

Energy, Carbohydrates and Fats - Questions by Topic

Q1.

The food we eat contains carbohydrates, lipids and proteins.

Carbohydrates, lipids and proteins can be used as sources of energy.

The table shows the average daily energy requirements for boys and girls aged 13 to 18.

Age / years	Daily energy requirement / kJ	
	Boys	Girls
13	10090	9292
14	10989	9789
15	11787	9990
16	12389	10090
17	12886	10291
18	13187	10291

(i) Calculate the percentage increase in the average daily energy requirements for boys aged 17 compared with their energy requirements aged 13.

(2)

Answer %

(ii) Many foods are labelled in kilocalories (kcal). One calorie is equal to 4.18 joules.

Which of the following is the average energy requirements for girls aged 13 in kilocalories (kcal)?

(1)

- A** 2.223 kcal
- B** 222.3 kcal
- C** 2223 kcal
- D** 2 223 000 kcal

(iii) State what will happen to the additional energy if an individual takes in more energy than is required.

(1)

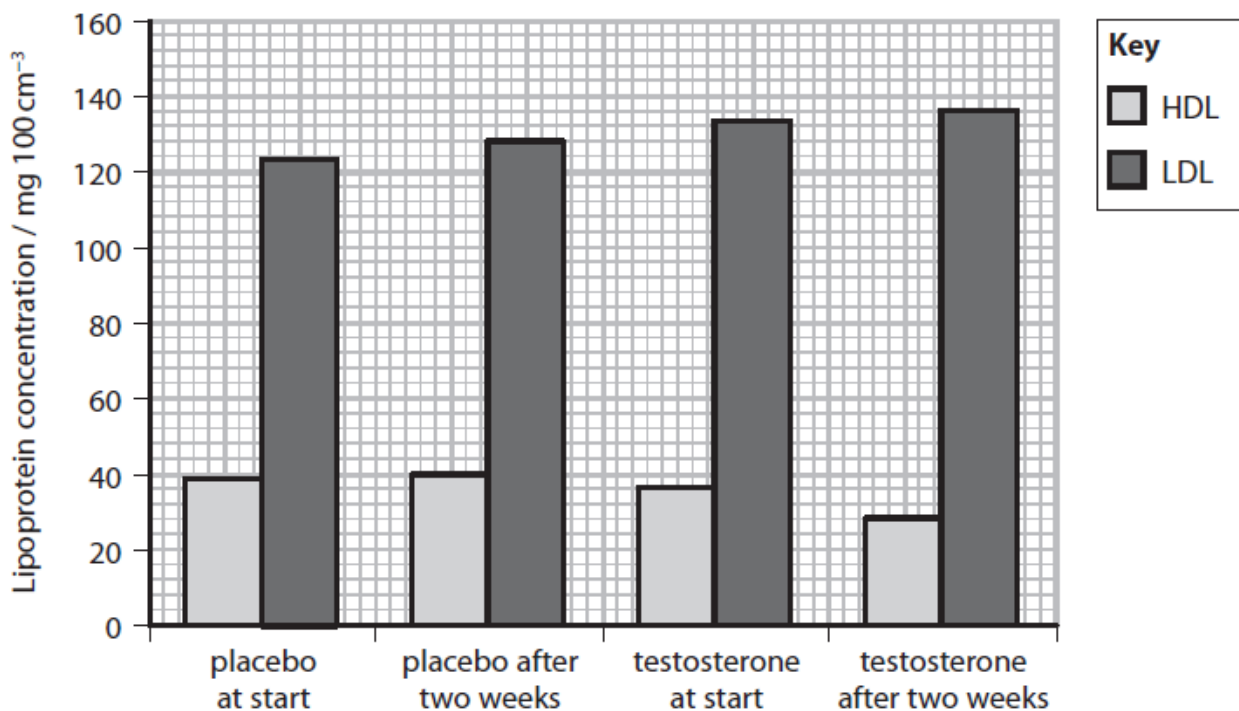
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Q2.

Anabolic steroids and testosterone have been used as performance-enhancing drugs by some athletes. These drugs can increase muscle mass and strength.

In another investigation, groups of men were given either a placebo or 300 mg of testosterone per week for two weeks. The concentrations of different lipoproteins (HDL and LDL) in the blood were measured at the start of the investigation and after two weeks.

