



Mark Scheme (Results)

January 2018

Pearson Edexcel International Adavance Level
In Biology (WBI02) Paper 01 Developments,
Plants And The Environment



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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)(i)	{ number / variety / range } of species ;	1 ACCEPT amount DO NOT ACCEPT organisms	(1)

Question Number	Answer	Additional guidance	Mark
1(a)(ii)	1. { variety / types } of allele ; 2. in a { gene pool / population / species } ;	1. ACCEPT different alleles IGNORE genetic variation IGNORE number of alleles DO NOT ACCEPT genes	(2)

Question Number	Answer	Additional guidance	Mark
1(b)	1. two factors that would decrease biodiversity ; e.g. hunting / predation, loss of habitat / food, climate change, pollution, farming, competition, disease, inbreeding, emigration, natural disasters / named example 2. two factors that would increase biodiversity ; e.g. conservation (areas) / wildlife reserves, reintroduction / breeding programmes, succession, immigration, (re)afforestation	1. IGNORE ref to asexual reproduction, interbreeding accept named example of habitat loss such as deforestation or urbanisation 2. IGNORE ref to seed banks, sexual reproduction 2. IGNORE negative comment from 1, e.g. <i>no pollution</i> .	(2)

Question Number	Answer	Mark
2(a)(i)	<p>2(a)(i). The only correct answer is D</p> <p><i>A is not correct because they do not consist of a network of microfibrils</i></p> <p><i>B is not correct because they do not consist of a network of microfibrils</i></p> <p><i>C is not correct because they do not consist of a network of microfibrils</i></p>	(1)

Question Number	Answer	Additional guidance	Mark
2(a)(ii)	microfibril ;	<p>ACCEPT cellulose microfibril</p> <p>ACCEPT phonetic spellings</p> <p>ACCEPT if plural words written</p> <p>DO NOT ACCEPT myofibril, myofibre, microfiber, fibril</p>	(1)

Question Number	Answer	Mark
2(a)(iii)	<p>2(a)(iii). The only correct answer is C</p> <p><i>A is incorrect because cellulose does not contain alpha glucose</i></p> <p><i>B is incorrect because cellulose does not contain alpha glucose</i></p> <p><i>D is incorrect because there are no 1-6 glycosidic bonds in cellulose</i></p>	(1)

Question Number	Answer	Additional guidance	Mark
2(b)(i)	<ol style="list-style-type: none"> cellulose decreases and lignin increases / eq ; idea that cellulose decreases evenly but large increase in lignin between D2 and D3 ; idea that cellulose changes more than lignin ; correct comparative values to quantify differences ; 	<p>Piece answer together if necessary</p> <ol style="list-style-type: none"> mp 1 should also be awarded if mp 2 is awarded 2.ACCEPT largest decrease in cellulose is between D1 and D2 but largest increase in lignin is between D2 and D3 but ACCEPT % decrease in cellulose is less than % increase in lignin e.g. cellulose decreases by 200mg g⁻¹ lignin increases by 51mg g⁻¹ cellulose decreases by 29.4%, lignin increases by 340% Units required where appropriate 4. ACCEPT differences comparing the same stages for both cellulose and lignin 	(3)

Question Number	Answer	Additional guidance	Mark
2(b)(ii)	<ol style="list-style-type: none"> support / eq ; waterproofing / eq ; 	<ol style="list-style-type: none"> ACCEPT rigidity / to strengthen stem / cell wall ACCEPT impermeable to water / water resistant 	(2)

Question Number	Answer	Additional guidance	Mark
3(a)	<p>1. the role of { a pangolin / a species / an organism } in its { environment / habitat / eq } ;</p> <p>2. the pangolin feeds on { ants / termites / insects } ;</p>	<p>1. ACCEPT community / ecosystem</p> <p>IGNORE exploits its habitat</p> <p>2. ACCEPT the pangolin provides food for predators / eq</p> <p>2. ACCEPT "they" to mean pangolins</p>	(2)

Question Number	Answer	Mark
3(b)	<p>3(b). The only correct answer is A</p> <p><i>B is incorrect because having a long tongue is not a behavioural adaptation</i></p> <p><i>C is incorrect because curling in a ball is not an anatomical adaptation</i></p> <p><i>D is incorrect because secreting saliva is not an anatomical adaptation</i></p>	(1)

