Biology A

A level Biological Molecules practise
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Please note that you may see slight differences between this paper and the original.

Candidates answer on the Question paper.

OCR supplied materials:
Additional resources may be supplied with this paper.

Other materials required:
- Pencil
- Ruler (cm/mm)

Duration: Not set

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions, unless your teacher tells you otherwise.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Where space is provided below the question, please write your answer there.
- You may use additional paper, or a specific Answer sheet if one is provided, but you must clearly show your candidate number, centre number and question number(s).

INFORMATION FOR CANDIDATES

- The quality of written communication is assessed in questions marked with either a pencil or an asterisk. In History and Geography a *Quality of extended response* question is marked with an asterisk, while a pencil is used for questions in which *Spelling, punctuation and grammar and the use of specialist terminology* is assessed.
- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **72**.
- The total number of marks may take into account some 'either/or' question choices.

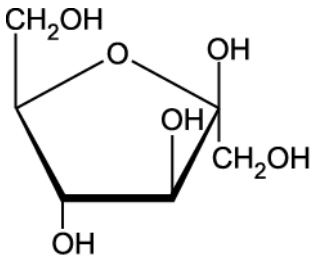
1. Which of the processes, **A** to **D**, describes the formation of cellulose?

A condensation polymerisation of amino acid molecules
B condensation polymerisation of β-glucose molecules
C hydrolysis polymerisation of α-glucose molecules
D hydrolysis polymerisation of deoxyribose molecules

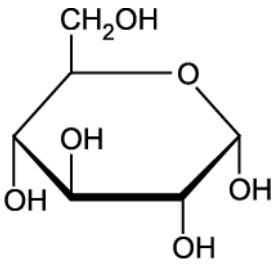
Your answer ☐

[1]

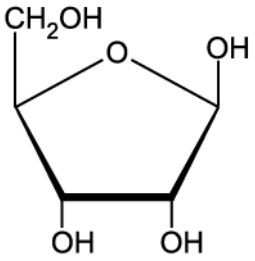
2. Which of the molecules, **A** to **D**, is a pentose sugar?



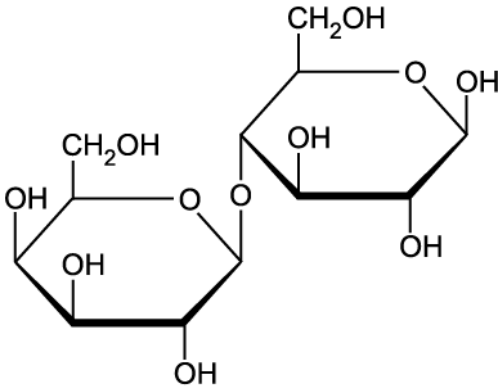
A



B



C

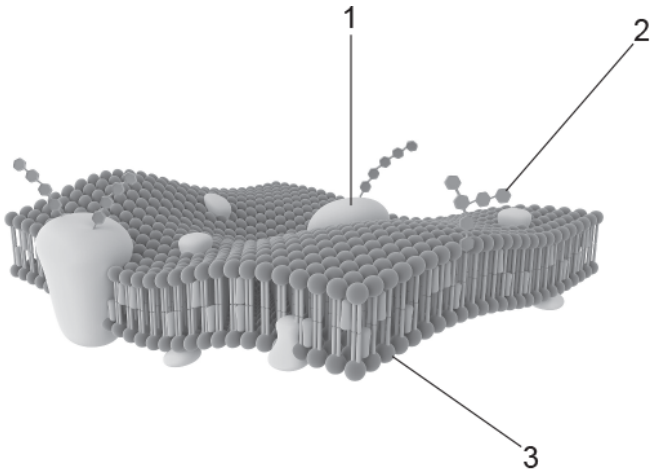


D

Your answer ☐

[1]

3. 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]**

4. The table below shows four biological molecules and their component elements.

Which of the rows, **A** to **D**, correctly identifies the elements in each molecule?

	sucrose	cholesterol	insulin	ATP
A	C, H, O	C, H, O, N	C, H, O, N, S	C, H, O, N, P
B	C, H, O, N	C, H, O	C, H, O, N, S	C, H, O, N, S
C	C, H, O	C, H, O	C, H, O, N, S	C, H, O, N, P
D	C, H, O	C, H, O	C, H, O, N, P	C, H, O, N, P

Your answer ☐ [1]

5. The following are a series of organic molecules and the chemical processes that occur to convert them into different molecules.

Which of the rows, **A** to **D**, is correct?

