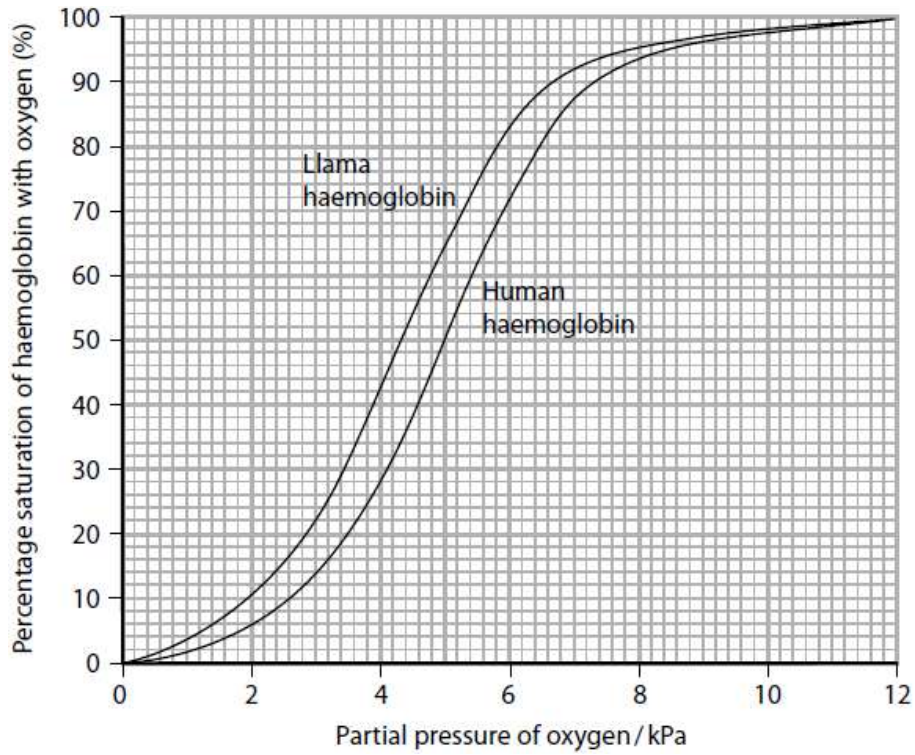
(3)

Answer dm^3

(c) As altitude (height above sea level) increases, the partial pressure of oxygen in the air decreases.

Llamas are mammals that are adapted to living at high altitudes.

The graph shows the oxygen dissociation curves for llama haemoglobin and human haemoglobin.



Explain the differences between the dissociation curves. Use the information in the graph to support your answer.

(4)

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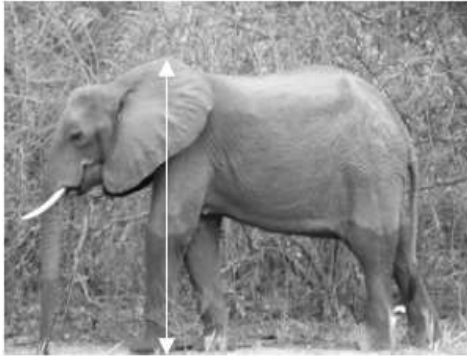
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(Total for question = 10 marks)

Q3.

The photographs show two mammals, an elephant and a mouse.



Magnification $\times 0.02$

(a) The height of a mouse is 3 cm.

Calculate how many times taller an elephant is than a mouse.

Use the white line drawn on the photograph of the elephant to calculate this value.

(2)

Answer

(b) The respiratory system of an elephant is different from that of other mammals.

The lungs are attached to the chest cavity wall and diaphragm by collagen fibres.

Describe how the lungs of an elephant are adapted for gas exchange.

