

A-Level Edexcel

BIOLOGY

UNIT 2(IAL)

2020 — 2025

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1 - ((WBI11)/2(IAL)_Summer_2020_Q1) - Cells, Development, Biodiversity And Conservation

Plants contain starch and cellulose.

(a) (i) Which part of a plant cell stores starch?

(1)

- ☐ **A** amyloplast
- ☐ **B** middle lamella
- ☐ **C** plasmodesmata
- ☐ **D** tonoplast

(ii) How many of the following statements about starch are correct?

1. it has a compact shape
2. it contains 1,6 glycosidic bonds only
3. it is a polymer of β -glucose
4. it is a polypeptide

(1)

- ☐ **A** one
- ☐ **B** two
- ☐ **C** three
- ☐ **D** four

(iii) How many of the following contain cellulose?

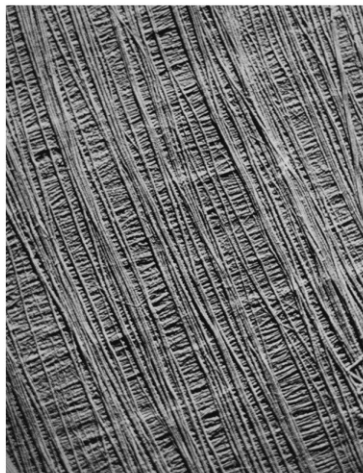
1. phloem
2. sclerenchyma
3. vacuole
4. xylem

(1)

- ☐ **A** one
- ☐ **B** two
- ☐ **C** three
- ☐ **D** four

(b) Microfibrils are composed of cellulose.

The photograph shows the arrangement of microfibrils in a plant cell wall, as seen using an electron microscope.



(Source: © Biophoto associates/Science photo library)

Explain how the structures of cellulose and microfibrils increase the strength of a plant cell wall.

Use the information in the photograph to support your answer.

(3)

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2 - ((WBI11)/2(IAL)_Summer_2020_Q2) - Cells, Development, Biodiversity And Conservation

All organisms contain one or more cells.

(a) (i) In which of the following is a cell membrane present?

(1)

- ☐ **A** animal cells only
- ☐ **B** animal and plant cells only
- ☐ **C** plant and prokaryotic cells only
- ☐ **D** animal, plant and prokaryotic cells

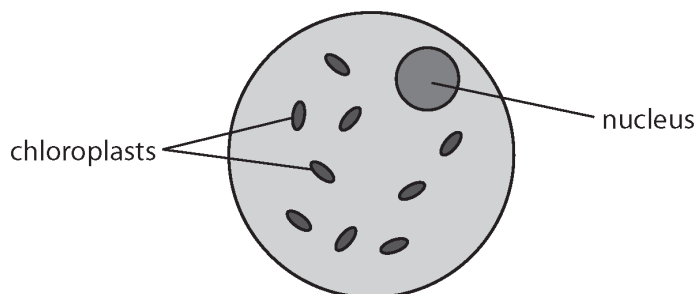
(ii) In which of the following is a cell wall present?

(1)

- ☐ **A** plant cells only
- ☐ **B** animal and plant cells only
- ☐ **C** plant and prokaryotic cells only
- ☐ **D** animal, plant and prokaryotic cells

(b) Sailor's eyeball (*Valonia ventricosa*) is a single-celled, spherical organism.

The diagram shows one of these cells.



(i) The diameter of this cell is $25\text{ }\mu\text{m}$.

Calculate the magnification of the diagram.

(2)

Answer

(ii) This cell contains chloroplasts.

State the function of these chloroplasts.

(1)

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(iii) This cell is not a prokaryotic cell as it contains chloroplasts.

Give **one** other reason why this organism is not a prokaryotic cell.