Question Number	Answer	Additional guidance	Mark
3(c)	<p>1. to { grind up / crush / eq } their { food / prey / named example of prey } ;</p> <p>2. it has no teeth ;</p> <p>3. to aid digestion by the enzymes / eq ;</p>	<p>1.ACCEPT mechanical digestion</p> <p>2. ACCEPT prey have hard exoskeletons</p> <p>3. ACCEPT to increase the surface area for enzymes</p>	(2)

Question Number	Answer	Additional guidance	Mark
3(d)(i)	<p>1. $170 \div 0.002 / 85\ 000$;</p> <p>2. $\times 365 = \{ 31\ 025\ 000 / 31\ 000\ 000 / 3.1 \times 10^7 \}$;</p>	<p>2. ALLOW CE for an incorrect division $\times 365.25 = 31\ 046\ 250$ $\times 366 = 31\ 110\ 000$ The correct answer alone gains two marks.</p>	(2)

Question Number	Answer	Additional guidance	Mark
3(d)(ii)	<p>1. 20 000 ants each day = (approx) 7 million ants each year ;</p> <p>2. difficult to count the number of { insects / ants / termites } (eaten) ;</p> <p>3. idea that the amount of { food eaten / energy needed } depends on { species / size / age / gender / metabolic rate / eq } of pangolin ;</p> <p>4. idea that ants have different masses / eq ;</p> <p>5. they have a mixed diet / eq ;</p> <p>6. different species of insect vary in { size / mass / eq } ;</p>	<p>Ignore references to weather / time of year / population size of ants</p> <p>3.ACCEPT number of ants / other insects eaten</p> <p>4. ACCEPT sizes</p> <p>5.ACCEPT idea that they eat termites / other insects as well as ants</p> <p>6. ACCEPT named insect</p>	(3)


Question Number	Answer	Mark
4(a)(i)	<p>4(a)(i). The only correct answer is A</p> <p><i>B is incorrect because pairs of homologous chromosomes do not line up on the equator in metaphase II</i></p> <p><i>C is incorrect because chromosomes are not lining up on the equator in these phases</i></p> <p><i>D is incorrect because chromosomes are not lining up on the equator in these phases</i></p>	(1)

Question Number	Answer	Additional guidance	Mark
4(a)(ii)	<ol style="list-style-type: none"> 1. idea that the (pairs of) homologous chromosomes randomly line up along the equator (of the cell) ; 2. (resulting in) { different / new } combinations of { chromatids / chromosomes } ; 3. (resulting in) { different / new } combinations of alleles in the { gametes / eq } ; 	<p>IGNORE descriptions of crossing over</p> <p>1. ACCEPT { bivalents / maternal and paternal chromosomes / homologous pairs } as equivalent to a pair of homologous chromosomes</p> <p>3. answer must be in context of where these combinations are</p> <p>3. DO NOT ACCEPT genes</p>	(2)

Question Number	Answer	Mark
4(b)(i)	<p>4(b)(i). The only correct answer is C</p> <p><i>A is incorrect because crossing over will have already occurred by anaphase I</i></p> <p><i>B is incorrect because crossing over does not occur in meiosis II</i></p> <p><i>D is incorrect because crossing over does not occur in meiosis II</i></p>	(1)

Question Number	Answer	Additional guidance	Mark																	
4(b)(ii)	<p>1. D positioned to the right of A ;</p> <p>2. Correct sequence shown ;</p> <p>3. correct sequence shown at correct intervals ;</p>	<p>2. A D B C (ignore intervals at this stage)</p> <p>3.</p> <table border="1" style="width: 100%; text-align: center;"> <tr> <td style="width: 20px;"> </td> <td style="width: 20px;"> </td> <td style="width: 20px;"> </td> <td style="width: 20px;">A</td> <td style="width: 20px;"> </td> <td style="width: 20px;"> </td> <td style="width: 20px;">D</td> <td style="width: 20px;"> </td> <td style="width: 20px;"> </td> <td style="width: 20px;"> </td> <td style="width: 20px;"> </td> <td style="width: 20px;"> </td> <td style="width: 20px;">B</td> <td style="width: 20px;"> </td> <td style="width: 20px;">C</td> <td style="width: 20px;"> </td> <td style="width: 20px;"> </td> </tr> </table>				A			D						B		C			(3)
			A			D						B		C						

