Mark Scheme (Results)

October 2018

Pearson Edexcel International Advanced Level
Biology (WBI02) Paper 01
Development, 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 and alternative response.

Using the Mark Scheme

Examiners should look for qualities to reward rather than faults to penalise. This does NOT mean giving credit for incorrect or inadequate answers, but it does mean allowing candidates to be rewarded for answers showing correct application of principles and knowledge. Examiners should therefore read carefully and consider every response: even if it is not what is expected it may be worthy of credit.

The mark scheme gives examiners:

- an idea of the types of response expected
- how individual marks are to be awarded
- the total mark for each question
- examples of responses that should NOT receive credit.

/ means that the responses are alternatives and either answer should receive full credit.
( ) means that a phrase/word is not essential for the award of the mark, but helps the examiner to get the sense of the expected answer.
Phrases/words in **bold** indicate that the meaning of the phrase or the actual word is **essential** to the answer.
ecf (error carried forward) means that a wrong answer given in an earlier part of a question is used correctly in answer to a later part of the same question.

Candidates must make their meaning clear to the examiner to gain the mark. Make sure that the answer makes sense. Do not give credit for correct words/phrases which are put together in a meaningless manner. Answers must be in the correct context.

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:

- write legibly, with accurate use of spelling, grammar and punctuation in order to make the meaning clear
- select and use a form and style of writing appropriate to purpose and to complex subject matter
- organise information clearly and coherently, using specialist vocabulary when appropriate.

Full marks will be awarded if the candidate has demonstrated the above abilities. Questions where QWC is likely to be particularly important are indicated (QWC) in the mark scheme, but this does not preclude others.

Question Number	Answer	Mark
1(a)(i)	**The only correct answer is c – 660 minutes** ***A*** *is incorrect because G1 lasts just under half of 23 hours which is 11x60 = 660 minutes* ***B*** *is incorrect because G1 lasts just under half of 23 hours which is 11x60 = 660 minutes* ***D*** *is incorrect because G1 lasts just under half of 23 hours which is 11x60 = 660 minutes*	**(1)**

Question Number	Answer	Additional guidance	Mark
1(a)(ii)	1. one of two (DNA) **molecules** that make up a chromosome / eq ; 2. Idea that DNA replicates (in S phase) / eq ;	**ACCEPT** equivalent wording for mark points 1 and 2 1.**ACCEPT** each chromatid contains one DNA **molecule** 1.**IGNORE** strand	**(2)**

Question Number	Answer	Mark
1(a)(iii)	**The only correct answer is c –**  ***A*** *is incorrect because the cell is in metaphase* ***B*** *is incorrect because the cell is in anaphase* ***D*** *is incorrect because the cell is in interphase*	**(1)**

Question Number	Answer	Mark
1(b)(i)	**The only correct answer is A – 1, 5, 6, 4, 3, 2** ***B*** *is incorrect because the coverslip has to be put on before the cells are squashed* ***C*** *is incorrect because the cells cannot be teased apart before adding acid* ***D*** *is incorrect because the cells cannot be teased apart before adding acid*	**(1)**

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

Question Number	Answer	Additional guidance	Mark
2(a)	Animal cells only: centriole ; Animal and plant cells: (cell) membrane / cytoplasm / Golgi (apparatus) / mitochondrion / endoplasmic reticulum / lysosome /nucleus / nucleolus / ribosome ; Plant cells only: chloroplast / cell wall / amyloplast / tonoplast / plasmodesma / {large / permanent / sap/ eq} vacuole ;	**ACCEPT** plural names **ACCEPT** phonetic spellings **DO NOT ACCEPT** when more than one answer is given in one part of the diagram if one of these answers is incorrect for the cell type **ACCEPT** centrosome/cortical granules **ACCEPT** <u>correctly</u> qualified answers e.g plasma membrane / rough ER /smooth ER / 80S ribosome IGNORE vacuole **ACCEPT** pits / middle lamella	**(3)**

Question Number	Answer	Additional guidance	Mark
2(b)	1. peptidoglycan cell wall ; 2. loop of DNA / nucleoid ; 3. plasmids ; 4. pili ; 5. (slime) capsule ; 6. 70 S ribosomes	**DO NOT ACCEPT** flagellum, glycogen granules, cytoplasm, membrane, ribosomes, 80S ribosomes 1.ACCEPT murein cell wall 2.**ACCEPT** circular DNA 4. **ACCEPT** fimbriae 5. **ACCEPT** slime layer 6. **IGNORE** small ribosomes 7. **ACCEPT** mesosome	**(3)**