A nucleic acid $\xrightarrow{\text{hydrolysis}}$ nucleotide $\xrightarrow{\text{hydrolysis}}$ polynucleotide

B α-glucose $\xrightarrow{\text{condensation}}$ amylopectin $\xrightarrow{\text{hydrolysis}}$ α-glucose

C amino acid $\xrightarrow{\text{condensation}}$ dipeptide $\xrightarrow{\text{hydrolysis}}$ polypeptide

D β-glucose $\xrightarrow{\text{condensation}}$ cellulose $\xrightarrow{\text{condensation}}$ maltose

Your answer ☐ [1]

6. Proteins are important biological molecules.

Hydrogen bonds also form between water molecules.

(i) Describe the formation of a hydrogen bond between two molecules of water and explain why water can form these bonds.

---

[3]

(ii) Hydrogen bonds allow water to act as a solvent.

Why is the ability of water to act as a solvent important for the survival of organisms?

---

[3]

7. Which of the statements, **A** to **D**, correctly describes the process of adhesion?

A attraction of water molecules to the impermeable walls of xylem tissue

B attraction of water molecules to other water molecules in the xylem tissue

C active transport of water molecules into phloem tissue

D attraction of water molecules to other water molecules in the phloem tissue

Your answer [ ] **[1]**

8. Root vegetables require sulfate ions (SO_4^{2-}) in order to grow to a normal size. The plant uses the sulfur atoms to synthesise biological molecules during growth.

Sulfur atoms are required for the synthesis of which type of biological molecule?

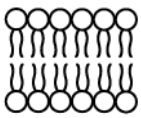
---

[1]

9. When interpreting the results of an experiment to investigate the effect of detergent on plasma membranes, a student looked for a diagram to show what the phospholipids may look like in the presence of detergent.

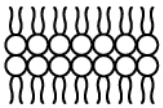
Which of the diagrams, **A** to **D**, should the student use?

A

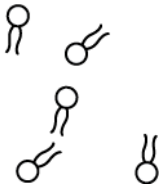


B

C



D



Your answer

[1]

10. An unknown solution of a single sugar was tested. The results were recorded in **Table 9.1**.

Colours observed after testing	
Benedict's test for reducing sugars	**Benedict's test for non-reducing sugars**
blue	brick red

Table 9.1

Identify the unknown sugar.

A fructose
B lactose
C sucrose
D glucose

Your answer ☐

[1]

11. A student mixed an unknown substance with water and ethanol. A white suspension formed in the tube.

Which of the explanations, **A** to **D**, is correct?

A lipid is present

B non-reducing sugar is present

C protein is present

D reducing sugar is present

Your answer ☐

[1]

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

1synthesis 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]

13. Which of the statements, **A** to **D**, about amylopectin is correct?

A it contains 1-4 and 1-6 glycosidic bonds between α-glucose monomers
B it is an unbranched chain of α-glucose monomers
C it contains α 1-4 and β 1-6 glycosidic bonds
D it is made up of β-glucose monomers and is uncoiled

Your answer ☐ **[1]**

14. The hormone ecdysone is synthesised in the prothoracic glands found in the upper thorax of some invertebrates and is released into haemolymph. It is then transported to cells near the surface of the body and causes the loss of the exoskeleton so that a new exoskeleton can form.

Which of the following statements explains how ecdysone is able to act on cells near the surface of the body?

1 Ecdysone is synthesised by specialised neurosecretory cells.
2 Ecdysone is soluble in haemolymph because it is a polar molecule.
3 Ecdysone is complementary to cell surface receptors on cells throughout the body of some invertebrates.

A 1, 2 and 3

B Only 1 and 2

C Only 2 and 3

D Only 1

Your answer ☐ **[1]**

15. 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.

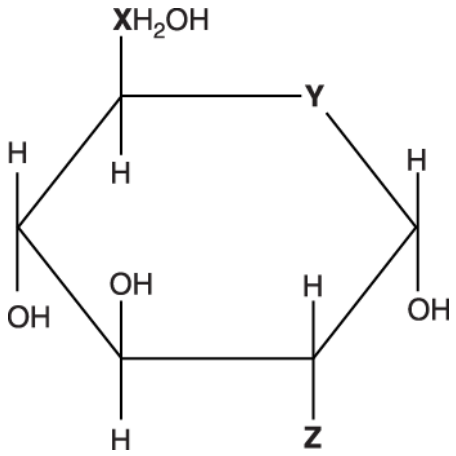
C Cholesterol absorbs ATP, preventing active transport across the membrane.

D Cholesterol binds to phospholipid fatty-acid tails, increasing the packing of the membrane, therefore reducing the fluidity of the membrane.

Your answer [ ] **[1]**

16. In cells, glucose can exist as α-glucose or as β-glucose.

The figure represents the structural formula of a molecule of α-glucose.



