Mark Scheme (Results)

Summer 2018

Pearson Edexcel International Advanced Level
In Biology (WBI02)
Development, Plants and the Environment

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Summer 2018
Publications Code WBI02_01_1806_MS

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.

<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional guidance</th><th>Mark</th></tr>
<tr><td>1(a)</td><td>
<table>
<tr><th>Description of adaptation</th><th>Type of adaptation</th></tr>
<tr><td>Sea anemones produce a poison.</td><td>physiological ;</td></tr>
<tr><td>This poison is located in the tips of the tentacles.</td><td>anatomical ;</td></tr>
<tr><td>Clownfish are brightly coloured, this attracts small fish to the sea anemone.</td><td>anatomical ;</td></tr>
<tr><td>Clownfish feed on dead sea anemone tentacles.</td><td>behavioural ;</td></tr>
</table>
</td><td>NOT two responses in one box
ACCEPT phonetic spellings

NOT psychological for mp1</td><td>(4)</td></tr>
</table>

Question Number	Answer	Additional guidance	Mark
1(b)	**Sea anemone** : 1. provides {food / shelter / protection} for the clownfish ; 2. feeds on fish ; **Clownfish** : 3. brings {food / fish} to the sea anemone ; 4. feeds on tentacles (of sea anemone) ;	1. IGNORE habitat 3. ACCEPT attracts fish to the sea anemone	**(3)**

Question Number	Answer	Additional guidance	Mark
2(a)(i)	1. increase in concentration of drug **A** increases the percentage of mice killed / eq ; 2. idea that the increase is non-linear ; 3. use of figures to support the range **OR** manipulation of figures to show change ;	IGNORE any reference to **B** 1. ACCEPT positive correlation 3. *Acceptable range points on the graph:* • drug **A** is only effective at concentrations higher than 0.12 / 0.13 (a.u.) • drug **A** concentration of over 0.74 / 0.76 / 0.78 (a.u.) kills all the mice *Manipulation of figures on the graph:* e.g. drug **A** concentration increase from 0.2 (a.u.) to 0.6 (a.u.) gives 90% increase in mice killed	**(2)**

Question Number	Answer	Additional guidance	Mark
2(a)(ii)	1. LD_{50} of drug **A** is lower / lower concentration of drug **A** needed to kill 50% of the mice / eq ; 2. by 0.09 (a.u.) ;	1. ACCEPT converse 1. ACCEPT if both LD_{50} values quoted Drug **A** is 0.42 / 0.43 and **B** is 0.52 /0.53 2. ACCEPT by 0.11 / 0.10 / 0.1 (a.u.)	**(2)**

Question Number	Answer	Additional guidance	Mark
2(b)	1. (phase I) drug tested on (small number of) healthy {people / volunteers} ; 2. (phase II) drug tested on small number of patients (with disease) ; 3. (phase III) drug tested on large number of patients (with disease) ; 4. reference to {**placebo** / **double blind** trial} (during phase II / phase III) ;	(fewer than 100) **2. ACCEPT** 100-300 if no written description **2. ACCEPT** slightly larger **3. ACCEPT** ≥ 1000 if no written description	**(4)**

Question Number	Answer	Additional guidance	Mark
3(a)	1. prokaryotic ; 2. Archaea ; 3. Bacteria ; 4. molecular phylogeny ;	MP2 and MP3 Archaea and Bacteria can be either way around ACCEPT phonetic spellings 1. ACCEPT prokaryote, prokaryota 2.ACCEPT Archaebacteria 2. ACCEPT spellings Archa, Archae, Archea, Arche but NOT arachnae 3.ACCEPT Eubacteria 4. IGNORE taxonomy	**(4)**

