WJEC EDUQAS AS BIOLOGY · COMPONENT 1

BIOLOGY



EXAM QUESTION PACK

1.1 BIOLOGICAL COMPOUNDS

SCORE	PERCENTAGE
/68	%

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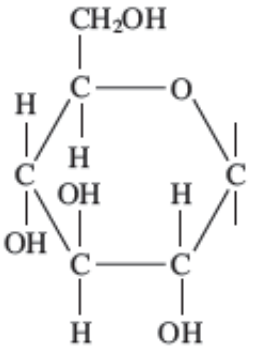
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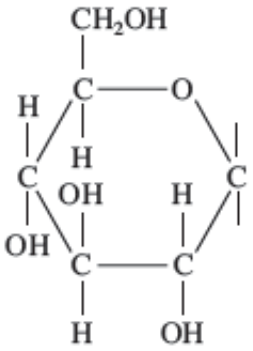
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1. Carbohydrate molecules contain the chemical elements carbon, hydrogen and oxygen only.

(a) The diagrams below show structural formulae of two isomers of glucose. Complete the drawings to distinguish between the and β isomers. [1]



α glucose



β glucose

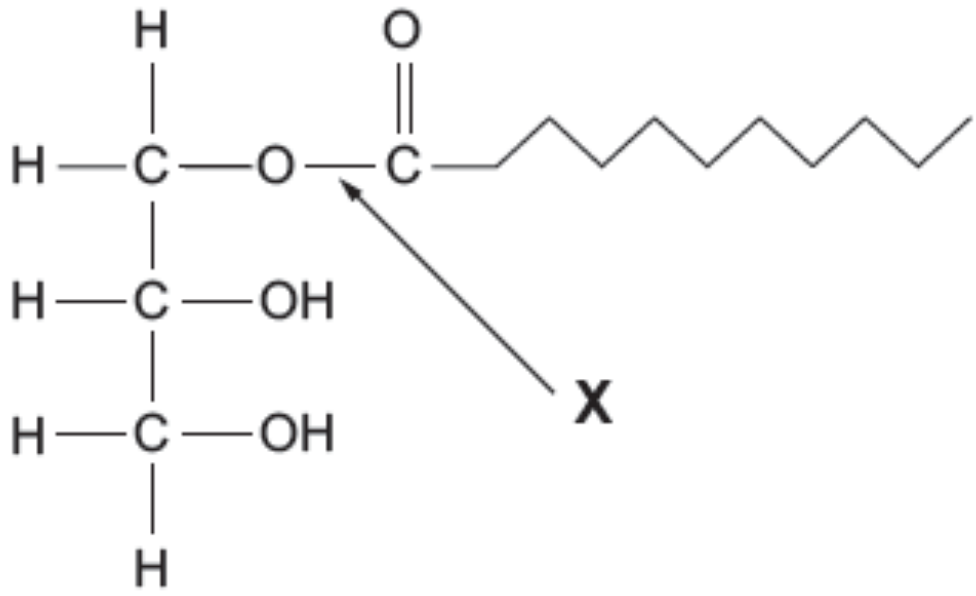
(b) (i) Starch and cellulose are both polymers of glucose, but they are formed from different isomers. State the isomer which is found in: [1]

Cellulose . . . . . Starch . . . . . .

(ii) Explain how the structures of starch and cellulose are related to their functions as storage and structural molecules respectively.

[4]

2. (a) The diagram below shows a monoglyceride.



During the digestion of monoglycerides, the bond labelled **X** is broken down by the enzyme lipase.

(i) Name the bond labelled **X** in the diagram above.

[1]

.....

(ii) State the **type** of reaction involved in the breakdown of the monoglyceride.

[1]

.....

(iii) In the space below **draw** and **name** the products of the breakdown of the monoglyceride.

[2]

. . . . . .

(iv) Explain why triglycerides are not considered to be polymers.

[1]

.....

.....

.....

(b) (i) Two fatty acids which are common in triglycerides are stearic acid and oleic acid. Stearic acid has the chemical formula of $C_{17}H_{35}COOH$ and oleic acid has the chemical formula of $C_{17}H_{33}COOH$.
What type of fatty acid is oleic acid? Give a reason for your answer. [2]

.....

.....

.....

.....

(ii) Apart from energy storage, state **two** functions of triglycerides in a mammal.

