



Mark Scheme (Results)

Summer 2017

Pearson Edexcel International Advanced Level
in Biology (WBI02) Paper 01
Development, Plants and the Environment



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Publications Code WBI02_01_1706_MS

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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)	<p>1. The only correct answer is C as the nucleus, nucleolus and mitochondrion are found in animal cells</p> <p><i>A is not correct because the nucleus, nucleolus and mitochondrion are found in animal cells</i></p> <p><i>B is not correct because the nucleus, nucleolus and mitochondrion are found in animal cells</i></p> <p><i>D is not correct because chloroplasts are not found in animal cells</i></p>	(1)

Question Number	Answer	Mark																
1(b)	<table border="1" data-bbox="385 946 1608 1164"> <thead> <tr> <th>Feature</th> <th>Plant cells</th> <th>Prokaryotic cells</th> <th>Plant cells and prokaryotic cells</th> </tr> </thead> <tbody> <tr> <td>cellulose cell wall</td> <td><input checked="" type="checkbox"/></td> <td></td> <td></td> </tr> <tr> <td>nucleus</td> <td><input checked="" type="checkbox"/></td> <td></td> <td></td> </tr> <tr> <td>ribosomes</td> <td></td> <td></td> <td><input checked="" type="checkbox"/></td> </tr> </tbody> </table> <p><i>Only plant cells have cellulose cell walls. Prokaryotic cell walls are made of peptidoglycan. Plant cells are eukaryotic cells so have a nucleus. Prokaryotic cells do not have a nucleus. Ribosomes are found in both eukaryotic cells and prokaryotic cells, although their sizes are different.</i></p>	Feature	Plant cells	Prokaryotic cells	Plant cells and prokaryotic cells	cellulose cell wall	<input checked="" type="checkbox"/>			nucleus	<input checked="" type="checkbox"/>			ribosomes			<input checked="" type="checkbox"/>	(3)
Feature	Plant cells	Prokaryotic cells	Plant cells and prokaryotic cells															
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Question Number	Answer	Additional guidance	Mark
1(c)	<p>1. pores in the cell wall between (adjacent) cells / eq ;</p> <p>2. idea that there is cytoplasm running through the plasmodesmata ;</p>	<p>PIECE TOGETHER e.g. "Areas where there is no cell wall and cytoplasm links two adjacent cells," gains mp1 and 2.</p> <p>1. ACCEPT gaps /channels / canals / holes as eq to pores 1. ACCEPT references to bridges only if in the context of cell wall 1. ACCEPT descriptions of no cell wall present 1. NOT pits</p> <p>2. IGNORE ref to symplast</p> <p>2. ACCEPT cytoplasm-filled channel / cytoplasmic bridge</p> <p>ACCEPT labelled diagram with the above points for 2 marks</p>	(2)

Question Number	Answer	Additional guidance	Mark
2(a)	Acrosome(s) / acrosome cap/acrosomal cap ;	ACCEPT phonetic spellings NOT acrosome reaction	(1)

Question Number	Answer	Mark
2(b)	<p>1. The only correct answer is C because mitochondria are only found in the mid piece.</p> <p><i>A is not correct because the mitochondria are only found in the mid piece and therefore not in the acrosome as well</i></p> <p><i>B is not correct because the mitochondria are only found in the mid piece and therefore not in the nucleus as well</i></p> <p><i>D is not correct because the mitochondria are only found in the mid piece and therefore not in the flagellum as well</i></p>	(1)
Question Number	Answer	Mark
2(c)	<p>1. The only correct answer is D as the nucleus and mitochondria contain DNA</p> <p><i>A is not correct because the acrosome does not contain DNA</i></p> <p><i>B is not correct because the acrosome does not contain DNA</i></p> <p><i>C is not correct because both the nucleus and mitochondria contain DNA</i></p>	(1)

Question Number	Answer	Additional guidance	Mark
2(d)	1. allow movement (of the sperm) ; 2. to transfer (the male) { genetic material / DNA } ; 3. (from the cervix) to the ovum / eq ;	1. ACCEPT allows sperm to swim 3. ACCEPT secondary oocyte /egg / egg cell as eq to ovum 3. NOT ovule	(2)