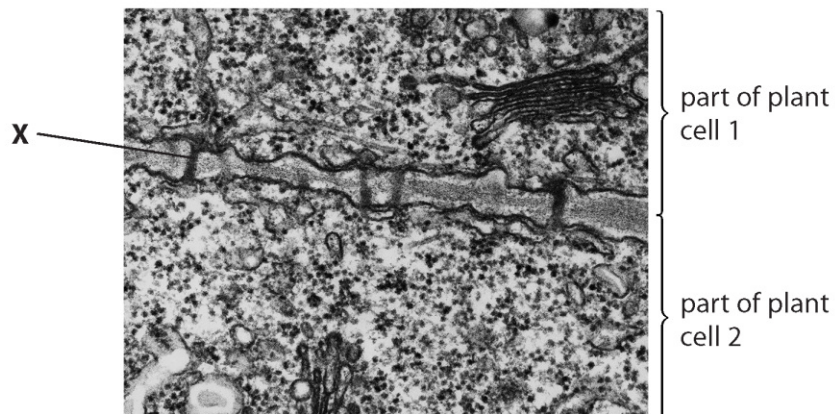
(1)

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- (c) The photograph shows part of two adjoining plant cells, as seen using an electron microscope.



(Source: © biophoto associates/Getty Images)

- (i) Name the part labelled **X**.

(1)

- (ii) Explain the function of the part labelled **X**.

(2)

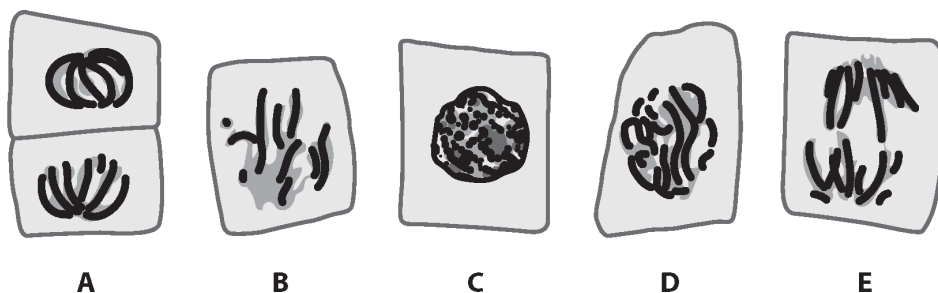
3 - ((WBI11)/2(IAL)_Summer_2020_Q3) - Cells, Development, Biodiversity And Conservation

Cells undergo cell division.

(a) The diagrams show cells from a plant.

The cells are in different stages of division.

These cells do not show the correct order for the process of division by mitosis.

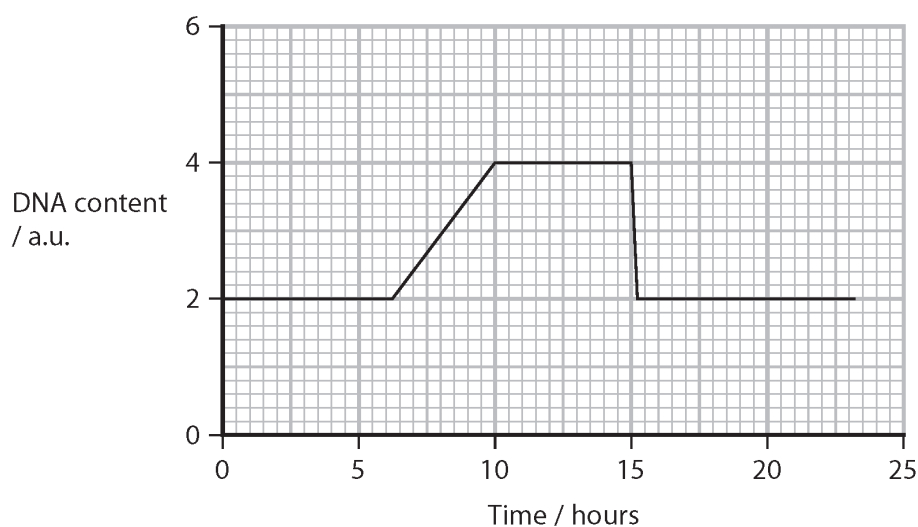


Which of the following shows the correct order for the process of division by mitosis?