The results of the investigation are shown in the graph.



(i) The ratio of total cholesterol to HDL is used as an indicator of the risk of cardiovascular disease. The higher the ratio of total cholesterol to HDL, the greater the risk.

In this investigation, the men given the placebo had a total cholesterol to HDL ratio of 4.2:1 after two weeks.

Calculate the ratio of total cholesterol to HDL for those taking testosterone after two weeks.

(2)

Ratio of total cholesterol to HDL

*(ii) Doses of testosterone are used to enhance performance in sports by increasing muscle mass and therefore strength.

- Testosterone increases the activity of an enzyme in the liver that breaks down HDL.
- The production of cholesterol is catalysed by the enzyme HMG CoA reductase (HMGCR).
- Testosterone increases levels of mRNA for HMGCR.

Explain why using testosterone as a performance-enhancing drug is unacceptable in terms of risks to health.

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(Total for question = 8 marks)

Q3.

There is evidence for a causal relationship between blood cholesterol levels and cardiovascular disease (CVD).

(a) Explain the meaning of the term **causal relationship**.

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Lipoproteins are composed of phospholipids, cholesterol and proteins.

(i) Proteins are made up of amino acids.

Describe how amino acids join together to form the three-dimensional structure of a protein.

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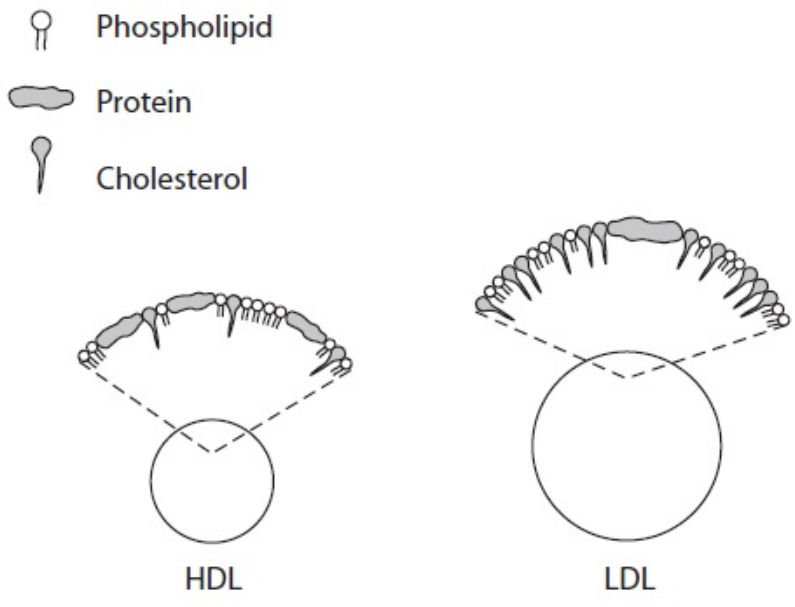
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(ii) The diagrams below show part of the structure of the surface of high-density lipoprotein (HDL) and low-density lipoprotein (LDL).



Using the information in the diagram, describe the differences between the structure of HDL and the structure of LDL.

