8 The types of lipid consumed in the diet can affect the health of individuals.

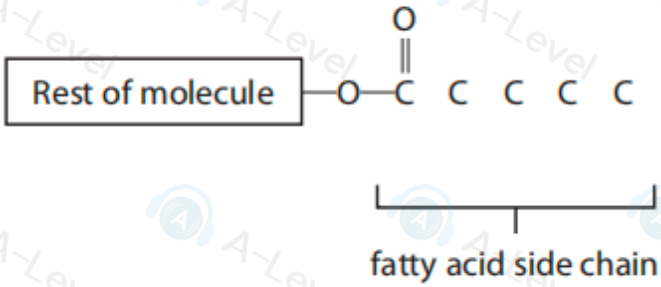
(a) Tropical sprue is a disorder that limits the absorption of nutrients into the blood.

Consumption of unsaturated lipids has been proposed as a cause of tropical sprue.

The diagram shows part of an unsaturated lipid.

Complete the diagram to show one possible structure of a fatty acid side chain of an unsaturated lipid.

(2)



(b) Consumption of high levels of cholesterol is associated with atherosclerosis.

In the development of atherosclerosis, lesions form in the coronary arteries and these develop into atheromas (plaques).

In an investigation, one group of primates was fed a diet supplemented with cholesterol and saturated fatty acids.

A second group was fed a diet supplemented with cholesterol and unsaturated fatty acids.

The primates were fed these diets from a young age and then monitored over a period of 60 months.

Primates are a higher order of mammals that include monkeys.

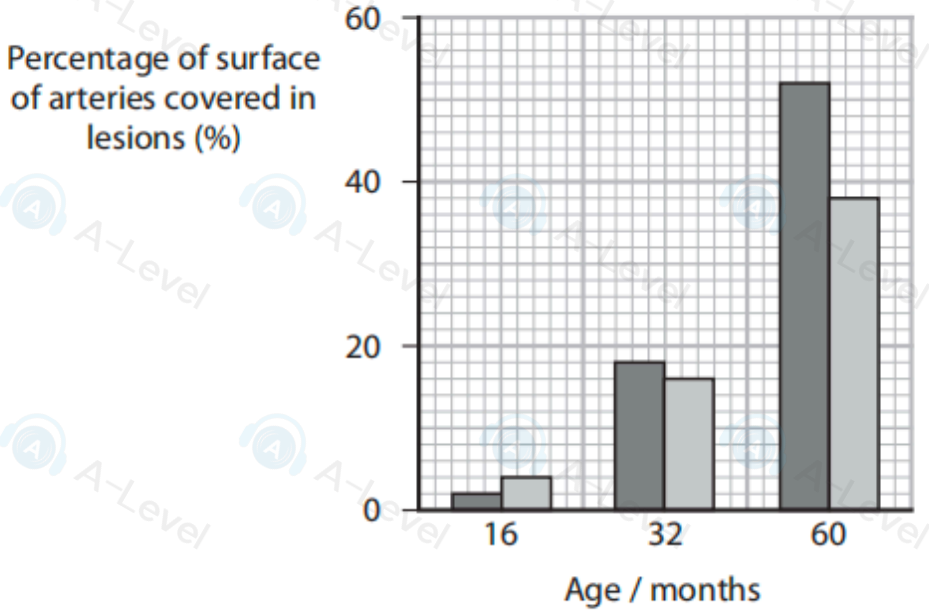
The results of the investigation are shown in the graphs.

