Biological Compounds (CC1): Eduqas A Level Biology Exam Questions by Topic

22 questions · 42 marks · about 50 minutes. Answer in the spaces, then check the mark schemes at the end.

Question 1 · AS Component 1 · June 2023 · Q1(a) · 2 marks

1. (a) Inorganic ions are found in many of the main biological molecules in living organisms. **Complete Table 1.1** to state **one** role of each of the inorganic ions shown. [2]

Table 1.1

Inorganic ion	Role in living organisms
Mg^{2+}	.....
Fe^{2+}	.....
Ca^{2+}	.....
PO_4^{3-}	.....

Question 2 · A level Component 1 · June 2025 · Q3(a)(ii) · 2 marks

(ii) State **one** role of each of the following elements **in plants**. [2]

calcium .....

magnesium .....

Question 3 · AS Component 1 · June 2018 · Q4(b)(i) · 2 marks

(b) The movement of water through xylem vessels partly relies on the polar nature of water molecules.

(i) Explain why water is a polar molecule. [2]

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Question 4 · A level Component 1 · Autumn 2020 · Q6(e) · 2 marks

(e) Explain why the respiratory rate is much slower when yeast uses sucrose as the respiratory substrate. [2]

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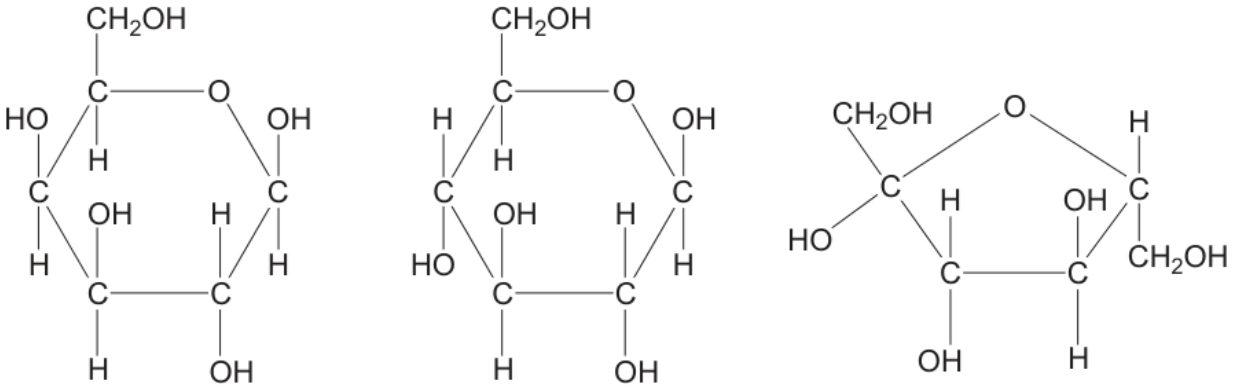
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Question 5 · A level Component 3 · Autumn 2021 · Q1(b)(i) · 1 mark

(b) Raffinose is a trisaccharide composed of galactose, glucose and fructose. It is found in some vegetables. Galactose, glucose and fructose are shown in **image 1.2**.

Image 1.2



When the three molecules are bonded together to form raffinose there are two condensation reactions. The molecular formula for each of glucose, fructose and galactose is $C_6H_{12}O_6$.

(i) Give the molecular formula of raffinose. [1]

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Question 6 · A level Component 3 · Autumn 2021 · Q1(c)(i) · 2 marks

(c) Starch is a storage polysaccharide made up of glucose.

(i) State **two** properties of starch that make it an effective storage molecule. [2]

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Question 7 · A level Component 3 · Autumn 2021 · Q1(d) · 2 marks

Cellulose is another polysaccharide found in the cell walls of plants.

(d) Give **two** differences between a starch molecule and a cellulose molecule. [2]

Question 8 · AS Component 1 · June 2024 · Q3(a)(ii) · 3 marks

(ii) Describe how the arrangement of the glucose molecules gives strength to the cell wall. [3]

Question 9 · A level Component 3 · June 2025 · Q3(a) · 4 marks

3. Sucrose and other carbohydrates, such as raffinose, are transported from mesophyll cells in leaves to other parts of a plant through the phloem.