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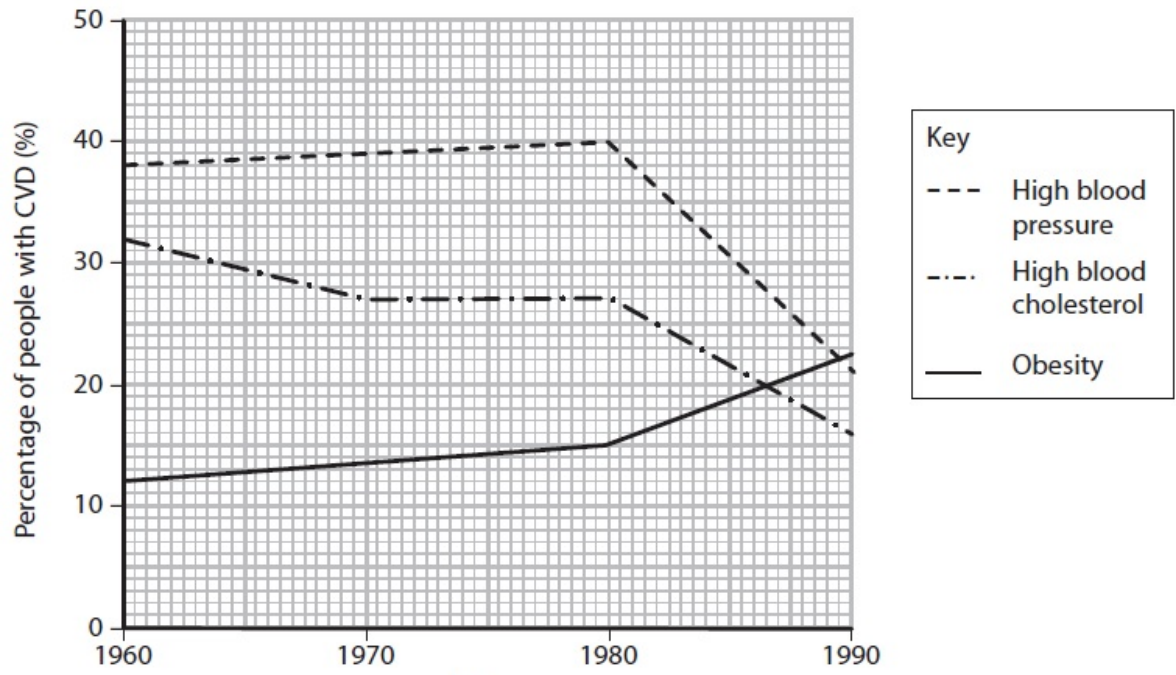
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(c) Obesity and high blood pressure are also factors that increase the risk of CVD.

The graph below shows the percentage of people with CVD who have high blood pressure or have high blood cholesterol or are obese for the period 1960 to 1990.



(i) Using the information in the graph, describe the overall changes that have occurred in these risk factors during this period.

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(ii) Suggest **two** reasons for the overall change in high blood cholesterol as a risk factor.

(2)

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(ii) St **two** factors, other than obesity, high blood pressure and high blood cholesterol, that increase the risk of CVD.

(1)

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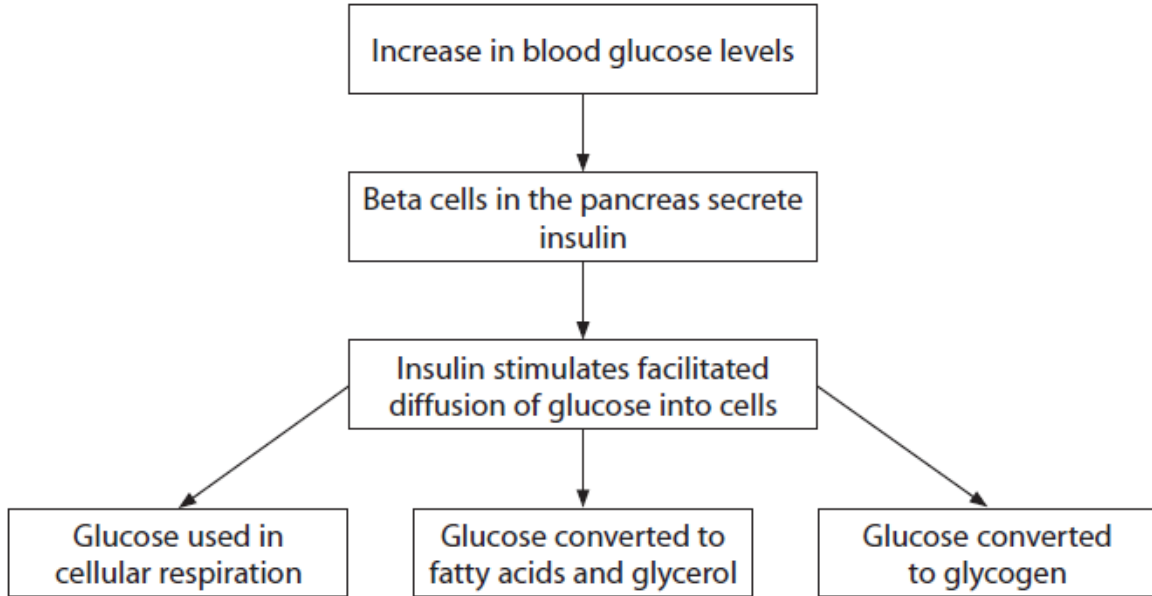
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(Total for question = 13 marks)

Q4.

