Water, Lipids, Proteins and Ions (2.1.2): OCR A Level Biology Exam Ques

20 questions · 41 marks · about 49 minutes. Answer in the spaces, then check the mark schemes at the end.

Question 1 · AS Paper 2 · June 2024 · Q6(a)(i) · 2 marks

6

(a)

(i) The general structure of an amino acid molecule has one R group and two other groups.

Name the **two** other groups in an amino acid molecule.

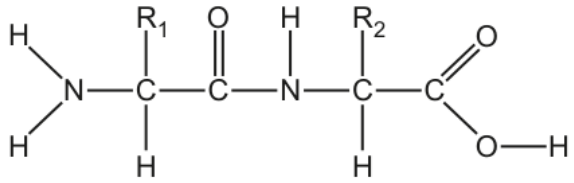
1 .....

2 .....

[2]

Question 2 · information from earlier in the question

(ii) Below is a diagram of a dipeptide.



Draw a circle around the peptide bond. Answer on the diagram. **[1]**

Question 2 · AS Paper 2 · June 2024 · Q6(a)(iii) · 1 mark

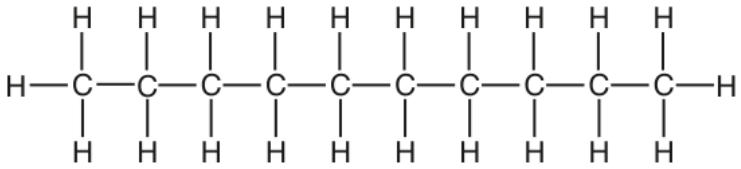
(iii) Name the type of reaction involved in breaking the peptide bond.

..... **[1]**

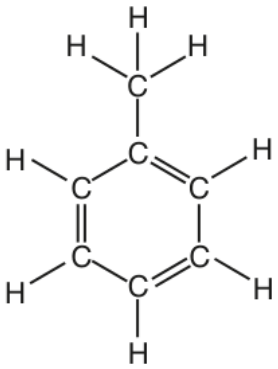
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22 Crude oil contains hydrocarbons. Three hydrocarbons commonly present in crude oil are shown in Fig. 22.

W



X



Y

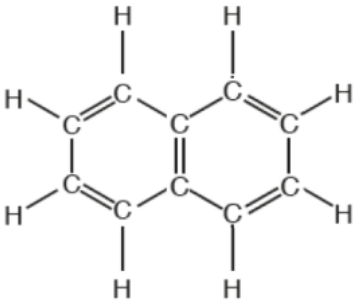


Fig. 22

(a) Compound **W** shows some structural similarities with fatty acids.

State one structural difference between compound **W** and a saturated fatty acid.

.....

.....

..... **[1]**

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Question 4 · AS Paper 2 · June 2018 · Q4(a)(i) · 2 marks

4 (a) (i) Ions have a number of important roles in living organisms.

Complete the table below by identifying the ion that plays each of the roles. Choose from the following list.

NH_4^+ Cl^- H^+ OH^- PO_4^{3-} Ca^{2+}

Important role	Ion
Production of nitrate ions by bacteria	NH_4^+
Loading of phloem	
DNA structure	
Cofactor for amylase	

[2]

Question 5 · AS Paper 1 · June 2022 · Q25(a)(i) · 3 marks

25 (a) Water molecules are transported in the stem of a sunflower. Water molecules are polar and are therefore attracted to each other.

(i) Draw **two** water molecules **and** label the bond between the two molecules.

[3]

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Question 6 · AS Paper 1 · June 2022 · Q25(a)(ii) · 3 marks

(ii) Explain how the properties of water are related to the transport role of water in a stem.

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.....

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.....

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.....

..... **[3]**

Question 7 · AS Paper 1 · June 2018 · Q22(c)(i) · 3 marks

(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]

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Question 8 · AS Paper 1 · June 2018 · Q22(c)(ii) · 2 marks

(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 sterate	$C_{19}H_{38}O_2$	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.

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.....

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.....

.....

..... **[2]**

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(b) Research indicates that reducing dietary intake of saturated triglycerides and cholesterol can reduce potential risk of developing cardiovascular disease (CVD) in later life.

Fig. 3.2 shows the structure of a saturated triglyceride.