[2]

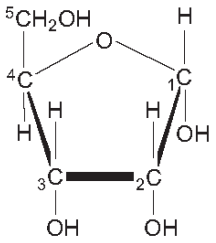
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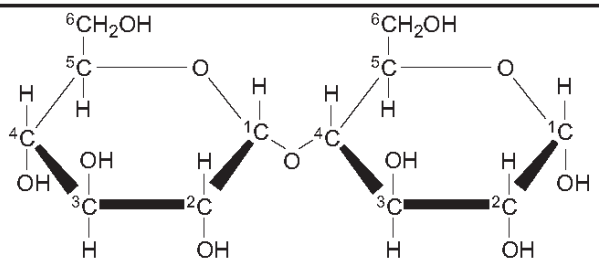
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3. The following diagrams represent the structure of some common organic molecules.

A

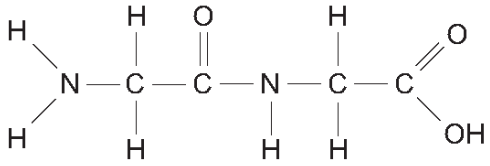


B

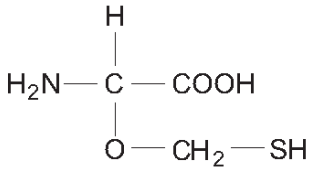


α 1,4 link

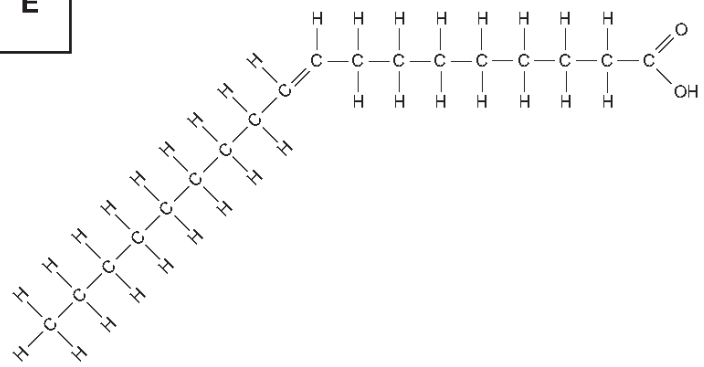
C



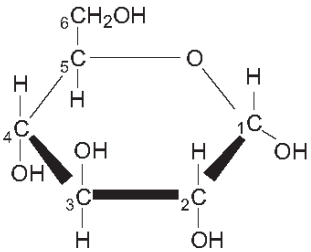
D



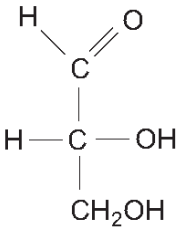
E



F



G



(a) Using letters **A**-**G**, complete the table below. You may use each letter once, more than once or not at all. [7]

Statement	Letter(s)
is a monosaccharide	
is a dipeptide	
would be found in nucleic acids	
contains C=C bonds	
contains a glycosidic bond	
is a triose sugar	

(b) (i) Describe a biochemical test for the presence of glucose in a solution. [2]

.....

.....

.....

.....

.....

.....

(ii) Explain why a positive result is seen with glucose but not for sucrose. [1]

.....

.....

.....

.....

4. Inorganic ions are needed by living organisms. Complete the table below to give a function for **each** of the four ions. [4]

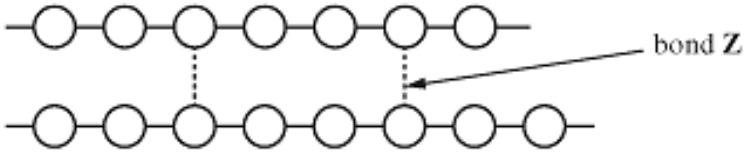
10

Ion	*Function*
Magnesium	
Iron	
Phosphate	
Calcium	

(Total 4 marks)

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5. The diagram represents part of a cellulose molecule.



(a) (i) Name bond **Z** as shown on the diagram. [1]

.....

(ii) Explain the importance of bond **Z** in the role of cellulose in plant cell walls. [2]

.....

.....

.....

(b) (i) Name the chemical reaction by which monomers join together to form cellulose. [1]

.....