Key

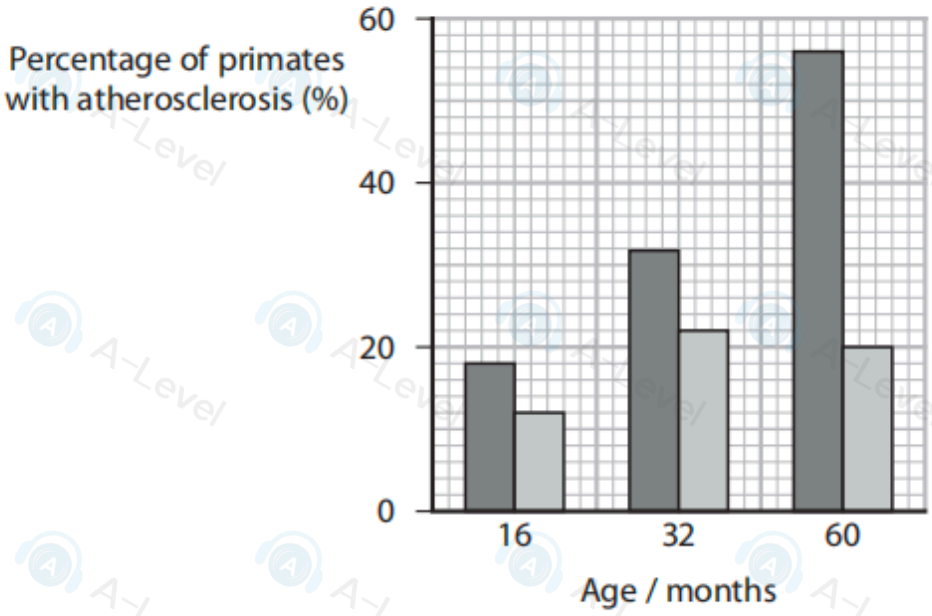
saturated lipids

unsaturated lipids

Graph 1



Graph 2

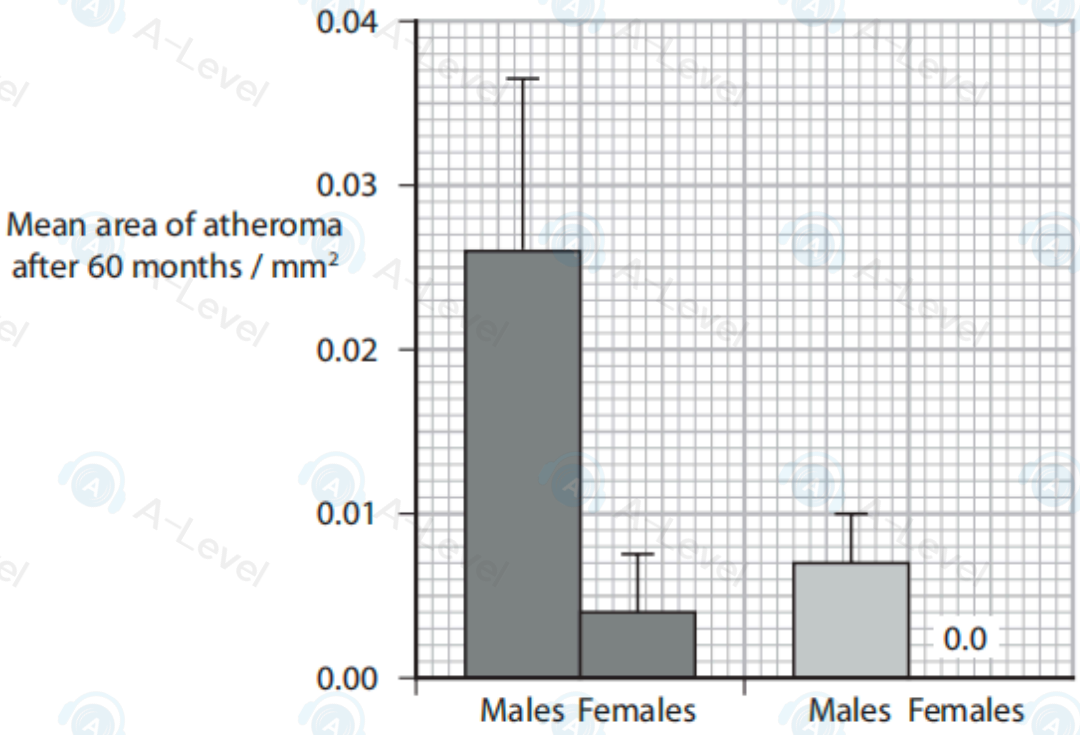


Key

saturated lipids

unsaturated lipids

Graph 3



(i) Calculate the mean rate of increase in the surface of arteries covered in lesions from 16 to 60 months in the primates given saturated lipids (graph 1).

(1)

Answer ..... percentage per month

(ii) Calculate the ratio of primates with atherosclerosis given saturated lipids to those given unsaturated lipids, at 32 months (graph 2).

(1)

Answer .....

(iii) Calculate the difference in the area of the atheromas in males compared with females, in primates given saturated fats (graph 3).

Give your answer in μm^2.

(2)

Answer ..... μm^2

*(iv) These primates were fed a diet supplemented with cholesterol and either saturated lipids or unsaturated lipids.

Deduce the effects of these two diets on the development of lesions in the coronary arteries, atherosclerosis and atheromas.

(6)

(v) Discuss the ethical issues relating to the use of primates and other animals in investigations such as this one.