Question Number	Answer	Additional guidance	Mark
*2(e)	<p>(QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence)</p> <ol style="list-style-type: none"> 1. to produce <i>haploid</i> { cells /nuclei/gametes } ; 2. reference to <i>crossing over</i> ; 3. credit detail of <i>crossing over</i> ; 4. idea of (resulting in) exchange of <i>alleles</i> between <i>chromatids</i> ; 5. (crossing over leads to) formation of <i>recombinants</i> ; 6. reference to { <i>random / independent</i> } <i>assortment</i> ; 7. credit detail of <i>independent assortment</i> ; 8. idea of new combinations of <i>alleles</i> in the gametes ; 	<p>Emphasis is on spelling of technical terms</p> <ol style="list-style-type: none"> 1. ACCEPT halving the <i>chromosome</i> number in gametes IGNORE ref to 23 chromosomes unless with ref to humans 3. e.g. formation of <i>chiasma / chiasmata</i> OR exchanging sections of <i>chromatids</i> OR description of breaking and rejoining 4. NOT genes or chromosomes 5. ACCEPT new combinations of <i>alleles</i> (on chromatids) 7. e.g. { <i>homologous chromosomes / maternal and paternal chromosomes</i> } line up in different combinations 	(5)

Question Number	Answer	Additional guidance	Mark
3(a)	<p>Any two from:</p> <ol style="list-style-type: none"> 1. reference to { sustainable / sustainability } ; 2. made from renewable materials / not made from non-renewable materials / eq ; 3. biodegradable / eq ; 	<p>ACCEPT converse statements</p> <p>1.ACCEPT they will not run out</p> <p>2. IGNORE plant-based plastics are renewable [i.e. answer has to have idea it is the plants rather than the plastics that are renewable]</p> <p>2. ACCEPT idea that more plants can be grown</p> <p>2. ACCEPT ref to plant-based plastics being carbon-neutral</p> <p>3. ACCEPT can be decomposed</p>	(2)

Question Number	Answer	Additional guidance	Mark
3(b)	<ol style="list-style-type: none"> 1. idea that sugar-based plastics cause more eutrophication ; 2. idea that corn-based plastics cause { less eutrophication than A / more than B } ; 3. idea that (both) plant-based plastics cause more damage to the ozone layer ; 4. credit a named problem caused by { drilling for / transporting / refining } oil e.g. oil slicks ; 5. credit a named problem of growing plants for plastic e.g. habitat destruction, decreased food production ; 6. correct manipulation of figures to compare oil-based and plant-based plastics ; 	<p>ACCEPT converse statements throughout</p> <p>3. ACCEPT sugar and corn</p> <p>5. IGNORE ref to fertilisers</p> <p>E.g. corn based plastic is 0.4 less than plastic A for eutrophication</p>	(4)

Question Number	Answer	Additional guidance	Mark
3(c)	<ol style="list-style-type: none"> 1. nitrate (ions) are needed for { nucleic acids / DNA / RNA / amino acids / proteins / ATP / eq } ; 2. calcium (ions) are needed for { cell wall / cell wall matrix / calcium pectate /middle lamella/ eq } ; 3. magnesium (ions) needed for chlorophyll ; 	<p>N.B. ACCEPT any other named ion with correct use e.g. phosphate ions for { nucleic acids / DNA / RNA / ATP / eq }</p> <p>ACCEPT chemical symbols</p>	(3)

Question Number	Answer	Additional guidance	Mark
3(d)	<ol style="list-style-type: none"> 1. ultraviolet light is an environmental { factor / effect } / eq ; 2. idea that ultraviolet light { causes mutations / is a mutagen } ; 3. idea that DNA { replication / repair / eq } is affected ; 4. reference to { formation of an oncogene / tumour suppressor genes being affected } ; 5. idea that control of cell cycle is lost ; 	<p>2. NOT mutation in melanin</p> <p>4. ACCEPT named examples of alleles predisposing to skin cancer e.g. CDKN2A and CDK4</p> <p>5. ACCEPT uncontrolled cell division</p>	(3)