(ii) Chitin has many chemical and structural similarities to cellulose.
In chitin what additional compound replaces one of the –OH groups in each of its monosaccharides? [1]

.....

(iii) State the structural role of chitin in insects and describe its properties that make it suitable for this role. [1]

(c) Other polysaccharides have a storage function.
Name a storage polysaccharide found in:

(i) animal cells; [1]

.....

(ii) plant cells. [1]

.....

(Total 8 marks)

6.

(a) When a triglyceride molecule is broken down name:

(i) the products formed; [2]

.....

(ii) the type of bond broken and describe the process. [3]

.....

.....

.....

.....

(b) Describe **two** functions of lipids in plants. [2]

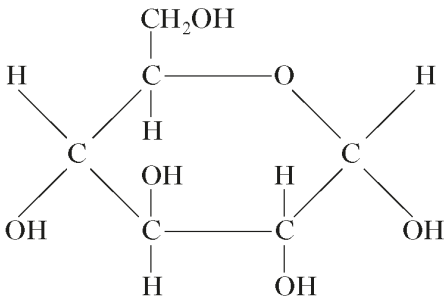
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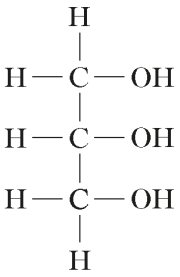
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(Total 7 marks)

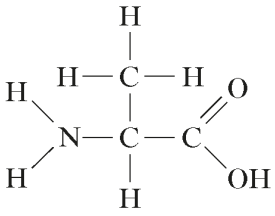
7. The following diagrams represent the structure of four biologically importa ıt compounds.



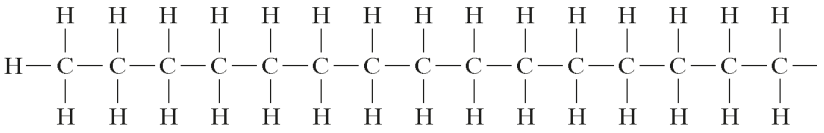
A



B



C



D

(a) A chemical element found in a molecule of compound **C** is not found i ı molecules of the other three compounds. **Name** this element. [1]

.....

(b) A reducing sugar in solution can be detected in the laboratory.

(i) Describe the biochemical test you would use to show that the so ution contained a reducing sugar. [2]

.....

.....

.....

(ii) Which of the compounds **A** to **D** will give a positive result with this biochemical test? [1]

.....

(c) Which of the compounds **A** to **D** has molecules that will join together by peptide bonds? [1]

(d) (i) Which of the compounds **A** to **D** is a fatty acid? [1]

.....

(ii) State how the structure of a saturated fatty acid differs from the structure of an unsaturated fatty acid. [2]

.....

.....

.....

.....

(Total 8 marks)

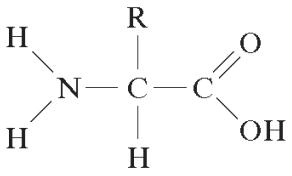
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8. Complete the following passage by inserting the correct terms in the spaces provided. [6]

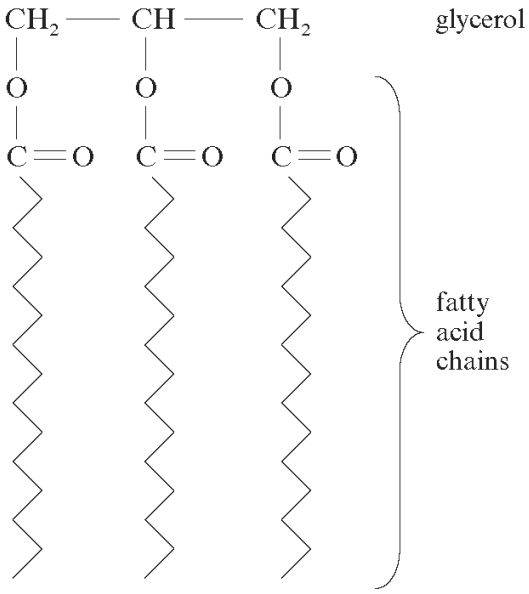
Cellulose is a fibrous molecule. It is a carbohydrate and is the main component of the .... of plants. Cellulose consists of chains of ..... glucose molecules which are joined together by 1-4 ..... bonds. Each adjacent glucose molecule is rotated by ..... ° resulting in a chain. Chains are held together by ..... bonds forming groups of chains known as ..... .