(1)

	1st	2nd	3rd	4th	5th
☐ A	A	E	B	D	C
☐ B	A	D	C	E	B
☐ C	C	D	B	E	A
☐ D	C	B	E	D	A

(b) The graph shows the changes in the DNA content of a cell during one cell cycle.



(i) Explain the changes in the DNA content as shown by this graph.

(4)

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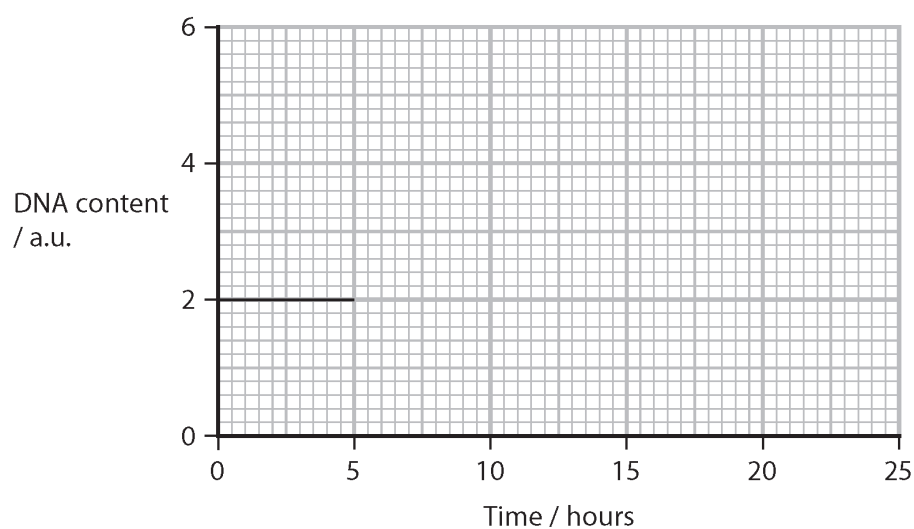
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- (ii) Complete the graph to show how the DNA content would change if the cell had undergone meiosis to form gametes.

(2)

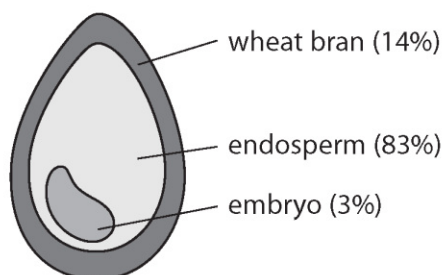


4 - ((WBI11)/2(IAL)_Summer_2020_Q4) - Cells, Development, Biodiversity And Conservation

Plant-based products can replace plastics produced from oil.

Wheat bran comes from the outer layers of grains of wheat.

(a) The diagram shows the structure and composition of a grain of wheat.



Wheat bran contains 43% fibre.

A grain of wheat has a mass of 48 mg.

Calculate the mass of fibre in the wheat bran of this grain of wheat.

Give your answer to **two** significant figures.

(3)

Answer mg

(b) Disposable plates and cutlery can be made from either plant-based products or from oil-based plastics.

The photograph shows cutlery and a plate made from wheat bran.



(Source: © Konektus Photo/Shutterstock)

Explain the advantages of using cutlery and plates made from wheat bran instead of oil-based plastics.

(3)

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- (c) The endosperm of a grain of wheat develops from the endosperm nucleus, formed during fertilisation.

Explain the role of the pollen tube and nuclei in the formation of the endosperm nucleus.

(3)

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5 - ((WBI11)/2(IAL)_Summer_2020_Q5) - Cells, Development, Biodiversity And Conservation

The five stages of cancer are used to describe the size and spread of a cancer in a human body.

(a) The mitotic index of a tissue can be used to determine the stage of cancer.

