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Mark Scheme (Results)

October 2020

Pearson Edexcel International Advanced Level
In Biology (WBI14)
Paper 01: Energy, Environment, Microbiology and Immunity

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

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Question number	Answer	Mark
1(a)	**C** thylakoid membranes | stroma The only correct answer is **C**. ***A*** *is incorrect because the light-dependent reactions take place in the thylakoid membranes* ***B*** *is incorrect because the light-dependent reactions take place in the thylakoid membranes and the light-independent reactions take place in the stroma* ***D*** *is incorrect because the light-independent reactions take place in the stroma*	**(1)**

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Question number	Answer	Additional guidance	Mark
1(b)	An answer that includes three of the following points: • 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)	**IGNORE** lipid droplets, stroma, thylakoid membranes **ACCEPT** plasmid / plasmid-like DNA **ACCEPT** starch granules **ACCEPT** / double membrane **IGNORE** size references	**(3)**

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

Question number	Answer	Additional guidance	Mark
1(d)	• rate of photosynthesis at different wavelengths of light		**(1)**

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

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

Question number	Answer	Additional guidance	Mark
2(a)	• 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
2(b)(i)	• 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 × 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
2(b)(ii)	An explanation that includes the following points: • (this) estimate would be {shorter / an under-estimate} (1) • because a body loses <u>heat</u> faster (in cooler conditions) (1)	**ACCEPT** converse	**(2)**

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Question number	Answer	Additional guidance	Mark
2(c)	An explanation that includes three of the following points: • 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)**

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

Question number	Answer	Additional guidance	Mark
3(a)(ii)	An explanation that includes four of the following points: • 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)	**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	**(4)**

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Question number	Answer	Additional guidance	Mark
3(b)(i)	• two from: C - H, C - O and C - C	**IGNORE** O - H **ACCEPT** bond between carbon and hydrogen bond between carbon and oxygen bond between carbon and carbon	**(1)**

Question number	Answer	Mark
3(b)(ii)	The only correct answer is **C**. ***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*	**(1)**

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Question number	Answer	Mark
3(c)(i)	<table><tr><td>carbon and nitrogen</td><td>condensation</td></tr></table> The only correct answer is **A**. ***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*	**(1)**

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Question number	Answer	Additional guidance	Mark
3(c)(ii)	An explanation that includes two of the following points: • 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)**

Question number	Answer	Additional guidance	Mark
4(a)(i)	• swollen / enlarged (hands)	**ACCEPT** oedema **IGNORE** other symptoms	**(1)**

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

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Question number	Answer	Additional guidance	Mark
4(b)(i)	An explanation that includes two of the following points: • 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)**

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Question number	Answer	Additional guidance	Mark
4(b)(ii)	An explanation that includes two of the following points: • 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)**

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Question number	Answer	Additional guidance	Mark
4(b)(iii)	An explanation that includes four of the following points: • 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)	e.g. antigen presentation / activation of T helper cells / humoral immune response e.g. destruction of lung tissue / organ failure / opportunistic infection / pneumonia / HIV / lung damage	**(4)**

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

Question number	Answer	Additional guidance	Mark
5(b)(i)	A description that includes two of the following points: • 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)	**IGNORE** direction of movement with respect to the cell	**(2)**

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Question number	Answer	Additional guidance	Mark
5(b)(ii)	An explanation that includes three of the following points: • 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)	**PIECE TOGETHER** **DO NOT ACCEPT** bases **ACCEPT** correctly named bond	**(3)**

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Question number	Answer	Additional guidance	Mark
5(b)(iii)	An explanation that includes the following points: • lysins break bonds between the {peptidoglycan / murein} molecules (1) • therefore the virus particles {leave the bacterial cells / get (out) through the cell wall} (once formed) (1)	**ACCEPT** are enzymes that breakdown {peptidoglycan / murein} **ACCEPT** causing {bacterial cells to burst / pores in the cell wall}	**(2)**

Question number	Answer	Additional guidance	Mark
6(a)	22.5 (cm^3)	**ACCEPT** 23.3 / 23.6 **IGNORE** any other units given	**(1)**

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Question number	Answer	Additional guidance	Mark
6(b)(i)	An answer that includes the following points: • give squirrel access to all three types of nut (1) • a range of sizes used (1) • determine the {number / order} that the nuts are eaten (by the squirrel) (1)	. **ACCEPT** record which size they prefer / comparing measurements made before and after	**(3)**

