Mark Scheme (Results)

January 2017

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

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General Marking Guidance

- This mark scheme provides a list of acceptable answers for this paper. Candidates will receive credit for all correct responses but will be penalised if they give more than one answer where only one is required (e.g. putting an additional cross in a set of boxes). If a candidate produces more written answers than the required number (two instead of one, three instead of two etc), only the first answers will be accepted. Free responses are marked for the effective communication of the correct answer rather than for quality of language but it is possible that, on some occasions, the quality of English or poor presentation can impede communication and lose candidate marks. It is sometimes possible for a candidate to produce a written response that does not feature in the mark scheme but which is nevertheless correct. If this were to occur, an examiner would, of course, give full credit to that answer.
- 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)	**Drawing mark** 1. two membranes drawn with inner membrane folded ; **Labelling marks** 2. outer membrane and {inner membrane / cristae} ; **Any two from**: 3. inter-membrane space; 4. matrix ; 5. stalked particles 6. (circular)DNA ; 7. (70S)ribosomes ;	**1.IGNORE** labels when assessing drawing mark **1.IGNORE** shape of mitochondrion **1.IGNORE** number of folds **IGNORE** labels of phosphate granules/lipid droplets **DO NOT ACCEPT** other structures including granum/stroma/thylakoid/starch grain/nucleus/cytoplasm/mesosome 2.**NOT** cell membrane/cell wall 2. **NOT** cisternae instead of cristae 2.**ACCEPT** double membrane/envelope **3. and 4.** Need to be labelled in the correct position but no additional drawing needed **5.6. and 7.** A drawing (not detailed) to represent them is needed as well as label being in correct position. (Quality of drawing is not being assessed in these marking points). **5.** Drawn attached to cristae **6. and 7.** Drawn in matrix and not attached to membrane	**(4) EXP**

Question Number	Answer	Additional Guidance	Mark
1(b)	1. (loop of) DNA ; 2. (70S / small) ribosomes ;	**IGNORE** answers about features that they don't have **1.IGNORE** plasmid /genetic material	**(2) GRAD**

Question Number	Answer	Additional Guidance	Mark
1(c)	1.top line = archaea ; 2. middle line = bacteria ; 3.bottom line = eukaryota ;	} **ACCEPT** either way around 1.**ACCEPT** archaebacteria 2.**ACCEPT** eubacteria **3 ACCEPT** eukaryote / eukarya/ eukaryotic	**(3) GRAD**

Question Number	Answer	Additional Guidance	Mark
1(d)	chloroplast / large vacuole / amyloplast ;	**DO NOT ACCEPT** any other structure **IGNORE** plastid **ACCEPT** sap vacuole/permanent vacuole	**(1) GRAD**

Question Number	Answer	Additional Guidance	Mark
2(a)(i)	Any **two** from: 1.to make the investigation valid ; 2.plants would be of same age; 3.same soil ; 4.same water availability ; 5.same temperature ; 6.same light (intensity / wave length / exposure/daylength) ;	**IGNORE** references to genotype/species **1.NOT** reliable / reproducible / accurate / precise/fair **2 -6. ACCEPT** similar as eq to same **3.ACCEPT** idea would receive same quantity of nutrients/minerals **3-6.ACCEPT** growth conditions/abiotic factors for 1 mark if none of the named growth conditions are specified	**(2) GRAD**

Question Number	Answer	Additional Guidance	Mark
2(a)(ii)	1. to soften the {stem/(soft) tissues/cell walls /middle lamella/ matrix / hemicellulose / pectate}; 2. so that the fibres can be {separated/removed/extracted} ;	**1. NOT** cellulose **1.ACCEPT** for {fungi/bacteria} to break down/decompose the soft tissues/eq **2.ACCEPT** easier to extract fibres **ACCEPT** to leave only fibres/cellulose [For answers in context of decomposition]	**(2) GRAD**

Question Number	Answer	Additional Guidance	Mark
2(a)(iii)	soaked in water ;	**ACCEPT** soaked in same solution without NaOH **IGNORE** should not be soaked in NaOH	**(1) GRAD**

Question Number	Answer	Additional Guidance	Mark
2(a)(iv)	to remove the NaOH / so that the fibres were safe to handle / eq ;	**ACCEPT** to remove the alkali	**(1) GRAD**

Question Number	Answer	Additional Guidance	Mark
2(a)(v)	1. idea that the {diameter/thickness/radius/shape} varies along the length of a fibre ; 2. to obtain/calculate {a mean / an average} ;	**1.IGNORE** fibres are different sizes **2.ACCEPT** idea of improved validity/ Reliability **2.ACCEPT** to find the smallest diameter/eq	**(2) EXP**