A higher mitotic index is usually linked to a later stage of cancer.

The mitotic index is calculated using the formula

$$\text{Mitotic index} = \frac{\text{number of cells in mitosis}}{\text{total number of cells}} \times 100$$

Tests were performed on three patients, P, Q and R, who had cancer.

The table shows the number of cells that were counted in each stage of the cell cycle per mm² of tissue, taken from the same organ in each patient.

Patient	Interphase	Prophase	Metaphase	Anaphase	Telophase
P	16	1	3	0	0
Q	14	2	1	1	2
R	11	2	2	3	2

(i) State what is meant by the term **tissue**.

(1)

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(ii) Using the data in the table, determine the stages of cancer in patients P and R.

(3)

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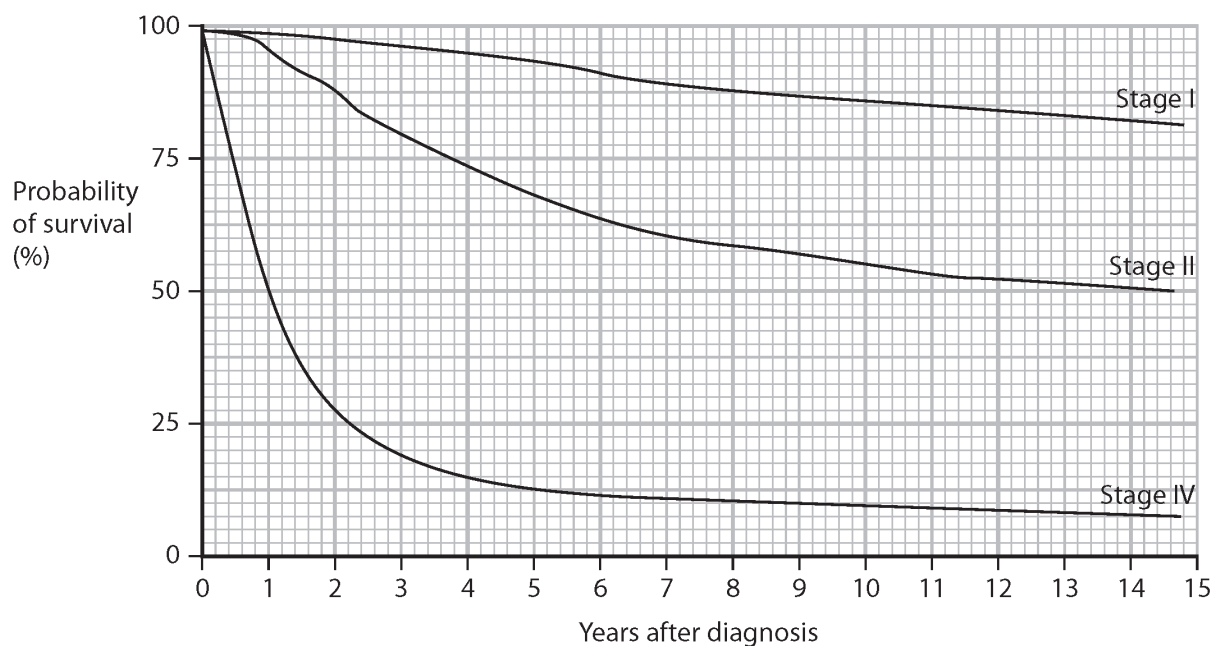
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(b) The graph shows the probability of survival for different stages of a cancer, after diagnosis.



(Source: http://www.mmmp.org/MMMP/import.mmmp?page=tnm_staging.mmmp)

Compare and contrast the probabilities of survival for the different stages of this cancer, as shown by the graph.

(3)

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- (c) Anticancer drugs have to undergo double-blind trials before they are used to treat patients.

Describe how a placebo is used in a double-blind trial.

