

2.2 Carbohydrates & Lipids

Question Paper

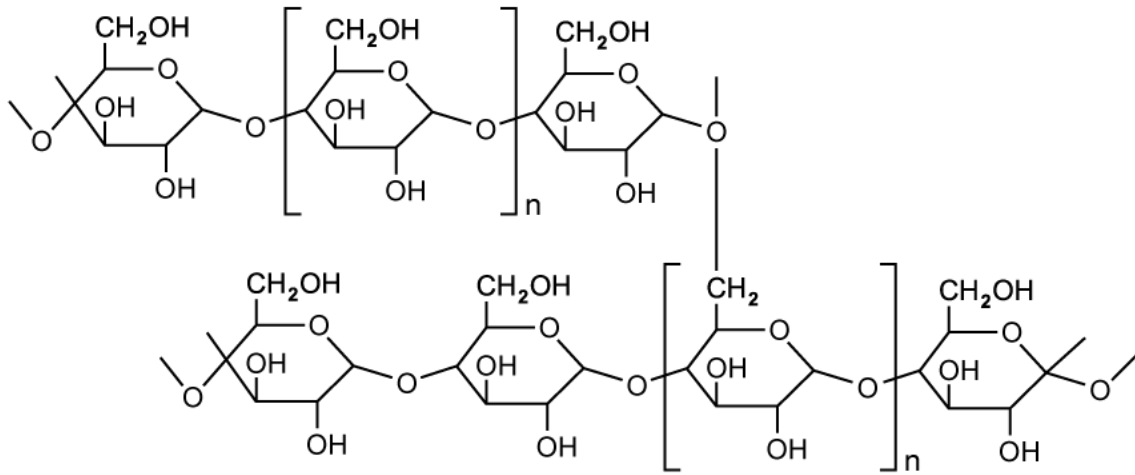
Course	DP IB Biology
Section	2. Molecular Biology
Topic	2.2 Carbohydrates & Lipids
Difficulty	Hard

Time allowed: 70
Score: /54
Percentage: /100

Question 1a

a)

The following diagram shows the structure of a polysaccharide found in plant cells.



i)

Identify the polysaccharide pictured in the diagram.

[1 mark]

ii)

Explain your answer at part i).

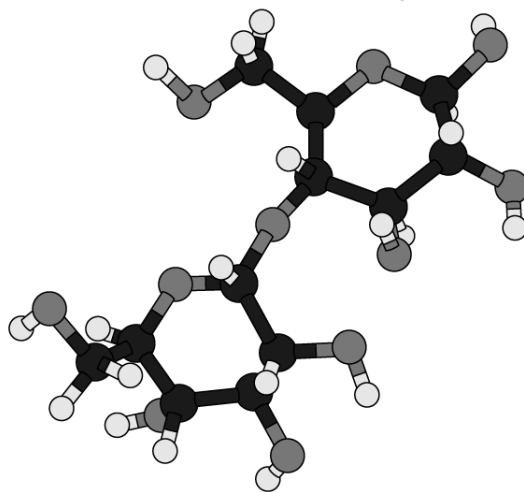
[1 mark]

[2 marks]

Question 1b

b)

Molecular visualisation software such as Jmol can be used to depict biological molecules.



Identify the molecule in this Jmol visualisation.

[2 marks]

[2 marks]

Question 1c

c)

Three molecules of the same monosaccharide are joined into a trisaccharide.

The molecular formula of the monosaccharide is $C_5H_{10}O_5$.

Deduce the formula of the resulting trisaccharide.

[2 marks]

[2 marks]

Question 1d

d)

The tetrasaccharide stachyose has the molecular formula $C_{24}H_{42}O_{21}$.

Describe **two** aspects of its molecular formula that identifies stachyose as a carbohydrate.

[2 marks]

[2 marks]

Question 1e

e)

A disaccharide has the formula $C_{12}H_{22}O_{11}$

It is made up of two identical monosaccharides.

Deduce the formula of the monosaccharides that form the disaccharide.