Question Number	Answer	Additional guidance	Mark
4(a)	<ol style="list-style-type: none"> 1. they are { undifferentiated/unspecialised } (cells) 2. that { divide continuously/ have unlimited cell division } ; 3. idea that they can become any cell type ; 	<p>2 ACCEPT no Hayflick limit</p> <p>3. ACCEPT all cell types</p> <p>3. ACCEPT embryonic AND extra-embryonic tissues</p> <p>3. ACCEPT so that a whole organism can be made</p>	(2)

Question Number	Answer	Additional guidance	Mark
4(b)	<ol style="list-style-type: none"> 1. increase in cell number /eq ; 2. cells will be genetically identical /eq ; 3. idea of an increase in the cell organelles during interphase ; 4. DNA replication { during S-phase / interphase } ; 	<p>3. ACCEPT G1 G2</p> <p>4. ACCEPT synthesis</p>	(3)

Question Number	Answer	Additional guidance	Mark
4(c)	<ol style="list-style-type: none"> 1. reference to differential gene expression ; 2. idea that some genes are { active / switched on / eq } ; 3. idea of { transcription / mRNA produced } at active genes ; 4. { proteins / polypeptides } produced (from this mRNA) / eq ; 5. idea that this protein (permanently) modifies cell <p>OR</p> <p>idea that this protein determines { cell structure / function } ;</p>	<p>3. e.g. only active genes are transcribed</p>	(3)

Question Number	Answer	Additional guidance	Mark
5(a)	<ol style="list-style-type: none"> 1. lemurs are found only on Madagascar ; 2. reference to geographical isolation ; 3. idea that there were different conditions on Madagascar ; 4. reference to natural selection ; 5. resulting in formation of { new species / different species / new gene pools } ; 6. idea of adaptation to conditions ; 	<p>3. ACCEPT different selection pressures, or different conditions within Madagascar</p> <p>5. ACCEPT a reference to speciation</p> <p>6. e.g. adapted to different foods</p>	(3)

Question Number	Answer	Additional guidance	Mark
5(b)(i)	1. values read from graph correctly : 23, 49, 20, 2 ; 2. values added together correctly / 94 ; 3. $(94 \div 103) \times 100$ to give 91.26 / 91.3 / 91 (%) ;	CE applies throughout Correct answer alone gains three marks	(3)

Question Number	Answer	Additional guidance	Mark
5(b)(ii)	1. number of threatened species has increased between 2008 and 2012 / eq ; 2. has increased by 47 / has increased by 100% / has doubled ; 3. more species of lemur classified as { critically endangered / endangered / vulnerable } ; 4. fewer species of lemur are near threatened ;	ACCEPT converse statements if in context of 2008 1. ACCEPT the threat of extinction has increased 2. ACCEPT CE from (b)(i) 3. ACCEPT all categories except near threatened have increased 4. NOT threat of extinction decreases 4. NOT just "threatened"	(4)

Question Number	Answer	Additional guidance	Mark
5(b)(iii)	<p>Any two from:</p> <ol style="list-style-type: none"> 1. decrease in { habitat / food / eq } ; 2. idea of increased problems due to low genetic diversity ; 3. increase in hunting / predation / eq ; 4. increased risk of disease ; 5. increase in pollution ; 6. idea that the reduced number of lemurs in the near threatened category is due to { conservation / becoming more threatened } ; 	<p>1. ACCEPT increase in competition for food/eq</p> <p>6.ACCEPT idea of reintroduction from captive breeding programmes</p>	(2)

Question Number	Answer	Additional guidance	Mark
6(a)(i)	<ol style="list-style-type: none"> 1. no effect until a concentration of greater than 20% / eq ; 2. increase in number of bacteria killed between 20% and 80% / eq ; 3. concentration { equal to / higher than / eq } 80% killed all the bacteria / eq ; 	<p>1. ACCEPT no effect { below 20% / from 0 to 20% }</p> <p>2. ACCEPT pieced together statements between 20%/40% and 40%/80%</p> <p>3. IGNORE graph levels off between 80-100%</p> <p>3. NOT there is no effect from 80 – 100%</p>	(2)