(i) In the figure, some atoms or groups have been replaced by the letters **X**, **Y** and **Z**.

Identify the correct atom or group that has been replaced by each letter.

X

Y

Z

---

[3]

(ii) Describe how the structure drawn in the figure above would be different if it represented a molecule of **β-glucose**.

---

[2]

(iii) Two α-glucose molecules can be joined to form a disaccharide molecule.

State the **precise** name of the covalent bond that forms between the two glucose molecules and the name of the disaccharide that is formed.

bond _____

disaccharide _____

[2]

17. Proteins are important biological molecules.

Protein structure can be represented at four levels: primary, secondary, tertiary and quaternary.

Below is a set of features that may be used when describing the structure of a protein such as haemoglobin.

Features	Letter
hydrogen bonds	A
peptide bonds	B
α and β subunits	C
the sequence of amino acids	D
the initial folding of the polypeptide chain	E
the overall 3D shape	F
ionic bonds	G

(i) Select the letters of the features that describe the primary level of protein structure.

---

[1]

(ii) Select the letter or letters of the feature(s) found in the secondary level of protein structure that are **not** present in the primary structure.

---

[1]

(iii) Select the letter or letters of the feature(s) that are found in the tertiary level of protein structure that are **not** present in the primary and secondary structures.

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[1]

(iv) Select the letter or letters of the feature(s) found only in the quaternary level of protein structure.

---

[1]

18. Complete the following statements about proteins using the most appropriate terms.

- The secondary structure of a protein may contain many regions folded in zig-zag patterns known as _____ _____.
- The secondary structure of a protein is determined by the arrangement of _____ bonds, which stabilise the structure.
- The _____ structure of collagen is described as a left-handed helix because of the direction in which the polypeptide twists.
- Polypeptides known as alpha (α) and beta (β) _____ form part of the _____ _____ structure of haemoglobin.

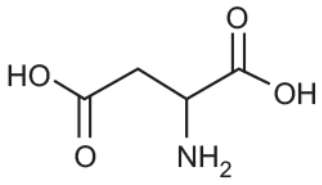
[5]

19. *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.

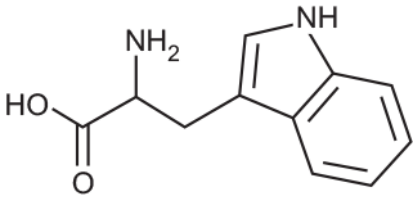
[9]

20. Which of the following could **not** be an amino acid?

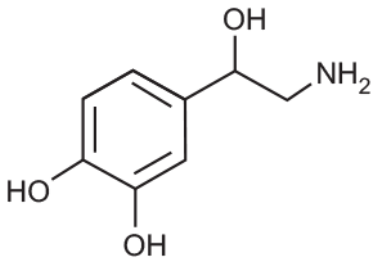
A



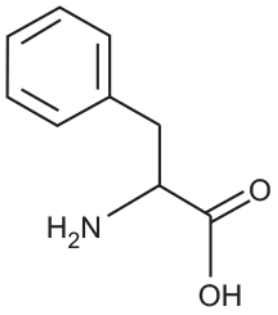
B



C



D



Your answer ☐ **[1]**

21. The following table describes the approximate percentage mass of different chemical elements in organic polymers.

	Polymer	N (%)	C (%)	O (%)	H (%)	P (%)
A	nucleic acid	20.0	30.0	20.0	10.0	20.0
B	carbohydrate	0.0	33.3	33.3	33.3	33.3
C	protein	30.0	10.0	10.0	0.0	50.0
D	lipid	0.0	50.0	49.0	1.0	0.0

Which of the rows, **A** to **D**, is correct?

Your answer [ ] [1]

22. Enzymes are important molecules in living organisms.

(i) A student decided to use the biuret test to detect the presence of enzyme in a solution.

Outline the procedure the student should follow in order to detect the presence of enzyme in a solution using the biuret test.

---

[2]

(ii) State why the structure of enzyme molecules allows them to be detected **in solution** using the biuret test.