(a) Sucrose is a disaccharide. Raffinose is a trisaccharide made up of galactose, glucose and fructose. Both sucrose and raffinose contain glycosidic bonds.

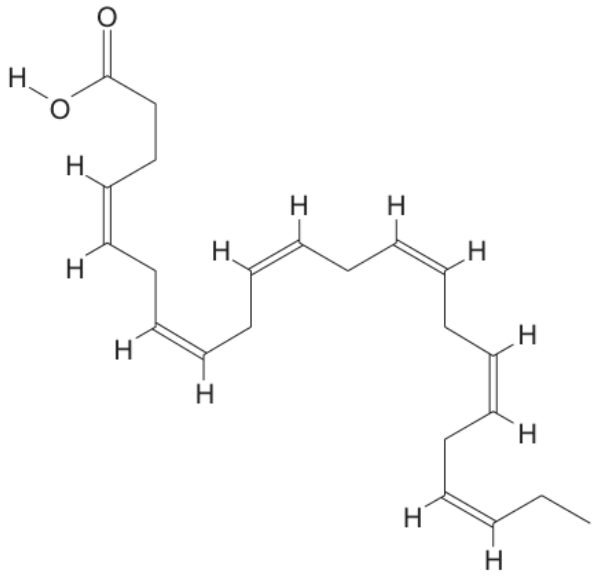
Raffinose is a non-reducing sugar.
Describe how you would show that raffinose is a **non-reducing sugar** and not a reducing sugar. [4]

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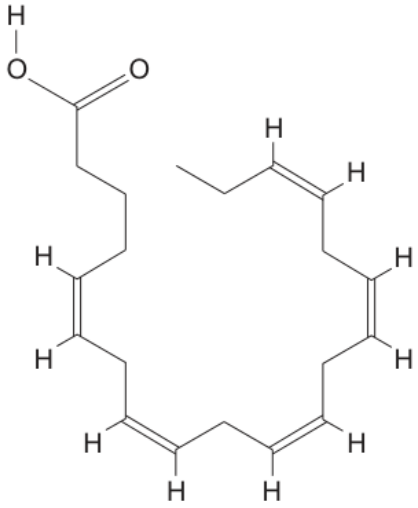
Question 10 · A level Component 2 · June 2017 · Q5(c)(i) · 2 marks

Nutritionists often recommend that fish are included in diets, due to their high omega-3 polyunsaturated fatty acid content.

The diagrams show two omega-3 polyunsaturated fatty acids.



eicosapentaenoic acid (EPA)



docosahexaenoic acid (DHA)

(c) With reference to the diagrams, explain why these compounds are described as:

(i) fatty acids; [2]

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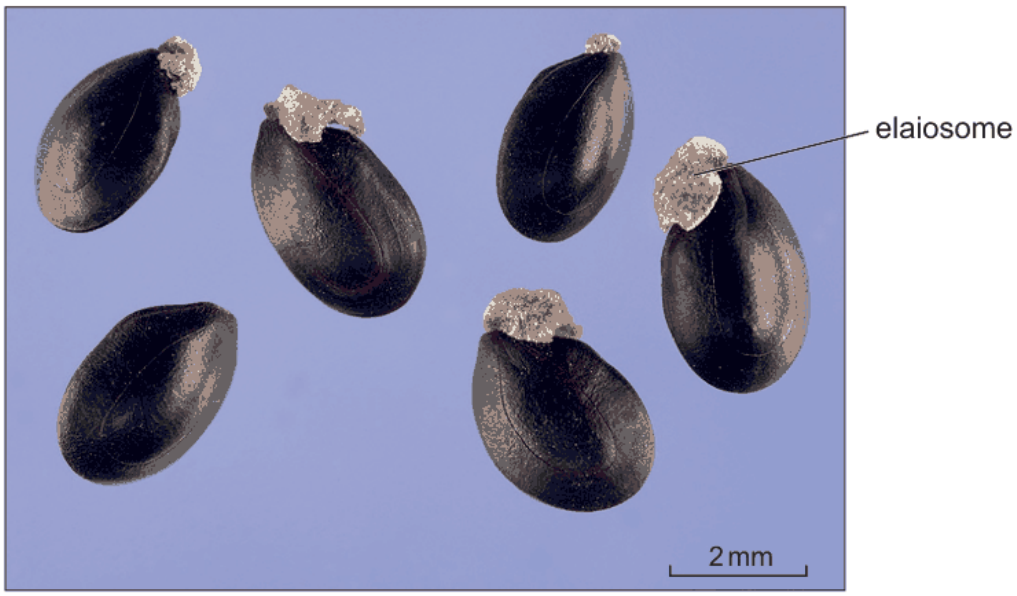
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Question 11 · A level Component 2 · June 2024 · Q5(a)(i) · 1 mark

