

A-Level Edexcel

BIOLOGY

UNIT 4(IAL)
2020 — 2025

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1 - ((WBI11)/4(IAL)_Summer_2020_Q1) - Energy, Environment, Microbiology And Immunity

Chloroplasts are involved in both the light-dependent reactions and light-independent reactions of photosynthesis.

(a) Which row of the table shows where the light-dependent reactions and light-independent reactions take place?

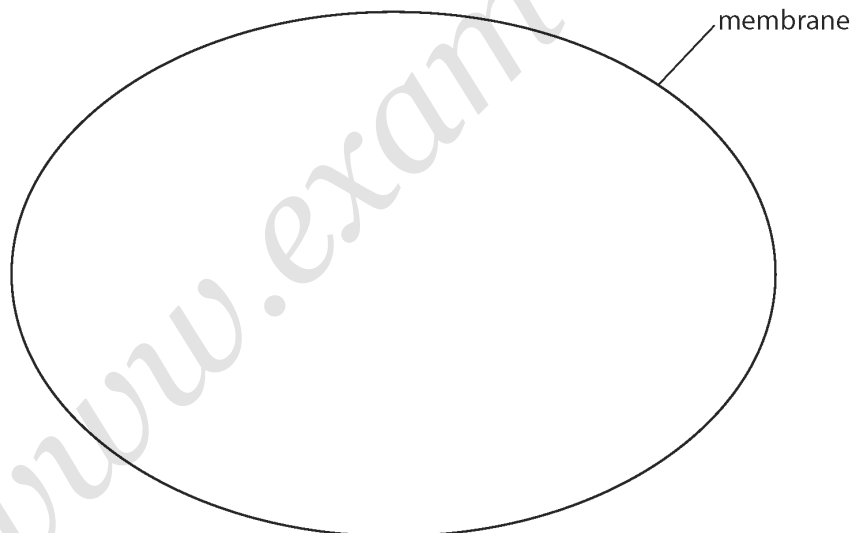
(1)

	Light-dependent reactions	Light-independent reactions
<input type="checkbox"/> A	stroma	stroma
<input type="checkbox"/> B	stroma	thylakoid membranes
<input type="checkbox"/> C	thylakoid membranes	stroma
<input type="checkbox"/> D	thylakoid membranes	thylakoid membranes

(b) The diagram shows the outline of a chloroplast.

Draw **three** labelled features on this diagram that are found in a chloroplast, other than the stroma and the thylakoid membranes.

(3)



- (c) An absorption spectrum shows how much light is absorbed by chloroplasts at different wavelengths of light.

The table shows the colour of light at four wavelengths.

Wavelength of light / nm	460	520	600	680
Colour of light	blue	green	yellow	red

Which wavelength of light is absorbed the **least** by chloroplasts?

(1)

- A** 460 nm
- B** 520 nm
- C** 600 nm
- D** 680 nm

- (d) State what is meant by the term **action spectrum**.

(1)

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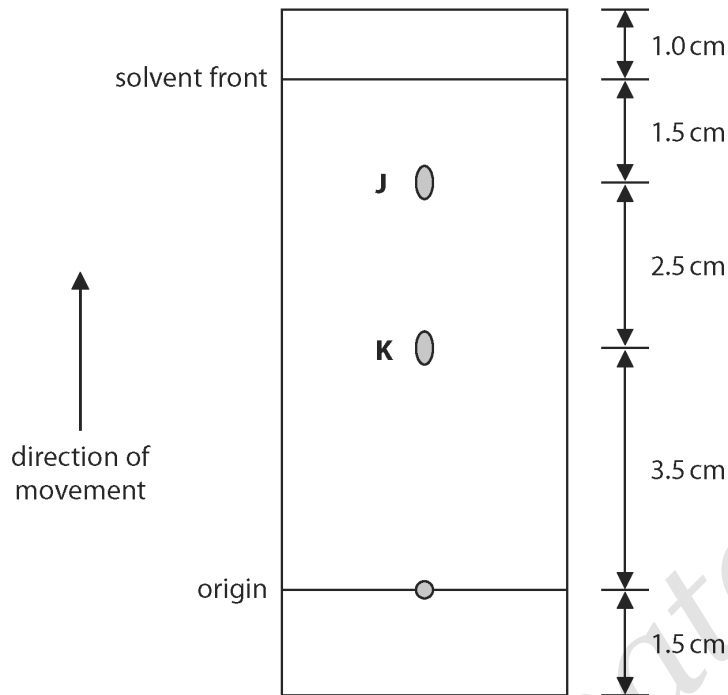
- (e) Chloroplast pigments can be separated and then identified by their R_f values.

- (i) Which process can be used to separate chloroplast pigments?

