Mark Scheme (Provisional)

Summer 2021

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

Question number	Answer	Mark
1(a)(i)	The only correct answer is **D**. **A** *is incorrect because cutting grass is biotic and competition is biotic* ***B*** *is incorrect because cutting grass is a biotic factor* ***C*** *is incorrect because cutting grass is biotic*	**(1)**

Question number	Answer	Mark
1(a)(ii)	The only correct answer is **C**. ***A*** *is incorrect because 0.7 × 100 ÷ 0.3 = 233.3* ***B*** *is incorrect because 0.7 × 100 ÷ 0.3 = 233.3* ***D*** *is incorrect because 0.7 × 100 ÷ 0.3 = 233.3*	**(1)**

Question number	Answer	Additional guidance	Mark
1(a)(iii)	An answer that includes two of the following points: • in the cut field the grass is faster growing reducing the light available to other plants (1) • in the cut field the grass is faster growing and absorbing {water / mineral ions / named mineral ion} (1) • bushes are slower growing so have not got time to grow before they are cut back (1) • bushes damaged during the cutting process (1)	**ACCEPT** bushes become established and shade the grass **ACCEPT** bushes become established and take up the {mineral ions / water}	**(2)**

Question number	Answer	Mark
1(b)(i)	The only correct answer is **D**. ***A*** *is incorrect because* ***P*** *is not the middle value and this is not a bar chart* ***B*** *is incorrect because* ***P*** *is not the middle value* ***C*** *is incorrect because this is not a bar chart*	**(1)**

Question number	Answer	Additional guidance	Mark
1(b)(ii)	• 2		(1)

Question number	Answer	Additional guidance	Mark
1(b)(iii)	1 : 2.049	**ACCEPT** 1 : 2.05 / 1 : 2 **DO NOT ACCEPT** 1 : 2.1	(1)

Question number	Answer	Additional guidance	Mark
1(b)(iv)	• class 2 mosses have (about) twice the genome size of class 1 mosses		(1)

Question number	Answer	Additional guidance	Mark
2(a)	An answer that includes three of the following points, with at least **one** similarity and **one** difference : **Similarities** • both have (circular) DNA (1) • both have ribosomes (1) • both have double membranes **Differences** • chloroplasts have stroma and mitochondria have a matrix (1) • chloroplasts have {thylakoids / thylakoid membranes / grana / intergranal lamellae} and mitochondria have {a folded inner membrane / cristae} (1) • chloroplasts have starch grains and mitochondria do not (1)	**DO NOT PIECE TOGETHER** **ACCEPT** both have an envelope	**(3)**

Question number	Answer	Additional guidance	Mark
2(b)(i)	An answer that includes the following points: • (**D**) chlorophyll / light-absorbing pigments / photosystems / PSI / PSII (1) • (**E**) electron carriers / electron transport proteins / cytochromes (1) • (**F**) {ADP / adenosine diphosphate} and (**G**) {phosphate (ions) / Pi / PO_4^{2-}} and (**H**) ATP / adenosine triphosphate (1)	**ACCEPT** named pigments **ACCEPT F** & **G** the other way around **DO NOT ACCEPT** P or incorrect formula for phosphate ions	**(3)**

Question number	Answer	Additional guidance	Mark
2(b)(ii)	• reduced NADP / NADPH	**ACCEPT** {r / red} for reduced reduced NADPH **DO NOT ACCEPT** NADP /reduced NAD/ NADH / reduced NADH	**(1)**

Question number	Answer	Additional guidance	Mark
2(b)(iii)	A description that includes two of the following points: • to split water (1) • electrons replace those lost by {photosystems / PSI / PSII / chlorophyll} (1) • {hydrogen ions / H^+ / protons} involved in formation of NADPH (1)		**(2)**

Question number	Answer	Additional guidance	Mark
3(a)(i)	An answer that includes the following points: • a place where organisms live (1) • (African) Plains is the place and the organisms are the {lions / giraffes / (acacia) trees} (1)	**NB** the African Plains is where {lions / giraffe / (acacia) trees} live = 2 marks	**(2)**