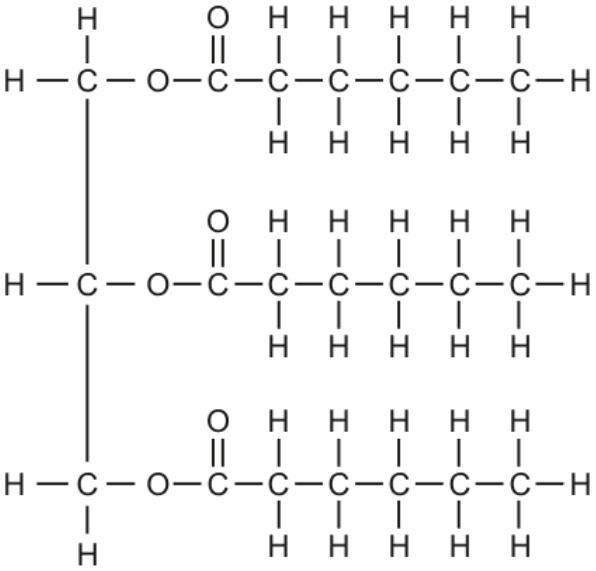


Fig. 3.2

(i) Describe how the structure of a polyunsaturated triglyceride molecule would **differ** from the molecule shown in **Fig. 3.2**.

.....

..... **[1]**

Turn over

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Question 10 · A level Paper 2 · June 2019 · Q21(c) · 2 marks

(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.

.....

.....

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.....

..... **[2]**

Question 11 · A level Paper 2 · November 2021 · Q18(a) · 3 marks

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

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

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..... **[3]**

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SECTION B

Answer **all** the questions.

21 Human insulin is a globular protein with a quaternary structure. One insulin molecule has 51 amino acids.

Fig. 21.1 shows the sequence of amino acids in one molecule of human insulin.

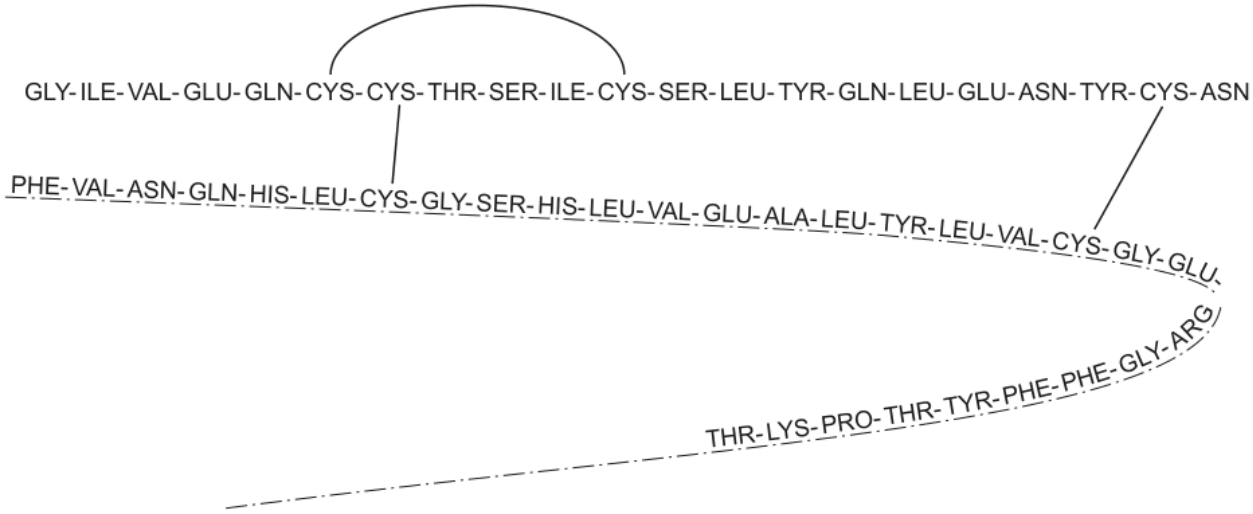


Fig. 21.1

(a) The amino acid cysteine is abbreviated to 'CYS' in **Fig. 21.1**. The side chain (R group) found in cysteine is shown in **Fig. 21.2**.

Complete **Fig. 21.2** to show the structure of the amino acid cysteine.