(1)

- A** chromatography
- B** dendrochronology
- C** osmosis
- D** PCR

(ii) The diagram shows separated chloroplast pigments, **J** and **K**.



What is the R_f value for chloroplast pigment **J**?

(1)

- A** 0.625
- B** 0.800
- C** 0.830
- D** 1.714

2 - ((WBI11)/4(IAL)_Summer_2020_Q2) - Energy, Environment, Microbiology And Immunity

Body temperature and the degree of muscle contraction can be used to determine the time since death of a person.

The table shows how body temperature and body stiffness, due to muscle contraction, change with time since death.

Time since death / hours	Body temperature	Body stiffness
< 3	warm	not stiff
3 to 8	warm	stiff
8 to 36	cold	stiff
> 36	cold	not stiff

(a) State how the temperature of a dead body should be measured.

(1)

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(b) (i) Body temperature can be used to estimate the time since death using the following information:

- loss of 0.78°C per hour for the first 12 hours after death
- after 12 hours, loss of 0.4°C per hour.

Estimate the time since death of a person whose body temperature had fallen 11.5°C .

Give your answer to the nearest hour.

(2)

Answer hours

(ii) Explain why this estimate would be different if the body had been left in a colder place.

(2)

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(c) Explain why using body stiffness only, as shown in the table, is insufficient to estimate the time since death accurately.

(3)

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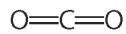
3 - ((WBI11)/4(IAL)_Summer_2020_Q3) - Energy, Environment, Microbiology And Immunity

The following equation summarises photosynthesis.

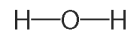


The diagrams show the bonds in carbon dioxide, water and oxygen.

carbon dioxide



water



oxygen



Energy is needed to break chemical bonds, and to form new chemical bonds. This is called the bond energy.

The table shows some bond energies for the bonds in carbon dioxide, water, glucose and oxygen.

Type of bond	Bond energy / kJ per bond
C=O	785
O—H	462
O=O	487

(a) (i) In photolysis, one of the bonds in each water molecule is broken.

Using the equation for photosynthesis, calculate how much energy is released by photolysis in order for one molecule of glucose to be made.

(1)

Answer kJ

(ii) Explain how light energy is converted into chemical energy in the form of ATP.

(4)

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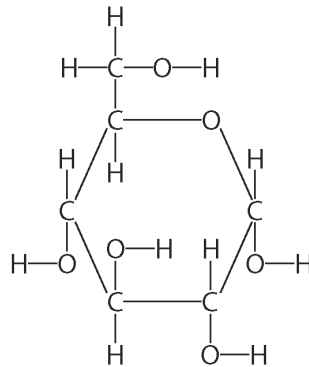
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(b) The diagram shows the structure of glucose.



The energy needed to form the bonds in one molecule of glucose is 9164 kJ.

(i) State what other information is needed in the table of bond energies for this value to be calculated.

(1)

(ii) Where in the chloroplasts are these bonds formed?

(1)

- A cytoplasm
- B matrix
- C stroma
- D thylakoid membrane

(c) Glucose is used by plants in the production of amino acids.

(i) Which row of the table describes how two amino acids join together?

(1)

	Bond formed between	Type of reaction
<input type="checkbox"/> A	carbon and nitrogen	condensation
<input type="checkbox"/> B	carbon and nitrogen	hydrolysis
<input type="checkbox"/> C	oxygen and nitrogen	condensation
<input type="checkbox"/> D	oxygen and nitrogen	hydrolysis

(ii) Explain why amino acids cannot be produced from glucose alone.

(2)

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ANSWERS

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1 - ((WBI11)/4(IAL)_Summer_2020_Q1) - Energy, Environment, Microbiology And Immunity

Question number	Answer	Mark		
(a)	<p>C</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="padding: 5px;">thylakoid membranes</td> <td style="padding: 5px;">stroma</td> </tr> </table> <p>The only correct answer is C.</p> <p><i>A is incorrect because the light-dependent reactions take place in the thylakoid membranes</i> <i>B is incorrect because the light-dependent reactions take place in the thylakoid membranes and the light-independent reactions take place in the stroma</i> <i>D is incorrect because the light-independent reactions take place in the stroma</i></p>	thylakoid membranes	stroma	(1)
thylakoid membranes	stroma			

Question number	Answer	Additional guidance	Mark
(b)	<p>An answer that includes three of the following points:</p> <ul style="list-style-type: none"> • DNA (loop) drawn and labelled (1) • starch grain drawn and labelled (1) • {envelope / inner membrane / outer membrane} drawn and labelled (1) • grana / grana stack / granum / (inter granal) lamellae (1) • ribosomes drawn and labelled (1) 	<p>IGNORE lipid droplets, stroma, thylakoid membranes</p> <p>ACCEPT plasmid / plasmid-like DNA</p> <p>ACCEPT starch granules</p> <p>ACCEPT / double membrane</p> <p>IGNORE size references</p>	(3)