Question Number	Answer	Additional guidance	Mark
*6(a)(ii)	<p>(*QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence)</p> <ol style="list-style-type: none"> 1. preparation of discs e.g. soaking discs in garlic extract ; 2. using { different / range of concentrations } ; 3. idea of using several different types of bacteria at each concentration ; 4. idea that a lawn of bacteria is created { on / within } (different) agar ; 5. idea of { placing discs onto lawn / agar / putting garlic extract into well } ; 6. idea of incubating cultures ; 7. idea of measuring { diameter / area } of { clear zones / eq } ; 8. reference to aseptic technique / credit description of aseptic technique e.g. work beside a Bunsen burner /using sterile equipment ; 	<p>Emphasis is on clarity of expression</p> <ol style="list-style-type: none"> 1. ACCEPT set volume of garlic solution added to culture if alternative method described 2. ACCEPT stated values e.g. 20% - 80% extract 4. ACCEPT making a suspension of bacteria if alternative method described 5. ACCEPT bacteria and garlic extract are mixed together if alternative method described 6. ACCEPT leave for 24h (at least) 7. e.g. ruler to measure clear zone 7. ACCEPT details of determining number of bacteria killed if alternative method described 	<p>(6)</p>

Question Number	Answer	Additional guidance	Mark																
6(b)	<p>Any two from:</p> <table border="1" data-bbox="423 304 1211 1175"> <thead> <tr> <th data-bbox="423 304 766 376">Withering</th> <th data-bbox="766 304 1211 376">Contemporary methods</th> </tr> </thead> <tbody> <tr> <td data-bbox="423 376 766 486">whole garlic extract</td> <td data-bbox="766 376 1211 486">isolated active ingredient / eq</td> </tr> <tr> <td data-bbox="423 486 766 630">{ not tested on animals / tested on humans }</td> <td data-bbox="766 486 1211 630">{ tested on animals / animals and humans }</td> </tr> <tr> <td data-bbox="423 630 766 774">{ not tested on healthy people / (only) tested on patients / eq }</td> <td data-bbox="766 630 1211 774">{ tested on healthy people / tested on healthy people and patients / eq }</td> </tr> <tr> <td data-bbox="423 774 766 884">no { placebo / double blind trial }</td> <td data-bbox="766 774 1211 884">uses { placebo / double blind trial }</td> </tr> <tr> <td data-bbox="423 884 766 994">small sample size</td> <td data-bbox="766 884 1211 994">large sample size</td> </tr> <tr> <td data-bbox="423 994 766 1104">didn't know the dose</td> <td data-bbox="766 994 1211 1104">dose worked out</td> </tr> <tr> <td data-bbox="423 1104 766 1175">no licence / control</td> <td data-bbox="766 1104 1211 1175">licence needed</td> </tr> </tbody> </table>	Withering	Contemporary methods	whole garlic extract	isolated active ingredient / eq	{ not tested on animals / tested on humans }	{ tested on animals / animals and humans }	{ not tested on healthy people / (only) tested on patients / eq }	{ tested on healthy people / tested on healthy people and patients / eq }	no { placebo / double blind trial }	uses { placebo / double blind trial }	small sample size	large sample size	didn't know the dose	dose worked out	no licence / control	licence needed	<p>Must be comparative throughout</p>	<p>(2)</p>
Withering	Contemporary methods																		
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Question Number	Answer	Additional guidance	Mark			
7(a)	<p>B</p> <table border="1" style="margin-left: 40px;"> <tr> <td style="padding: 5px;">ribosome</td> <td style="padding: 5px;">rough endoplasmic reticulum</td> <td style="padding: 5px;">Golgi apparatus</td> </tr> </table> <p><i>Polypeptide chains are synthesised on the ribosome and then move through the cytoplasm in the RER to the Golgi apparatus where they are modified. Therefore any other sequence is incorrect.</i></p>	ribosome	rough endoplasmic reticulum	Golgi apparatus		(1)
ribosome	rough endoplasmic reticulum	Golgi apparatus				

Question Number	Answer	Additional guidance	Mark
7(b)	<ol style="list-style-type: none"> 1. idea that this is where { protein / polypeptide } synthesis occurs ; 2. using radioactive amino acids ; 	<p>1. ACCEPT translation</p> <p>2. ACCEPT idea of radioactive amino acids being transported to { P / ribosome }</p>	(2)