<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional guidance</th><th>Mark</th></tr>
<tr><td>3(b)</td><td>
<table>
<tr><th>Name of organelle</th><th>Structure of organelle</th><th>Role of organelle</th></tr>
<tr><td>centrioles</td><td>Any two of:
1. pair of { cylinders / tubes / hollow rods } ;
2. at right angles ;
3. 9 triplets of (micro)tubules ;</td><td>formation of spindle fibres</td></tr>
<tr><td>mitochondrion ;</td><td>1. inner membrane folded to form cristae
2. circular DNA found in the matrix</td><td>aerobic respiration</td></tr>
<tr><td>Golgi apparatus</td><td>Any two of:
1. stacks of cisternae / eq ;
2. (cisternae) have curved shape ;
3. vesicles ;</td><td>modification of { protein / lipid } / eq ;</td></tr>
<tr><td>ribosome ;</td><td>1. consists of two subunits
2. made of protein and RNA</td><td>Translation</td></tr>
<tr><td>lysosome ;</td><td>1. surrounded by a single membrane
2. contains hydrolytic enzymes</td><td>destruction of bacteria</td></tr>
</table>
</td><td>ACCEPT plural word for the names
ACCEPT phonetic spellings

1. NOT tubules

2.ACCEPT perpendicular / 90°
3. NOT 9 + 2
3. ACCEPT 9 + 0

Structure: mp1 ACCEPT stack of { flattened sacs / fluid-filled sacs }

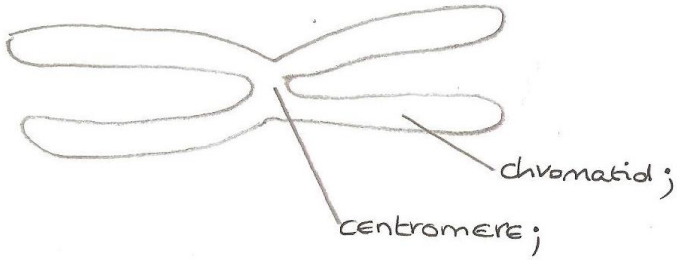
Role: ACCEPT production of { lipoprotein / glycoprotein / lysosomes }

ACCEPT lysozome but NOT lysozyme</td><td>(8)</td></tr>
</table>

Question Number	Answer	Additional guidance	Mark
4(a)	1. group of cells ; 2. with similar {structure / function / origin} ;	1.ACCEPT similar cells 2. ACCEPT description of a function e.g. (all) involved in support / transport (of water / mineral ions / eq)	**(2)**

Question Number	Answer	Additional guidance	Mark
4(b)(i)	(acetic / ethanoic / propionic) orcein / toluidine (blue) ;	ACCEPT phonetic spellings ACCEPT Schiff's (reagent) / Feulgen's (stain) / (aceto)carmine / methylene blue NOT iodine	**(1)**

Question Number	Answer	Mark
4(b)(ii)	The only correct answer is **D** ***A*** *is incorrect because* ***R*** *is metaphase which comes before* ***P*** *which is anaphase* ***B*** *is incorrect because* ***Q*** *is telophase which comes after* ***P*** *which is anaphase* ***C*** *is incorrect because* ***R*** *is metaphase which comes before* ***P*** *which is anaphase*	**(1)**

Question Number	Answer	Additional guidance	Mark
4(b)(iii)	1. chromosome drawn showing two chromatids ; 2. one/both of the chromatids labelled correctly ; 3. centromere labelled correctly ;	e.g.  **1.** ACCEPT simple line drawings and ignore any drawings of nuclear spindle. **1.**IGNORE labels when assessing mp1 **2. and 3.** ACCEPT phonetic spellings **2. and 3.** IGNORE any other labels	**(3)**

Question Number	Answer	Additional guidance	Mark
***4(c)**	**QWC – Spelling of technical terms must be correct and answer must be organised in a logical sequence** 1. indication of using aseptic technique ; 2. idea of removing {cells / (small sample of) tissue / explants / eq} ; 3. from all 4 regions ; 4. idea of growing {cells / sample / explants} on (nutrient) agar ; 5. incubation at appropriate stated temperature ; 6. idea of leaving sample for a few weeks ; 7. idea that other {parts / tissues / eq} of the plants develop only from region 3 ;	**QWC emphasis is logical sequence** **In answers that are limited to describing root tip squash procedures only mp 2 and 3 are accessible** 1. e.g. using sterile scalpel / sterile agar 2. NOT root tip 2. IGNORE section / part 3. piece answer together if necessary 3. ACCEPT each region 3. IGNORE different regions 4. ACCEPT section / part / region 5. ACCEPT a range between 20 and 35^{O}C / room temperature ; 6. minimum value one week 7. ACCEPT idea of recording which regions have developed other parts of the plants	**(5)**