(2)

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6 - ((WBI11)/2(IAL)_Summer_2020_Q6) - Cells, Development, Biodiversity And Conservation

Stomach ulcers are sores that develop in the lining of the stomach.

The mucus produced by the stomach prevents bacteria from reaching the lining of the stomach.

Stomach ulcers can be caused by infection with the bacterium *Helicobacter pylori*.

These bacteria reproduce in the stomach as it provides all the conditions required for the growth of bacteria.

(a) Explain the conditions needed for the growth of bacteria.

(4)

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(b) The plant *Cibotium barometz* is native to several countries in East Asia.

The photograph shows hairs on the surface of this plant.



hairs

(Source: © Mauro Rodrigues/123RF)

Extracts from the hairs on this plant have antimicrobial properties.

An investigation compared the use of this extract and the drug omeprazole to treat stomach ulcers in rats.

The mass of mucus and the area of ulcer were measured in five groups of rats.

The table shows the treatments and the results of this investigation.

Group	Treatment / mg kg^{-1}	Mean mass of mucus / g	Mean area of ulcer / mm^2
Control rats with no ulcer	0.00	2.28	0.00
Control rats with ulcer	0.00	0.75	802.71
Rats with ulcer treated with omeprazole	20.00	1.92	95.71
Rats with ulcer treated with extract	125.00	1.87	202.80
Rats with ulcer treated with extract	500.00	2.17	172.80

(Source: adapted from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5244617/>)

- (i) Calculate the percentage decrease in the mean areas of ulcer of the rats treated with omeprazole compared with the control rats with ulcer.

(2)

Answer%

(6)

ANSWERS

1 - ((WBI11)/2(IAL)_Summer_2020_Q1) - Cells, Development, Biodiversity And Conservation

Question Number	Answer	Additional guidance	Mark
(a)(i)	The only correct answer is A amyloplast <i>B is not correct because starch is not stored in the middle lamella</i> <i>C is not correct because starch is not stored in the plasmodesmata</i> <i>D is not correct because starch is not stored in the tonoplast</i>		(1)

Question Number	Answer	Additional guidance	Mark
(a)(ii)	The only correct answer is A one <i>B is not correct because starch contains 1,4 and 1,6 glycosidic bonds, is a polymer of α-glucose and is a polysaccharide</i> <i>C is not correct because starch contains 1,4 and 1,6 glycosidic bonds, is a polymer of α-glucose and is a polysaccharide</i> <i>D is not correct because starch contains 1,4 and 1,6 glycosidic bonds, is a polymer of α-glucose and is a polysaccharide</i>		(1)

Question Number	Answer	Additional guidance	Mark
(a)(iii)	The only correct answer is C three <i>A is not correct because phloem, sclerenchyma and xylem cell walls contain cellulose</i> <i>B is not correct because phloem, sclerenchyma and xylem cell walls contain cellulose</i> <i>D is not correct because the vacuole does not contain cellulose</i>		(1)

Question Number	Answer	Additional guidance	Mark
(b)	An explanation that includes the following points: - because there are hydrogen bonds between (adjacent) cellulose molecules (1) {layers / sheets} of microfibrils (1) - which have microfibrils at different angles (therefore it increases the strength) (1)	ignore {layers / sheets} of cellulose ACCEPT microfibrils arranged in a {criss-cross pattern / mesh}	(3)

2 - ((WBI11)/2(IAL)_Summer_2020_Q2) - Cells, Development, Biodiversity And Conservation

Question Number	Answer	Additional guidance	Mark
(a)(i)	The only correct answer is D animal, plant and prokaryotic cells <i>A is not correct because all three cell types contain a cell membrane</i> <i>B is not correct because all three cell types contain a cell membrane</i> <i>C is not correct because all three cell types contain a cell membrane</i>		(1)

Question Number	Answer	Additional guidance	Mark
(a)(ii)	The only correct answer is C plant and prokaryotic cells only <i>A is not correct because prokaryotic cells contain a cell wall</i> <i>B is not correct because animal cells do not contain a cell wall</i> <i>D is not correct because animal cells do not contain a cell wall</i>		(1)