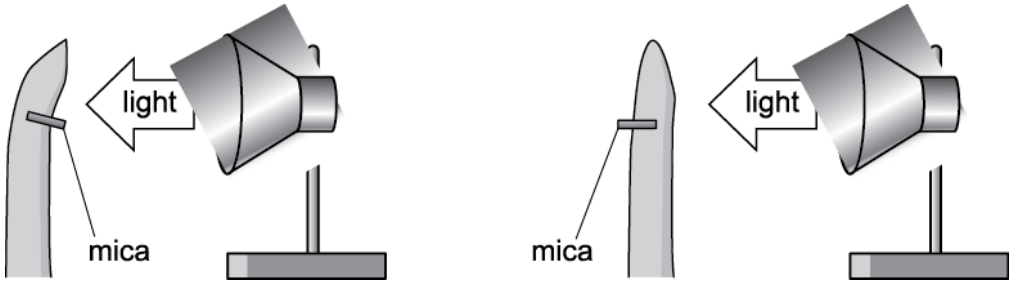
---

[1]

23. In 1913, scientist Peter Boysen-Jensen investigated phototropism in plants.

He inserted mica plates into growing shoots illuminated from one side only. Mica allows electrical impulses to pass through, but does not allow soluble molecules to pass through.

The diagram below summarises Boysen-Jensen's results.



Which of the following statements correctly explains these results?

1 The factor causing phototropism moves away from the tip.
2 The factor causing phototropism is not an electrical impulse.
3 The factor causing phototropism moves away from light.

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

Your answer ☐

[1]

24. One of the main functions of the liver cells is the formation of urea by the ornithine cycle, an outline of which is shown in Fig. 17.2.

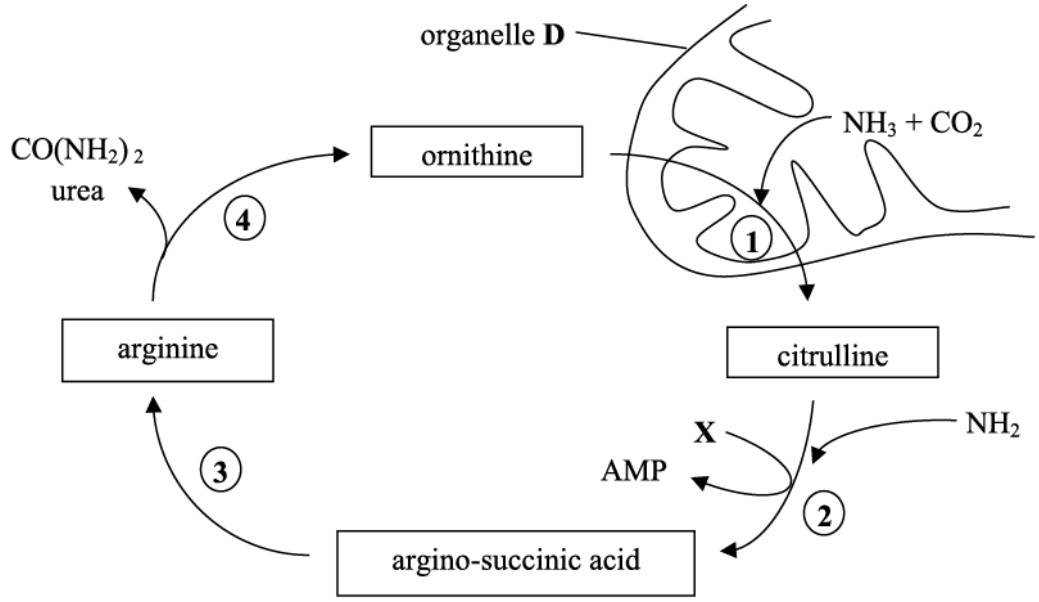


Fig. 17.2

(i) Step 1 of the cycle takes place in the organelle represented by D.

Identify organelle D.

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

(ii) During the cycle ornithine moves into organelle D and citrulline moves out of the organelle.

Suggest the method by which these molecules move into and out of the organelle during the cycle. Give reasons for your choice.

---------- [2]

(iii) How has the ammonia that is used in step 1 been formed?

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

(iv) Identify the compound labelled X in Fig. 17.2.

[1]

25. Energy can be stored in living organisms in the form of carbohydrates or lipids.

Name the carbohydrate molecules used to store energy in plants and animals.

plants _____

animals _____

[1]

26. Cellulose is a polysaccharide that is present in some living organisms.

(i) Complete the following table to show **three** other differences in the **structures** of starch (amylose) and cellulose molecules.

Amylose	Cellulose
coiled	no coiling

[3]

(ii) Which properties of cellulose make it suitable for forming cell walls?

_____

_____

_____

[2]

27. Pepsin is an enzyme that digests protein foods in the mammalian stomach.

Protein molecules are made from chains of amino acids.

(i) Name the covalent bond between two adjacent amino acids in a chain of amino acids.

---

[1]

(ii) Name the type of reaction involved in breaking this bond **and** describe what happens in this reaction.