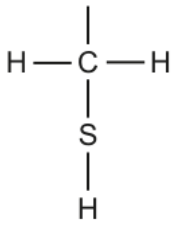


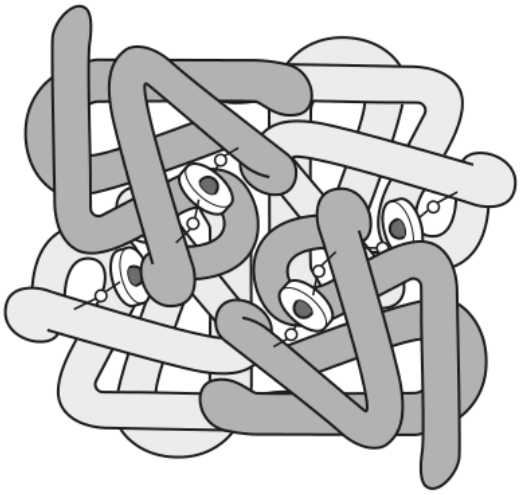
Fig. 21.2

[3]

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24 Haemoglobin is a conjugated protein with quaternary structure.

(a) The image shows the quaternary structure of a haemoglobin molecule.



(i) In addition to having a quaternary structure, haemoglobin also has primary, secondary and tertiary structures.

The table below contains statements about the structure of haemoglobin.

Complete the table to show the level of protein structure described in each statement.

You can choose each level of protein structure **once**, **more than once** or **not at all**.

Statement	Level of Protein Structure
Disulfide bonds are formed when two cysteine amino acids in an α-globin chain come together after the alpha helix folds	
Haemoglobin is made up of two α-globin chains and two β-globin chains	
Each α-globin and β-globin chain is folded into a spherical shape	
The β-globin chain has 147 amino acids in a specific sequence	

[3]

Questions, mark schemes and examiners' report extracts © OCR.

Question 14 · information from earlier in the question

SECTION B

Answer **all** the questions.

16 Haemoglobin is a globular protein.

Fig. 16.1 shows the structure of haemoglobin.

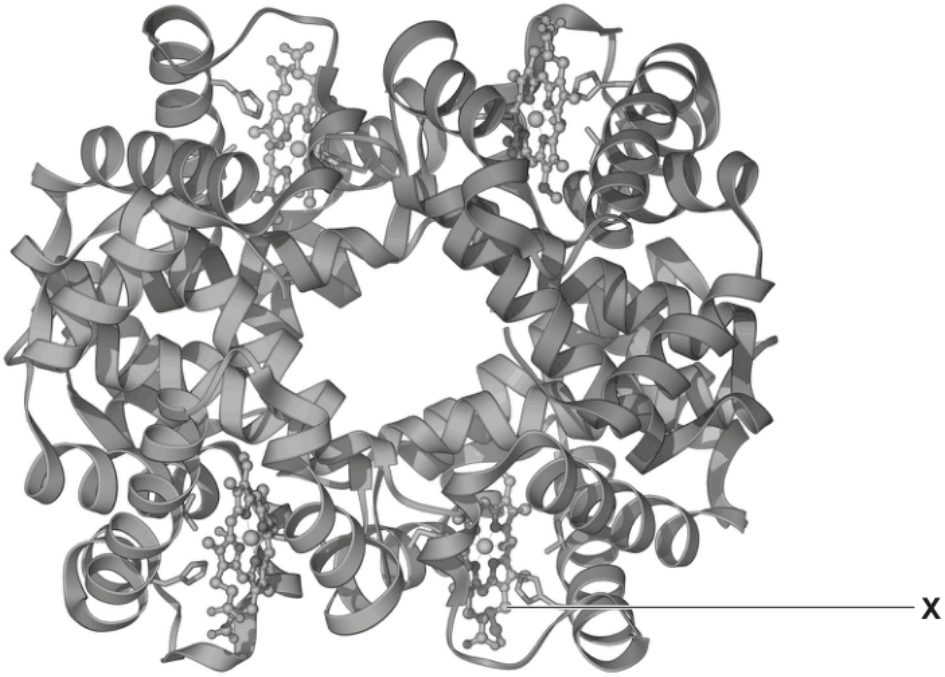


Fig. 16.1

(a) There are four levels of protein structure.

(i) Name the bond present in the primary structure of a protein.

..... **[1]**

Question 14 · A level Paper 2 · June 2022 · Q16(a)(iii) · 1 mark

(iii) State **one** feature, visible in **Fig. 16.1**, that shows that haemoglobin is a globular protein.

