

Biological Molecules: Lipids

1. The diagram below shows part of a plasma membrane.

Which of the label lines points to a structure that could contain a sulfur atom?

- A 1, 2 and 3
- B Only 1 and 2
- C Only 2 and 3
- D Only 1

Your answer

[1]

2. Which of the following processes involves the formation of ester bonds?

- 1 synthesis of polynucleotides
- 2 synthesis of triglycerides
- 3 synthesis of polypeptides

- A 1, 2 and 3
- B Only 1 and 2
- C Only 2 and 3
- D Only 1

Your answer

[1]

3. Lipids are a diverse group of chemicals that are neither polar nor charged and hence are insoluble in water. The ___(1)___ nature of the heads of phospholipids allows them to form membranes. ___(2)___ also contain fatty acids and form part of the membrane. Lipids can be used for energy storage in the form of ___(3)___. Some hormones are also lipids and they are similar in structure to ___(4)___.

Which row shows the correct sequence of missing words?

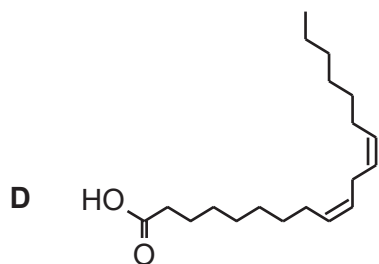
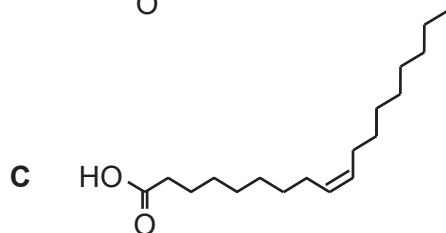
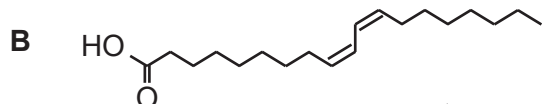
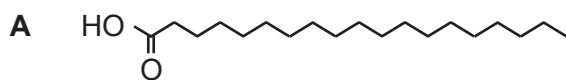
	1	2	3	4
A	hydrophilic	glycolipids	triglycerides	cholesterol molecules
B	hydrophilic	triglycerides	cholesterol molecules	glycolipids
C	hydrophobic	cholesterol molecules	triglycerides	bile
D	hydrophobic	cholesterol molecules	triglycerides	glycolipids

Your answer

[1]

4. Oleic acid is a monounsaturated fatty acid found in vegetable oil.

Which of the following, **A** to **D**, is the correct structure for oleic acid?



[1]

Your answer

5. Human pancreatic lipase breaks the bonds between fatty acids and glycerol.

What name is given to this reaction?

- A condensation
- B esterification
- C hydration
- D hydrolysis

Your answer

[1]

6. Which option, **A to D**, describes the role of cholesterol in cell surface membranes in the human body?

- A Cholesterol binds to phospholipid phosphate heads, increasing the packing of the membrane, therefore reducing the fluidity of the membrane.
- B Cholesterol binds to phospholipid fatty-acid tails, reducing the packing of the membrane, therefore increasing the fluidity of the membrane.
- C Cholesterol absorbs ATP, preventing active transport across the membrane.
- D Cholesterol binds to phospholipid fatty-acid tails, increasing the packing of the membrane, therefore reducing the fluidity of the membrane.

Your answer

[1]

7. Which of the following formulae of fatty acids represents a saturated fatty acid?

Statement 1: Palmitic acid, C₁₅H₃₁COOH

Statement 2: Oleic acid, C₁₇H₃₃COOH

Statement 3: Linoleic acid, C₁₇H₃₁COOH

- A. 1, 2 and 3
- B. Only 1 and 2
- C. Only 2 and 3
- D. Only 1

Your answer

[1]

8. Triglycerides contain three elements.



i. **M** and **N** are formulae for two macromolecules,

Which of the formulae, **M** or **N**, corresponds to a triglyceride?
Explain your answer.

Formula

Because

----- [1]

ii. Phospholipid molecules are similar to triglycerides but they also contain the element phosphorus as part of a phosphate group.

Explain how the structure of phospholipids allows them to form the bilayer of a plasma membrane.

----- [3]

9(a). Triglycerides consist of glycerol combined with three fatty acids.

Fig. 18 shows a glycerol molecule and a fatty acid molecule.

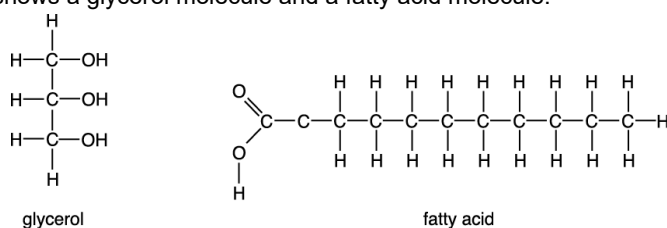


Fig. 18

i. In the space below draw a monoglyceride molecule.