---

[2]

28. Triglycerides contain three elements.

(i) **M** and **N** are formulae for two macromolecules,

$C_{55}H_{98}O_6$ **M** $C_{18}H_{30}O_{16}$ **N**

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]

29. Which of the options, **A to D**, is a correct statement about polysaccharides of glucose?

A Cellulose microfibrils are formed by hydrogen bonding between adjacent chains of α-glucose molecules bonded with 1,4-glycosidic bonds.

B Amylose is a straight chain of α-glucose monomers bound by 1,6-glycosidic bonds to allow for dense packing.

C Glycogen has a high proportion of 1,6-glycosidic bonds to produce a highly branched molecule for rapid release of α-glucose.

D Amylopectin has a mixture of 1,4-glycosidic and 1,6-glycosidic bonds between β-glucose molecules for rapid release of energy.

Your answer  [1]

30. Glycogen molecules stored in the liver are branched.

Glycogen storage disease type IV occurs when the liver is unable to catalyse the addition of branches of glucose molecules. People with this disease may develop liver damage over time.

Suggest why this disease may result in liver damage.

---

[1]

31. Phospholipid bilayers play crucial roles within plant cells.
Which of the following statements linked to the importance of membranes in plant cells is / are true?

Statement 1: ATP synthase embedded in thylakoid membranes maintains chemiosmotic gradients.
Statement 2: Phospholipid bilayers within the chloroplast are impermeable to protons.
Statement 3: Thylakoid membranes contain electron transport chain proteins.

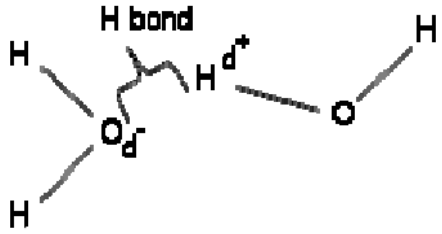
A 1, 2 and 3
B Only 1 and 2
C Only 2 and 3
D Only 1

Your answer ☐

[1]

END OF QUESTION PAPER

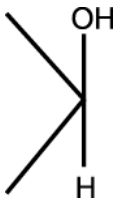
Question			Answer/Indicative content	Marks	Guidance
1			B ✓	1	
			Total	1	
2			C ✓	1	
			Total	1	
3			D ☐	1	Examiner's Comments Around half of candidates were able to successfully apply their knowledge of biochemistry to the context of a plasma membrane.
			Total	1	
4			C ✓	1	Examiner's Comments This question tested knowledge of molecular structure. Candidates should be aware that carbohydrates and lipids contain only C, H and O. Candidates should also know that insulin is a protein and therefore contains N. ATP being closely related to nucleotides must also contain N as well as P. It appears that many less able candidates became confused by the numbers of letters involved in each row and guessed at the correct response (C).
			Total	1	
5			B ✓	1	
			Total	1	

Question			Answer/Indicative content	Marks	Guidance
6		i	1 between O and H (of adjacent molecules); 2 between, electropositive / δ^+ / delta$^+$ (H), and, electronegative / δ^- / delta$^-$ (O); 3 water molecule, is polar / has charge separation;	3	1 DO NOT CREDIT O/H molecules 2 ACCEPT slightly, positive / negative 2 IGNORE oxygen is negative / hydrogen is positive 2 DO NOT CREDIT ions AWARD mp 1 and 2 for diagram below, i.e. H bond can be drawn as dotted or dashed or labelled, but IGNORE solid line DO NOT AWARD mark if diagram contradicts text  3 ACCEPT electrons pulled closer to oxygen atom / water is a dipole 3 IGNORE electronegative / electropositive 3 IGNORE oxygen is negative / hydrogen is positive 3 DO NOT CREDIT ions Examiner's Comments This question was well answered. Candidates frequently used the space available to draw a diagram which was usually accurately drawn and gained 2 marks. Many candidates then gained the third mark for stating the polar nature of the water molecule. Candidates who referred to oxygen or hydrogen as molecules or ions were not awarded one or more of the marking points.

Question			Answer/Indicative content	Marks	Guidance
		ii	1 medium for (metabolic) reactions; 2 (because) allows (named) ionic compound(s) to separate; 3 transport; 4 **two** named transport, systems / media **OR** one example of a transport, medium / system, with a named example of what is transported; 5 (organisms can) absorb / take in, (named) minerals / ions / (named) gas / food; 6 able to dilute toxic substances;	3 max	1 **ACCEPT** reactions can happen in water 1 **ACCEPT** supports metabolic reactions 4 **IGNORE** nutrients 5 **ACCEPT** apoplast / sap / blood / symplast / vacuolar pathway / blood / lymph / xylem / phloem / tissue fluid / CSF 5 **IGNORE** nutrients / substances 5 **IGNORE** get / obtain **IGNORE** refs to osmosis **Examiner's Comments** Most responses were awarded 1 or 2 marks. Reference to transport was the most commonly seen correct response. Marks were also awarded frequently for mention that water is a medium for reactions (processes was not sufficient) or giving examples of transport systems and what is carried in them. Many responses discussed the idea of absorption but used words such as ‘get’ or ‘obtain’ or ‘nutrients’, which were not precise enough. It was common for answers to imply that uptake of minerals was a feature of aquatic organisms only. Further detail of reaction facilitation was rarely seen and dilution of toxic substances was equally rare. A significant minority of responses did not focus on the word ‘solvent’ in the question and discussed other properties of water for no credit. Some responses described the *process* of dissolution despite the question asking about *importance*.
			Total	6	