Question Number	Answer	Mark
2(a)(vi)	**The only correct answer is C** **A** is not correct because there are no units for area **B** is not correct because units should refer to area not length **D** is not correct because units should refer to area not volume	**(1) COMP**

Question Number	Answer	Additional Guidance	Mark
2(b)	1. difficult to compare data / eq ; 2. because the diameter of the fibres in the two groups are not the same / eq ; 3. NaOH reduces the tensile strength / eq ; 4. idea that NaOH does not reduce tensile strength at all diameters ; 5. credit correct manipulation of figures ;	2. **ACCEPT** only one diameter/only 0.080 is the same in both groups **3.ACCEPT** weakens fibres 4. **ACCEPT** There are anomalies **EXAMPLE** the tensile strength of 0.080 diameter is reduced by 244 (Nm^{-2}) **5.ACCEPT** 31.3% decrease	**(3) EXP**

Question Number	Answer	Additional Guidance	Mark
3(a)	1. number of cells {decreases /doesn't increase/ eq} ; 2. cell length increase is same as untreated cells / radiation has {very little /no effect} on cell length compared to untreated cells ;	**PIECE TOGETHER** answer if needed **IGNORE** comments about rate of growth **1.IGNORE** quoted values **1.ACCEPT** in context of γ radiation graph alone or as a comparison with untreated group **2.ACCEPT** up to 155/160 hours stem length is (slightly) reduced compared to untreated cells / after 155/160 hours length of cells (slightly) increased compared to untreated cells	**(2) EXP**

Question Number	Answer	Additional Guidance	Mark
3(b)	1. idea that γ radiation prevents {new cells from being made/mitosis/cell division} so height does not increase as much ; 2. idea that cell elongation is {not affected/affected very little} by γ radiation so height still increases ;	**IGNORE** comments about mutation **IGNORE** comments about rate of growth **1. ACCEPT** fewer cells so height is lower (than untreated coleoptiles).	**(2) EXP**

Question Number	Answer	Additional Guidance	Mark
*3(c)	**(*QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence.)** 1. idea of using coleoptiles tips with and without γ radiation ; 2. place (coleoptiles) in acid and {acetic orcein /Feulgen's stain/Schiff's reagent/Toluidine blue}; 3. idea of teasing (cells / coleoptiles) apart ; 4. description of mounting (cells / coleoptiles) ; 5. description of squashing (cells / coleoptiles) ; 6. idea of warming slide to intensify stain ; 7. idea of counting number of cells undergoing mitosis and {cells in interphase/total number of cells} ; 8. idea of {calculating a percentage /calculate the mitotic index/ counting same number of cells for each tip } ;	**QWC Emphasis is on logical sequence** **NB** use of root tips would only prevent mp1 being awarded 1.**PIECE TOGETHER** if necessary **2.ACCEPT** if done in two stages (ie acid is added then stain added later) **2.IGNORE** context of heat **3.**eg use of needle to break tip / spread cells **3.ACCEPT** macerate the tips/coleoptiles 4 **ACCEPT** use of slide with {acid / stain / water} [care: this is sometimes described in two different sentences] **5.** eg pressing cells/tip/eq with coverslip/second slide	**(6) EXP**

Question Number	Answer	Additional Guidance	Mark
***4(a)**	**(*QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence.)** 1. (phase I) involves (small) number of healthy {people / volunteers} ; 2. (phase II) involves small number of patients / eq ; 3. (phase III) involves {large/larger number} of patients / eq ; 4. reference to a double blind trial ; 5. reference to use of placebo ; 6. idea that neither the patient nor the doctor knows who is receiving the placebo ;	**QWC emphasis is on clarity of expression** 2.**ACCEPT** idea that there are more people than in phase I **2.ACCEPT**100-300 3.**ACCEPT** > 1000 **4.5.6**. **ACCEPT** in context of phase II or phase III	**(5) EXP**

Question Number	Answer	Additional Guidance	Mark
4(b)	1. pre-clinical (to phase I): idea that {animals harmed by drug / not safe to use on people} ; 2. phase I (to phase II): idea that drug had {side effects/showed toxicity} ; 3. phase II (to phase III): idea that {patients were not cured / drug had no effect on condition/drug was less effective than existing drugs} ; 4. phase III onwards: idea that drug was not successful enough compared to the placebo/existing treatment ;	**NB** Answers must be related to a stage. **2. ACCEPT** an example eg nausea/dizziness 3. **ACCEPT** idea of further side effects noted **4.ACCEPT** long term side effects OR idea of rare side effects/eq that only show in large samples	**(3) EXP**