(Total 6 marks)

9. The diagrams below show two molecules, **A** and **B**, which are found in living organisms.



molecule **A**



molecule **B**

(a) (i) Name molecules **A** and **B**. [2]

A .....

B .....

(ii) Name an element found in molecule **A** that is not found in molecule **B**. [1]

.....

(b) Many molecules of **A** can join together to form a long chain. Name the process that joins the molecules together and the bond formed when they join. [2]

.....

.....

(c) (i) Describe a suitable test that could be performed to show that a solution contained polymers of molecule **A**. [2]

.....

.....

.....

(ii) Suggest a problem that could arise in using this test if very low concentrations of the polymer are present in the solution. [1]

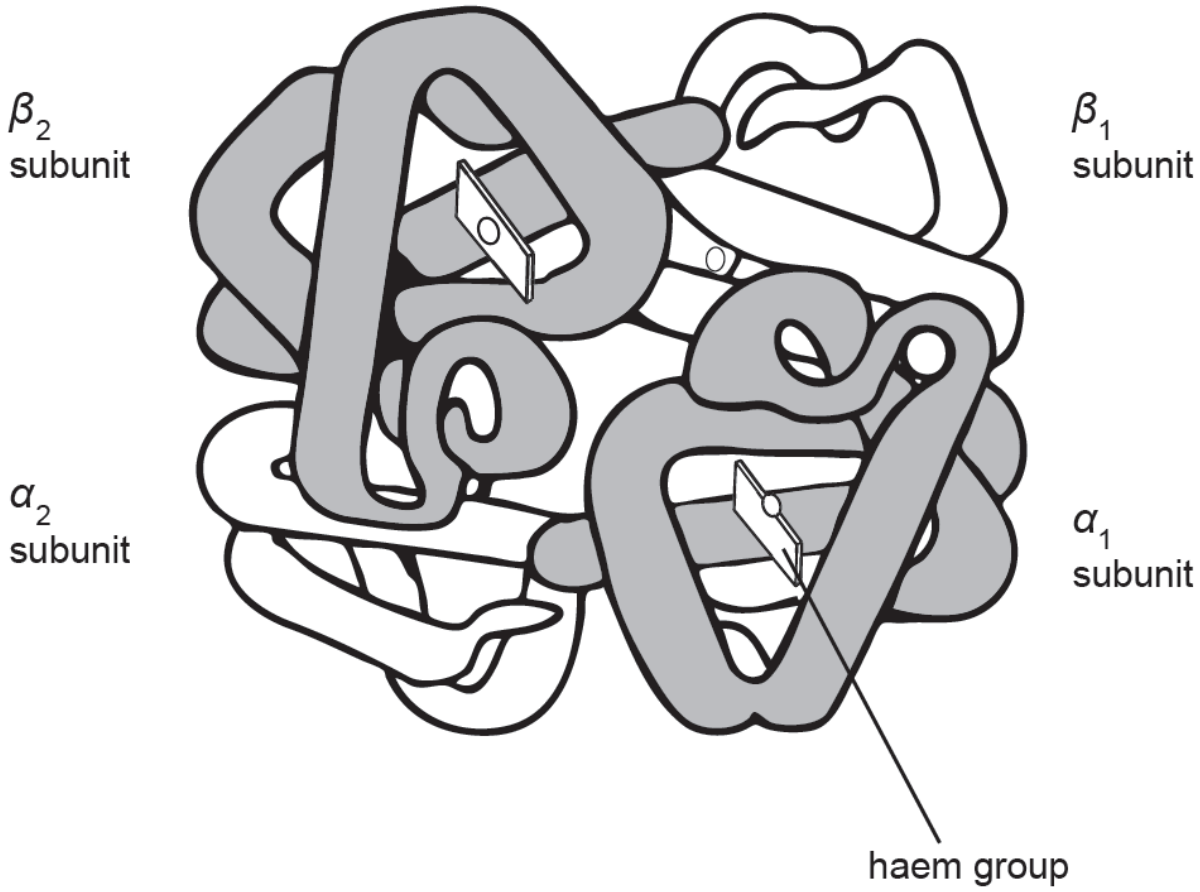
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(Total 8 Marks)

10. The diagram below shows a molecule of haemoglobin.



(a) State the inorganic ion present in the haem group.