5. Black wattle (*Acacia mearnsii*) is a plant that lives in dry environments that are subjected to forest fires. Black wattle seeds have elaiosomes. These are structures containing lipids and proteins. The seeds are shown in **Image 5**.

Image 5



(a) It has been found that there are more saturated fatty acids than unsaturated fatty acids in the elaiosomes.

(i) State **one** difference between saturated and unsaturated fatty acids. [1]

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Question 12 · AS Component 1 · Autumn 2020 · Q1(a)(iii) · 1 mark

(iii) Explain why it would be incorrect to refer to a triglyceride as a polymer. [1]

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Many seeds contain large amounts of lipid as a proportion of their mass.

During germination the new plant uses the food reserves within the seed to provide it with the energy it requires for growth. This food reserve is composed mainly of carbohydrate in the form of starch and lipid in the form of triglycerides. **Table 1.2** shows the energy made available to the germinating plant when lipids and carbohydrates are respired.

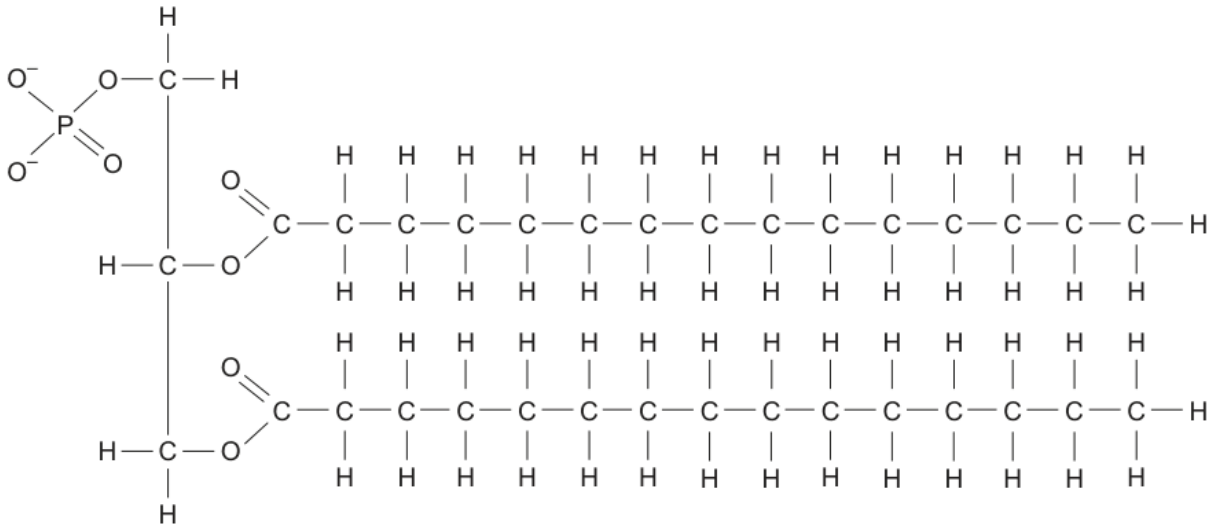
Table 1.2

Molecule metabolised	Oxygen consumption ($dm^3\ g^{-1}$)	Energy released ($kJ\,g^{-1}$)
Triglyceride	1.96	38
Carbohydrate	0.81	17