Question Number	Answer	Additional guidance	Mark
5(a)(i)	<ol style="list-style-type: none"> idea that DNA will be replicated (in S phase) ; idea that it prevents formation of daughter cells with damaged DNA ; idea that if the DNA is damaged then proteins will not function ; 	<p>IGNORE references to mutation</p> <p>2.ACCEPT if cell divides, daughter cells will have damaged DNA</p>	(2)

Question Number	Answer	Additional guidance	Mark
5(a)(ii)	<ol style="list-style-type: none"> X shaped chromosome drawn ; both chromatid and centromere correctly labelled ; 	<p>1. ACCEPT simple line drawings and IGNORE any drawings of nuclear spindle.</p> <p>1.IGNORE labels when assessing mp1</p> <p>1. If whole cell drawn, assess one chromosome within it</p>  <p>2. ACCEPT phonetic spellings</p> <p>2. IGNORE any other labels</p>	(2)

Question Number	Answer	Additional guidance	Mark
5(a)(iii)	<ol style="list-style-type: none"> 1. no { nucleus / nuclear envelope / nucleolus / eq } ; 2. chromosomes { aligned / lined up } along the equator / eq ; 3. reference to spindle fibres ; 4. spindle fibres attached to centromeres (and centrioles) ; 5. centrioles (of animal cells) at poles / eq ; 	<p>ACCEPT mark points from an appropriately labelled diagram</p> <p>2.DO NOT ACCEPT pairs of chromosomes lined up 2.ACCEPT centre of cell 2.ACCEPT chromatids</p> <p>3.ACCEPT spindle</p> <p>4. mp 3 should also be awarded if mp 4 is awarded</p>	(3)

Question Number	Answer	Additional guidance	Mark
5(b)	<ol style="list-style-type: none"> 1. idea of using cancer cells and healthy cells ; 2. from the same type of tissue ; 3. credit correctly named stain ; 4. credit correct details of method ; 5. idea of counting number of cells in mitosis ; 6. idea of counting { number of cells not in mitosis / total number of cells } ; 7. credit details of what will be compared between the two samples e.g. percentage of cells in mitosis ; 	<p>If root tips are described, only mps 3, 4, 5 and 6 are accessible</p> <p>1. Piece together for this MP if needed</p> <p>3. e.g. (aceto)carmine, Feulgen's, Schiff's, toluidine (blue), orcein</p> <p>4. e.g. heating, adding acid, squashing, teasing apart</p> <p>7. ACCEPT counting same number of cells in both samples (for direct comparison) ACCEPT calculating mitotic Index (in each sample)</p>	(5)

Question Number	Answer	Additional guidance	Mark
*6(a)	<p>QWC – Spelling of technical terms must be correct and answer must be organised in a logical sequence</p> <p>Pollen tube nucleus</p> <ol style="list-style-type: none"> 1. contains the DNA coding for the enzymes ; 2. { DNA is transcribed / mRNA is produced } in the nucleus ; <p>Rough ER</p> <ol style="list-style-type: none"> 3. idea that the ribosomes are involved in { translation / polypeptide synthesis } ; 4. idea that the polypeptide chain becomes folded in the RER ; 5. the polypeptide { is packaged into vesicles / moves to Golgi in vesicles } ; <p>Golgi apparatus</p> <ol style="list-style-type: none"> 6. polypeptide is modified in Golgi apparatus / eq ; 7. secretory vesicles form from Golgi apparatus ; 8. exocytosis of enzymes out of (pollen tube / cell) ; 9. idea that the enzymes are needed to digest the style ; 	<p>QWC – Emphasis is on logical sequence</p> <p>mp 3, 4, 5 and 6: ACCEPT protein / enzyme as eq to polypeptide</p> <p>4.ACCEPT formation of secondary or tertiary structure, or 3D structure</p> <p>7.ACCEPT lysosome</p> <p>9.ACCEPT break down the style 9.ACCEPT “enzymes digest a pathway to the micropyle”</p>	<p>(6)</p>