[2]

ii. Name the bond formed between the glycerol and the fatty acid.

[1]

iii. Name the other molecule formed when this bond is made.

[1]

(b). *Describe and explain how the structure and properties of different carbohydrate and lipid molecules suit them to their role as energy storage molecules in plants and animals.

[9]

10(a). Fig. 22 shows a triglyceride molecule found in sunflower oil.

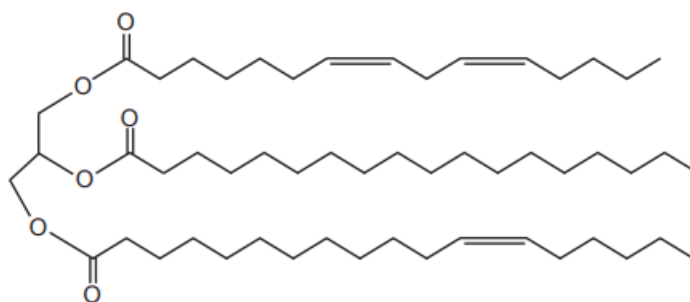


Fig. 22

On Fig. 22 circle an ester bond.

[Answer on Fig. 22]

[1]

(b). Sunflower oil is used to make biodiesel, which contains methyl esters. The fatty acids in the triglyceride molecule are reacted with methanol in a process called transesterification.

After the reaction, two liquid products form which naturally separate from each other. The methyl esters float on top of a more dense liquid.

Name the part of the molecule seen in Fig. 22 that forms this more dense liquid.

[1]

(c). Living organisms have many uses for triglycerides, one of which is the production of phospholipids.

- i. Name three **other** functions of triglycerides in living organisms.

1

2

3

[3]

- ii. Table 22 shows the melting points of some of the methyl esters made from the transesterification of sunflower oil fatty acids.

Methyl ester	Formula	Melting point (°C)
Methyl stearate	C ₁₉ H ₃₈ O ₂	39.1
Methyl oleate	C ₁₉ H ₃₆ O ₂	-19.9
Methyl linoleate	C ₁₉ H ₃₄ O ₂	-35.0

Table 22

Describe and explain the pattern of the melting points of these three methyl esters.

----- [2]

(d). Phospholipid molecules also contain fatty acids.

Explain how the fatty acids in phospholipids allow the formation of membranes.

[2]

11(a). Lipoproteins are roughly-spherical structures that transport lipids in the blood.

Fig. 21 shows a simplified drawing of a section from the widest part of a lipoprotein.

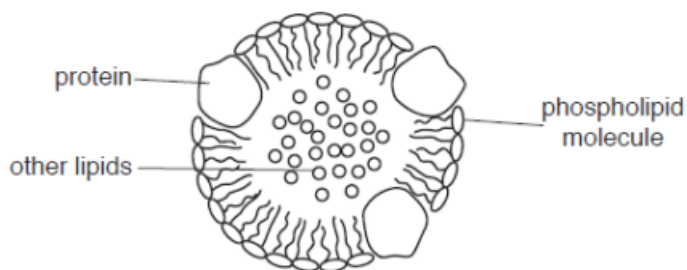


Fig. 21

- i. Calculate the number of phospholipid molecules in the outer surface of the lipoprotein shown in Fig. 21.

Assume that the pattern of proteins and phospholipids shown in Fig. 21 is continued across the whole surface of the lipoprotein.

Use the formula: Surface area of sphere = $4\pi r^2$

number of phospholipid molecules = [2]

- ii. Lipoproteins with fewer phospholipids and more protein in the outer layer are known as high density lipoproteins.

Lipoproteins with a larger number of phospholipids but less protein are known as low density lipoproteins.

Use this information to explain why lipids can increase the buoyancy of aquatic animals.

----- **[1]**

(b). Complete the passage by choosing the most appropriate word from the list.

bile carbon hydrogen insoluble

nitrogen oxygen permeability production solid soluble

stability storage vitamins

Lipids have many roles in living organisms. Some are used for energy in adipose cells. Unsaturated fatty acids contain at least one double bond between two atoms and so contain fewer atoms. All lipids are in water so need to be transported in the blood by lipoproteins. Cholesterol molecules increase the of membranes, and cholesterol is also used to synthesise steroid hormones and

[6]

(c). Triglycerides are a type of lipid molecule that can be broken down during hydrolysis reactions.

Using the structure of triglyceride molecules as an example, explain what is meant by hydrolysis.

[2]

12. Cells are surrounded by a plasma membrane that contains phospholipids.

Explain how the structure of phospholipid molecules allows for the formation of plasma membranes.

[3]