Question number	Answer	Additional guidance	Mark
3(a)(ii)	An answer that includes the following points: • organisms of **one** species found in a particular area (1) • {(one from) lions / giraffe / (acacia) trees} found on the (African) Plains (1)	**ACCEPT** type for species	**(2)**

Question number	Answer	Additional guidance	Mark
3(a)(iii)	An answer that includes the following points: • a group of organisms of **different** species interacting in a particular area (1) • lions, giraffes and (acacia) trees on the (African) plains (1)	**ACCEPT** {dependent / rely} on each other for interacting **ACCEPT** two of the named organisms	**(2)**

Question number	Answer	Additional guidance	Mark
3(a)(iv)	An answer that includes two of the following points: • the role of an organism in its habitat (1) **One of the following** • (acacia) trees provide food for giraffes (1) • (acacia) trees provide shade for the lions (1) • giraffes provide food for lions (1) • giraffes keeping the {size / number} of (acacia) tree under control (1) • lions keep the number of giraffes under control (1) • {lions / giraffes} are a source of mineral ions for the (acacia) trees (1)		**(2)**

Question number	Answer	Additional guidance	Mark
3(b)	8.42 / 8.4 / 8 (%)		**(1)**

Question number	Answer	Additional guidance	Mark
4(a)	An explanation that includes the following points: • allopatric speciation (1) • (allopatric) because lemurs have the same common ancestor isolated from those in Africa (1) • sympatric speciation (1) • (sympatric) because Sifakas and Indri live together but have a different diet (1)	**ACCEPT** geographic speciation **ACCEPT** description of how diet is different	**(4)**

Question number	Answer	Additional guidance	Mark
4(b)(i)	An explanation that includes two of the following points: • because only small quantities of DNA can be collected (1) • therefore need to {amplify / increase the number of copies of} DNA (1) • so that there is enough to {run on gel electrophoresis / analyse} (1)	**ACCEPT** collecting a sample is difficult	**(2)**

Question number	Answer	Additional guidance	Mark
4(b)(ii)	An explanation that includes two of the following points: • gel electrophoresis run on DNA from both groups of lemurs (1) • pattern of bands were similar showing the lemurs were genetically similar (1) • base sequencing would show similar sequences (1)	**ACCEPT** use of bioinformatics to show that the base sequences were similar	**(2)**

Question number	Answer	Mark
5(a)	The only correct answer is **C**. ***A*** *is incorrect because dendrochronology is dating trees using tree rings* ***B*** *is incorrect because epigenetics studies changes in gene expression* ***D*** *is incorrect because species diversity is a measure of the number of different species in an area*	**(1)**

Question number	Answer	Additional guidance	Mark
5(b)(i)	• 0.12 (1) • mm hr^{-1} (1)	**NB** If different units have been used, award a correct numerical value e.g. 0.012 cm hr^{-1} = 2 marks	**(2)**

Question number	Answer	Additional guidance	Mark
5(b)(ii)	An answer that includes three of the following points: • suitable as a mean is calculated (1) • but there is no indication of sample size so may not be that suitable (1) • data looks more suitable in the first 45 hours as the error bars are small (1) • may not be suitable as the incubation temperature may be different to body temperature (1) • will not be suitable if person died more than 120 hours ago (1)	**ACCEPT** {reliable / accurate} as an alternative for suitable throughout **ACCEPT** overall the error bars are (quite) small **parts** of the graph where the error bars do not overlap are suitable / converse **ACCEPT** body temperature does not remain constant	**(3)**

Question number	Answer	Additional guidance	Mark
5(b)(iii)	A description that includes three of the following points: • (start the investigation with) several blowfly eggs (1) • measure the length of larvae (at intervals) over a period of 120 hours (1) • credit a named control variable appropriate to this data collection (1) • calculate mean **and** {standard deviation / range bars / error bars} (1)	**e.g.** same food supply, species of blowfly **IGNORE** inappropriate named control variables eg pH	**(3)**

Question number	Answer	Additional guidance	Mark
5(c)	An answer that includes four of the following points: **THREE FROM:** • body temperature is readily available information (1) • {calibration curves / formulae} available to work backwards to estimate time of death (1) • but the change in body temperature is due to several factors (1) • credit example of one of these factors (1) **AND** • therefore of limited use unless used in conjunction with other methods (1)	**ACCEPT** calculations can be made to estimate time of death **e.g.** ambient temperature **ACCEPT** on its own	**(4)**