Question Number	Answer	Mark
5(a)	**The only correct answer is D** **A** is not correct because neither xylem vessels nor sclerenchyma fibres are organs **B** is not correct because xylem vessels are not an organ and sclerenchyma fibres are not an organ systems **C** is not correct because xylem vessels are not an organ system	**(1) COMP**

Question Number	Answer	Mark
5(b)	**The only correct answer is A** **B** is not correct because neither guideline points to a xylem vessel **C** is not correct because the xylem vessel label is pointing to sclerenchyma fibres **D** is not correct because the labels are the wrong way round	**(1) COMP**

Question Number	Answer	Mark
5(c)	**The only correct answer is C** **A** is not correct because xylem vessels do contain cellulose **B** is not correct because xylem vessels do contain lignin **D** is not correct because xylem vessels do contain cellulose and pits	**(1) COMP**

Question Number	Answer Additional Guidance	Mark
5 (d)	**The only correct answer is C** **A** is not correct because xylem vessels are also involved with support **B** is not correct because sclerenchyma fibres have no transport function **D** is not correct because xylem vessels are also involved with support and sclerenchyma fibres have no transport function	**(1) COMP**

Question Number	Answer	Additional Guidance	Mark
5(e)	Any **two** from magnesium calcium nitrates ;	**ACCEPT** correct chemical symbols of **ions** **ACCEPT** any other **two** correct ions e.g. sulfates or sulphates/ phosphates /chloride/ potassium / sodium /iron / manganese /zinc / copper / ammonium	**(1) GRAD**

Question Number	Answer	Additional Guidance	Mark
5(f)(i)	1. idea that as pressure increases so does rate of flow ; 2. {(directly) proportional / linear increase / eq} / credit correct manipulation of figures ;	**1.ACCEPT** positive correlation 2. **Example** calculation: for a diameter of 200(μm) when pressure increases from 0 - 0.2(au) rate of flow increases by 200(mh^{-1})	**(2) Expert**

Question Number	Answer	Additional Guidance	Mark
5(f)(ii)	1. idea that as diameter increases so does rate of flow ; 2. {non-linear increase / eq} / credit correct manipulation of figures ;	**1.ACCEPT** positive correlation **2.Example** calculation: (at pressure of 0.2) when diameter increases from 100-200(μm) rate of flow increases by 70(mh^{-1})	**(2)** **Expert**

Question Number	Answer	Additional Guidance	Mark
6(a)(i)	1. Length of head with correct units ;	**ACCEPT** a range of 9-10mm / 0.9 – 1.0cm;	**(1) expert**

Question Number	Answer	Additional Guidance	Mark
6(a)(ii)	1. length of head divided by 2000; 2. (multiplied by 30) to give correct answer;	**NB allow error carried forward from (a)(i)** **Units must be stated to gain full marks** **2.** Answer must be expressed to 2 or 3 sig figs **EXAMPLE calculations**: (30 x 9)/2000 = 0.135mm OR (30 x 10)/2000 = 0.15mm **ACCEPT** answers converted to μm or m eg 135 μm or 1.35 $x10^{-4}$m Correct answer alone **with units** gains 2 marks.	**(2) expert**

Question Number	Answer	Additional Guidance	Mark
6(b)	1. sperm has a {flagellum/tail} (but a female gamete does not) ; 2. sperm has an acrosome (but a female gamete does not) ; 3. no cortical granules in a sperm (but there are in a female gamete); 4. no {food store / glycogen/lipid/ eq} in a sperm (but there is in a female gamete) ; 5. no zona pellucida in a sperm (but there is in a female gamete) ;	**ACCEPT** converse statement throughout **ACCEPT** secondary oocyte / ovum / egg cell for female gamete throughout 1. **ACCEPT** idea of a comparison of shape eg sperm is streamlined female gamete is spherical **5.IGNORE** follicle cells	**(2) EXP**

Question Number	Answer	Additional Guidance	Mark
6(c)(i)	1. both are forms of nuclear division ; 2. mitosis produces two cells but meiosis produces four cells / eq ; 3. idea that mitosis produces diploid cells but meiosis produces haploid cells ; 4. one division in mitosis but two divisions in meiosis / eq ; 5. no {crossing over/independent assortment} in mitosis but there is in meiosis / eq ; 6. mitosis produces genetically identical cells but meiosis produces genetically variable cells / eq ;	**PIECE TOGETHER ANSWER** **A statement about both is needed** **1.IGNORE** cell division 6. identical needs to be qualified once	**(3) EXP**

