

Mark Scheme (Results)

June 2022

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	Additional guidance	Mark
1(a)	• a {chemical / substance / medicine / drug / compound / molecule} that {kills / destroys} bacteria	**ACCEPT** pathogen / microorgansims **DO NOT ACCEPT** viruses antibodies / antigens **DO NOT ACCEPT** inhibit the growth **IGNORE** descriptions of mechanisms	**(1)**

Question number	Answer	Additional guidance	Mark
1(b)	• bacteria are prokaryotic (and humans are eukaryotic)	**ACCEPT** named target site e.g. cell wall, biochemistry, metabolism only prokaryotic cells **IGNORE** specific antigens receptors	**(1)**

Question number	Answer	Additional guidance	Mark
1(c)	A description that includes two of the following points: • finish the course of antibiotics (1) • take the antibiotics as directed (by the doctor) • warnings / precautions that may be necessary	**IGNORE** advise that would be given to doctors and not the patients **ACCEPT** specific examples e.g. correct {dose / number / timings}, do not share your antibiotics, do not take antibiotics not prescribed (by your doctor) e.g. they might make you sleepy	**(2)**

Question number	Answer	Additional guidance	Mark
1(d)	A description that includes the following points: • bacteria types J and K are {destroyed / killed / eradicates} (1) • antibiotic results in an increase in {<u>proportion / percentage / ratio</u>} of bacteria types M and N (1) • bacteria type O and L {not affected / growth inhibited} (1)	Piece together **ACCEPT** antibiotic is bactericidal to J and K **IGNORE** increase in number **ACCEPT** antibiotic is bacteriostatic to O and L	**(3)**

Question number	Answer	Mark
2(a)	The only correct answer is A. ***B** is incorrect because this is not a method of counting bacteria* ***C** is incorrect because colonies are counted not weighed* ***D** is incorrect because colonies are counted on agar. Turbidity would not work on agar.*	**(1)**

Question number	Answer	Additional guidance	Mark
2(b)	An explanation that includes the following points: • attach lid to dish to ensure {lid does not fall off / bacteria do not enter / bacteria do not leave / no contamination} (1) • not completely sealed {so that conditions remain aerobic / prevent the growth of anaerobic bacteria} (1)	**ACCEPT** a description for both marking points e.g. sellotape used in places / sellotape not used all the way round **ACCEPT** a description of how to attach e.g. tape up the petri dish, use sellotape to seal petri dish **ACCEPT** leave gaps so there is oxygen NB leave air holes in the sealing = this mark	**(2)**

Question number	Answer	Mark
2(c)(i)	The only correct answer is **C**. **A** *is incorrect because lag comes before exponential and death comes at the end* ***B*** *is incorrect because exponential comes between lag and death* ***D*** *is incorrect because lag comes before exponential and stationery comes after*	**(1)**

Question number	Answer	Mark
2(c)(ii)	The only correct answer is **D**. **A** *is incorrect because all four are correct* ***B*** *is incorrect because all four are correct* ***C*** *is incorrect because all four are correct*	**(1)**

Question number	Answer	Additional guidance	Mark
2(c)(iii)	• $\log_{10} N_t$ and $\log_{10} N_0$ values read from graph and subtracted (1) • 2.49 (1)	6.5 – 2 / 4.5 **IGNORE** 'log' before the 6.5 and 2 if they clearly haven't used the log value ecf if log of logs have been taken and given to 2 dps = 0.28	**(2)**

Question number	Answer	Additional guidance	Mark
3(a)(i)	A description that includes the following points: • compete with pathogen for {space / nutrients / metabolites / named nutrient} (1) • (skin flora) producing toxins (to pathogens) (1) • preventing {the growth of the pathogens / colonisation (of the skin) by pathogens} (1)	**ACCEPT** other {bacteria / microorganisms} for pathogens **ACCEPT** nutrition **IGNORE** food **ACCEPT** anti-microbials chemicals if linked to mp 3 or qualified as being poisonous **DO NOT ACCEPT** sebum **ACCEPT** stimulate the immune system (toxins) kill pathogens	**(2)**