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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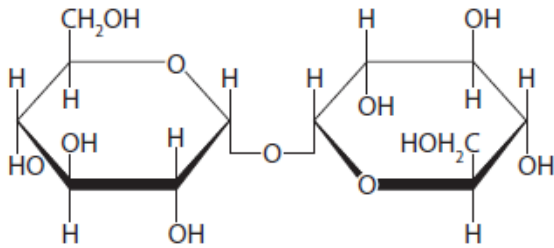
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Q5.

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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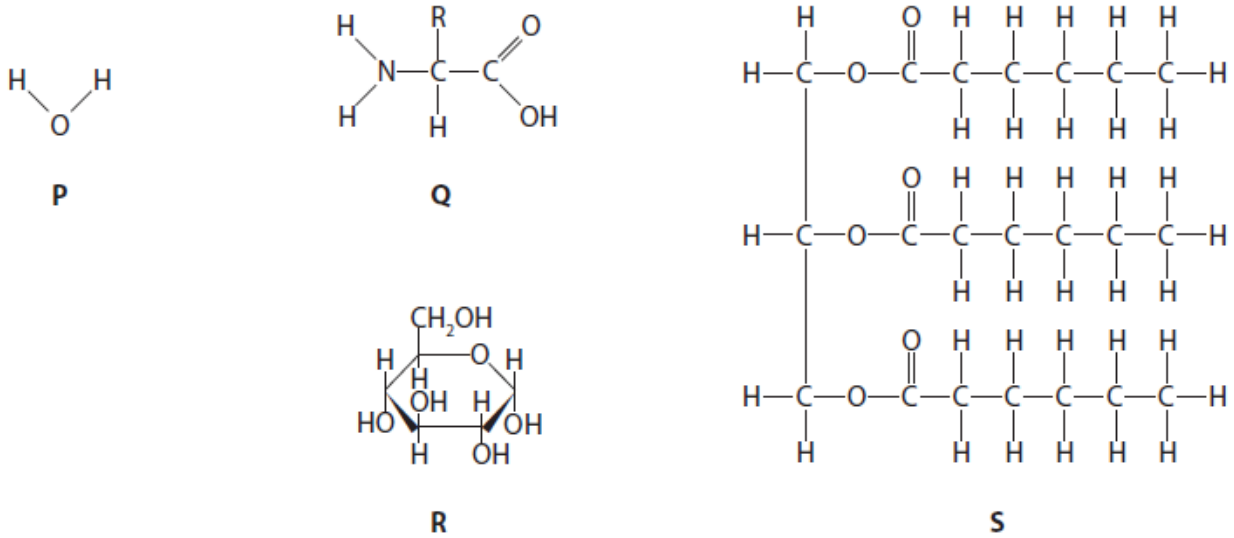
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(Total for question = 4 marks)

Q6.

The diagram below shows four molecules, P, Q, R and S, found in living organisms.

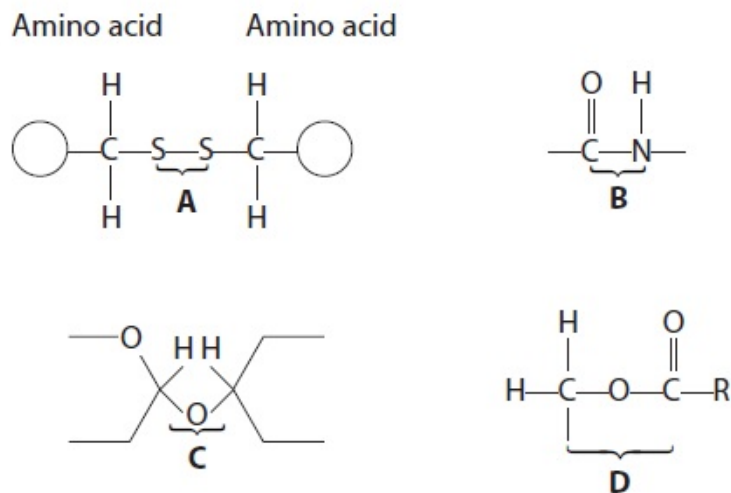


Draw a diagram to show the molecules produced when **two** molecules of **R** join together during a condensation reaction.