Question Number	Answer	Additional guidance	Mark
2(c)	1. idea that classification was based on {anatomy / morphology /physical structure / eq}; 2. idea of use or availability of {improved / electron} microscopes ; 3. use of molecular phylogeny; 4. idea that {more / new} **species** {have been / will be} discovered ; 5. idea that in the future, technology will continue to develop ;	**IGNORE** references to natural selection 2. and 3. **named** equipment or methods must be given 3.**ACCEPT** a name or description of chemical analysis e.g. proteomics / DNA profiling / DNA analysis 4. **DO NOT ACCEPT** new organisms 4. **IGNORE** references to speciation, this has to be in context of **discovery** or **identification** of species 5. e.g. improved technology / chemical analysis / DNA analysis (**in the future**)	**(3)**

Question Number	Answer	Mark
3(a)(i)	**The only correct answer is C – 46 23** ***A*** *is incorrect because mitosis does not halve the number of chromosomes* ***B*** *is incorrect because mitosis does not halve the number of chromosomes but meiosis does* ***D*** *is incorrect because meiosis halves the number of chromosomes*	**(1)**

Question Number	Answer	Additional guidance	Mark
3(a)(ii)	1. to increase the number of **primary spermatocytes**; 2. idea that large numbers of sperm cells are produced ;	1. the cells must be named 2. **ACCEPT** many more sperm are produced 2. **ACCEPT** increase the number of sperm	**(2)**

Question Number	Answer	Mark
3(b)(i)	**The only correct answer is A – P** ***B*** *is incorrect because the acrosome is in the front of the head* ***C*** *is incorrect because the acrosome is in the front of the head* ***D*** *is incorrect because the acrosome is in the head*	**(1)**

Question Number	Answer	Mark
3(b)(ii)	**The only correct answer is C – S** ***A*** *is incorrect because the mitochondrion is located in the neck* ***B*** *is incorrect because the mitochondrion is located in the neck* ***D*** *is incorrect because the mitochondrion is located in the neck*	**(1)**

Question Number	Answer	Additional guidance	Mark
3(b)(iii)	1. (L=) 0.6 × 5 / 3 (μm) ; 2. (M=) 10 × 5 / 50 (μm) ; 3. (total length =) 58 (μm) ;	**Correct answer alone gains three marks**	**(3)**

Question Number	Answer	Additional guidance	Mark
4(a)	any two dominant alleles only one dominant allele p p q q r r ;	e.g. p p Q q R r e.g. p p q q R r	**(1)**

Question Number	Answer	Additional guidance	Mark
4(b)(i)	1. idea that one {characteristic / phenotype / eq} determined by more than one gene ; 2. skin colour determined by {three genes / P, Q and R} ;	1. **ACCEPT** trait, feature, physical appearance, external appearance as eq to characteristic 1.**DO NOT** award mp1 if answer is in context of genes at the same loci 1.**DO NOT** award in the context of alleles 2. **ACCEPT** PP QQ RR unless answer is in context of alleles	**(2)**

Question Number	Answer	Additional guidance	Mark
4(b)(ii)	1. {observable / expressed / eq} {characteristic / feature / eq} ; 2. skin colour ;		**(2)**

Question Number	Answer	Additional guidance	Mark
4(b)(iii)	1. idea that there is a range of {phenotypes / characteristics / traits /eq} ; 2. credit list of {skin colours / numerical values} ;	1. **ACCEPT** normal distribution 2. More than two should be stated or listed	**(2)**

Question Number	Answer	Additional guidance	Mark
4(c)(i)	as one variable / factor increases the other decreases	**ACCEPT** converse **ACCEPT** lighter the skin the greater the risk of developing skin cancer **ACCEPT** skin colour increases / numerical value increases as eq to darker **ACCEPT** inverse relationship **DO NOT ACCEPT** answers that state a causal relationship	**(1)**