Question number	Answer	Mark
(c)	<p>The only correct answer is B.</p> <p><i>A is incorrect because green wavelengths are reflected</i> <i>C is incorrect because green wavelengths are reflected</i> <i>D is incorrect because green wavelengths are reflected</i></p>	(1)

Question number	Answer	Additional guidance	Mark
(d)	<ul style="list-style-type: none"> • rate of photosynthesis at different wavelengths of light 		(1)

Question number	Answer	Mark
(e)(i)	<p>The only correct answer is A</p> <p><i>B is incorrect because dendrochronology is the study of tree growth rings</i> <i>C is incorrect because osmosis is the movement of free water molecules from a high solute potential to a lower solute potential</i> <i>D is incorrect because PCR amplifies the number of DNA molecules</i></p>	(1)

Question number	Answer	Mark
(e)(ii)	The only correct answer is B . <i>A is incorrect because the Rf value of J is distance moved by J divided by distance moved by solvent front = $6 \div 7.5 = 0.800$</i> <i>C is incorrect because the Rf value of J is distance moved by J divided by distance moved by solvent front = $6 \div 7.5 = 0.800$</i> <i>D is incorrect because the Rf value of J is distance moved by J divided by distance moved by solvent front = $6 \div 7.5 = 0.800$</i>	(1)

2 - ((WBI11)/4(IAL)_Summer_2020_Q2) - Energy, Environment, Microbiology And Immunity

(a)	<ul style="list-style-type: none"> using a {thermometer / (temperature) probe} to take the temperature of the {liver / rectum} 	ACCEPT into the core / deep into the body / up the anus IGNORE other parts of body	(1)
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Question number	Answer	Additional guidance	Mark
(b)(i)	<ul style="list-style-type: none"> drop in body temperature in first 12 hours calculated and subtracted from 11.5°C (1) this value divided by 0.4, added to 12 hours and answer rounded to nearest hour (1) 	$11.5 - (0.78 \times 12) / 11.5 - 9.36 / 2.14$ 17 (hours) $17.35 = 1$ mark Correct answer with no working gains 2 marks	(2)

Question number	Answer	Additional guidance	Mark
(b)(ii)	An explanation that includes the following points: <ul style="list-style-type: none"> (this) estimate would be {shorter / an under-estimate} (1) because a body loses <u>heat</u> faster (in cooler conditions) (1) 	ACCEPT converse	(2)

Question number	Answer	Additional guidance	Mark
(c)	An explanation that includes three of the following points: <ul style="list-style-type: none"> because temperature affects {rigor / body stiffness} (1) because deciding when a body is stiff or not stiff is subjective (1) because if the body is stiff, the time since death can only be estimated as being between 3 and 36 hours (1) because if the body is not stiff, there is no way of telling if it has been dead for less than 3 hours or more than 36 hours (1) 	ACCEPT exercise / body shape / body fat / ATP levels ACCEPT gives a wide range of (time) values ACCEPT if not stiff cannot tell how many hours after 36 hours time of death was	(3)

3 - ((WBI11)/4(IAL)_Summer_2020_Q3) - Energy, Environment, Microbiology And Immunity

Question number	Answer	Additional guidance	Mark
(a)(i)	2772	IGNORE any other units given	(1)

Question number	Answer	Additional guidance	Mark
(a)(ii)	<p>An explanation that includes four of the following points:</p> <ul style="list-style-type: none"> light is absorbed by {photosystems / chlorophyll} (1) which {excites electrons / releases high-energy electrons / releases electrons to higher energy levels} (1) these electrons are passed along a series of (electron) carriers (1) therefore releasing <u>energy</u> to phosphorylate ADP into ATP (cyclic)(1) phosphorylation of ADP via the proton gradient to form ATP (non-cyclic) (1) 	<p>ACCEPT description e.g. hydrogen ions pass through ATP synthase releasing energy for phosphorylation of ADP NB reference to ATP being synthesised from ADP only needed once to award both 4th and 5th marking point</p>	(4)

Question number	Answer	Additional guidance	Mark
(b)(i)	<ul style="list-style-type: none"> two from: C - H, C - O and C - C 	<p>IGNORE O - H ACCEPT bond between carbon and hydrogen bond between carbon and oxygen bond between carbon and carbon</p>	(1)

Question number	Answer	Mark
(b)(ii)	<p>The only correct answer is C.</p> <p>A is incorrect because there is no cytoplasm inside chloroplasts B is incorrect because the matrix is not found in chloroplasts D is incorrect because glucose is synthesized in the stroma of chloroplasts</p>	(1)