[2 marks]

[2 marks]

Question 2a

a)

Draw a molecular diagram of a 10-carbon saturated fatty acid.

[2 marks]

[2 marks]

Question 2b

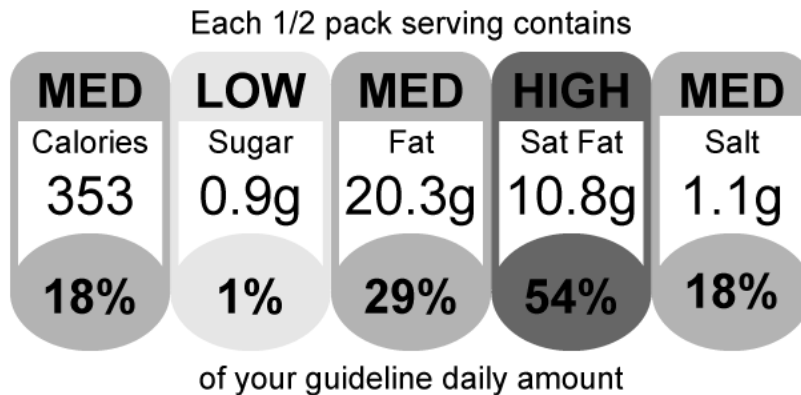
b)
Explain why unsaturated fatty acids form different shaped-triglycerides whereas saturated fatty acids do not.

[2 marks]

[2 marks]

Question 2c

c)
Below is a typical label printed on a piece of food packaging.



The product in question is a cookie-style snack food, sold in small packets with see-through plastic packaging.

Suggest and explain **one** aesthetic reason why a food company might wish to market such a food product despite its high saturated fat content.

[2 marks]

[2 marks]

Question 2d

d)

Doctors recommend that the majority of dietary fat intake should come from monounsaturated and polyunsaturated fats.

Explain why.

[2 marks]

[2 marks]

Question 3a

a)

Typical energy content values of various food group molecules are given in the table below.

Food Group	Typical energy content / kJg^{-1}
Protein	15
Carbohydrate	17
Fat	38

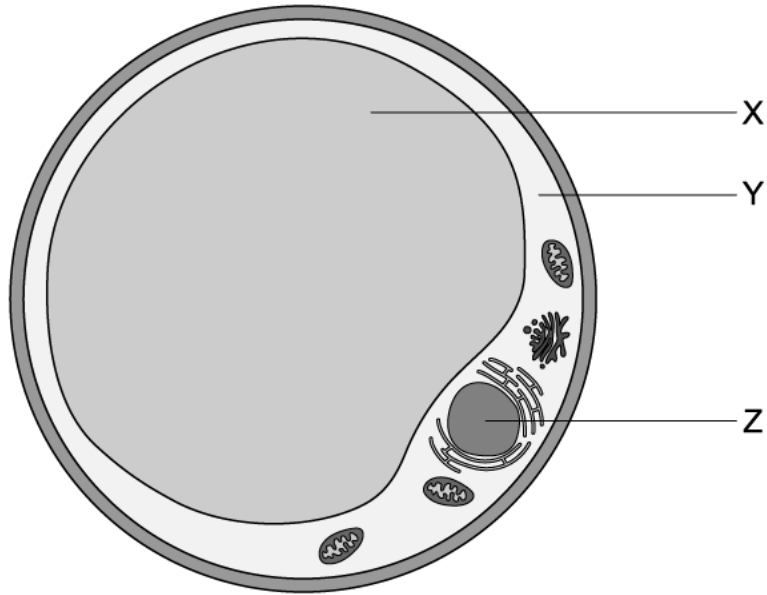
State the molecular feature of fats that allows them to contain more energy per gram than carbohydrates or proteins.

[2 marks]

[2 marks]

Question 3b

b)
The diagram shows a cell with a role in storage.



i)
Identify structures X, Y and Z in this diagram.

[3 marks]

ii)
Suggest which tissue this cell forms part of.