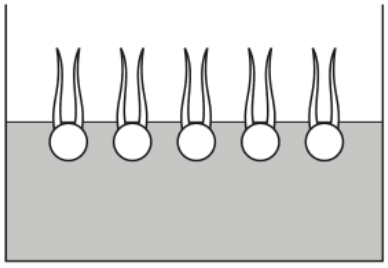
(b) With reference to the data in **table 1.2** explain the advantage to plants of using lipid as a food reserve in their seeds as opposed to carbohydrate. [3]

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(b) The diagram below shows a different type of lipid. It is the main component of cell membranes.



When these lipid molecules are extracted from the plasma membranes of cells, they arrange themselves on the surface of water as shown in the diagram below.



(i) Explain why they arrange themselves in this way. [2]

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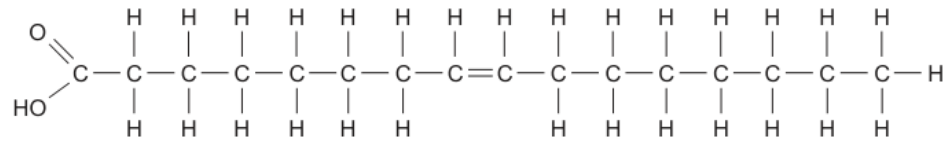
Question 15 · A level Component 3 · Autumn 2020 · Q3(a)(i) · 1 mark

3. The fat in cow's milk consists of triglycerides with different fatty acid chains.

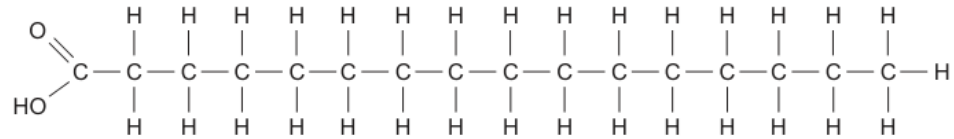
Two fatty acid chains, **A** and **B**, are shown in **image 3.1**.

Image 3.1

Chain **A**



Chain **B**



(a) (i) Identify which of these chains would have a more negative effect on human health. Explain your answer. [1]

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Question 16 · AS Component 1 · June 2016 · Q2(b) · 2 marks

(b) Describe the biochemical structure of a glycoprotein. [2]

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Question 17 · AS Component 1 · June 2023 · Q1(c)(i) · 2 marks

(c) Acid phosphatase (ACP) is an enzyme that catalyses the removal of an inorganic phosphate ion from a substrate by the induced fit model of enzyme action.

(i) The enzyme acid phosphatase is a protein. Name the reagent that would be used to test for protein **and** the colour produced by a positive result. [2]

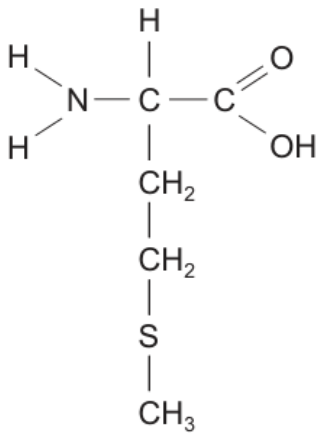
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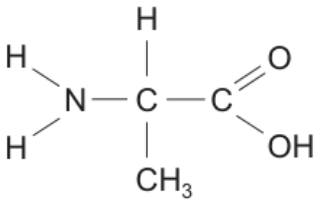
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(b) During translation amino acids can be joined together in different sequences. The drawings below show the structural formulae of the amino acids methionine and glycine.

methionine



glycine



Methionine and glycine can bond together in two different ways:

methionine – glycine	or	glycine – methionine

Name the bond that would join these amino acids and with reference to the structure of the molecules, explain why two different dipeptides could be formed. [2]

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Question 19 · A level Component 1 · Autumn 2020 · Q2(a)(i) · 2 marks

2. RuBisCO is the most abundant enzyme on Earth. Each RuBisCO molecule is made of eight **identical** long chain polypeptides and eight **identical** short chain polypeptides.