(3)

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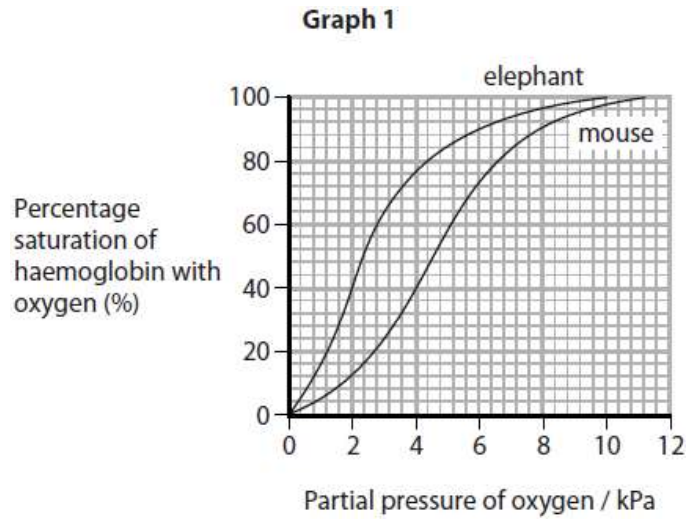
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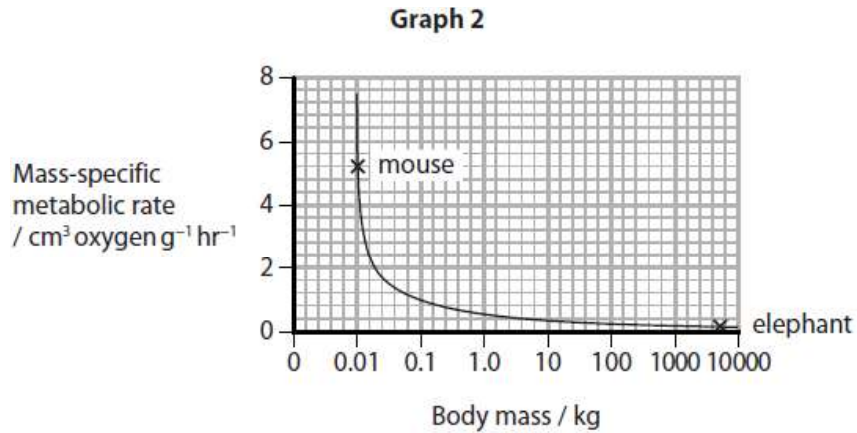
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* (c) Graph 1 shows the oxygen dissociation curve of haemoglobin for a mouse and for an elephant.



Graph 2 shows the mass-specific metabolic rate for a mouse and for an elephant.

Mass-specific metabolic rate is a measure of how much oxygen is needed for chemical reactions per gram of body tissue.



Explain the difference in the oxygen dissociation curves of haemoglobin for a mouse and for an elephant.

Use the information in both graphs to support your answer.

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(Total for question = 11 marks)

Q4.

Platelets are involved in the blood clotting process.

(a) The table shows the phospholipid content of the membranes of platelets.

Phospholipid	Percentage of total membrane phospholipids (%)	Percentage distribution of phospholipids in the membrane (%)
phosphatidylethanolamine	30	
phosphatidylcholine	27	
sphingomyelin	23	
phosphatidylserine	15	
other types	5	

When platelets trigger the blood clotting process, more phosphatidylserine molecules move into the outer layer of the membrane.

(i) Estimate the ratio of phosphatidylserine in the inner layer to that in the outer layer before the blood clotting process is triggered.

(1)

Answer

(ii) Describe the effect that the movement of phosphatidylserine into the outer layer will have on the content of phospholipids in the membranes of platelets.

(2)

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(iii) Describe how the movement of phosphatidylserine into the outer layer results in the production of thrombin in the blood clotting process.

(4)

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(b) Thrombin inhibitors are drugs that have an effect on the time taken for blood to clot. Explain why thrombin inhibitors affect the time taken for blood to clot.

(4)

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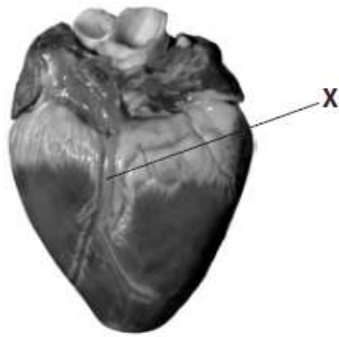
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(Total for question = 11 marks)

Q5.

The photograph shows a mammalian heart.



The blood vessel labelled **X** is a branch from the aorta.