(3)

Q7.

(a) The diagrams below show four different bonds, A, B, C, and D, found in biological molecules.



Place a cross in the box to complete each of the following statements.

(i) The bond which occurs in a triglyceride molecule is (1)

A

B

C

D

(ii) The bond which may occur in the tertiary, but not the primary, structure of a protein is (1)

A

B

C

D

(iii) The peptide bond is (1)

A

B

C

D

(iv) The ester bond is (1)

A

B

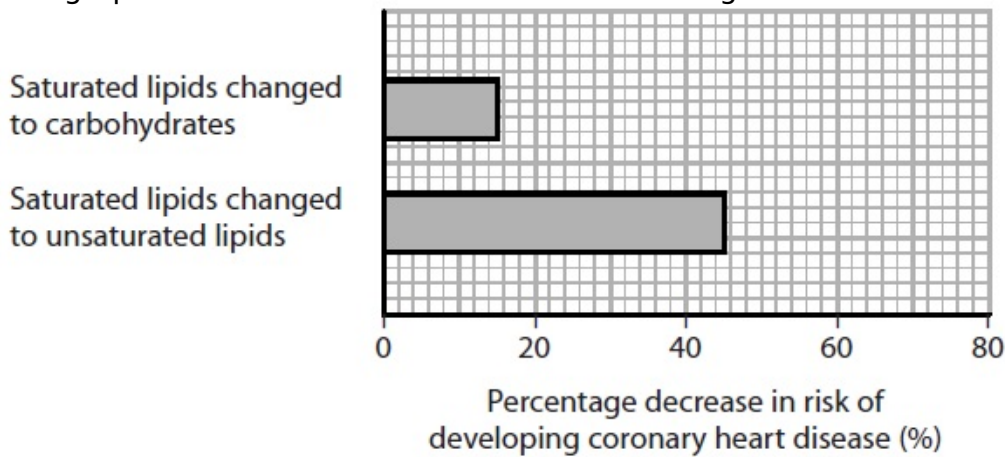
C

D

(b) Adult volunteers took part in an investigation to find out the effect of dietary changes on their risk of developing coronary heart disease.

In this investigation, 5% of the volunteers' energy intake was changed from one food source to another. The volunteers' total energy intake remained constant.

The graph below shows the results of this investigation.



(i) Suggest why it was necessary to ensure that their total energy intake remained constant.

(2)

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(ii) Using the information in the graph and your own knowledge, suggest an explanation for the results of this investigation.

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(Total for question = 9 marks)

Q8. Lipoprotein lipase is a biological catalyst and is involved in the hydrolysis of triglycerides.

(a) For each of the statements below, put a cross in the box that corresponds to the correct statement.

(i) A catalyst

(1)

A decreases the rate of reaction by increasing the activation energy

B decreases the rate of reaction by reducing the activation energy

C increases the rate of reaction by increasing the activation energy

D increases the rate of reaction by reducing the activation energy

(ii) Hydrolysis results in bonds between glycerol and a fatty acid

(1)

A being broken and water being formed

B being broken and water being used

C being formed and water being formed

D being formed and water being used

(iii) A triglyceride is made from

(1)

A one glycerol and one fatty acid

B one glycerol and three fatty acids

C three glycerols and one fatty acid

D three glycerols and three fatty acids

(iv) A type of bond found in a triglyceride is

(1)

A an ester bond

B a glycosidic bond

C a hydrogen bond

D a phosphodiester bond

(b) Some people have a mutation in the gene coding for lipoprotein lipase.

The table below shows the mean concentration of some types of lipid in the blood of people without the mutation and in the blood of people with the mutation.

Type of lipid	Mean concentration of lipid in blood / mg dm ⁻³	
	People without the mutation	People with the mutation
Triglyceride	102	93
LDL cholesterol	121	111
HDL cholesterol	48	49
Total cholesterol	186	179

It has been suggested that people with this mutation may be more at risk of developing cardiovascular disease (CVD).

(i) Give **two** reasons why the information in the table does **not** support this suggestion.

(2)

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(ii) Name the type of drug that could be given to people with this mutation, to reduce the risk of developing CVD.

(1)

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(iii) State **one** health risk associated with using this type of drug.

(1)

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(Total for Question = 8 marks)