(a) (i) RuBisCO shows all four levels of protein structure. Briefly describe what is meant by the following terms: [2]

Primary structure .....

.....

Secondary structure .....

.....

Tertiary structure .....

.....

Quaternary structure .....

.....

Question 20 · A level Component 2 · June 2024 · Q2(b)(i) · 1 mark

(b) DNA base sequencing has also been completed for other organisms to determine evolutionary relatedness. The base sequences coding for some of their proteins have been completed, including haemoglobin.

Haemoglobin is a globular protein with a quaternary structure that transports oxygen around the body of many animals.

(i) Explain the meaning of quaternary structure. [1]

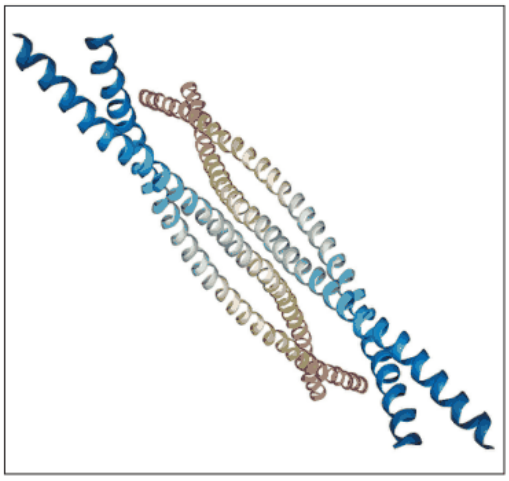
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(b) Proteins are major biological molecules. The structures of keratin and lysozyme are shown in **Image 1.2**.

Image 1.2



Keratin



Lysozyme

(i) State **two** structural differences between the two types of proteins shown in **Image 1.2**. [2]

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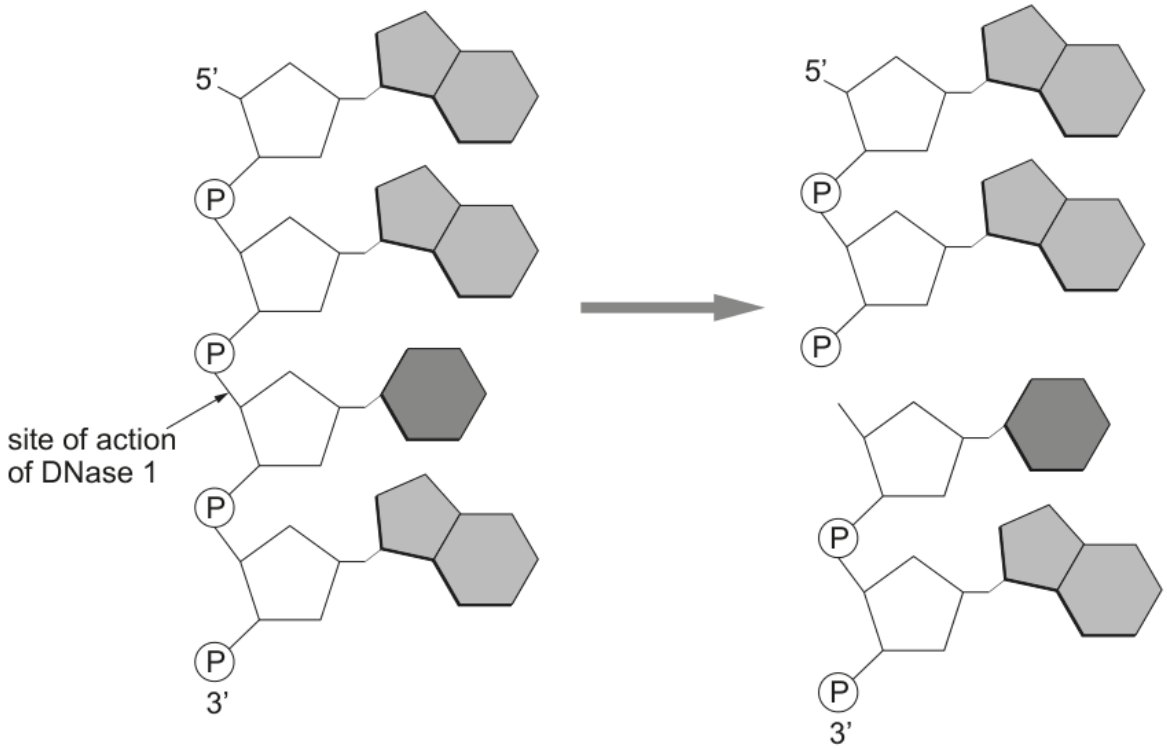
Question 22 · AS Component 1 · June 2017 · Q5(a)(i) · 1 mark