The aorta is one of the major blood vessels of the heart.

(a) Explain why it is important that blood vessel **X** branches directly from the aorta.

(3)

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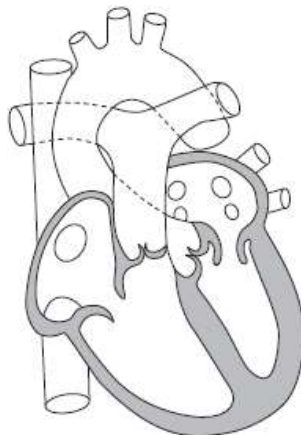
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(b) The diagram shows the internal structure of a mammalian heart.



(i) Explain which stage of the cardiac cycle is shown in this diagram.

(2)

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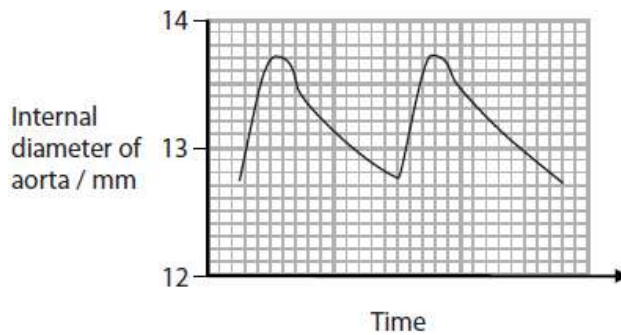
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(ii) Draw arrows on the diagram to show the flow of blood through the left side of the heart and into the aorta.

(3)

(c) The graph shows the changes in the internal diameter of the aorta during two cardiac cycles.



Explain the changes in the internal diameter of the aorta.

(3)

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(Total for question = 11 marks)

Q6.

Carbohydrates are one of the main types of nutrient. They include polysaccharides, disaccharides and monosaccharides.

(a) (i) Which formula is correct for a monosaccharide?

(1)

A $C_nH_nO_{2n}$

B $C_nH_{2n}O_n$

C $C_{2n}H_nO_n$

D $C_{2n}H_{2n}O_n$

(ii) Name the reaction that joins two monosaccharides together to form a disaccharide.

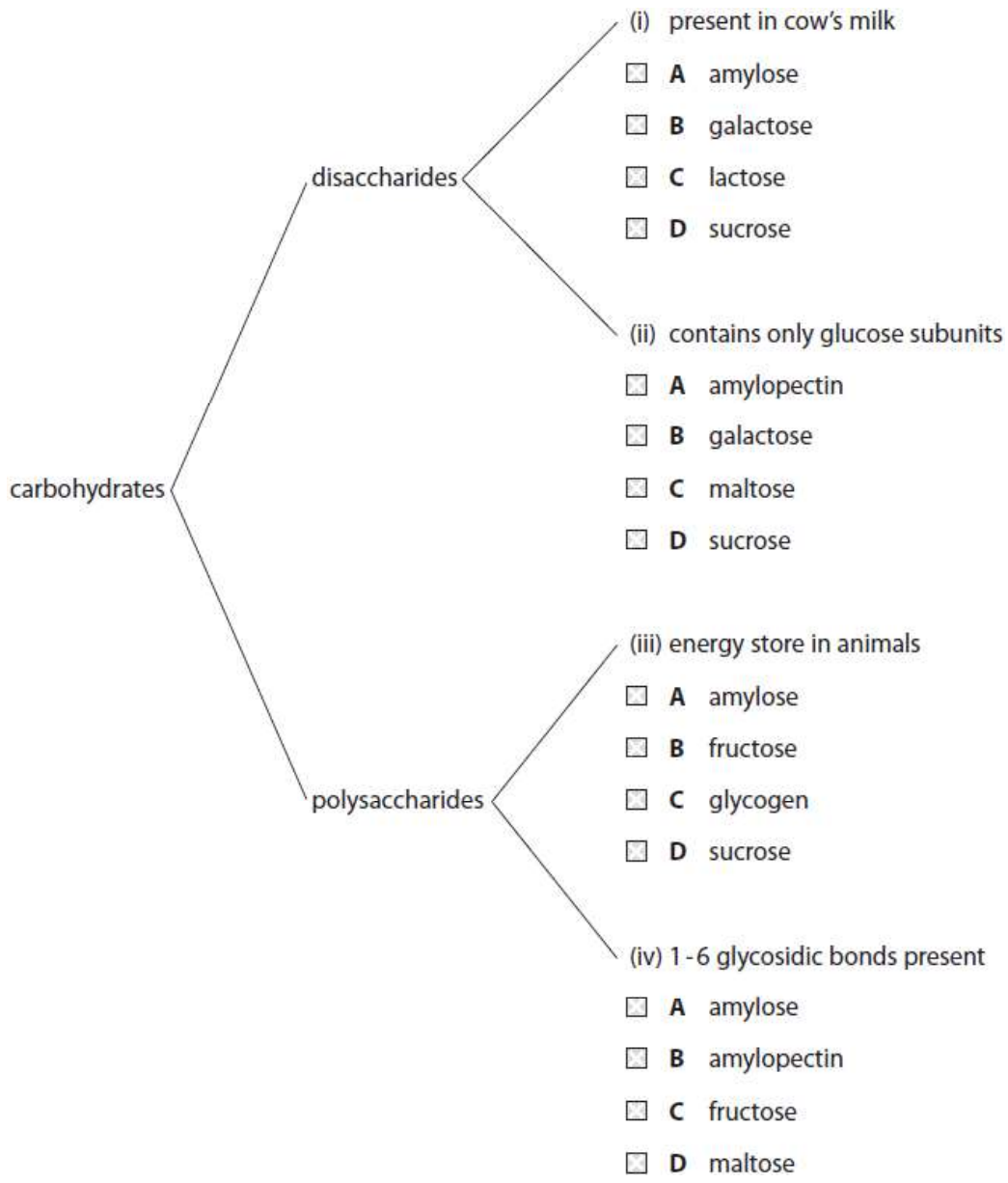
(1)

