

Carbohydrates and lipids: practice questions

8 questions • 24 marks • mark scheme at the back

For IB Diploma Biology, Standard Level and Higher Level (first assessment 2025). **HL only** is additional higher level content, for HL students only.

Name

Total / 24

1 PAPER 1A STYLE [1 mark]

Which statement describes a hydrolysis reaction?

- A. ☐ Two monomers are linked by a covalent bond and a water molecule is released.
- B. ☐ A water molecule is split and its $-H$ and $-OH$ are added to the products as a bond is broken.
- C. ☐ A polymer is broken into monomers by the removal of water.
- D. ☐ A monomer is oxidised to release energy for the cell.

2 PAPER 1A STYLE [1 mark]

A molecular diagram shows a ring of five carbon atoms and one oxygen atom, with a sixth carbon outside the ring and an $-OH$ group above the ring on carbon 1. Which molecule is shown, and which polymer is it a monomer of?

- A. ☐ Ribose, a monomer of RNA
- B. ☐ Alpha-glucose, a monomer of glycogen
- C. ☐ Beta-glucose, a monomer of cellulose
- D. ☐ Beta-glucose, a monomer of starch

3 PAPER 1A STYLE [1 mark]

A molecule from an animal has a skeleton of four fused carbon rings, three with six carbons and one with five. Which property would allow it to enter a target cell?

- A. ☐ It is hydrophilic, so it passes through protein channels.
- B. ☐ It is amphipathic, so it forms a bilayer with the membrane.
- C. ☐ It is non-polar, so it diffuses through the hydrophobic core of the phospholipid bilayer.
- D. ☐ It is charged, so it is attracted to the phosphate heads and pulled across.

[6 marks]

Melting points of fatty acids with 18 carbon atoms		
Fatty acid	Number of C=C double bonds	Melting point / °C
Stearic acid	0	69
Oleic acid	1	13
Linoleic acid	2	−5
Linolenic acid	3	−11

[illegible]

[3 marks]

[illegible]

[3 marks]

[illegible]

[3 marks]

Answer =

[illegible]

[6 marks]

[illegible]

Mark scheme

One mark for each point unless a maximum is given. Words in brackets are not needed for the mark.

1. [1]

B B [1]

2. [1]

C C [1]

3. [1]

C C [1]

4. [6]

- (a) oleic acid [1]
- (b) 74 °C [1] Accept 74 without unit; do not accept 64
- (c) more C=C double bonds, lower melting point / negative correlation [1] Accept: largest decrease between 0 and 1 double bond
- (d) double bonds cause bends / kinks in the hydrocarbon chain [1]
- (d) chains cannot pack closely together so attractions between them are weaker / less energy needed to melt [1] OWTTE
- (e) oils stay liquid at the temperatures of plant tissues / plants are not endotherms, so stores remain fluid / easy to mobilise [1]

5. [3]

- polymer of alpha-glucose [1]
- highly branched / coiled so compact, storing much glucose in a small space [1]
- large molecule so relatively insoluble / no osmotic effect / does not leave the cell [1]
- many chain ends so glucose added or removed quickly by condensation / hydrolysis [1]
- max 3

6. [3]

- glycoproteins are proteins with carbohydrate chains attached on the outer surface of the plasma membrane [1]
- carbohydrate chain acts as a marker / antigen recognised by other cells [1]
- ABO antigens on red blood cells differ in the carbohydrate chain / A and B have an extra sugar, O has neither [1]
- antibodies bind to antigens not present on the recipient's own cells, causing agglutination / so transfused blood must be matched [1]
- max 3

7. [3]

- (a) $1850 \div 37 = 50$ g [1]
- (b) glycogen mass = $1850 \div 17 = 108.8$ g; $108.8 \div 50 = 2.2$ times [1] Accept 2.1-2.2; ECF from (a)
- (c) glycogen is stored with water, so the real difference in mass is greater / triglyceride also provides thermal insulation / insoluble so no osmotic effect [1]

8. [6]

- both contain carbon, hydrogen and oxygen / are carbon compounds [1]
- both are made by condensation and mobilised by hydrolysis [1]
- both are insoluble in their storage form so have little osmotic effect [1]
- carbohydrates are stored as starch in plants and glycogen in animals [1]
- lipids are stored as triglycerides / in adipose tissue in animals / as oils in seeds [1]
- lipids release about twice as much energy per gram when oxidised (about 37 kJ g^{-1} compared with 17 kJ g^{-1}) [1]
- glycogen is stored with water so is heavier per unit of energy; triglycerides are stored without water [1]
- carbohydrates for short-term storage, lipids for long-term storage [1]
- glucose can be released from glycogen / starch more rapidly, from many branch ends [1]
- triglycerides also act as thermal insulation; polysaccharide stores do not [1]
- glucose is soluble and transported easily, so it is the form carried in blood rather than stored [1]
- max 6