[1]

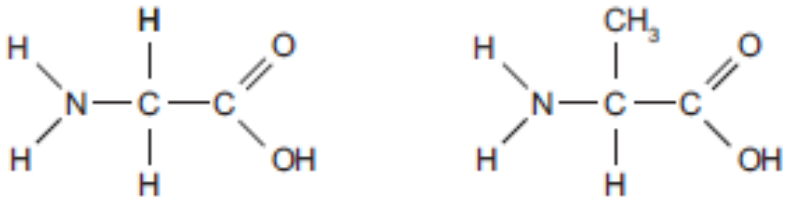
(b) Using the diagram above, explain why this molecule is regarded as having a quaternary structure. [2]

(c) Describe the biochemical test that could be performed to test for a protein. [2]

11. β-Bungarotoxin is a neurotoxin found in the venom of Krait snakes. The neurotoxin is a protein that causes muscle paralysis and eventual death.

The diagram below shows the structure of two amino acids found within the protein.

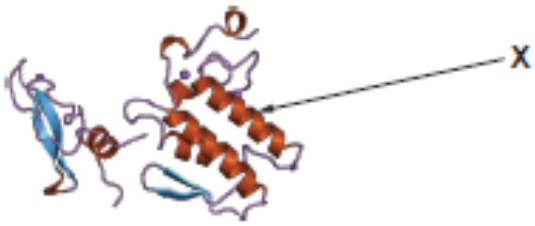
(a) (i) **Complete** the diagram, to show the products formed when these amino acid molecules are joined by a condensation reaction. [2]



(ii) State the bond formed. [1]

.....

(b) The diagram below shows the structure of the β-bungarotoxin. The protein is composed of two polypeptide chains.



(i) State the highest level of protein structure exhibited by the β-bungarotoxin. [1]

.....

(ii) Name the structure labelled **X** and state how this structure is maintained. [2]

.....

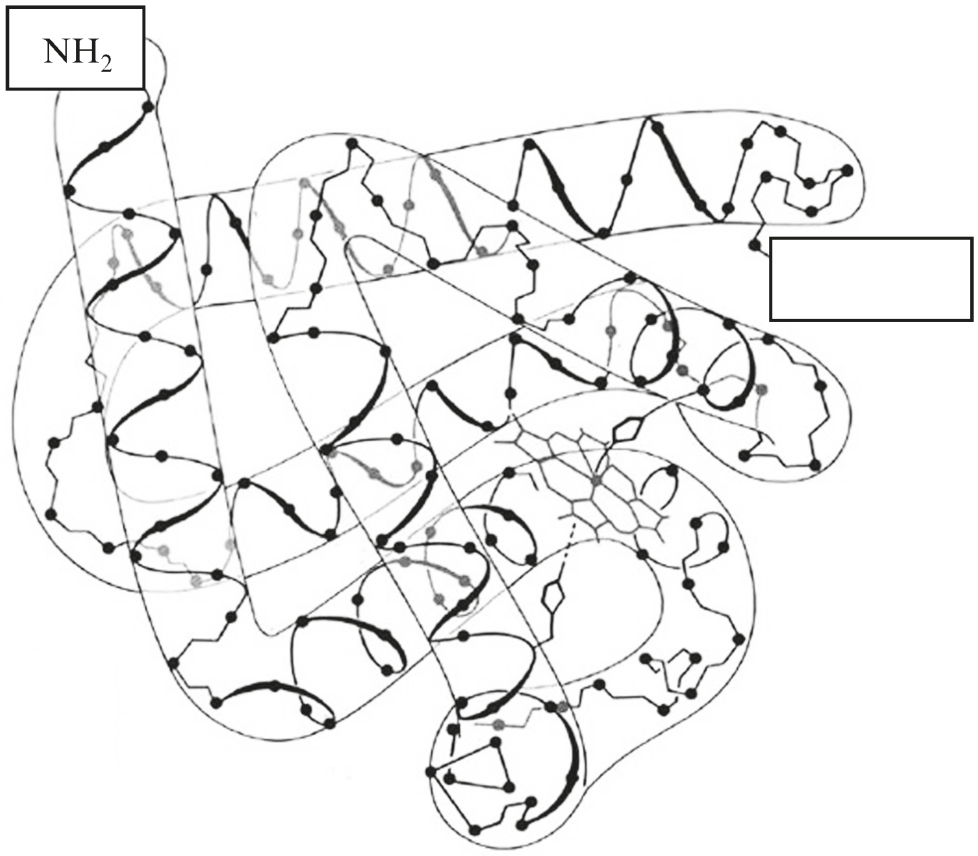
.....