..... **[1]**

Turn over

Questions, mark schemes and examiners' report extracts © OCR.

Question 15 · AS Paper 2 · June 2023 · Q5(b)(ii) · 2 marks

(ii) Collagen is a protein found in ligaments. Ligaments attach bone to bone and stabilise joints.

State the properties of collagen that make it suitable for this function.

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.....

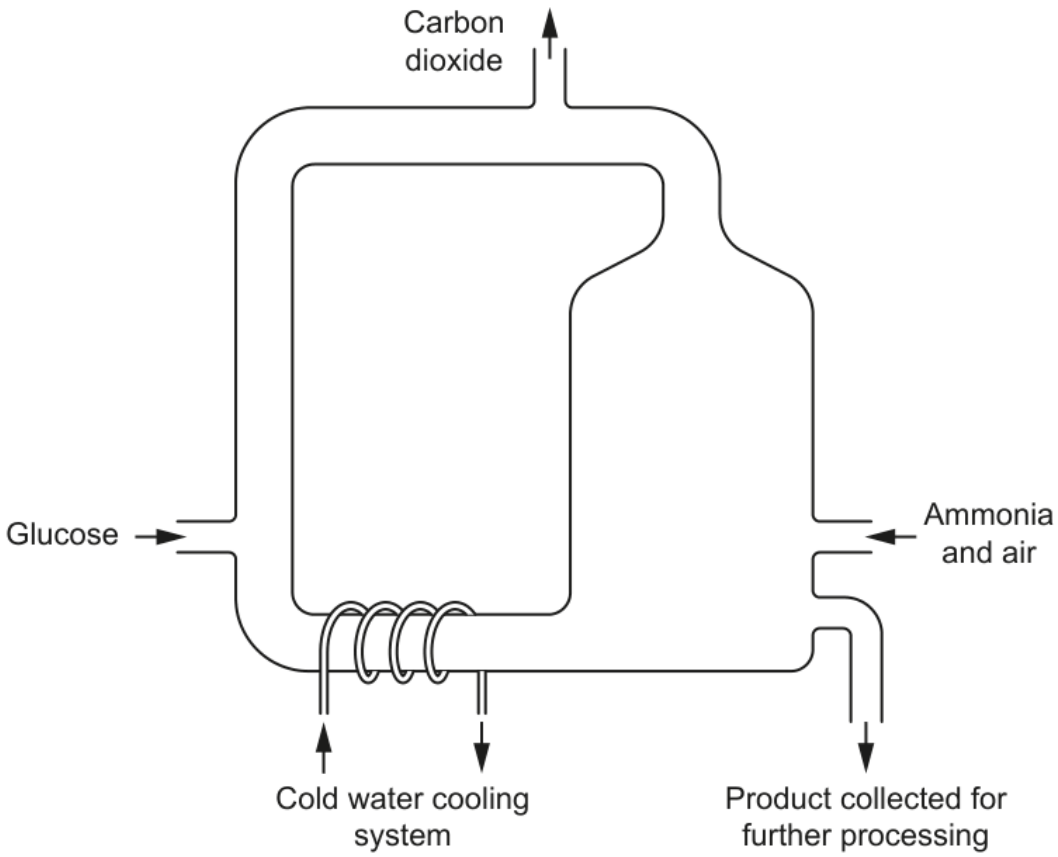
.....

..... **[2]**

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(c) The microorganism that is used to produce mycoprotein is a fungus.

The diagram is of a fermenter used for mycoprotein production.



(i) Use the diagram to name the type of fermentation process used for mycoprotein production.

Justify your answer.

Name .....

Justification .....

.....

[1]

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Question 16 · A level Paper 2 · June 2022 · Q21(c)(iii) · 2 marks

(iii) The air inlet provides the fungus with oxygen for respiration, and ammonia.

Suggest and explain why the fungus is provided with ammonia.

.....

.....

.....

.....

..... **[2]**

Question 17 · AS Paper 2 · June 2023 · Q3(a)(i) · 1 mark

3 (a) A group of students was provided with a sample of an unknown liquid and various chemical reagents. It was suggested that the sample of unknown liquid contained protein.

Here is the chemical test proposed by one of the students to test this suggestion:

- Add 3 cm^3 of unknown liquid sample to an equal volume of sodium hydroxide solution
- Mix
- Leave to stand for 5 minutes.

(i) The above test would not detect the presence of protein in the sample.