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Question number	Answer	Additional guidance	Mark
6(b)(ii)	An answer that includes the following points: • a reason based on size (1) • a reason based on shell (1) • a reason based on energy content (1)	e.g. more hazelnuts eaten (in the investigation) because they are smaller walnuts are too big to fit in the pouch e.g hazelnuts are easier to eat than walnuts because they have a hard covering and not a hard shell walnuts have a hard shell but squirrels have sharp teeth e.g. walnuts provide a lot of energy so squirrels get enough energy for hibernation more acorns have to be eaten as they store less energy **NB** if a comparison is made between the nuts using the three sets of information, award 1 mark if no other marks awarded	**(3)**

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Question number	Answer	Additional guidance	Mark
6(c)	An answer that includes three of the following points: • variation is size of pouches / polygenic (1) • squirrels with larger pouches could {gather / store} more food (1) • squirrels with (largest) pouches survived and reproduced (1) • increasing (large) food pouch allele frequency (1)	**ACCEPT** mutation in {DNA / gene} resulting in pouches **ACCEPT** squirrels with pouches can store food (compared to those without pouches) **ACCEPT** passed the (large) food pouch alleles onto their offspring **DO NOT ACCEPT** gene for allele	**(3)**

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Question number	Answer	Mark
7(a)(i)	The only correct answer is **B**. ***A*** *is incorrect because nuclei, Golgi apparatus and mitochondria are organelles surrounded by membrane* ***C*** *is incorrect because nuclei, Golgi apparatus and mitochondria are organelles surrounded by membrane* ***D****is incorrect because nuclei, Golgi apparatus and mitochondria are organelles surrounded by membrane*	**(1)**

Question number	Answer	Additional guidance	Mark
7(a)(ii)	An explanation that includes the following points: • it is not a plant because it has glycogen granules (1) • it is not an animal because it has a cell wall (1) • it is not a bacterium because it has {nuclei / Golgi apparatus / mitochondria / membrane-bound organelles} (1)	**ACCEPT** does not have cellulose cell wall **IGNORE** chloroplast / vacuole **IGNORE** flagellum / pili / capsule / ER **DO NOT ACCEPT** ribosomes / cytoplasm / glycogen granules / cell membrane / cell wall unless qualified as {chitin / not peptidoglycan}	**(3)**

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Question number	Answer	Additional guidance	Mark
7(b)	An explanation that includes four of the following points: • there is a correlation between the number of prescriptions and the percentage of resistant *E.coli* (1) • the use of aminopenicillin acts as a selection pressure (1) • therefore the resistant bacteria reproduce and the non-resistant bacteria die (1) • percentage of resistant *E. coli* falls when prescriptions fall because non-resistant *E. coli* are not destroyed (1) • credit a comment about competition between resistant and non-resistant bacteria (1)	**ACCEPT** pattern / trend **IGNORE** directly proportional **ACCEPT** therefore the resistant bacteria {are **more** likely to reproduce / reproduce **more**} **ACCEPT** as the prescriptions go up the number of resistant bacteria go up **and** when the prescriptions go down the number of bacteria go down for 1 mark if no other marks awarded	**(4)**

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Question number	Answer	Additional guidance	Mark
7(c)	An explanation that includes three of the following points: • because the codes of practice (regarding the prescription of antibiotics) are being ignored (1) • use of antibiotics is a selection pressure (1) • therefore the number of antibiotic resistant bacteria is increasing (1) • our (current) antibiotics may become useless and people will {remain ill / die} (1)	**ACCEPT** (medical) advice **ACCEPT** reference to evolutionary race in an appropriate context natural bacterial flora destroyed by antibiotics	**(3)**

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Question number	Answer	Mark
8(a)(i)	The only correct answer is **D** blood type O ***A*** *is incorrect because A antigens are not present on red blood cells of humans with blood group B or O* ***B*** *is incorrect because B antigens are not present on red blood cells of humans with blood group A or O* ***C*** *is incorrect because A antigens are not present on red blood cells of humans with blood group B or O and B antigens are not present on red blood cells of humans with blood group A or O*	**(1)**

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Question number	Answer	Additional guidance	Mark
8(a)(ii)	An explanation that includes four of the following points: • B antigens are recognised as foreign antigens (1) • and therefore initiate an (humoral) immune response (1) • credit details of humoral immune response (1) • resulting in antibodies released by plasma cells (1) • credit consequence of humoral immune response (1)	e.g. opsonisation / agglutination / destruction of RBCs (in liver / spleen / by phagocytes / formation of memory cells	**(4)**