Question number	Answer	Mark
6(a)	<table><tr><th rowspan="2">Structure</th><th colspan="4">Carbohydrate found in</th></tr><tr><td>both plants and animals</td><td>plants but **not** animals</td><td>animals but **not** plants</td><td>neither plants nor animals</td></tr><tr><td>Amylose</td><td>☐</td><td>**X**</td><td>☐</td><td>☐</td></tr><tr><td>Glucose</td><td>**X**</td><td>☐</td><td>☐</td><td>☐</td></tr><tr><td>Glycogen</td><td>☐</td><td>☐</td><td>**X**</td><td>☐</td></tr><tr><td>Starch</td><td>☐</td><td>**X**</td><td>☐</td><td>☐</td></tr></table>	**(4)**

Question number	Answer	Additional guidance	Mark
6(b)(i)	• diffusion of carbon dioxide / carbon dioxide dissolving	**ACCEPT** CO_2 **DO NOT ACCEPT** CO / Co / C	**(1)**

Question number	Answer	Additional guidance	Mark
6(b)(ii)	• 6.1×10^{13} / 61 000 000 000 000 (kg)	**ACCEPT** 61 trillion / 61 million million	**(1)**

Question number	Answer	Additional guidance	Mark
6(b)(iii)	A description that includes three of the following points: • as carbon dioxide from respiration (1) **AND ANY TWO FROM:** • by plants (1) • by microorganisms that decompose (dead) plants (1) • by {animals that eat the plants / herbivores} (1)	**DO NOT ACCEPT** CO / Co / C	**(3)**

Question number	Answer	Additional guidance	Mark
6(c)(i)	An answer that includes the following points: • (anthropogenic) caused by the effect of humans (1) • (climate change) changes to (mean) {temperature / rainfall} (1)	**IGNORE** named activities **ACCEPT** long-term (mean) change in weather patterns **IGNORE** weather unqualified / global warming / results of global warming / climate	**(2)**

Question number	Answer	Additional guidance	Mark
6(c)(ii)	An explanation that includes the following points: • named example of method to reduce the burning of fossil fuels (1) • because this will reduce the carbon dioxide released into the atmosphere (1) **OR** • reforestation (1) • because more plants will absorb more carbon dioxide for photosynthesis (1) **OR** • reduce the number of cattle being farmed (1) • as this will reduce the methane being released into the atmosphere (1)	**e.g.** lift sharing, public transport, use of solar power **ACCEPT** reduce the extent of rice farming	**(2)**

Question number	Answer	Mark
7(a)(i)	The only correct answer is **D**. ***A*** *is incorrect because pH is a log scale so the difference of 2 is 100 fold* ***B*** *is incorrect because pH is a log scale so the difference of 2 is 100 fold* ***C*** *is incorrect because there are fewer hydrogen ions at pH 8.5 than pH 6.5*	**(1)**

Question number	Answer	Additional guidance	Mark
7(a)(ii)	650 (%)		**(1)**

Question number	Answer	Additional guidance	Mark
*7(a)(iii)	Indicative content: • soil depth increases with distance from the sea (D) • because these are older sand dunes (E) • so more time for humus to build up (E) • organic material increases with distance from the sea (D) • because these are older sand dunes • so more decomposition adds organic material to the sand (E) • due to activity of microorganisms (E) • pH falls with distance from the sea (D) • because more humus is added to the sand (E) • more rain (over the years) washes out minerals (E) • percentage of bare rock decreases with distance from sea (D) • because pioneer species break it down (E) • because as more soil is produced, it covers the bare rock (E) • number of different species of plant increase with distance from sea (D) • because the soil {is becoming more fertile / salinity is decreasing} (E) • organic material holds more moisture than sand alone (E) • types of plant change with distance from sea (D) • as soil becomes more favourable for more plant species (E) • more plants improve soil conditions further (E)	Level 1 : 1 mark = 1 description of {data / succession} 2 marks = 3 descriptions {of data / succession} OR 1 description of data + an explanation Level 2 : 3 marks = 2 descriptions of the data and an explanation of both 4 marks = 3 descriptions of the data and all three explained Level 3 : 5 marks = 4 descriptions of the data and all 4 explained 6 marks = 5 descriptions of the data and all five explained	**(6)**