Question Number	Answer	Additional guidance	Mark
6(b)(i)	<ol style="list-style-type: none"> 1. idea that rate is { variable / inconsistent / fluctuating / eq } ; 2. idea that pollen tube length increases ; 3. credit use of figures with units to support mark point 1 or 2 ; 	<p>e.g. length increases by 42µm (accept 41.5 to 42 µm)</p> <p>e.g. rate is 0.57 µm min⁻¹ at 7 minutes and 1.0 µm min⁻¹ at 24 minutes</p>	(3)

Question Number	Answer	Mark
6(b)(ii)	<p>6(b)(ii). The only correct answer is B</p> <p><i>A is incorrect because the tube has to grow through the style to reach the ovule</i></p> <p><i>C is incorrect because the stigma is the first structure that the tube grows through</i></p> <p><i>D is incorrect because the stigma is the first structure that the tube grows through</i></p>	(1)

Question Number	Answer	Additional guidance	Mark
6(b)(iii)	<ol style="list-style-type: none"> 1. reference to double fertilisation ; 2. idea that one (haploid male) { gamete / nucleus } fuses with (haploid) { egg cell / egg nucleus / egg cell nucleus / female gamete / female nucleus } ; 3. to produce a { diploid / $2n$ } { zygote / embryo } ; 4. idea that one (haploid male) { gamete / nucleus } fuses with { polar nuclei / diploid endosperm nucleus / fusion nucleus } ; 5. to produce a { triploid / $3n$ } endosperm (nucleus) ; 	<p>Note all marking points are stand alone</p> <p>2 ACCEPT sperm nucleus NOT generative nucleus IGNORE ovum / egg unqualified</p> <p>4 NOT generative nucleus / polar bodies</p>	(3)

Question Number	Answer	Additional guidance	Mark
7(a)(i)	<ol style="list-style-type: none"> 1. to { dissolve / act as a solvent for } { solutes / ions / molecules / named molecule / named ion } ; 2. to act as a medium for chemical reactions / eq ; 3. idea of turgor pressure to { provide support / keep plants upright } ; 4. to transport { minerals / ions / named mineral ion / sugar / sucrose / organic molecules } ; 5. to bring about hydrolysis of bonds in reactions ; 6. as a reactant / eq in photosynthesis ; 7. to regulate temperature by { evaporation / transpiration / latent heat (of vaporisation) } ; 	<p>2. ACCEPT to activate enzymes</p> <p>4.ACCEPT carry 4. context of mineral transport can be through the plant or from soil into plant</p> <p>6. ACCEPT an example such as it provides electrons or protons for photosynthesis</p> <p>7.ACCEPT cooling effect</p>	(3)

Question Number	Answer	Additional guidance	Mark
7(a)(ii)	<p>1. to produce { amino acids / proteins / nucleic acids / bases / DNA / ATP / chlorophyll } ;</p> <p>2. idea of how this organic compound is used by the plant ;</p>	<p>1. ACCEPT RNA, NAD, NADP</p> <p>2. IGNORE ref to growth and repair</p> <p>2. e.g. amino acids for the synthesis of proteins, proteins as enzymes, bases for synthesis of DNA, nucleic acids for cell division, ATP as an energy source, chlorophyll for photosynthesis</p>	(2)

Question Number	Answer	Additional guidance	Mark
7(a)(iii)	yellow leaves / eq ;	ACCEPT stunted growth / reduced growth / smaller plant / chlorosis / yellow spots on leaves / white patches on leaves / eq	(1)

Question Number	Answer	Mark
7(b)(i)	<p>The only correct answer is D</p> <p><i>A is incorrect because the lines are thicker at all of these values compared with pH 9</i></p> <p><i>B is incorrect because the lines are thicker at all of these values compared with pH 9</i></p> <p><i>C is incorrect because the lines are thicker at all of these values compared with pH 9</i></p>	(1)

Question Number	Answer	Mark
7(b)(ii)	The only correct answer is B <i>A is incorrect because three ions have very low availability in this range</i> <i>C is incorrect because two ions have very low availability in this range</i> <i>D is incorrect because two ions have very low availability in this range</i>	(1)