[1 mark]

[4 marks]

Question 3c

c)

A person's body mass index is 26.4 and their mass is 78.3kg.

Calculate the person's height in metres, to 2 decimal places. The formula for BMI is shown below:

$$\text{Body Mass Index} = \frac{\text{Body mass (kg)}}{\text{Height}^2 \text{ (metres)}}$$

[2 marks]

[2 marks]

Question 3d

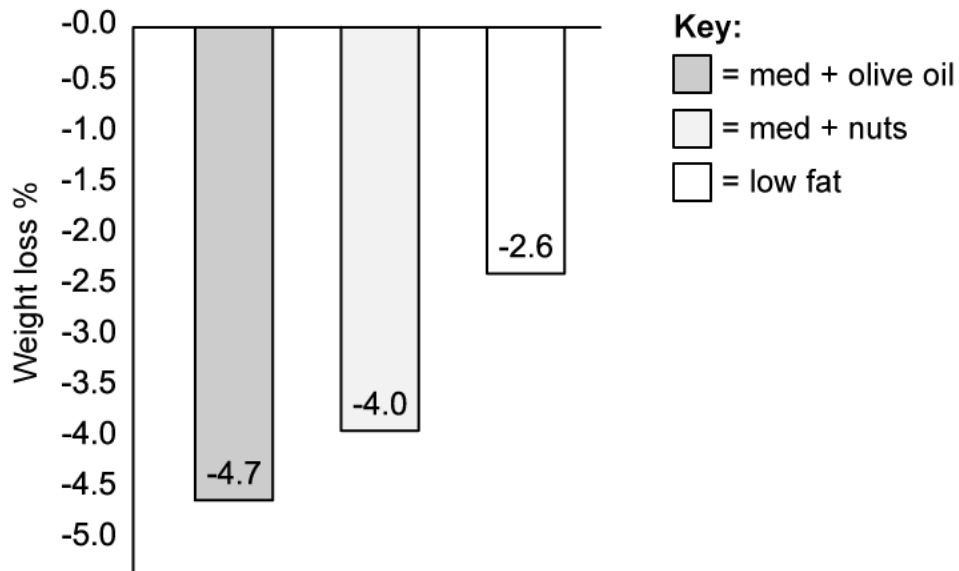
d)
A newspaper heading states that "High fat diets lead to weight loss!" based on the following study and data.

Scientists carried out a study across five years in which 8254 participants followed one of three diets:

- o a Mediterranean diet with added extra virgin olive oil
- o a Mediterranean diet with added nuts
- o a low fat diet

None of the diets involved reducing calories or increasing physical activity.

The graph below shows the results of weight loss in participants after five years.



Use the data and information provided to evaluate the newspaper's claim.

[4 marks]

[4 marks]

Question 4a

a)

Explain why cholesterol forms associations with proteins called lipoproteins eg. LDL (low density lipoproteins) and HDL (high density lipoproteins).

[2 marks]

[2 marks]

Question 4b

b)

Outline the series of events by which low density lipoproteins (LDLs) raise the risk of a person suffering from coronary heart disease.

[4 marks]

[4 marks]

Question 4c

c)

Many claims about the health benefits and drawbacks of food are made. One such is the claim that a high consumption of trans- fats causes coronary heart disease.

Evaluate this claim.

[3 marks]

[3 marks]

Question 5a

One mark is available for clarity of communication throughout this question.

a)

Compare and contrast the compounds glycogen and starch.

[8 marks]

[8 marks]

Question 5b

b)
Sketch a labelled diagram of the part of a *trans*-fatty acid that identifies its chemical structure as *trans*-.

[3 marks]

[3 marks]

Question 5c

c)
A healthy 35 year-old man of height 1.75m has a mass of 95kg.

He calculated correctly that his Body Mass Index was 31, which places him in the 'obese' category. Online sources he read gave him cause for concern about his future health prospects.

Evaluate the claim that a BMI of 31 is detrimental to his health.

[4 marks]

[4 marks]