State the change that needs to be made to this test to enable protein to be detected.

.....

..... **[1]**

Question 18 · AS Paper 2 · June 2023 · Q3(a)(ii) · 2 marks

(ii) Sodium hydroxide is a white solid ionic compound which is highly soluble in water. It consists of anions and cations.

Complete the table below.

State the chemical symbol of the **anion** present in sodium hydroxide.	
State one use of this **anion** in a biological process.	

[2]

Questions, mark schemes and examiners' report extracts © OCR.

Question 19 · information from earlier in the question

1 Fig. 1.1 shows the structure of the amino acid leucine.

(a) (i) On Fig. 1.1, draw a circle around the R group of leucine.

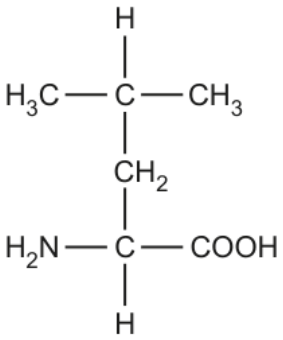


Fig. 1.1

[1]

Question 19 · A level Paper 3 · June 2017 · Q1(a)(ii) · 1 mark

(ii) Students used thin layer chromatography to separate leucine from other amino acids. The chromatogram they produced is shown in Fig. 1.2.

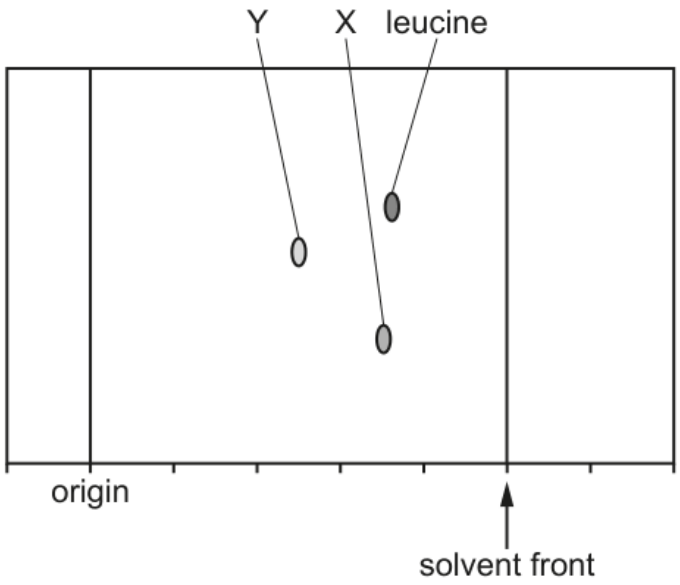


Fig. 1.2

What can you conclude about the chemical properties of leucine and amino acid X?

.....

..... **[1]**

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Question 20 · A level Paper 3 · June 2017 · Q1(a)(iii) · 3 marks

(iii) Amino acid Z was in the mixture analysed by the students. It is not shown on the chromatogram in Fig. 1.2. Amino acid Z has an R_f value that is 0.20 lower than that of amino acid Y.

Place a dot on the chromatogram in Fig. 1.2 to show the distance moved by amino acid Z.

Show your working.

[3]

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Mark schemes

Question 1 · AS Paper 2 · June 2024 · Q6(a)(i) · 2 marks

6	(a)	(i)	amine ✓ carboxyl ✓	2	**IGNORE** structural / molecular, formulae **ALLOW** amino for 'amine' **ALLOW** carboxylic acid (group) for 'carboxyl'

Question 2 · AS Paper 2 · June 2024 · Q6(a)(iii) · 1 mark

	(iii)	hydrolysis ✓	1

Question 3 · A level Paper 2 · June 2018 · Q22(a) · 1 mark

22	(a)	*saturated fatty acids have…* carboxyl(ic group) / COOH / OH / hydroxyl / oxygen atoms ✓	1

Mark first response only

IGNORE hydroxide

Questions, mark schemes and examiners' report extracts © OCR.