Question Number	Answer	Additional guidance	Mark
(b)(i)	A calculation in which: - cell diameter measured and converted into micrometres (1) - diameter divided by 25 with no units (1) OR 25 converted to mm - diameter divided by 0.025 with no units	<u>Example of calculation:</u> 42mm=42000 µm 42000 ÷ 25 = x1680 ecf for ±1mm and incorrect conversions Correct answer with no units and with no working scores full marks	(2)

Question Number	Answer	Additional guidance	Mark
(b)(ii)	An answer that includes one of the following points: (site of) photosynthesis / converts light energy to {chemical energy / ATP} (1)	ACCEPT formation of correct named product of photosynthesis e.g. glucose ignore makes food	(1)

Question Number	Answer	Additional guidance	Mark
(b)(iii)	An answer that includes the following point: this organism has a nucleus / prokaryotic cells do not contain a nucleus (1)	DO NOT ACCEPT cell membrane / cytoplasm ignore contains membrane bound organelles	(1)

Question Number	Answer	Additional guidance	Mark
(c)(i)	plasmodesma / plasmodesmata (1)		(1)

Question Number	Answer	Additional guidance	Mark
(c)(ii)	An explanation that includes the following points: - communication between / connects (connected) cells (1) - therefore signalling substances pass through {symplast / cytoplasm} / cytoplasmic streaming / transport of suitable named molecules e.g. minerals, water, glucose, amino acids, proteins, RNA (1)	allow ECF for pits, cell wall and middle lamella only pits - communication between / connects (connected) cells - therefore transport of suitable named molecules cell wall (sieve like network made of) cellulose fibres support the cell - therefore helps retain rigid structure / prevent cell lysis middle lamella - joins (adjacent) cell (walls) together - therefore increases {strength / stability} of {plant / cell (wall)}	(2)

3 - ((WB111)/2(IAL)_Summer_2020_Q3) - Cells, Development, Biodiversity And Conservation

Question Number	Answer	Additional guidance	Mark
(a)	C - C D B E A The only correct answer is C A is not correct because the correct order is C D B E A B is not correct because the correct order is C D B E A D is not correct because the correct order is C D B E A		(1)

Question Number	Answer	Additional guidance	Mark
(b)(i)	An explanation that includes four of the following points: - DNA content remains constant during {G1 / G2/ mitosis} (1) - the DNA content doubles (1) - due to {DNA / chromosome} replication / S phase / replication (1) - the cell divides / cytokinesis (after 15 hours) (1) (therefore) it will produce (two) diploid (daughter) cells (1)	ACCEPT DNA content stays at 2 during G1 / DNA content stays at 4 during {G2 / mitosis} ACCEPT DNA content increases {to 4 / by 2} ignore interphase ignore telophase ACCEPT (therefore) it will produce (two) genetically identical (daughter) cells	(4)

Question Number	Answer	Additional guidance	Mark
(b)(ii)	An answer that includes the following points: - similar shape graph as mitosis (1) - with a further division line to reduce DNA content to {haploid / 1 a.u.} (1)	<u>Example of graph</u>	(2)

4 - ((WBI11)/2(IAL)_Summer_2020_Q4) - Cells, Development, Biodiversity And Conservation

Question Number	Answer	Additional guidance	Mark
(a)	A calculation showing the following steps: - mass of bran calculated (1) - mass of fibre calculated (1) - correct answer to two significant figures (1)	<u>Example of calculation</u> $(48 \div 100) \times 14 = 6.72 \text{ (mg)}$ $(6.72 \div 100) \times 43 = 2.889 \text{ (mg)}$ 2.9 mg Correct answer with no working scores full marks	(3)