Question			Answer/Indicative content	Marks	Guidance
7			A ✓	1	Examiner's Comments The majority of candidates chose the correct option for this question.
			Total	1	
8			protein / polypeptide ✓	1	ALLOW cysteine IGNORE (other named) amino acids
			Total	1	
9			B ✓	1	
			Total	1	
10			C	1	
			Total	1	
11			A	1	
			Total	1	
12			B ✓	1 (AO1.2)	Examiner's Comments Most candidates got this right. Some thought polypeptides contained ester bonds and some were perhaps unaware either that phosphodiester bonds contain esters, or that they are present in polynucleotides.
			Total	1	
13			A ☐	1	Examiner's Comments A large majority of candidates achieved the mark.
			Total	1	
14			C ✓	1	Examiner's Comments Option A provided a distractor and common incorrect response to the correct option C in this question, as statement 1 relating to the cells synthesising ecdysone, would not form part of an explanation for the site of action of the hormone.
			Total	1	

Question			Answer/Indicative content	Marks	Guidance
15			D ✓	1	ACCEPT A Examiner's Comments Candidates could reasonably suggest either A or D as correct answers and both were credited in order to be fair to candidates.
			Total	1	

Question			Answer/Indicative content	Marks	Guidance
16		i	X: C / carbon; Y: O / oxygen; Z: OH / hydroxyl (group);	3	**Mark the first answer.** If the answer is correct and an additional element or group is given = **0 marks.** For example X = C or CH_2 = 0 marks **Y DO NOT CREDIT** O_2 **Z IGNORE** hydroxy / hydroxide **Z IGNORE** OH^- **Examiner's Comments** was generally answered well. The most common error was describing Z as hydroxide.
		ii	OH and H groups reversed / AW (on single C atom); on, C_1 / right hand C atom / AW;	2	*Max 1 if any other change is described / shown.* **CREDIT** a correct diagram **ACCEPT** right hand part of molecule only **IGNORE** parts of molecule labelled X, Y and Z **IGNORE** C number if it contradicts an otherwise correct answer  = 2 marks **Examiner's Comments** was also well answered by the majority of candidates. If the maximum 2 marks were not achieved, it tended to be for reversing OH and H on C4 instead of, or in addition to, on C1.

Question			Answer/Indicative content	Marks	Guidance
		iii	(α / alpha / a / A) 1–4 glycosidic; maltose;	2	ACCEPT glycosidic 1,4 IGNORE covalent Examiner's Comments Despite the question emphasising the term 'precise' to naming of the bond, very many candidates stated 'glycosidic' but failed to include the '1–4' detail. Most candidates correctly gave maltose for the name of the disaccharide although sucrose was occasionally seen, along with a variety of incorrect molecules.
			Total	7	
17		i	*primary* B and D;	1	DO NOT CREDIT if another letter is shown
		ii	*secondary* A and E;	1	DO NOT CREDIT if another letter is shown
		iii	*teritory* F and G;	1	DO NOT CREDIT if another letter is shown
		iv	*quaternary* C;	1	DO NOT CREDIT if another letter is shown Examiner's Comments The ability to apply knowledge of the fundamental aspects of protein structure was required for this question but many candidates were clearly uncomfortable with the topic. Part (i) was the part most frequently answered correctly. Only a minority answered (ii) - (iv) correctly and very few scored all 4 marks. A number of responses contained only one letter, when, for parts (i)-(iii), two were required. The most common response to part (iv) was F.
			Total	4	

Question			Answer/Indicative content	Marks	Guidance
18			beta– / β- / B / b, pleat(ed sheet) / fold; hydrogen / H; secondary; subunits / chains; quaternary;	5	 DO NOT CREDIT H^+ / H_2 ACCEPT 2° IGNORE tertiary / fibrous ACCEPT globins IGNORE strands / units / peptides ACCEPT 4° IGNORE globular Examiner's Comments Few candidates scored full marks for this question. The most common incorrect answer was to describe the left-handed twisting of the polypeptide chain as an aspect of tertiary, rather than secondary, structure. Collagen has an atypical structure that many candidates find confusing and textbooks often do little to clarify.
			Total	5	