Question Number	Answer	Additional guidance	Mark
***5**	**QWC – Spelling of technical terms must be correct and answer must be organised in a logical sequence** 1. reference to **natural selection** ; 2. variations (between tortoises) due to mutations ; 3. individuals with advantageous alleles { survive / reproduce / pass these alleles on to offspring } ; 4. idea that { climate / food availability / environment } are different selection pressures (on different islands) ; 5. reference to geographical isolation ; 6. idea that the saddleback is smaller as food is limited ; 7. idea that saddleback tortoise has long neck for reaching food ; 8. so saddleback can survive (in dry habitat) where there is limited food near the ground ; 9. saddleback outcompeted by the larger domed tortoise where there is a lot of vegetation near the ground ;	**QWC emphasis is clarity of expression** 3. **NOT** genes 6. to 9. ACCEPT converse for domed tortoise 6. e.g. idea that domed can grow larger as more food available 7. e.g. idea that domed can only reach food near ground as has a short neck 8. e.g. so domed can't survive where there is limited food near ground 9. e.g. domed outcompeted by saddleback (in dry habitat) where there is little vegetation near the ground	**(6)**

Question Number	Answer	Additional guidance	Mark
6(a)	1. to {generate / increase / eq} genetic variation (within a species) ; 2. idea of resulting in increased survival chances (of the species) ; 3. to produce haploid {nuclei / cells} / halve the chromosome number ;	3. ACCEPT to produce gametes	**(2)**

Question Number	Answer	Mark
6(b)(i)	The only correct answer is **D** **A** is incorrect because all the nuclei are haploid **B** is incorrect because **P** is also haploid **C** is incorrect because **S** is also haploid	**(1)**

Question Number	Answer	Mark
6(b)(ii)	The only correct answer is **B** **A** is incorrect because the pollen tube grows through the style to reach the micropyle **C** is incorrect because the pollen lands on the stigma and then grows through the style **D** is incorrect because the pollen lands on the stigma and then grows through the style	**(1)**

Question Number	Answer	Additional guidance	Mark
6(b)(iii)	1. (mitosis in nucleus **P**) results in two {haploid / male} nuclei ; 2. reference to **double fertilisation** ; 3. one (male) nucleus is needed to fuse with the {female gamete / egg cell / nucleus S /female nucleus} to form the zygote ; 4. one (male) nucleus is needed to fuse with {the other / polar / R} nuclei to form (primary) endosperm (nucleus) ;	ACCEPT male gametes as eq to male nuclei throughout 3. ACCEPT fertilise as eq to fuse with 4. **NOT** polar bodies	**(3)**

Question Number	Answer	Additional guidance	Mark
6(c)(i)	2.22 (μm hr^{-1}) ;	ACCEPT 2 / 2.0 / 2.2 / 2.2 recurring	**(1)**

Question Number	Answer	Mark
6(c)(ii)	The only correct answer is **B** ***A*** *is incorrect because increasing the range will not help* ***C*** *is incorrect because the maximum value could be lower than 7 or higher than 9* ***D*** *is incorrect because maximum value could be below 8*	**(1)**

<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional guidance</th><th>Mark</th></tr>
<tr><td>7(a)</td><td>
<table>
<tr><th>feature</th><th>starch only</th><th>cellulose only</th><th>both starch and cellulose</th><th>found in neither starch nor cellulose</th></tr>
<tr><td>consists of two different polysaccharides</td><td>☒</td><td></td><td></td><td></td></tr>
<tr><td>made from β glucose</td><td></td><td>☒</td><td></td><td></td></tr>
<tr><td>1, 4 - glycosidic bonds present</td><td></td><td></td><td>☒</td><td></td></tr>
<tr><td>hydrogen bonds between molecules</td><td></td><td></td><td>☒</td><td></td></tr>
</table>
</td><td></td><td>(4)</td></tr>
</table>

Question Number	Answer	Additional guidance	Mark
7(b)	1. bioplastics are {sustainable / will not run out} because {more plants can be grown / they are made from renewable materials / eq} ; 2. less pollution because bioplastics {reduce the use of fossil fuels / can be decomposed / are biodegradable} ;	**ACCEPT** converse statements 2. Examples of pollution reduction: e.g. do not contribute to landfill e.g. reduce CO_2 emissions	**(2)**