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(b) The diagram shows some information about carbohydrates.

Which carbohydrate is being described in each of (i) to (iv)?

(4)



(Total for question = 6 marks)

Q7.

The diagram shows a coronary heart disease (CHD) risk calculator.

Coronary Heart Disease Risk Calculator

Sex: Female
Ethnicity: Native American
Age: 50
Total Cholesterol: 196 mg/dL
HDL Cholesterol: 49 mg/dL
Systolic BP: 110 mmHg
Patient taking blood pressure medication:
Patient has diabetes:
Patient smokes:

10 Year CHD Risk: 6.62%

Calculate

(a) Which of the following is a medication to control blood pressure?

(1)

- A** anticoagulant
- B** antihypertensive
- C** platelet inhibitor
- D** statin

(b) Explain why the risk calculator takes into account total cholesterol and HDL cholesterol levels.

(2)

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(c) Explain why the 10 Year CHD Risk would change if this person ticked the box next to the 'Patient smokes' on the risk calculator.

(3)

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(d) (i) State one other factor that the risk calculator should include to improve the accuracy of the value for the 10 Year CHD Risk.

(1)

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(ii) Predict the effect that taking this factor into account would have on the value for the 10 Year CHD Risk.

(1)

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(iii) A person used this risk calculator.

Explain why the value obtained for the 10 Year CHD Risk may be an underestimate.

(2)

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(Total for question = 10 marks)

Q8.

Lipids and carbohydrates can be used as energy storage molecules.

(a) Lactose is an important energy source in milk.

(i) What type of chemical reaction is involved in breaking a lactose molecule into two monosaccharides?

(1)

- A condensation
- B esterification
- C hydrogen bonding
- D hydrolysis

(ii) Milk contains 4.9 g of lactose per 100 g of milk.

Each gram of lactose provides 16 kJ of energy.

Calculate the energy available from the lactose in 200 g of milk.

(1)

Answer kJ

(b) Carbohydrates used as energy storage molecules include glycogen and starch.

Compare and contrast the structures of glycogen and starch.

(4)

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(c) (i) State one difference between the structure of a saturated lipid and an unsaturated lipid.

(1)

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(ii) Describe how a triglyceride is synthesised.

(3)

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(Total for question = 10 marks)