(3)

(Total for Question 8 = 15 marks)

TOTAL FOR PAPER = 80 MARKS

5 Several risk factors may contribute to the development of cardiovascular disease (CVD).

The table below shows the percentage contribution of different risk factors to the development of CVD.

Risk factor	Percentage contribution to CVD (%)
inactivity	11
smoking	19
obesity	13
high blood cholesterol	26

(a) Give **one** reason why the percentage total in the table is less than 100%.

(1)

(b) Obesity can be estimated using the body mass index (BMI) of a person.

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

The table below can be used to identify the category to which a person belongs.

Category	BMI range
underweight	below 18.5
healthy	18.5 to 24.9
overweight	25 to 29.9
obese	30 or above

Calculate the minimum mass for an overweight person who is 1.92 metres tall.

Show your working.

(2)

..... kg

(c) Cholesterol is transported in the blood as lipoproteins.

High levels of low density lipoproteins (LDLs) are known to increase the risk of CVD.

Over half of all adults in the UK have raised blood cholesterol levels ($\geqslant$ 5 mmol dm^{-3}).

(i) Name the type of drug used to reduce blood cholesterol levels. State **one** risk associated with its use.

(2)

Type of drug .....

Risk .....

.....

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*(ii) Explain how high levels of LDLs and obesity contribute to the development of CVD.

(5)

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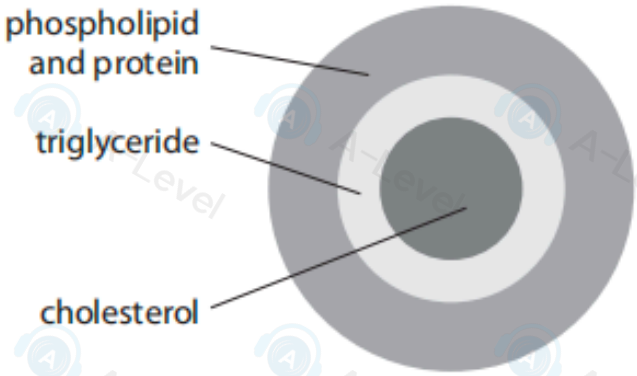
(Total for Question 5 = 10 marks)

8 Low-density lipoproteins (LDLs) transport lipids around the body in the blood.

Low-density lipoproteins can result in the development of atherosclerosis.

They can be absorbed into the endothelial cells lining arteries and broken down by free radicals.

The diagram shows a low-density lipoprotein containing cholesterol.



(a) Compare and contrast the structure of a triglyceride and a phospholipid.

(3)

(b) Explain why the properties of LDLs enable cholesterol to be transported in the blood.

(3)

(c) The diameters of LDLs range from 19 nm to 24 nm.

The table shows some information about LDLs.

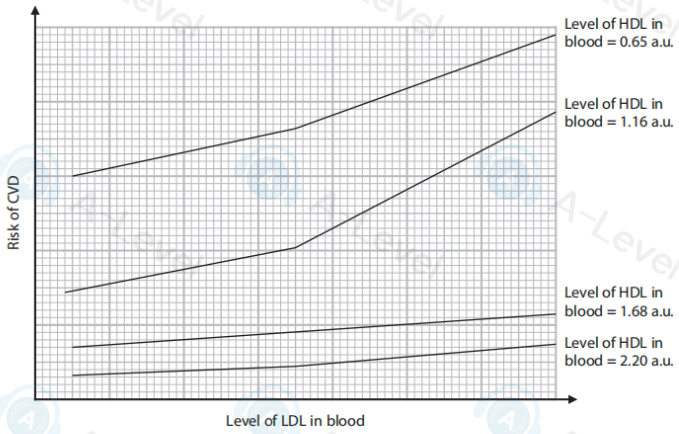
Diameter of LDL / nm	Volume of LDL / nm³	Volume of cholesterol / nm³	Ratio of LDL volume to cholesterol volume
19	3590	523	7:1
24		523	

(i) Complete the table by calculating the volume of LDL and the ratio of LDL volume to cholesterol volume.

Use the formula $v = \frac{4}{3}\pi r^3$

(3)

*(ii) The graph shows the relationship between LDLs, high-density lipoproteins (HDLs) and the risk of CVD.



Explain why measuring only the level of LDL in the blood is **not** a reliable predictor of CVD.

Use the graph, all the information in this question and your own knowledge to support your answer.

(6)

(Total for Question 8 = 15 marks)

TOTAL FOR PAPER = 80 MARKS