Question Number	Answer	Additional guidance	Mark
(b)	An explanation that includes the following points: - more sustainable (than oil-based plastic) (1) - biodegradable / can be broken down by decomposers (1) - carbon neutral (1)	ACCEPT ORA for oil-based plastic ACCEPT renewable / can be regrown / available for future generations ALLOW can decompose ACCEPT {does not contribute to / reduces} {greenhouse effect / global warming}	(3)

Question Number	Answer	Additional guidance	Mark
(c)	An explanation that includes three of the following points: - pollen tube transports {generative nucleus/male nuclei} to {embryo sac / ovary / micropyle} (1) (by releasing) digestive enzymes (1) - one of the male nuclei {fertilises / fuses with} the (two) polar nuclei (1) (causing) the formation of a {3n/ triploid} endosperm (nucleus) (1)	ACCEPT pollen tube transports {generative nucleus/male nuclei} down the style ACCEPT male gamete / sperm nucleus ACCEPT male gamete / {sperm / haploid} nucleus	(3)

5 - ((WBI11)/2(IAL)_Summer_2020_Q5) - Cells, Development, Biodiversity And Conservation

Question Number	Answer	Additional guidance	Mark
(a)(i)	An answer that includes the following point: group of (similar) cells (working together to) perform a (specific) function (1)	ACCEPT cells with similar {structure / function / origin}	(1)

Question Number	Answer	Additional guidance	Mark
(a)(ii)	An answer that includes the following points: - patient P has a mitotic index of 20 (1) - patient R has a mitotic index of 45 (1) - correct order of cancer stage identified (1)	e.g. P has an earlier stage of cancer (than R), R has a more advanced stage of cancer ACCEPT ecf from calculated MI for P and R	(3)

Question Number	Answer	Additional guidance	Mark
(b)	An answer that includes at least one similarity and one difference: similarity: - the survival probability decreases over time (for all three stages) (1) differences: - stage I has the highest survival probability for all years whereas stage IV has the lowest probability for all years (1) - stage IV has the {fastest/steeper} decrease (in survival probability) / stage I has the slowest decrease (in survival probability) (1)	ACCEPT correct order of survival probability for a point on the graph	(3)

Question Number	Answer	Additional guidance	Mark
(c)	A description that includes the following points: - correct description of a placebo being given to one group (and the other group receiving (anticancer) drug) (1) - neither the patient nor the doctor knows whether the patient is receiving (the drug or) the placebo (1)	ACCEPT description of a placebo e.g. has no active ingredient / already known drug / sugar pill / dummy drug ACCEPT scientist / researcher for doctor	(2)

6 - ((WBI11)/2(IAL)_Summer_2020_Q6) - Cells, Development, Biodiversity And Conservation

Question Number	Answer	Additional guidance	Mark
(a)	An explanation that includes four of the following points: • water for {hydrolysis reactions / form cytoplasm / solvent / hydration} (1) • (some bacteria require) oxygen for (aerobic) respiration (1) • (suitable/optimum) temperature for {enzyme-controlled / metabolic} reactions to occur (at suitable rate) (1) • (suitable/optimum) pH for {enzyme-controlled / metabolic} reactions to occur (at suitable rate) (1) • named organic molecule and an explanation of why that organic molecule is needed (1)	ACCEPT (some anaerobic bacteria require) no oxygen for anaerobic respiration ACCEPT (suitable) temperature so enzymes do not denature ACCEPT (suitable) pH so enzymes do not denature e.g. glucose for respiration / lipids to provide fatty acid chains for new cell membrane / proteins to provide amino acids for {protein synthesis / growth}	(4)

Question Number	Answer	Additional guidance	Mark
(b)(i)	A calculation showing the following steps: • calculation of difference in mean area of ulcer (1) • calculation of percentage decrease (1)	<u>Example of calculation</u> $(802.71 - 95.71) = 707$ $\frac{(802.71 - 95.71)}{802.71} \times 100 = 88 / 88.077 / 88.08 / 88.1 (\%)$ Correct answer with no working shown scores full marks	(2)

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