Question Number	Answer	Additional guidance	Mark
4(c)(ii)	1. idea that skin colour is genetic **and** (exposure to) ultraviolet light is environmental ; 2. ultraviolet (light / radiation) is known to {cause mutations / be a mutagen} ; 3. credit example of result of mutation (at gene level) ; 4. idea that control of cell cycle is lost ;	1.**Piece together** if necessary 1.**ACCEPT** melanin production is genetic 1.**ACCEPT** genotype as eq to genetic 2.**IGNORE** radiation **3** e.g. DNA repair mechanisms decrease, formation of oncogene, tumour suppressor gene affected 4 e.g. cell growth cannot be controlled, cell division cannot be controlled, no Hayflick limit	**(3)**

Question Number	Answer	Additional guidance	Mark
5(a)	Xylem cellulose **and** lignin ; (ignore pectin) absent / eq ; absent / eq ; Any **two** from: transport of water transport of mineral (ions) support / eq ;	**CARE** two correct functions must be stated to gain the one available mark	**(4)**

Question Number	Answer	Additional guidance	Mark
5(b)	1. (starch) contains {large numbers of glucose molecules / polymer of glucose molecules} ; 2. branched so that it can be {hydrolysed / release energy} easily / eq ; 3. compact so that {more/ a lot of} glucose can fit into a particular space / eq ; 4. insoluble so no osmotic effect / eq ;	1. **ACCEPT** starch can store a large amount of energy 2. **ACCEPT** broken down 2. **ACCEPT** readily hydrolysed 2. **ACCEPT** if amylopectin stated rather than starch 3.**ACCEPT** if amylose / amylopectin is stated rather than starch 4. **ACCEPT** insoluble so is not lost from the cell / storage organ	**(3)**

Question Number	Answer	Additional guidance	Mark
5(c)	1. supplies water {for photosynthesis / to keep cells turgid} / eq ; 2. supplies magnesium (ions) for synthesis of chlorophyll / eq ; 3. supplies nitrate for synthesis of {amino acids / protein / DNA / eq} ; 4. supplies calcium (ions) for cell wall structure / eq ; 5. supplies phosphate for synthesis of {ATP /DNA /eq} ; 6. supports the leaves so they are exposed to sunlight ;	1. to 5. **ACCEPT** answers in context of (parenchyma) cells need these materials 3. **DO NOT ACCEPT** nitrogen 5.**DO NOT ACCEPT** phosphorus 6.**IGNORE** supports the plant	**(3)**

Question Number	Answer	Additional guidance	Mark
6(a)	1. the {number / variety / range} of species ; 2. in a habitat / eq ; OR 1. the {variety / types} of alleles ; 2. in a {gene pool / population / species} ;	1. **DO NOT ACCEPT** organisms 1. **ACCEPT** amount 1. **ACCEPT** species richness 2. **ACCEPT** area / region / ecosystem	**(2)**

Question Number	Answer	Additional guidance	Mark
***6(b)(i)**	1. idea of testing {different / named} parts of each plant ; 2. idea of grinding the plant material up ; 3. idea of preparing a lawn of bacteria ; 4. credit description of how extract will be added to culture ; 5. incubating bacteria at temperature in range 20 º to 35 ºC **and** stated time in range 1 to 7 days; 6. idea of measuring {diameter / area} of zones of inhibition ; 7. indication of using aseptic technique ; 8. repeat experiment **and** calculating a mean ;	**QWC focusing on logical sequence** 1.Do not award if context is using whole plant 2.**ACCEPT** make / use an extract 3.**ACCEPT** add bacteria to agar / broth /eq 4. e.g. adding extract to wells, soaking discs in extract 6. **ACCEPT** measuring the clarity of broth 7. e.g. using sterile equipment 8.**ACCEPT** taking several diameter measurements and calculating mean	**(5)**

Question Number	Answer	Additional guidance	Mark
6(b)(ii)	1. testing which bacteria were affected ; 2. determining the concentration to use ; 3. animal testing ; 4. testing on (small group of) healthy people ; 5. testing on a small group of patients / eq ; 6. idea of testing on a large group of patients / eq ;	2. **ACCEPT** dosage 3. **ACCEPT** cell toxicity or tissue culture 5. **ACCEPT** 100-300 if no written description 6. **ACCEPT** ≥ 1000 if no written description	**(4)**

