

Exercise walk-through

1.2

Lipids and ester bonds (statement 1.5)

Pearson Edexcel · International A-Level · Biology

Atheroma, clot, catastrophe

Damage : smoking, hypertension, LDL cholesterol harm the endothelium

Plaque : inflammation and LDL deposition narrow and stiffen the artery

Clot : thromboplastin converts prothrombin to thrombin; fibrinogen becomes fibrin

Read a health study like an examiner

Your turn

Gum disease correlates with endothelial damage. List three checks before claiming causation.

- A. Who was sampled, how selected, how many?
- B. Were confounders like smoking, age, diet controlled?
- C. Is there a mechanism and a dose-response pattern?

DNA copies itself semi-conservatively

Unzip : helicase breaks the hydrogen bonds between the strands

Template : each old strand pairs with free nucleotides by complementary base pairing

Join : DNA polymerase links the nucleotides into a new strand

Exercises 2.1·2.3

2.1 Describe how a triglyceride is synthesised, naming the reactants, the type of reaction and the bond formed. [3]

2.2 Oleic acid contains one C=C bond per chain and stearic acid contains none. Explain which fat solidifies at the lower temperature. [2]

2.3 State one advantage of storing energy as triglyceride rather than glycogen. [1]

Exercises 2.1·2.3

2.1 Describe how a triglyceride is synthesised, naming the reactants, the type of reaction and the bond formed. [3]

2.1 Glycerol and three fatty acids join in condensation reactions forming ester bonds between each fatty acid and the glycerol.

2.2 Oleic acid contains one C=C bond per chain and stearic acid contains none. Explain which fat solidifies at the lower temperature. [2]

2.2 Stearic acid (no C=C) solidifies at the higher, not lower, temperature – its straight chains pack closely, so more energy is needed to separate them. Oleic acid's kinked chains pack loosely, so it is liquid at a lower temperature.

2.3 State one advantage of storing energy as triglyceride rather than glycogen. [1]

2.3 Any one: more energy per gram; insoluble so no effect on cell water potential; more compact per unit energy.

Exercise 3.1

3.1 The table shows the percentage of fatty acids in three dietary fats.

Fat	Saturated / %	Monounsaturated / %	Polyunsaturated / %
Butter	51	21	3
Olive oil	14	73	8
Sunflower oil	10	20	66

Use your knowledge of fatty-acid structure to explain why butter is solid at room temperature while sunflower oil is liquid, and suggest which fat a doctor might recommend to a patient with high blood LDL-cholesterol. Justify your answer. [5]

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3.1 Butter's high saturated proportion means straight chains packing tightly – solid at room temperature. Sunflower oil's polyunsaturated chains carry several kinks, preventing close packing – liquid. Olive oil, rich in monounsaturates, is the usual recommendation for high LDL-cholesterol because replacing saturated fat with monounsaturated fat lowers LDL while keeping HDL; sunflower oil is also acceptable with the same justification via polyunsaturates.

Exercises 3.2·3.3

3.2 A triglyceride contains the fatty acids $\text{C}_{17}\text{H}_{33}\text{COOH}$, $\text{C}_{17}\text{H}_{35}\text{COOH}$ and $\text{C}_{17}\text{H}_{35}\text{COO}$. Determine how many of the three fatty-acid chains are unsaturated, state the total number of water molecules released when this triglyceride forms, and name the bonds that link the fatty acids to glycerol. [4]

3.3 Adipose tissue stores triglyceride but muscle stores glycogen. Explain this difference by comparing energy per gram and the effect on cell water potential, and state one situation in which the body preferentially mobilises lipid rather than glycogen. [5]

Exercises 3.2-3.3

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3.2 A saturated 18-carbon fatty acid is $\text{C}_{17}\text{H}_{35}\text{COOH}$ (fully hydrogenated); $\text{C}_{17}\text{H}_{33}\text{COOH}$ has two fewer H, so one $\text{C}=\text{C}$ – unsaturated. One unsaturated chain. Three water molecules released, one per ester bond formed.

3.3 Adipose tissue stores triglyceride but muscle stores glycogen. Explain this difference by comparing energy per gram and the effect on cell water potential, and state one situation in which the body preferentially mobilises lipid rather than glycogen. [5]

3.3 Triglyceride yields more ATP per gram (about twice carbohydrate) and, being non-polar and insoluble, does not lower cell water potential the way dissolved glycogen would. Glycogen's advantage is speed – it is mobilised first during intense exercise. Lipid is preferentially mobilised during prolonged low-intensity activity or fasting, when glycogen stores fall.