12. Red blood cells are involved with the transport of oxygen around the body. Red blood cells lack internal organelles and their cytoplasm contains haemoglobin. Haemoglobin is a protein that consists of four polypeptide chains linked together.

(a) State the level of protein structure shown by haemoglobin. [1]

.....

(b) The diagram below shows one of the polypeptide chains from haemoglobin.



(i) On the diagram above, use an arrow to **clearly label** an alpha –helix. [1]

(ii) Complete the diagram above by writing in the empty box, the molecular group that would be present at the end of the polypeptide chain. [1]

(iii) Name **two** types of bonds that would be present to maintain the 3D shape of this polypeptide chain. [1]

.....

.....

(c) The plasma membrane contains proteins and phospholipids. Describe **two** ways in which the structure of phospholipids differ from triglycerides. [2]

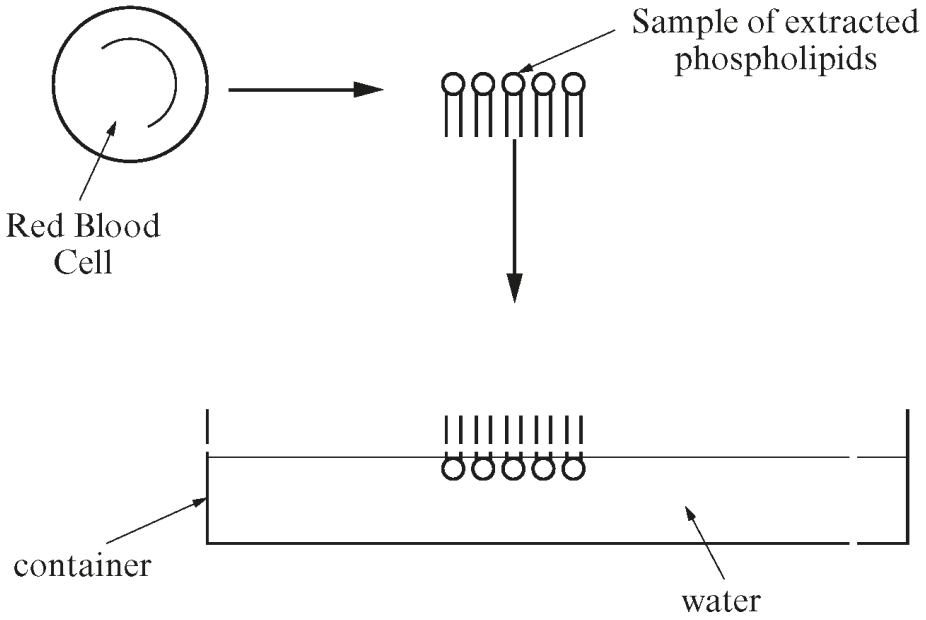
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.....

.....

.....

(d) In 1925, two scientists, Gorter and Grendel investigated the arrangement of phospholipids in the plasma membrane. This involved the removal of the phospholipids from the surface membrane of all the red blood cells in $10cm^3$ of blood. The phospholipids were then placed on the surface of water and allowed to spread out to form a single layer, called a monofilm.



(i) Explain fully the arrangement of the phospholipid molecules as shown in the container on the diagram above. [2]

.....

(Total 8 marks)

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13. The diagram below shows two molecules which are sub-units of proteins.



(a) (i) Complete the diagram above to show how a reaction takes place to join the two molecules.

[3]

(ii) Name the type of reaction involved.