Question number	Answer	Mark		
(c)(i)	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="padding: 5px;">carbon and nitrogen</td> <td style="padding: 5px;">condensation</td> </tr> </table> <p>The only correct answer is A.</p> <p>B is incorrect because bonds form by condensation reactions not hydrolysis C is incorrect because the peptide bond joins the C of one amino acid to the N of the other D is incorrect because the peptide bond joins the C of one amino acid to the N of the other and bonds form by condensation reactions not hydrolysis</p>	carbon and nitrogen	condensation	(1)
carbon and nitrogen	condensation			

Question number	Answer	Additional guidance	Mark
(c)(ii)	An explanation that includes two of the following points: <ul style="list-style-type: none"> because amino acids contain nitrogen (1) because some {amino acids / R groups} contain sulfur (1) nitrogen obtained from nitrates / sulfur obtained from sulfates (1) 	ACCEPT glucose does not contain nitrogen IGNORE nitrates ACCEPT glucose does not contain sulfur IGNORE sulfates ACCEPT nitrates / sulfates needed	(2)

4 - ((WBI11)/4(IAL)_Summer_2020_Q4) - Energy, Environment, Microbiology And Immunity

Question number	Answer	Additional guidance	Mark
(a)(i)	<ul style="list-style-type: none"> swollen / enlarged (hands) 	ACCEPT oedema IGNORE other symptoms	(1)

Question number	Answer	Additional guidance	Mark
(a)(ii)	Any two from: pain / hurts / tender / aches redness / red warmth / heat / increased temperature / hot	IGNORE swelling IGNORE immobility / itching IGNORE fever	(1)

Question number	Answer	Additional guidance	Mark
(b)(i)	An explanation that includes two of the following points: <ul style="list-style-type: none"> because when the virus replicates the {DNA / gene} will be transcribed (1) and when the RNA is translated the {protein / TNF} will be synthesized (1) TNF incorporated into capsid when virus is assembled (1) 	ACCEPT RNA / mRNA will be made ACCEPT description ACCEPT when new particles are made NB The {gene / DNA} is transcribed and translated = 1 mark if no other mark awarded	(2)

Question number	Answer	Additional guidance	Mark
(b)(ii)	An explanation that includes two of the following points: <ul style="list-style-type: none"> antibody {binds to / neutralises / agglutinates} TNF (1) therefore will prevent the TNF from binding to the cells (1) and therefore inflammatory responses will not be triggered (1) 	DO NOT ACCEPT antibody binds to cells / antibody destroys TNF IGNORE opsonisation DO NOT ACCEPT antibody binds to receptors (on the cells) ACCEPT inflammation will {not occur / be reduced}	(2)

Question number	Answer	Additional guidance	Mark
(b)(iii)	<p>An explanation that includes four of the following points:</p> <ul style="list-style-type: none"> because (as a result of the TNF antibodies binding to TNF) phagocytosis (by macrophages) will {not happen / be reduced} (1) therefore {fewer bacteria will be destroyed / bacteria will increase in number} (if less phagocytosis) (1) credit details of what will not take place if <u>macrophages</u> are impaired (1) therefore tubercles (more likely to) form (1) credit example of how TB can cause death (1) 	<p>e.g. antigen presentation / activation of T helper cells / humoral immune response</p> <p>e.g. destruction of lung tissue / organ failure / opportunistic infection / pneumonia / HIV / lung damage</p>	(4)

5 - ((WBI11)/4(IAL)_Summer_2020_Q5) - Energy, Environment, Microbiology And Immunity

Question number	Answer	Mark
(a)	<p>The only correct answer is C lambda phage (λ phage)</p> <p>A is incorrect because Ebola virus infects humans</p> <p>B is incorrect because the HIV infects humans</p> <p>D is incorrect because TMV infects plants</p>	(1)

Question number	Answer	Additional guidance	Mark
(b)(i)	<p>A description that includes two of the following points:</p> <ul style="list-style-type: none"> provide a {polar / hydrophilic} channel (1) so that lysins can pass through the {non-polar / hydrophobic} {membrane / phospholipids / fatty acid tails} (out of cell) (1) down their concentration gradient (1) 	<p>IGNORE direction of movement with respect to the cell</p>	(2)

Question number	Answer	Additional guidance	Mark
(b)(ii)	<p>An explanation that includes three of the following points:</p> <ul style="list-style-type: none"> primary structure is the sequence of amino acids that will determine the (tertiary) structure of {holin / protein} (1) as this will determine the {bonds / position of bonds} (1) (amino acids with) polar R groups will face into the channel (1) (amino acids with) non-polar R groups will face outwards to the {fatty acids / phospholipids / membrane} (1) 	<p>PIECE TOGETHER DO NOT ACCEPT bases</p> <p>ACCEPT correctly named bond</p>	(3)