Question			Answer/Indicative content	Marks	Guidance
19			*Please refer to the marking instructions on page 3 of this mark scheme for guidance on how to mark this question. In summary:* *Read through the whole answer. (Be prepared to recognise and credit unexpected approaches where they show relevance.) Using a 'best-fit' approach based on the science content of the answer, first decide which of the level descriptors,* ***Level 1****,* ***Level 2*** *or* ***Level 3****, best describes the overall quality of the answer.* *Then award the higher, middle or lower mark within the level, according to the* ***Communication Statement*** *(shown in italics):* • *award the higher mark where the Communication Statement has been met.* • *award the middle mark where aspects of the Communication Statement are missing.* • *award the lower mark where the Communication Statement has not been met.* • ***science content determines the level.*** • ***Communication Statement determines the mark within a level.***		

Question			Answer/Indicative content	Marks	Guidance
			Level 3 (7–9 marks) A good range of structural details and properties are provided including reference to fats and carbohydrates in both plants and animals. Explanations are provided for each structural comment. *The explanations are clearly linked to the structure of the molecules and the use of scientific terminology is at an appropriate level. All the information presented is relevant and forms a continuous narrative.* **Level 2 (4–6 marks)** Some structural details and properties are provided including reference to molecules in both plants and animals. Explanations are provided for each structural comment. *The explanations are clearly linked to the structure of the molecules but may not fully explain how the structure suits the role and use of scientific terminology may not always be appropriate. The information presented is mostly relevant.* **Level 1 (1–3 marks)** A limited number of structural details are provided. The explanations do not clearly show how the molecules are suited to their role. *There is a logical structure to the answer. The explanations, though basic, are clear.* 0 marks No response or no response worthy of credit	Max 9	**Indicative scientific points may include: Structures (S), Properties (P) and Explanations (E):** Carbohydrates: S1. Polymers of glucose E1. Glucose can be used in respiration to release energy S2. Large molecules P2. Insoluble E2. Do not affect water potential of cell S3. 1–4 glycosidic bonds E3. Easy to make and break to release glucose / monomers S4. Coiled shape / compact E4. Take up less space in cell S5. Amylose unbranched / amylopectin with few branches E5. No need for rapid release of monomers in plants S6. Glycogen more branched E6. Allows more rapid release of monomers in animals Lipids (**ACCEPT** lipids or fats): S7. Fats have more carbon-carbon bonds / carbon-hydrogen bonds P7. Fats are energy rich / contain more energy per molecule E7. More energy stored in less space P8. Fats are insoluble E8. Do not affect water potential of cell S9. Fatty acids are long carbon chains E9. Can be broken down to release two carbon / acetyl groups (which enter Krebs cycle) S10. Animal fats saturated / harder E10. Have role in protection / insulation as well as energy storage.
			Total	**9**	

Question			Answer/Indicative content	Marks	Guidance
20			C ✓	1 (AO2.1)	Examiner's Comments Most candidates were able to correctly spot that C did not have a terminal –COOH group.
			Total	1	
21			A ✓	1	Examiner's Comments Many candidates were able to correctly identify nucleic acids (option A) here, demonstrating knowledge of the composition of some organic polymers. Some candidates opted for B which, although providing the correct elements present in carbohydrates, the approximate percentage mass for each of these elements could not be true for carbohydrates.
			Total	1	

Question			Answer/Indicative content	Marks	Guidance
22		i	add / AW, biuret solution / biuret reagent / biuret mixture / NaOH and $CuSO_4$; observe colour;	2	IGNORE 'biuret' unqualified DO NOT CREDIT heat / warm / neutralise / put in water bath ACCEPT see if it goes, lilac / purple / mauve / violet DO NOT CREDIT if incorrect colour change described DO NOT CREDIT precipitate Examiner's Comments This question blended familiar recall, that suited candidates who had spent time learning the specification, with some AO3 questions that many candidates found challenging. was generally done well. Candidates had learnt how to carry out a Biuret's test. Where candidates lost marks it was for failing to recognise that the key addition was Biuret *solution*, not just 'Biuret'. Some candidates mentioned heating and received no credit.
		ii	(enzymes are) globular, proteins / polypeptide; hydrophilic / water soluble, (R-)groups on outside (of enzyme);	1 max	Examiner's Comments This question blended familiar recall, that suited candidates who had spent time learning the specification, with some AO3 questions that many candidates found challenging. This mark was rarely awarded. The words 'in solution' were emboldened in the question in an attempt to get candidates to link enzyme structure to solubility. Few candidates appeared to recognise which aspect of knowledge they were being asked to apply.
			Total	3	
23			A ✓	1	
			Total	1	

