



ANSWER BOOK

Lipids: triglycerides, phospholipids and the ester bond

Biological molecules, water and inorganic ions · Unit B02

AQA 3.1.3 · OCR A 2.1.2 · CAIE 2.2

9 questions · 25 marks

NAVY EDITION

SECTION A · Short, 1 to 2 marks

- A1** **A1** glycerol and fatty acids. **A1** an ester bond. [2]
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- A2** **B1** a phospholipid has two fatty acids and a phosphate group, whereas a triglyceride has three fatty acids. **B1** the phosphate group is charged, so the head of a phospholipid is hydrophilic while the tails are hydrophobic. [2]
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- A3** **M1** each triglyceride contains three ester bonds, and hydrolysing one bond uses one molecule of water. **A1** $180 \times 3 = 540$ molecules of water. [2]
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SECTION B · Standard, 3 to 5 marks

- B1** **B1** shake the sample with absolute ethanol so that any lipid dissolves. **B1** pour the ethanol into an equal volume of water in a clean tube. **B1** a white, cloudy emulsion shows that a lipid is present, because the lipid comes out of solution as droplets that scatter light. **B1** as a control, repeat the procedure using distilled water in place of the sample; the mixture should remain clear. [4]
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- B2** **B1** one molecule of glycerol reacts with three fatty acid molecules. **B1** a hydroxyl group of the glycerol reacts with the carboxyl group of each fatty acid in a condensation reaction. **B1** three ester bonds are formed and three molecules of water are released. [3]
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- B3** **B1** sunflower oil contains a high proportion of unsaturated fatty acids, which have one or more carbon to carbon double bonds, whereas beef fat is largely saturated with none. **B1** a double bond puts a permanent bend in the hydrocarbon tail, so the molecules cannot pack closely together. **B1** fewer attractions form between neighbouring molecules, so less energy is needed to separate them and the melting point is lower. [3]
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- B4** **B1** a triglyceride releases about twice as much energy per gram as a carbohydrate when respired, because its fatty acid tails are hydrocarbon and contain little oxygen. **B1** so the same energy is carried for less mass, which reduces the energy needed for flight. **B1** triglyceride is insoluble, so it has no effect on the water potential of the cell storing it, and respiring it releases water that the bird can use. [3]
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B5 **B1** both are insoluble in water, because their fatty acid tails are non-polar and [3]
hydrophobic. **B1** a triglyceride is hydrophobic at every point, so it forms droplets,
whereas a phospholipid has a hydrophilic phosphate head that interacts with water. **B1**
so phospholipids arrange themselves with their heads in the water and their tails away
from it, forming a bilayer, which triglycerides do not.

B6 **B1** the side chains on the outside of the protein are largely non-polar, so they [3]
are hydrophobic and are not attracted to water. **B1** such a surface is compatible with
the hydrocarbon tails of the phospholipids rather than with water. **B1** so the protein sits
within the hydrophobic core of the bilayer rather than on the surface of the membrane.