Question Number	Answer	Additional guidance	Mark
7(c)(i)	1. addition of cellulose increases tensile strength ; 2. idea that {there is little/no difference / standard deviations overlap} between {100:2.5 and 100:5 / 100:10 and 100:15} ; 3. credit correct manipulation of figures ;	1. **NOT** increasing ratio of starch : cellulose increases tensile strength 3. e.g. changing ratio from 100:5 to 100:15 increases tensile strength by 12.0 (MPa)	**(3)**

Question Number	Answer	Additional guidance	Mark
7(c)(ii)		ACCEPT weight for mass throughout	
	1. idea of using all five types of plastic ;	Answers describing using natural plant fibres should not be awarded mp1	
	2. of the same diameter / eq ;	2. ACCEPT length /width / cross-sectional area	
	3. description of apparatus set up to be used ;	3. e.g. clamping plastic between two clamp stands e.g. suspending plastic from forcemeter /spring balance or using a pulley	
	4. idea of hanging masses onto each plastic ;		
	5. recording the mass that breaks the plastic ;	5. ACCEPT recording heaviest mass that does not break the plastic 5.IGNORE recording the tensile strength	
	6. repeat for each plastic and calculate the mean ;	6. ACCEPT to improve validity	**(4)**

Question Number	Answer	Additional guidance	Mark
8(a)	1. 1% = (2493÷11 =) 226.64 ; 2. 22664 (species) ;	Correct answer alone gains both marks 1. ACCEPT 2493÷11 x 100 **OR** 2493÷0.11 **OR** 2493÷11 2. DO NOT ACCEPT answers with decimal places 2. ACCEPT 22663	**(2)**

Question Number	Answer	Additional guidance	Mark
8(b)(i)	1. so that germination will not take place ; 2. so that fungi do not grow / eq ; 3. to reduce enzyme activity ; 4. so that seeds will remain viable / eq ;	1. ACCEPT to reduce germination 1. ACCEPT so seeds remain dormant 2. ACCEPT bacteria / microorganisms / mould / pathogens 3. ACCEPT to reduce metabolic activity 4. ACCEPT so that seeds will not { decompose / eq } ;	**(3)**

Question Number	Answer	Additional guidance	Mark
8(b)(ii)	1. to check seed viability / eq ; 2. to grow plants to collect more seeds / to find out if more seeds need to be collected ;	1. e.g. to check if seed / embryo is alive 1. IGNORE to see if seeds germinate	**(2)**

Question Number	Answer	Additional guidance	Mark
8(c)(i)	1. from {1.5 / 5} to 11^{O}C the % germination is higher in species **Y** / eq ; 2. species **Y** germinates at lower temperatures ; 3. species **Y** has a lower optimum temperature / eq ; 4. species **Y** germinates over a smaller range of temperatures ; 5. credit correct comparative manipulation of data relating to temperature ;	ACCEPT converse comments for species **Z** **IGNORE** comparison that states that Z has higher max % germination than Y 1. ACCEPT above 11^{O}C the % germination is higher in species **Z** /eq 1. ACCEPT both have same germination % at 11^{O}C 2. ACCEPT grows 3. ACCEPT a description of optimum 4. ACCEPT grows / survives 5. e.g. the optimum temperature for germination of **Y** is 5^{O}C lower ; the range for **Y** is 18.5 but for **Z** it is 20^{O}C ; germination % of Y is 20% higher than Z at 10^{O}C ; e.g. Z optimum is 5◦C higher than Y gets 2 marks, MP5 and 3	**(3)**

Question Number	Answer	Additional guidance	Mark
8(c)(ii)	1. idea that a suitable temperature is between 5 °C and 20 °C ; 2. idea that they would know that different species of plant need different storage temperatures ; 3. idea they can find the optimum (storage) temperature for a species ; 4. idea of knowing the likely % germination allows scientists to decide how many seeds need to be stored ; 5. idea that they can save money by not keeping the temperature lower than necessary ;	2. ACCEPT idea that they can find which species can be stored together / have to be stored separately 3. ACCEPT highest germination as optimum	**(3)**

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