Question number	Answer	Additional guidance	Mark
3(a)(ii)	• keratin / antimicrobial secretions (by the skin) / oils / sebum	**ACCEPT** barrier **IGNORE** sweat explanations and other methods	(1)

Question number	Answer	Additional guidance	Mark
3(b)(i)	A description that includes the following points: • majority of bacteria are three types • males of all ages have the same (predominant) groups of bacteria present on their skin (1) • Proteobacteria are the highest group of bacteria in all age groups (1) • middle aged men and elderly men have similar proportions of the three types of bacteria present on their skin (1)	**IGNORE** reference to 'others' throughout **Do not piece together** **ACCEPT** Firmicutes is lowest named bacteria in all groups **ACCEPT** <u>teenagers</u> have {<u>more</u> Firmicutes and Actinobacteria / <u>less</u> Proteobacteria} (than middle aged and elderly men)	(3)

Question number	Answer	Additional guidance	Mark
3(b)(ii)	A description that includes two of the following points: • collect from same part of {body / skin} (1) • men should use same washing regime (1) • men from same environment (1) • men should not be taking antibiotics (1)	**ACCEPT** description e.g number of showers, same soaps **ACCEPT** same parts of the world, named environmental conditions e.g. UV light, humidity, temperature **ACCEPT** should not use antibacterial {soaps / creams} no skin conditions	**(2)**

Question number	Answer	Additional guidance	Mark
3(c)(i)	A description that includes the following points: • macrophages {engulf / phagocytose / ingest} the bacteria (1) • and destroy the bacteria with enzymes (1)	**ACCEPT** pathogens / microorganisms **DO NOT ACCEPT** viruses **DO NOT ACCEPT** in context of opsonisation **ACCEPT** digestive enzymes / named digestive enzyme / lysozyme	**(2)**

Question number	Answer	Additional guidance	Mark
3(c)(ii)	A description that includes two of the following points: • macrophages present antigen (on surface / on MHC) (1) • (macrophages present antigen) to {T helper / CD4} cells (1) • macrophage engulf opsonised bacteria (1)	**DO NOT ACCEPT** to T killer cells / B cells / other cells **ACCEPT** description of opsonisation	**(2)**

Question number	Answer	Additional guidance	Mark
4(a)(i)	• not enough (male) birds left to teach them the song	**ACCEPT** hear the songs of other birds and learn them	**(1)**

Question number	Answer	Additional guidance	Mark
4(a)(ii)	An explanation that includes the following points: • female birds will not recognise the males (song / courtship behaviour) (1) • therefore the level of breeding may drop (1) • therefore the number of birds will drop (further) / extinction (1) • hybridisation may occur (1)	**ACCEPT** reduced mating / reproduction **ACCEPT** mating with another <u>species</u> would produce infertile offspring **IGNORE** references to reproductive isolation	**(3)**

Question number	Answer	Additional guidance	Mark
4(a)(iii)	An answer that includes the following points: • keep them away from other species / house them with (only) their species (1) • (in captivity) keep with other birds that can sing the songs (to teach them) (1) • and then release the birds that have learnt the song back into the wild (1)	**ACCEPT** play recorded {songs / videos} / whistle the song	**(2)**
Question number	**Answer**	**Additional guidance**	**Mark**
4(b)	A description that includes the following points: • take DNA samples from {feather / dropping / skin / blood} (of both species) (1) • use of PCR (1) • (followed by) (gel) electrophoresis (1) • {number / width / position / patterns} of <u>bands</u> will show similarities (1)	**ACCEPT** DNA profiling / bioinformatics **ACCEPT** similar base sequences (using DNA profiling / bioinformatics)	**(4)**

	Answer	Mark
5(a)(i)	The only correct answer is **C**. **A** *is incorrect because m is an area so two dimensional* ***B*** *is incorrect because year is one dimensional* ***D*** *is incorrect because year is one dimensional*	**(1)**