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Question number	Answer	Additional guidance	Mark
8(b)(i)	An explanation that includes two of the following points: • they {reduce / destroy / prevent the growth of / prevent the infection of} pathogenic bacteria (1) • because they compete for {nutrients / named nutrient / space} (1) • produce {toxins / chemicals} (that destroy pathogenic bacteria) (1)	**ACCEPT {**foreign / other} bacteria / pathogens **IGNORE** food **ACCEPT** produce vitamin K	**(2)**

Question number	Answer	Additional guidance	Mark
8(b)(ii)	An answer that includes the following points: • (because the bacteria can) {absorb / use} sugar for respiration (1) • to produce ATP (for the bacteria) (1)	**ACCEPT** glucose for sugar throughout **ACCEPT** {it / they} to mean bacteria	**(2)**

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Question number	Answer	Additional guidance	Mark
8(b)(iii)	An explanation that includes two of the following points: • there will be no (foreign) antigens on the red blood cells (1) • the immune response will not be triggered (1) • therefore this blood can be used in any transfusion (if no antigens present) (1)	**ACCEPT** antigens removed from the red blood cells red blood cells will not be recognised as {foreign / non-self} **ACCEPT** can be used in a transfusion as will not be rejected blood will act like {group O blood / universal donor}	**(2)**

Question number	Answer	Additional guidance	Mark
9(a)(i)	• extrapolation / line of best fit / calculation of mean decrease (per year)		**(1)**

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Question number	Answer	Additional guidance	Mark
9(a)(ii)	• values read from the graph and subtracted • percentage drop calculated	7.6 - 3.4 / 4.2 4.2 × 100 ÷ 7.6 = 55 / 55.3 / 55.26 (%)	**(2)**

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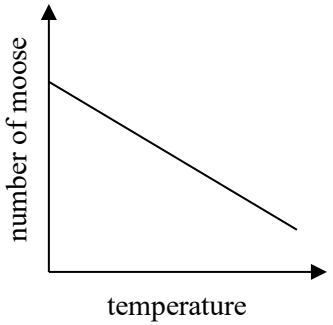
Question number	Answer	Additional guidance	Mark
9(a)(iii)	An answer that includes the following points: • temperature on the x axis (1) • number of moose on the y axis (1) • {relatively / stepped} straight line sloping down from top left to bottom right (1)	**ACCEPT** rainfall / days of drought **ACCEPT** axes labelled the other way for 1 mark **NB** Check direction of slope if axes wrongly labelled for a CE  **ALLOW** a correct graph of temperature against year for 1 mark **ALLOW** a double y axis graph correctly labelled + line for three marks	**(3)**

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Question number	Answer	Additional guidance	Mark
9(b)(i)	• total number of moose added up and total number of moose with 50 000 or more ticks calculated • percentage calculated to max 2 dps	214 and 41 41 × 100 ÷ 214 = 19 / 19.16 / 19.2 CE applies if only one of the two numbers is incorrect	**(2)**

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Question number	Answer	Additional guidance	Mark
*9(b)(ii)	Indicative content: **Comment on global warming (S1)** • global warming will increase the temperature of the earth's {surface / atmosphere} • winters will get warmer so less snow • winters will get shorter so snow present for fewer days **Effect of change on ticks (S2)** • warmer conditions decrease life cycle time • fewer ticks will die in the snow in early spring • more females to lay eggs • larvae less likely to be covered in snow in autumn • so more larvae become nymphs **Effect of ticks on moose (S3)** • more ticks mean larger volumes of blood removed from each moose • moose become weaker if less blood in them • moose die from lack of {nutrients / oxygen / anaemia / energy} (R) • less energy for hunting so they starve (R) • less energy for reproduction (R) • if moose lose their fur they will not be able to keep warm • moose die from the cold (R) • scratching can cause open wounds that can get infected • ticks pass on pathogens • moose die from infections (R)	**Level 1 :** 1 mark = description made from one section 2 marks = descriptions made from at least two sections but no links **Level 2 :** 3 marks = a link made between descriptions of two sections 4 marks = at least two links made between descriptions of all three sections **Level 3 :** 5 marks = links made between all sections with one reason (R) for moose number declining 6 marks = links made between all sections with two reasons (2R) for moose number declining **(6)**	

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