Question Number	Answer	Additional guidance	Mark
7(c)(i)	1. it increases between 10 and 20 minutes ; 2. it decreases after 20 minutes ;	1. ACCEPT between 5 and 20 minutes 2. ACCEPT between 20 and 40 minutes	(2)

Question Number	Answer	Additional guidance	Mark
7(c)(ii)	1. idea that { proteins / polypeptides } { enter / are in / move through } Q 2. idea that { proteins / polypeptides } are { packaged in vesicles / transported to R / transported to Golgi apparatus } ;	ACCEPT { RER / eq } as alternative to Q throughout 2. ACCEPT enter as eq to transported	(2)

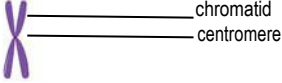
Question Number	Answer	Additional guidance	Mark
7(d)(i)	<ol style="list-style-type: none"> 1. idea that some of the proteins are { for intracellular use / synthesised on free ribosomes } ; 2. idea that some of the proteins { are still in vesicles / remain in the RER / Q } ; 3. idea that some { amino acids / proteins } were in the cytoplasm ; 4. idea of radioactive decay ; 	<p>ACCEPT polypeptides as eq to proteins throughout answer</p> <p>1. ACCEPT idea that not all proteins need modification 1. ACCEPT some proteins are made { in mitochondria / on mitochondrial ribosomes }</p> <p>2. ACCEPT some vesicles have not reached the Golgi / R</p>	(2)

Question Number	Answer	Additional guidance	Mark
7(d)(ii)	<ol style="list-style-type: none"> 1. levels will decrease / eq ; 2. as proteins { move into vesicles / move into lysosome / are secreted from cell / are removed by exocytosis } ; 	<p>1. ACCEPT stated values below 20 e.g. zero / 5</p> <p>2. ACCEPT due to radioactive decay /eq 2. ACCEPT non-radioactive amino acids now being used</p>	(2)

Question Number	Answer	Mark
8(a)	<p>1. The only correct answer is B as the zygote is diploid and the fertilised endosperm nucleus is triploid</p> <p><i>A is not correct because the endosperm nucleus is triploid</i></p> <p><i>C is not correct because the zygote is diploid and the fertilised endosperm nucleus is triploid</i></p> <p><i>D is not correct because the zygote is diploid</i></p>	(1)

Question Number	Answer	Additional guidance	Mark
8(b)(i)	<p>1. idea of preventing contamination of cultures ;</p> <p>2. { bacteria / eq } could use the { nutrients / oxygen / eq } ;</p> <p>3. { bacteria / eq } could cause disease of plants / explants / eq ;</p> <p>4. { bacteria / eq } could be { harmful / pathogenic / eq } to humans ;</p>	<p>1. ACCEPT to prevent infection of plants 1. ACCEPT to prevent growth of bacteria / fungi / microorganisms</p> <p>2. ACCEPT compete for nutrients / oxygen / other named nutrient IGNORE food / resources</p> <p>3.ACCEPT { bacteria / eq } could produce chemicals/toxins that could poison the plants</p>	(3)

Question Number	Answer	Additional guidance	Mark
8(b)(ii)	1. idea that {stem / meristem / totipotent } cells were needed ; 2. as they are capable of {dividing / differentiating /eq } ; 3. an example of a suitable named part of the plant stated ;	1. IGNORE undifferentiated cells needed 2. ACCEPT undergoing mitosis as eq 2. ACCEPT differentiated cells would not divide 3. e.g. shoot tips or root tips	(2)

Question Number	Answer	Additional guidance	Mark
8(b)(iii)	1. chromosome drawn showing two chromatids ; 2. one/both of the chromatids labelled correctly ; 3. centromere labelled correctly ;	 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
8(c)	1. idea of { preserving / storing / eq } seeds ; 2. in large numbers to maintain { genetic diversity / gene pool } ; 3. idea of growing seeds to { produce more plants / obtain more seeds } ; 4. idea that these plants / seeds could be { planted in the wild / natural habitat } ;	2. IGNORE increasing { genetic diversity / gene pool } 4. ACCEPT idea of when environmental conditions are right	(2)