	Answer	Mark
5(a)(ii)	The only correct answer is **B**. **A** *is incorrect because NPP = GPP - R* ***C*** *is incorrect because NPP = GPP - R* ***D*** *is incorrect because NPP = GPP - R*	**(1)**

Question number	Answer	Additional guidance	Mark
5(a)(iii)	• 98 : 10 : 1	**ACCEPT** 98 : 9.6 : 1 98.3 : 9.6 : 1 100 : 10 : 1 10 : 1 : 0.1 10.3 : 1 : 0.1 1 : 0.1: 0.01	**(1)**

Question number	Answer	Additional guidance	Mark
5(a)(iv)	An explanation that includes the following points: • because not enough energy (in trophic level 3) (1) • to sustain (organisms in) a fourth trophic level (1) **OR** • energy is lost between trophic levels (1) • so not enough energy for another trophic level (1)	**IGNORE** no energy / biomass **ACCEPT** support **IGNORE** no energy / biomass	**(2)**
Question number	**Answer**	**Additional guidance**	**Mark**
5(a)(v)	A description that includes the following points: • breakdown organic matter (1) • with (hydrolytic) enzymes (1) • releasing carbon <u>dioxide</u> from respiration (to the atmosphere) (1) • where it is used for photosynthesis (by plants) (1)	**ACCEPT** dead {tree / gerenuk / lion} / tissues / named organic molecule **ACCEPT** named enzyme **NB** release {<u>digestive / hydrolytic</u>} enzymes onto dead organisms = 2 marks	**(3)**

Question number	Answer	Additional guidance	Mark
*5(b)	**Level 1 points:** • due to natural selection (Descriptions of differences in features) • gerenuk's food is higher up / springbok's food is lower down • gerenuks have longer {necks / limbs} • gerenuk's white areas are {underneath / more concealed} • better adapted organisms survive and reproduce • passing their alleles onto their offspring **Level 2 points:** • occupy a different niche because they eat different food (Descriptions of how mutation caused a difference) • change in length of {neck / limbs} due to a mutation • change in type of horns due to a mutation (Explanations of how a features are an adaptation / result in difference in behaviour) • organisms with longer neck could reach the higher leaves • organisms with smaller horns did not get caught up in branches • smaller organisms had to go to waterhole for water • organisms with larger horns could defend off predators • male gerenuks kept horns for fighting for females • reference to {reduced gene flow / change in allele frequency / reproductive isolation} with no links made **Level 3 points:** • length of {neck / limbs} is a polygenic characteristic • type of horns is a polygenic characteristic • therefore organisms will show (continuous) variation for this phenotype • height of food acted as a selection pressure on size • {branches / predators} acted as a selection pressure on horns • organisms that {occupy a different niche / feed on different food} are not in competition with each other • two groups of organisms moved apart depending on where their food was • sympatric speciation / organisms not separated by a physical barrier • therefore reduced gene flow (between the two groups) • resulting in changes in the allele frequency • eventually resulting in reproductively isolated • and the formation of two species	**Level 1:** 1 mark = 1 point made from any level 2 marks = 3 points made from any level **Level 2:** **NB Must be a reference to the data / context of the question** 3 marks = 4 points made which include at least one level 2 point 4 marks = 5 points made which include at least one level 2 point **Level 3:** **NB Horns and {leg / neck} length must be included** 5 marks = 6 points made which includes at least one level 3 point 6 marks = 7 points made which includes at least one level 3 point	**(6)**

Question number	Answer	Mark
6(a)(i)	The only correct answer is **D**. **A** *is incorrect because R is a glycoprotein* ***B*** *is incorrect because Q is an enzyme* ***C*** *is incorrect because S is the capsid*	**(1)**

Question number	Answer	Mark
6(a)(ii)	The only correct answer is **D**. **A** *is incorrect because Q is an enzyme, R is a glycoprotein and S is the protein capsid* ***B*** *is incorrect because Q is an enzyme, R is a glycoprotein and S is the protein capsid* ***C*** *is incorrect because Q is an enzyme, R is a glycoprotein and S is the protein capsid*	**(1)**