Question Number	Answer	Additional guidance	Mark
6(c)	1. store seeds ; 2. in a seed bank ; OR 3. take cuttings ; 4. and grow them in {greenhouses / eq} ; OR 5. make certain areas of the rainforest into protected areas ; 6. so that they cannot be used for {deforestation / housing / eq} ;	If two methods are described credit the one that yields the higher mark 2. **ACCEPT** at low temperature **and** low humidity 3. **ACCEPT** take explants 4. **ACCEPT** growing in tissue culture	**(2)**

Question Number	Answer	Additional guidance	Mark
7(a)	1. both {divide indefinitely / are unspecialised / eq} ; 2. idea that totipotent stem cells can become all cell types but pluripotent stem cells can become {many / most} cell types ;	**Piece together answers if necessary** 1.**ACCEPT** undifferentiated 1.**ACCEPT** no Hayflick limit 2. **ACCEPT** totipotent can give rise to all cells, pluripotent cannot give rise to placental / extraembryonic cells	**(2)**

Question Number	Answer	Additional guidance	Mark
***7(b)**	1. mitosis to increase number of cells / eq ; 2. idea of responding to {chemical / environmental} stimulus ; 3. reference to **differential gene expression** ; 4. credit example from question of genes switched on ; 5. credit example from question of genes switched off ; 6. idea of {transcription / mRNA produced} at active genes ; 7. {proteins / polypeptides / eq} produced (from this mRNA) ; 8. idea that this protein (permanently) modifies cell **OR** idea that this protein determines {cell structure / function } ;	**QWC focus on clarity of expression** 2.**ACCEPT** hormone / external stimulus 4. e.g. gene for production of insulin switched on in pancreatic cells 5. e.g. gene for production of insulin switched off in nerve cells / muscle cells / heart muscle cells 7. **ACCEPT** mRNA is translated	**(6)**

Question Number	Answer	Additional guidance	Mark
7(c)	1. idea they {monitor research / ensure research is necessary} ; 2. idea that they issue licences (for stem cell research) ; 3. idea they monitor sources of stem cells ; 4. ensure that only early stage embryos are used (as sources of stem cells) ; 5. prevent unethical use of stem cells ;	1. **ACCEPT** to ensure experiments are not unnecessarily repeated 2.**ACCEPT** idea of giving permission for the research 2.**ACCEPT** idea that guidelines are adhered to 4. in the UK this is up to 14 days 4. **ACCEPT** to determine the maximum age of embryos that can be used 5. e.g. human cloning, genetic manipulation 5.IGNORE designer babies, playing God, right to life	**(3)**

Question Number	Answer	Mark
8(a)(i)	**The only correct answer is B – behavioural anatomical** ***A*** *is incorrect because wading is behavioural* ***C*** *is incorrect because possessing feathers in anatomical* ***D*** *is incorrect because wading is behavioural*	**(1)**

Question Number	Answer	Additional guidance	Mark
8(a)(ii)	1. (the birds) occupy different niches ; 2. they have different length of beak / eq; 3. idea they have different sources of food / eq; 4. to avoid competition with each other / eq ;	**Piece together answer if necessary** 3.**ACCEPT** idea of their food is at different depths 3.**ACCEPT** they have different food 4.**ACCEPT** less competition	**(3)**

Question Number	Answer	Additional guidance	Mark
8(b)(i)	1. idea of water supplying the food ; 2. idea of water containing oxygen ; 3. {gills / large surface area} for the uptake of oxygen ; 4. idea of being protected from predators ;	1.**ACCEPT** nutrients 3. **IGNORE** gas exchange	**(3)**

Question Number	Answer	Additional guidance	Mark
8(b)(ii)	1. The range is the same in winter and summer ; 2. tunnels are deeper in the winter / eq ; 3. more tunnels in winter ; 4. greater variation in the number in winter / eq ;	**ACCEPT** converse for summer throughout 1. **ACCEPT** the range is 30mm in both 3.**IGNORE** comments about one specific depth	**(2)**

Question Number	Answer	Additional guidance	Mark
8(b)(iii)	1. there is not enough food ; 2. (so) there is competition for {food / lugworms} ; 3. credit explanation of how competition is avoided ;	1.**ACCEPT** not enough lugworms 2. **ACCEPT** between godwits or with other species 3. e.g. move to where the lugworms are not buried so deeply, move to where there are lugworms e.g. change to another food source, feed on species still available, feed on species nearer the surface **IGNORE** change their diet	**(3)**