Question 4 · AS Paper 2 · June 2018 · Q4(a)(i) · 2 marks

4(a)(i) 2

Important role	Ion
Production of nitrate ions by bacteria	NH_4^+
Loading of phloem	H^+
DNA structure	PO_4^{3-}
Cofactor for amylase	Cl^-

✓ ✓

Additional incorrect answer in a cell = 0 marks

Symbols must be fully correct

all three correct = 2 marks

one or two correct = 1 mark

none correct = 0 marks

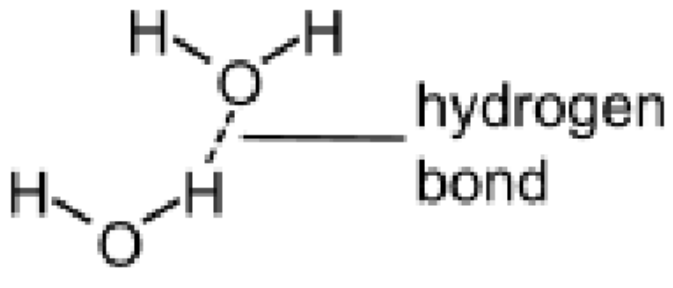
Question 5 · AS Paper 1 · June 2022 · Q25(a)(i) · 3 marks

25 (a) (i) 3

water molecules correctly drawn ✓

horizontal / vertical, dashed line between **H** of one molecule and **O** of the adjacent molecule ✓

hydrogen bond labelled ✓



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Question 6 · AS Paper 1 · June 2022 · Q25(a)(ii) · 3 marks

25	**(a)**	**(ii)**	cohesion, attracts / holds, water molecules together ✓ allows chain of water molecules to be pulled up xylem ✓ adhesion allows water molecules, to stick / AW, to xylem vessel <u>walls</u> ✓ (moving water up vessel) by capillary action ✓ (water as) a solvent to dissolve, sucrose / assimilates, for, transport in the phloem / translocation **OR** (water as) a solvent to dissolve ions for transport in the, xylem / transpiration stream ✓

Max 3	**ALLOW** cohesion, water molecules form hydrogen bonds with each other **ALLOW** named ions /correct ion formulae

Question 7 · AS Paper 1 · June 2018 · Q22(c)(i) · 3 marks

(c)	**(i)**	energy source for respiration / respiratory substrate ✓ energy storage ✓ thermal insulation ✓ electrical insulation ✓ buoyancy ✓ *idea of:* (physical) protection ✓	3 max

DO NOT ALLOW energy for respiration
IGNORE for warmth unless linked to insulation
e.g protection around kidneys

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Question 8 · AS Paper 1 · June 2018 · Q22(c)(ii) · 2 marks

(ii)	fewer hydrogens / more double bonds / less saturated, gives lower melting point ✓ (fewer hydrogens / less saturated) more kinked, chain / molecule ✓ (molecules) less uniformly packed together (so lower temperature needed for melting) ✓	2 max

One mark for description (1st mark point)
One mark for explanation.

Note mp1 only awarded for clear statement of trend not for full description of data
DO NOT ALLOW hydrogen, ions / bonds / molecules

Question 9 · AS Paper 2 · June 2022 · Q3(b)(i) · 1 mark

3	**(b)**	**(i)**	**1** more than one, C=C / double bond (between carbons) ✓ **2** more than one, kink / bend ✓ **3** fewer H atoms ✓	**1 max**	AO 1.1

1 ALLOW has double bond**s** (between carbons)
2 ALLOW has, kink**s** / bend**s**

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Question 10 · A level Paper 2 · June 2019 · Q21(c) · 2 marks

(c)	uses / AW , water ✓ (to) break 3 ester bonds ✓ lysis means splitting **and** fatty acids are , split / AW , from glycerol ✓	
		Total

2	**CREDIT** points from annotated diagram **ALLOW** '3' inferred from water molecules used or number of fatty acids
11	

Question 11 · A level Paper 2 · November 2021 · Q18(a) · 3 marks

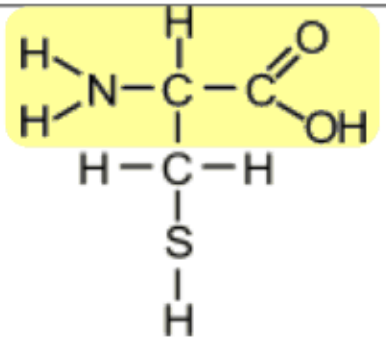
18	**(a)**		phosphate (on head), is hydrophilic / bonds with water (molecules) ✓ (two) fatty acid tails are hydrophobic ✓ heads orientate towards water / tails orientate towards other fatty acids / tails orientate away from water , (so a bilayer forms)✓	**3**