Question			Answer/Indicative content	Marks	Guidance
24		i	mitochondrion	1	ALLOW mitochondria.
		ii	*either* facilitated diffusion (1) conversion of ornithine into citrulline creates concentration gradients **or** (molecules are not lipid soluble so) require protein channels to cross membrane (1) *or* active transport (1) ornithine and citrulline need to be moved into and out of **D** more quickly than would be met by diffusion (1)	2	
		iii	deamination / removal of NH_2 group from amino acid (1)	1	
		iv	ATP (1)	1	
			Total	**5**	
25			starch **AND** glycogen✓	1	**ALLOW** amylose , amylopectin
			Total	**1**	

Question			Answer/Indicative content	Marks	Guidance
26		i		3	Mark the first 3 responses AWARD 1 mark for each correct row irrespective of boxes Three correct rows of responses written within the same box can be awarded 3 points.

Amylose	Cellulose	
coiled	*no coiling*	
(contains) α / alpha / A / a ,-glucose	(contains) β / beta / B / b , -glucose	;
α / alpha / A / a 1-4 glycosidic bonds	β / beta / B / b 1-4 glycosidic bonds	;
all , monomers / AW , in same orientation	alternate monomers at , 180° / AW , to each other	;
granular / not fibrous	fibrous / not granular	;
H bonds within molecule / no (H) bonds (between molecules)	(H) bonds between adjacent molecules	;

ACCEPT every second one is flipped

ACCEPT fibres / microfibrils / fibrils / macrofibrils
DO NOT CREDIT myofibrils
ACCEPT grains

ACCEPT '(cross)links' as AW for 'bonds'

Examiner's Comments

This question was not answered well. Most candidates gained 1 or 2 marks, usually for identifying α- and β-glucose as subunits, the fibrous nature of cellulose or the arrangement of hydrogen bonding. Few got full marks. A significant minority used terms associated with protein structure and gained no credit. Similarly, many candidates gave differences relating to function rather than structure and gained no credit. A large number of candidates answered as if one of the molecules they were describing was glycogen, as reference to 1-6 bonds and branches was often seen. Candidates who did not compare like with like within a given row were not credited, nor were responses that were written in a 4th or 5th row.

Question			Answer/Indicative content	Marks	Guidance
		ii	(tensile) strength / strong; (H) bonds / links, can form (between adjacent fibrils); insoluble;	2 max	ACCEPT mechanical strength IGNORE fibrous / rigid ACCEPT fibres / microfibrils / fibrils / macrofibrils IGNORE refs to bonding with water IGNORE ionic / myofibrils ACCEPT crosslinks DO NOT CREDIT peptide / covalent / glycosidic / disulfide etc Examiner's Comments Many gained 2 marks here for ‘strong’ and ‘insoluble’. Those that attempted to describe binding between molecules sometimes failed to provide enough detail or were not given the mark because of incorrect or contradictory science. A significant number of candidates discussed the permeability of the cell wall and gained no credit.
			Total	5	

Question			Answer/Indicative content	Marks	Guidance
27		i	peptide (bond / link);	1	DO NOT CREDIT dipeptide Examiner's Comments The vast majority of candidates got this mark; of those who did not 'polypeptide', 'dipeptide' and 'hydrogen' were the most common responses.
		ii	hydrolysis; water / H_2O, is, added / used / needed;	2	IGNORE name of bond CREDIT OH and H put back on amino acids ACCEPT (broken down) with water Examiner's Comments This was also a high scoring question with over three-quarters of candidates getting both marks. Some described condensation in some detail, for no marks or mixed up hydrolysis and condensation and got one mark only.
			Total	3	
28		i	*formula* M (no mark) *because* high ratio of hydrogen to oxygen / N has (approximately) 2 H to 1 O (1)	1	
		ii	hydrophilic head and hydrophobic tails (1) hydrophobic part / tails, repelled / AW, by water (1) head / hydrophilic part, forms H bonds with water (1) *idea that* medium outside / inside plasma membrane is aqueous (1) *idea that* hydrophobic nature of tails results in their facing towards each other (1)	3	
			Total	4	
29			C ✓	1	Examiner's Comments This was fairly well answered.
			Total	1	

Question			Answer/Indicative content	Marks	Guidance
30			*idea that* the glycogen deposited is, in long chains / not branched, so not compact (which damages liver cells); *idea that* glucose, is in excess / remains in cells, so lowers water potential (which damages liver cells);	1 max	
			Total	1	
31			C	1	
			Total	1	