Question Number	Answer	Additional Guidance	Mark
6(c)(ii)	1. release of {acrosin/enzymes} from sperm / eq ; 2. {sperm/enzymes} digests the {follicular cells /zona pellucida/ eq} ; 3. {fusion / penetration / touches /eq} of sperm with female gamete membrane; 4. release of cortical granules / eq ; 5. zona pellucida {hardens / thickens/eq}; 6. fusion of sperm nucleus with female (gamete) nucleus / eq ;	**ACCEPT** secondary oocyte / ovum / egg cell for female gamete throughout **1.ACCEPT** reference to the acrosome reaction **2. ACCEPT** jelly layer **3.ACCEPT** head as eq to sperm **4.ACCEPT** reference to cortical reaction **5. ACCEPT** a reference to formation of fertilisation membrane	**(4) EXP**

Question Number	Answer	Mark
7(a)	**The only correct answer is C** **A** is not correct because Phenotype P is not affected by the environment **B** is not correct because Phenotype P is not affected by the environment **D** is not correct because Phenotype P is not affected by the environment	**(1) COMP**

Question Number	Answer	Mark
7(b)	**The only correct answer is** D **A** is not correct because autism is affected most by the genotype and most by the environment **B** is not correct because autism is affected most by the genotype **C** is not correct because autism is affected most by the environment	**(1) COMP**

Question Number	Answer	Additional Guidance	Mark
7(c)(i)	1. {Genotype/eq} determines levels of MAOA; 2. idea of environmental influence as {stress / maltreatment / abuse /violence/ maternal rejection / lack of continuity in people looking after child / eq} ; 3. (only) individuals with low levels of MAOA affected (by environment) / eq ; 4. interaction results in antisocial behaviour / convictions / eq ; 5. males more affected than females (by this interaction) ;	**PIECE TOGETHER ANSWERS**	**(3) EXP**

Question Number	Answer	Additional Guidance	Mark
7(c)(ii)	1. behaviour is affected by other genes / polygenic inheritance/ eq ; 2. idea other environmental factors / lifestyle factors/eq may be involved;	**1. ACCEPT** idea that behaviour can't be easily quantified **2.ACCEPT** difficult to eliminate/control other environmental factors/difficult to measure stress/abuse/eq	**(2) EXP**

Question Number	Answer	Additional Guidance	Mark
8(a)(i)	1. idea that overall the number of Iberian lynx have increased ; 2. idea that the number of Iberian lynx originally from wild increases (from 2000) to 2006 ; 3. idea that the number of Iberian lynx born in captivity increases from 2005; 4. credit correct manipulation of figures (to show an increase) ;	**1.IGNORE** in the wild **2.DO NOT ACCEPT** in the wild **3.ACCEPT** after 2004 4. **Example calculation** Total number in breeding programmes increase by34 overall	**(3) EXP**

Question Number	Answer	Additional Guidance	Mark
8(a)(ii)	1. idea of more (captive) Iberian lynx {to breed with / reintroduce} ; 2. idea that Iberian lynx originally from the wild {increases gene pool/genetic diversity/reduces inbreeding}; 3. idea that Iberian lynx being born in captivity shows that the {breeding programme is successful / the animals are not stressed} ; 4. idea that fewer lynx need to be originally taken from the wild because they are breeding in captivity ;	**2.ACCEPT** increases number of alleles in population [as alternative to gene pool]	**(3) EXP**

Question Number	Answer	Additional Guidance	Mark
8(b)	1. idea that enough animals need to remain in the breeding programme to maintain the gene pool; 2. idea that enough need to be reintroduced at the same time {to improve chance that breeding (in the wild) will occur/maintain gene pool(in the wild); 3. otherwise there could be {birth defects / disease / e.g. of another consequence of inbreeding} ;		**(3) EXP**

Question Number	Answer	Additional Guidance	Mark
8(c)	1. idea of exchanging {animals/sperm} between the centres ; 2. idea of keeping breeding records ; 3. idea of sharing {resources / money /veterinary care /knowledge of husbandry /knowledge of release sites /raising awareness/eq} ; 4. idea of {quarantining / not breeding with sick animals / eq } ; 5. idea of not releasing too many lynx into one area ;	**1. ACCEPT** zoos **2.ACCEPT** stud books	**(3) EXP**

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