Question number	Answer	Additional guidance	Mark
7(b)(i)	A description that includes the following points: • NPP above ground is always greater than the NPP below the ground (1) • the NPP above and below the ground depends on the type of sand dune (1) • fixed sand dunes have the highest (total) NPP / shifting sand dunes have the lowest (total) NPP (1) • shifting sand dune has the largest {percentage difference / ratio} between NPP above the ground and NPP below the ground (1)		**(3)**

Question number	Answer	Additional guidance	Mark
7(b)(ii)	An explanation that includes four of the following points: • because {light-independent reactions / Calvin cycle} produce {GALP / glucose / hexose} (1) • {GALP / glucose / hexose}} used to produce sucrose (1) • {GALP / glucose / hexose}} used to produce amino acids (1) • (sucrose / amino acids) transported in the phloem to the {roots / rhizomes} (1) • {glucose / sucrose / amino acids} used to synthesise {organic material / biomass / named organic molecule / NPP} (1)	**DO NOT ACCEPT** glucose transported	**(4)**

Question number	Answer	Additional guidance	Mark
8(a)(i)	An explanation that includes the following points: • (combination of antibiotics given) because different bacteria are resistant to different antibiotics (1) • (given for several months) to expose bacteria to high enough doses for long enough (1)	**ACCEPT** to ensure all bacteria destroyed	**(2)**

Question number	Answer	Additional guidance	Mark
8(a)(ii)	An answer that includes three of the following points: • because *Mycobacterium* infects the lungs (1) • (*Mycobacterium* infection) destroying lung tissue (1) • therefore reduced gas exchange (1) • so insufficient oxygen to meet (oxygen) demands of patient (1)	**ACCEPT** a description e.g. necrosis **IGNORE** breathing problems	**(3)**

Question number	Answer	Additional guidance	Mark
8(a)(iii)	An explanation that includes four of the following points: • because if DNA synthesis cannot take place neither can mitosis (1) • and therefore clonal expansion of {T cells / B cells} cannot take place (1) • without T killer cells, host-infected cells cannot be destroyed (1) • without {B cells / plasma cells} there will be no antibody for opsonisation (of bacteria) (1) • therefore macrophages cannot destroy the *Mycobacteria* (1)	**ACCEPT** {T cells / B cells} cannot divide **DO NOT ACCEPT** B cells release antibody	**(4)**

Question number	Answer	Additional guidance	Mark
*8(b)	**Indicative content:** • number of bacteria still increasing at start of phage therapy (D) • because it takes time for lytic cycle (E) • bacteria number decrease (D) • because cells get destroyed when viruses burst out (E) • due to lytic cycle (E) • virus numbers increase (D) • because viruses replicate inside bacteria (E) • and burst out (E) • virus numbers increase after bacterial numbers increase (D) • because it takes time for synthesis of new components (E) • virus particles decrease (D) • because they get {engulfed / destroyed} by macrophages (E) • cyclical increase and decrease in the number of bacteria (D) • because not all bacteria get infected (E) • therefore surviving bacteria reproduce and increase in number (E) • cyclical increase and decrease in number of viruses (D) • because macrophages cannot destroy all viruses (E) • because viruses infect more bacteria (E) • eventually no viruses or bacteria (D)	**Level 1 :** 1 mark = 1 comment made about the graph or viral infections 2 marks = 3 comments made about {graph / viral infections} **OR** 1 description and a linked explanation **Level 2 :** 3 marks = 2 descriptions and linked explanations 4 marks = 3 descriptions and linked explanations **Level 3 :** 5 marks = 4 descriptions and linked explanations that includes both virus and bacterial number changes 6 marks = 5 descriptions and linked explanations that includes both virus and bacterial number changes + the cyclical nature of the data	**(6)**

	• because viruses destroy bacteria faster than they can reproduce (E) • viruses have no more host cells / destroyed by macrophages (E)		

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