Question Number	Answer	Additional guidance	Mark
7(b)(iii)	<p>QWC – Spelling of technical terms must be correct and answer must be organised in a logical sequence</p> <ol style="list-style-type: none"> 1. idea of growing plants at a range of pH values ; 2. credit correct reference to use of buffers ; 3. use plants of same { age / size / mass / species } ; 4. idea that all mineral ions should be present ; 5. in high enough concentrations to supply the plants ; 6. idea that the investigation would need to run over a long period of time ; 7. idea of measuring a named suitable parameter for growth ; 8. idea that same { temperature / water availability / light / eq } should be used ; 9. repeat at each pH to determine a mean ; 	<p>QWC – Emphasis is on clarity of expression</p> <ol style="list-style-type: none"> 1. ACCEPT five or more stated values 3. ACCEPT use of explants (in cultures), or seeds from same plant 4. IGNORE nutrients 6. if a value is stated it should be a minimum of 1 week / 7 days 7. e.g. height of plant, length of roots, length or number of leaves, mass, biomass, dry mass of plant 8. ACCEPT same mass of soil / same volume of solution / / same volume of agar / same concentration of minerals 	(5)

Question Number	Answer	Additional guidance	Mark
8(a)(i)	idea that pluripotent stem cells can give rise to many cell types but totipotent stem cells give rise to all cell types ;	ACCEPT reference to differentiation / level of specialisation e.g. totipotent can give rise to all cells, pluripotent cannot give rise to extraembryonic cells	(1)

Question Number	Answer	Additional guidance	Mark
8(a)(ii)	<ol style="list-style-type: none"> 1. idea of need to { monitor research / ensure research is necessary } ; 2. to issue licences (for stem cell research) ; 3. to monitor sources of stem cells ; 4. ensure that only early stage embryos are used as sources of stem cells ; 5. to prevent unethical use of stem cells ; 	<p>1. ACCEPT to ensure experiments are not unnecessarily repeated</p> <p>2.ACCEPT idea of giving permission for the research</p> <p>2.ACCEPT idea that guidelines are adhered to</p> <p>4. in the UK this is up to 14 days</p> <p>4. ACCEPT to determine the maximum age of embryos that can be used</p> <p>5. e.g. human cloning, genetic manipulation</p> <p>5.IGNORE designer babies, playing God, right to life</p>	(2)

Question Number	Answer	Additional guidance	Mark
8(b)	<ol style="list-style-type: none"> 1. idea that the chemicals switch on some genes ; 2. reference to differential gene expression ; 3. genes coding for heart cell { structures / functions / eq } are { active / switched on } ; 4. idea of { transcription / mRNA produced } at active genes ; 5. mRNA is { translated / used to produce } proteins ; 6. idea that these proteins determine the { structure / function } of mature heart cells ; 	<p>1.ACCEPT converse</p> <p>3.ACCEPT genes coding for proteins not needed by heart cells become switched off</p>	(4)

Question Number	Answer	Additional guidance	Mark
8(c)(i)	1. idea that these cells will function like heart cells ; 2. idea that the use of animals is reduced ; 3. idea that clinical trials will not be carried out unless drugs target heart cells ; 4. clinical trials will not be carried out unless the drugs are shown to be safe ; 5. credit how a named condition can be more tightly controlled e.g. concentration of drug reaching the cell ;	1. ACCEPT idea that these cells are similar to heart cells in body 2. ACCEPT no need to test on animals 3. ACCEPT to ensure drugs work on heart cells 4. ACCEPT to ensure drug is safe / has no side effects before testing on people 5. ACCEPT to find a safe dosage	(2)

Question Number	Answer	Additional guidance	Mark
8(c)(ii)	1. (phase I) drug tested on (small number of) healthy { people / volunteers } ; 2. (phase II) drug tested on small number of patients (with heart disease) ; 3. (phase III) drug tested on large number of patients (with heart disease) ; 4. reference to { placebo / double blind trial } (during phase II / phase III) ;	(fewer than 100) 2.ACCEPT 100-300 2.ACCEPT slightly larger 3.ACCEPT ≥ 1000	(3)