Question number	Answer	Mark
6(a)(iii)	The only correct answer is **A**. **B** *is incorrect because TMV does not have an envelope* ***C*** *is incorrect because TMV does not have an envelope* ***D*** *is incorrect because Ebola virus has both an envelope and RNA*	**(1)**

Question number	Answer	Mark
6(a)(iv)	The only correct answer is **D**. ***A*** *is incorrect because 60mm is 60 000 000 nm, divide this by 120nm = 500 000* ***B*** *is incorrect because 60mm is 60 000 000 nm, divide this by 120nm = 500 000* ***C*** *is incorrect because 60mm is 60 000 000 nm, divide this by 120nm = 500 000*	**(1)**

Question number	Answer	Additional guidance	Mark
6(b)(i)	An explanation that includes two of the following points: • because the y axis would have to be extended to {37 / 38 / 39 / 40} (1) • otherwise this would make the rest of the data too squashed (1) **OR** • so that <u>all</u> the data can be plotted on one graph (1) • so that it can <u>all</u> be compared (1)	**ACCEPT** would require a bigger scale larger graph **ACCEPT** changes in deaths and new infections would not be so accurately presented **ACCEPT** with data for new infections and deaths **IGNORE** easier / harder other data **ACCEPT** with data for new infections and deaths **IGNORE** easier / harder other data	**(2)**

Question number	Answer	Additional guidance	Mark
6(b)(ii)	An answer that includes two of the following points: • two values read from graph, subtracted and divided by 5 (1) • 2×10^5 / 2.0×10^5 / 2.00×10^5 (1)	(3.2 – 3.1) ÷ 5 = 0.02	**(2)**

Question number	Answer	Additional guidance	Mark
6(b)(iii)	An explanation that includes two of the following points: • more infected people are surviving (1) • (more) people are surviving due to {better / new} {treatments / health care} (1)	**ACCEPT** fewer infected people are dying **IGNORE** death rates **IGNORE** vaccines, antibiotics, technology	**(2)**

Question number	Answer	Additional guidance	Mark
6(b)(iv)	• extrapolation (of data / graph / line) / extending the line (to 2025) (1)	**ACCEPT** extend a line of best fit **IGNORE** draw a line of best fit unqualified	**(1)**

Question number	Answer	Additional guidance	Mark
6(b)(v)	An explanation that includes two of the following points: • because vaccines result in {(artificial active) immunity / an immune response} (1) • due to the {formation / presence} of memory cells (1) • therefore (as a result of the vaccine) there would be fewer people with HIV (1) • and therefore non-immune people less likely to become infected by someone with HIV (1)	**ACCEPT** number of infections decrease **ACCEPT** herd immunity	**(3)**

Question number	Answer	Additional guidance	Mark
7(a)	• 83 / 83.0 / 83.3 / 83.33 (%) (1)	**DO NOT ACCEPT** any other values including recurring numbers e.g. $83.\dot{3}$ **IGNORE** {decrease / - / ↓}	**(1)**

Question number	Answer	Additional guidance	Mark
*7(b)(i)	**Table:** • Tasmanian devils spend less time feeding in cancer areas (D) • because there are fewer Tasmanian devils in these areas (E) • because they have died from the cancer (E) • because they are sick and get chased away by the other scavengers (E) • because they are sick and have lost their appetite (E) • {ravens / quolls / cats} all spend longer feeding in cancer areas (D) • because there are fewer Tasmanian devils (E) • therefore more food to go round / less competition (E) • because there are fewer Tasmanian devils to frighten them away (E) • because sick Tasmanian devils are too ill to chase scavengers away (E) • ravens, quolls and feral cats in similar proportions in both areas (D) • because they eat different parts of the carcass (E) • so are not in competition with each other (E) **Graph:** • carcasses in cancer areas are lasting longer than those in the healthy area (D) • because there are fewer Tasmanian devils to feed on the carcass (E) • because they are sick and have lost their appetite (E) • because scavengers do not eat as fast as Tasmanian devils (E) • because scavengers do not eat all the carcasses (E) • but they eventually breakdown by {decomposers / other scavengers} (E)	**ACCEPT** converse throughout where appropriate **Level 1:** 1 mark = one description only 2 marks = two descriptions **OR** one simple explanation **Level 2:** 3 marks = more than one explanation from either table or graph 4 marks = explanations for both table and graph **Level 3:** 5 marks = explanations for both table and graph, one of which is extended 6 marks = to include extended explanations for both table and graph **NB** Extended explanation either offers two alternative explanations or has two steps to it	**(6)**