[1]

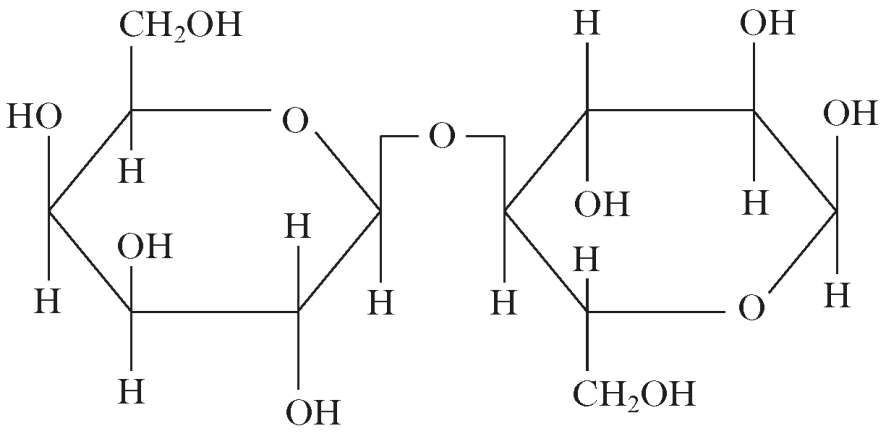
. . . . . .

(iii) Name the type of bond formed.

[1]

. . . . . .

14. Lactose is a disaccharide found in milk. The diagram below shows the structure of lactose.



(a) Lactose can be broken down into its constituent monosaccharides.

(i) Complete the diagram above to show how lactose is broken down. [2]

(ii) State the type of reaction involved in the breakdown of lactose. [1]

.....

(iii) Name the bond that is broken during this reaction. [1]

.....

(iv) Name the molecules produced when lactose is broken down. [1]

.....

(Total 5 marks)

1. (a)

(i)

α glucose OH on C1 down, H up + β glucose OH on C1 up, H down; Allow HO (both for 1 mark). 1

(b)

(i)

Cellulose -Beta Starch - alpha; (both for 1 mark). 1

Allow symbols.

(ii)

Starch: any 2

correct reference to amylose and/or amylopectin;

glycosidic bonds (α 1-4);

molecules coil/branch (in amylopectin); NOT compact

NOT: amylopectin - coiled or amylase branched

easy to add/remove {glucose / maltose} units; 2

Cellulose: any 2; 2

alternate units rotate / head up, head down / 180° rotation;

straight chain only / no branches; NOT parallel

hydrogen bonds between / reference to cross linking;

gives strength or stability / forming microfibrils;

Question 1 total 6

2.

Question			Marking details	Marks Available
2	*(a)*	(i)	Ester;	1
		(ii)	Hydrolysis;	1
		(iii)	Glycerol and fatty acid drawn correctly; Glycerol and fatty acid named;	2
		(iv)	Glycerol and fatty acids have different structures / OWTTE; (not just reference to monomers)	1
	(b)	(i)	(Oleic acid is) unsaturated; It contains at least one C=C double bond (in the hydrocarbon chain) / is not fully saturated with hydrogen (atoms); NOT hydrogen bonds/ fewer hydrogens	2
		(ii)	Any 2 protection of internal organs against impact; thermal insulation; buoyancy; waterproofing skin/fur; source of metabolic water;	Max 2
			Question 2 total	**[9]**

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3.

Question			Marking details		Marks Available
3	*(a)*		**Statement**	**Letter(s)**	
			Is a monosaccharide Any 2 from 3 correct	A,F,G ;	
			Is a dipeptide	C ;	
			Would be found in nucleic acids	A ;	7
			contain C=C bonds	E ;	
			Contains a glycosidic bond	B ;	
			Is a triose sugar	G ;	
	(b)	(i)	Add Benedicts/Fehlings (reagent) and {heat / boil};		
			Colour would change from blue to {red / orange / green / brown};		2
			Blue precipitate = neutral		
		(ii)	Glucose is a reducing sugar / reduces copper II sulphate (to copper I oxide) / sucrose is a non reducing sugar;		1
			Question 3 total		**[10]**

4.

needed for / found in / used in /component of chlorophyll;

(allow: middle lamella / enzyme co-factors)

component haemoglobin; enzyme Co factors

component nucleic acids/DNA/RNA/ATP/ (plasma) membrane/ phospholipids/

hardens bone / nucleotide;

hardens/deposited in bones/teeth/ossification/synaptic transmission

enzyme co-factors/middle lamella (not: strengthen bones) **[4]**

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5. (a) (i) hydrogen/H — 1

(ii) {Holds/binds} {cellulose/glucose} {chains/molecules} together/ forms microfibrils; — 1

strengthens (the wall)/ (cellulose fibres are) strong/ rigid/ gives structural stability/ can resist turgor/ osmotic pressure/ prevents plant cells bursting. — 1