5. In some lung conditions, the DNA from dead cells in the alveoli and bronchioles makes mucus less fluid and difficult to remove from the lungs.

Deoxyribonuclease 1 (DNase 1) is an *endonuclease* enzyme and works in a similar way to an endopeptidase. It digests DNA into fragments ranging from one to four base pairs in length.

It has been suggested that DNase 1 could be used to break down the DNA in mucus. This would make the mucus more fluid and easier for cilia to move from the lungs.

The enzyme causes *hydrolysis* of the bond between a phosphate group attached to carbon atom 5 of a deoxyribose which has a pyrimidine base attached to carbon atom 1. The digestion of a short length of DNA by DNase 1 is shown in the diagram below.



(a) (i) What is meant by the term *hydrolysis*? [1]

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Mark schemes

Question 1 · AS Component 1 · June 2023 · Q1(a) · 2 marks

1	(a)	Mg^{2+} Component of chlorophyll/ essential for photosynthesis Fe^{2+} Component of haemoglobin/ transport of oxygen Reject makes red blood cells Ca^{2+} Strengthen bones / teeth PO_4^{3-} Phospholipids/ATP/Nucleic acids e.g. of DNA/RNA/nucleotides NOT plasma membrane 4 correct = 2 marks 2/3 correct = 1 mark 0/1 correct = 0 marks	2	2

Question 2 · A level Component 1 · June 2025 · Q3(a)(ii) · 2 marks

(ii)	Strengthen plant cell walls (1) Component of chlorophyll (1) 2		2

Question 3 · AS Component 1 · June 2018 · Q4(b)(i) · 2 marks

(b)	(i)	$H^{\delta+}$ / slight positive charge (1) $O^{\delta-}$ / slight negative charge (1) Accept shown on diagram uneven distribution of charge/electrons / dipole / hydrogen has positive charge and oxygen has a negative charge = 1 mark	2	2

Question 4 · A level Component 1 · Autumn 2020 · Q6(e) · 2 marks

(e)	Sucrose is a disaccharide (1) must be broken down / hydrolysed. (1)	2	2	2

Question 5 · A level Component 3 · Autumn 2021 · Q1(b)(i) · 1 mark

(b)	(i)	$C_{18}H_{32}O_{16}$	1	1

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Question 6 · A level Component 3 · Autumn 2021 · Q1(c)(i) · 2 marks

(c)	(i)	**Any two (x1) from:** Insoluble (1) Too large to diffuse out (1) Doesn't cause osmosis (1) Compact so can fit a large amount in a small space (1)	2	2

Question 7 · A level Component 3 · Autumn 2021 · Q1(d) · 2 marks

(d)	**Any two (x1) from:** Starch only alpha glucose, cellulose only B glucose (1) Starch can be branched/coiled, cellulose straight (1) Starch all glucose same orientation, cellulose every other glucose is inverted (1) (not microfibrils)	2	2

Question 8 · AS Component 1 · June 2024 · Q3(a)(ii) · 3 marks

(ii)	**Any three (x1) from:** Chains of glucose linked by (beta) glycosidic bonds (1) alternate glucose molecules rotated by 180 degrees (1) chains cross linked by hydrogen bonds (1) Forming microfibrils (1)	3	3