2.1 2.5	**DO NOT CREDIT** reference to incorrect bond, e.g. covalent This point is for a description of why a bilayer forms and key terms are not required

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Question 12 · AS Paper 1 · June 2022 · Q21(a) · 3 marks

21	(a)		R group attached to central carbon ✓ amine group on (one side of) central carbon ✓ carboxyl group on (the other side of) central carbon ✓

3	 **ALLOW** amine and carboxyl group either way round **ALLOW** -NH_2 , -COOH **IGNORE** separate diagram showing the generalised structural formula

Question 13 · AS Paper 1 · June 2024 · Q24(a)(i) · 3 marks

24	(a)	(i)		3

Statement	Level of Protein Structure
Disulfide bonds are formed when two cysteine amino acids in an α-globin chain come together after the alpha helix folds	tertiary
Haemoglobin is made up of two α-globin chains and two β-globin chains	quaternary
Each α-globin and β-globin chain undergoes folding into a spherical shape	tertiary
β-globin is an amino acid sequence, 147 amino acids in length	primary

4 correct answers = 3 marks ✓✓✓
3 correct answers = 2 marks ✓✓
2 or 1 correct answer(s) = 1 mark ✓

ALLOW phonetic spelling e.g. quarternary

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Question 14 · A level Paper 2 · June 2022 · Q16(a)(iii) · 1 mark

(iii)	spherical (shape) / no fibres / (contains) prosthetic groups ✓	**1**	2.1

ALLOW round / ball-shaped
IGNORE coiled / compact / tertiary structure

Question 15 · AS Paper 2 · June 2023 · Q5(b)(ii) · 2 marks

(ii)	*Any two from* fibrous ✓ insoluble ✓ (high) tensile strength ✓ resistant to stretching ✓	**Max 2**	**2.1**	**ALLOW** (high) mechanical strength

Question 16 · A level Paper 2 · June 2022 · Q21(c)(iii) · 2 marks

(iii)	source of , nitrogen / N / amine / NH_2 ✓ for (producing) amino acids / polypeptides / proteins ✓

2	2.5	**IGNORE** nitrate / NH_3 **ALLOW** for (named) nucleic acids

Question 17 · AS Paper 2 · June 2023 · Q3(a)(i) · 1 mark

3	**(a)**	**(i)**	add Biuret (instead of sodium hydroxide) ✓	**1**	**3.4**

ALLOW add copper sulphate (solution)
IGNORE ref to changing temperature

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Question 18 · AS Paper 2 · June 2023 · Q3(a)(ii) · 2 marks

(ii)	OH^- ✓ ***One*** *from* catalyses reactions ✓ determines/regulates, pH (of body fluids) ✓ neutralise acids (from stomach) ✓ determining shape of proteins ✓	**Max 2**

1.2	**IGNORE** hydroxide **DO NOT ALLOW** any additional ion **ALLOW** ecf for correct function related to an incorrect *anion* stated for mp1 **ALLOW** pH buffer **ALLOW** proton acceptor

Question 19 · A level Paper 3 · June 2017 · Q1(a)(ii) · 1 mark

ii	solubility / adsorption / interactions with the stationary phase, similar / same / AW ✓ R/ functional / residual, groups, similar / AW ✓

1 max	**ACCEPT** leucine *slightly* more soluble / interacts *slightly* less with stationary phase **ACCEPT** both more soluble than Y **IGNORE** size/ charge

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Question 20 · A level Paper 3 · June 2017 · Q1(a)(iii) · 3 marks

iii	a mark shown on the diagram at 1.5 cm from the origin ✓✓✓		**3**

Correct answer = 3 marks (indicated by 3 ticks on diagram) even if no working shown
ACCEPT a mark in the range 1.4 -1.6 cm
ACCEPT centre of dot on or within guidelines

Max 2 for calculation if mark not drawn on the diagram within this range, OR if two dots drawn and second dot incorrect
Marks for seeing in calculation:
(R_f of Y =) 2.5 / 5 = 0.5 /
(R_f of Y =) 25 / 50 = 0.5 ✓

(R_f of Z =) 0.5 - 0.2 = 0.3 ✓
ALLOW ECF for R_f *value* of Y

(Distance moved by Z) = 0.3 x 5 = 1.5 /
(Distance moved by Z) = 0.3 x 50 = 15 ✓
ALLOW ECF for R_f *value* of Z

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