Question number	Answer	Additional guidance	Mark
7(b)(ii)	An explanation that includes four of the following points: • (type or number) {microorganisms / insect species} that decompose the carcasses (1) • other species of scavengers as they would also feed on the carcasses (1) • people as this could frighten away the {scavengers / Tasmanian devils} (1) • other predators because they could affect the number of {scavengers / Tasmanian devils} feeding (1) • pathogens as they could affect the number of {scavengers / Tasmanian devils} feeding (1)	**ACCEPT** competing for carcass **ACCEPT** named activity of people and the effect **NB** If no marks awarded, allow 1 mark for a named biotic factor from the mark scheme	**(4)**

Question number	Answer	Additional guidance	Mark
8(a)(i)	A description that includes three of the following points: • need to withstand {harsh / extreme} environments (1) • need to be able to withstand {dessication / lack of shade} (1) • have a low requirement for {minerals / mineral ions / named mineral ion / soil} (1) • have {fast life-cycles / grow fast / reproduce asexually / produce lots of seeds / wide dispersal mechanisms} (1)	**ACCEPT** can live in dry conditions **ACCEPT** can grow in {poor quality soil / bare rock} **IGNORE** nutrients	**(3)**

Question number	Answer	Additional guidance	Mark
8(a)(ii)	An explanation that includes two of the following points: • changes to the habitat have to take place before a different organism can survive there (1) • credit named improvement (1) • credit organism that would appear in next stage following this improvement (1)	**ACCEPT** (one species) {improves conditions / provides suitable conditions} (for the next species) e.g. make soil, improve soil, provide food (for animals) e.g. (deeper soil) bushes / trees, (food / shelter) animals	**(2)**

Question number	Answer	Additional guidance	Mark
8(b)(i)	An answer that includes the following points: • eruption results in a drop in temperature (within 1.25 years) (1) • by 0.2°C (1)	**IGNORE** references to subsequent increase **ACCEPT** value in range of 0.02 to 0.2, but must be correct if time period stated **OR** • (overall) increase in temperature (1) • by {0.1 / 0.15}°C (1)	**(2)**

Question number	Answer	Additional guidance	Mark
8(b)(ii)	An explanation that includes the following points: • less (UV / shorter wave length) light will (indirectly) result in cooler temperatures (1) • because there will be less {IR (radiation) / long wave length} (reflected from the Earth's surface to warm up the atmosphere) (1) • with time, the particles will {disperse / decrease} (1) • and more (UV / shorter wave length) light will be able to {reach the Earth / pass through} increasing the temperature (1)	**ACCEPT** {particles / ash / sulfur dioxide} throughout **IGNORE** heat **ACCEPT** less heat trapped	**(4)**

Question number	Answer	Additional guidance	Mark
8(b)(iii)	• 700 / 7 × 10^2 (times / eruptions) (1)		**(1)**

Question number	Answer	Additional guidance	Mark
8(b)(iv)	An answer that includes four of the following points: • graph shows that there is no significant change in levels of carbon dioxide following the eruptions (1) • but there is evidence that volcanoes release some carbon dioxide (1) • so they might contribute to the greenhouse effect and cause {climate change / global warming / increase in temperatures} (1) • but this might be offset by the {sulfur dioxide / ash} produced (1)	**ACCEPT** volcanoes {do release / increase} carbon dioxide **ACCEPT** volcanoes do contribute to the greenhouse effect and cause {climate change / global warming / increase in temperatures} **ACCEPT** carbon dioxide is a greenhouse gas and causes climate change	**(3)**

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