Question 9 · A level Component 3 · June 2025 · Q3(a) · 4 marks

3	*(a)*	A. Test with Benedict's and heat – {negative result / stays blue / no colour change} (1) **Any three (x1) from** B. {Heat/ warm} {sample / raffinose / sugar} with (dilute) {HCl / acid} (1) C. Neutralise the (acid) solution (with sodium hydrogen carbonate) (1) D. (repeat) Benedict's test (and heat) (1) E. {red / orange / yellow/ green} (shows it was a non-reducing sugar) (1)	3	1	4	4

Question 10 · A level Component 2 · June 2017 · Q5(c)(i) · 2 marks

(c)	(i)	They have a carboxylic acid group/ carboxyl (1) NOT COOH And a long {chain of carbon atoms/ hydrocarbon chain} / (1)	2	2

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Question 11 · A level Component 2 · June 2024 · Q5(a)(i) · 1 mark

5	(a)	(i)	Must be comparable statements: Saturated / Unsaturated No {Carbon-carbon double bond / C=C bonds} / has C-C bonds / Has C-C double bond / C=C bonds} (s) / {More / maximum} H / Less H	1		1	

Question 12 · AS Component 1 · Autumn 2020 · Q1(a)(iii) · 1 mark

(iii)	A polymer is a chain of identical monomers/ triglyceride is not a chain/ ORA (1)	1		1

Question 13 · AS Component 1 · Autumn 2020 · Q1(b) · 3 marks

(b)	More energy (released per g) (1) Twice as much energy from 1g of lipid than carbohydrate / lipid releases 38 kj g^{-1}, carbohydrate releases 17 kj g^{-1} / correct use of data (1) Plant will germinate/ grow more quickly / smaller food store needed in seed/ seeds may be lighter (1)	2	1	3

Question 14 · AS Component 1 · June 2017 · Q1(b)(i) · 2 marks

(b)	(i)	• {phosphate/ head} is {hydrophilic/ polar} so attracted to water/ owtte (1) • {fatty acids/ tails} are {hydrophic/ non-polar} so repelled from water/ owtte (1) Accept heads are hydrophilic, tails are hydrophobic (with no explanation)	2	2

Question 15 · A level Component 3 · Autumn 2020 · Q3(a)(i) · 1 mark

3	*(a)*	(i)	(Chain B (no mark) as it is saturated	1	1

Question 16 · AS Component 1 · June 2016 · Q2(b) · 2 marks

(b)		(Globular) protein (1) Accept Polypeptide With a carbohydrate (chain)/polysaccharide/oligosaccharide (attached to it) (1) Reject Glycogen	2	2

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Question 17 · AS Component 1 · June 2023 · Q1(c)(i) · 2 marks

(c)	(i)	Add biuret (reagent) / copper sulfate and {sodium/ potassium} hydroxide (1) Lilac/purple colour (1)	2	2	2

Question 18 · AS Component 1 · June 2018 · Q3(b) · 2 marks

(b)	peptide (1) bond could form due to loss of OH from methionine or from glycine/amino end and carboxyl end / depends upon the {DNA/mRNA} base sequence (1)	1	1	2

Question 19 · A level Component 1 · Autumn 2020 · Q2(a)(i) · 2 marks

2	*(a)*	(i)	Primary: Sequence of amino acids Secondary: Coiled into an alpha helix/ beta pleated sheet Tertiary, folded into a 3D shape Accept globular shape Quaternary, Two or more polypeptides joined together. **All** correct = **2** marks **2** correct = **1** mark	2	2

Question 20 · A level Component 2 · June 2024 · Q2(b)(i) · 1 mark

(b)	(i)	Contains more than one polypeptide {bonded / joined} together	1	1

Question 21 · AS Component 1 · June 2023 · Q1(b)(i) · 2 marks

(b)	(i)	**Any two (x1) from** Comparative statements needed	2	2

Keratin	Lysozyme
fibrous	globular
Helical/ coiled/ owtte	Folded and coils, alpha helices and beta pleated sheets
Secondary accept quaternary	tertiary structure

Question 22 · AS Component 1 · June 2017 · Q5(a)(i) · 1 mark

5	(a)	(i)	{insertion/ addition} of <u>water</u> to break a <u>bond</u> NOT hydrogen	1	1

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