(b) (i) condensation/ polymerisation — 1

(ii) (Has) amino acid (added)/glucosamine (to form a mucopolysaccharide)/ amine/ NH_2 — 1

(iii) (exo)skeleton – strong/waterproof/ light/ rigidity/ tough — 1

NOT exoskeleton gives protection

(c) (i) glycogen — 1

(ii) starch (accept amylose/ amylopectin) — 1

(Total 8 marks)

6. (a) (i) glycerol;

(3) fatty acids; **[2]**

(ii) ester; **[1]**

hydrolysis;

chemical insertion of water/water added to bond **[2]**

(iii) energy storage / respiratory substrate/source of energy

waxy cuticle/leaf waterproofing;

membrane structure; **[2]**

(Total 7 Marks)

7.	(a)	nitrogen (not: N)	1
	(b) (i)	heat/boil with {Benedict's/ Fehlings A + B} solution; NOT boil	1
		with acid	1
		colour change from blue to {green/yellow/orange/brick red/ brown}	
	(ii)	A	1
	(c)	C	1
	(d) (i)	D	1
	(ii)	saturated- no double bonds/ all carbon atoms have/attached	1
		to two hydrogens ;	
		Fewer hydrogen atoms (or converse)	1
		Must have comparison for each	

(Total 8 marks)

8. cell wall;

beta/β;

glycosidic;

180;

hydrogen;

microfibrils; (not: microfibres) **[6]**

9.

(a) (i)	amino acid;	
	triglyceride; (not: lipid/triglycerol)	**2**
(ii)	nitrogen/sulphur; (not: chemical symbols)	**1**
(b)	condensation;	
	peptide;	**2**
(c) (i)	add Biuret to test solution; (not: if ref. to boiling)	**1**
	blue changing to mauve/purple colour is positive result;	**1**
(ii)	little colour change/mauve colour may be masked;	**1**
		(Total 8 marks)

10.

Question	Marking details	Marks Available
(a)	Iron / Fe^{2+};	1
(b)	{Four polypeptide chains / two alpha and two beta subunits}; in tertiary form are {combined/joined};	2
(c)	Add {biuret (reagent) / copper sulphate and sodium hydroxide}; Reject boil/heat Colour changes from blue to {purple/lilac/violet};	2

Question 3 Total **[5]**

11.

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
11	(a)	(i)		Molecules drawn with a peptide bond correct (1) Molecule of water/H_2O also produced (1)	2			2		
		(ii)		peptide bond	1			1		
	(b)	(i)		Quaternary	1			1		
		(ii)		α helix (1) By hydrogen bonding (1) Ignore reference to peptide bonds	2			2		

12. *(a)* Quaternary/ 4°; 1

(b) (i) (Labelled) arrow in correct position; 1

(ii) COOH/ carboxyl/ carboxylic acid; 1

(iii) Disulphide {bond/ bridges} / ionic bonds / hydrogen / hydrophobic interactions / Van der Waals; (Any 2) 1
NOT peptide / S-S (covalent – neutral)

(c) **Mark points must be comparative** Max 2

phospholipid	triglyceride
2 fatty acids	3 fatty acids;
phosphate (head)	do not contain a phosphate (head)
polar/hydrophilic head and non-polar/hydrophobic tails	non-polar/hydrophobic;

(d) (i) {Heads/ phosphates} are {hydrophilic/ polar} and are {attracted to/ in} the water; 2
{Tails/ fatty acids} are {hydrophobic/ non polar} and are {repelled by/ above/ avoid} water;
NOT react/ dissolve with water

13. (a)

(i)

OH and H removal shown on diagram;

formation of water (H2O) shown;

dipeptide correctly drawn with C joined to N; [3]

(ii)

Condensation; [1]

(iii)

Peptide; NOT dipeptide; [1]

14. *(a)* (i) Molecule of water (drawn with arrow towards the O atom of the glycosidic bond); NOT water going out
Monosaccharides drawn with –OH groups in correct position on C1 and C4 (involved in bond); 2

(ii) Hydrolysis; NOT hydrolysation (ignore reference to acid) 1

(iii) Glycosidic; 1

(iv) Glucose and galactose; ignore alpha/ beta 1