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Mark Scheme (Results)

Summer 2016

Pearson Edexcel GCE in Biology Spec A (8BN0) Paper 02 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 an alternative response.
- Mark schemes will indicate within the table where, and which strands of QWC, are being assessed. The strands are as follows:

  i) ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear
  ii) select and use a form and style of writing appropriate to purpose and to complex subject matter
  iii) organise information clearly and coherently, using specialist vocabulary when appropriate

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/TE/cq (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)	**D** to ensure that only one sperm fertilises the egg	(1)

Question Number	Answer	Mark
1(b)(i)	**A** the acrosome	(1)

Question Number	Answer	Additional Guidance	Mark
1(b)(ii)	An answer making reference to the following point: • { energy / ATP } for movement of flagellum (1)	ALLOW (to release) energy for the sperm to swim ALLOW **provide** energy IGNORE 'move' alone NOT **produce** energy NOT energy **for** respiration	(1)

Question Number	Answer	Additional Guidance	Mark
1(c)(i)	• correct extrapolation to find the speed for 40µm (1) • correct units (1)	<u>Example of calculation</u> 18 ÷ 10 = 1.8 (ALLOW 1.75 to 1.85) 84 + (1.8 x 8) = 98.4 µm/s ALLOW **98 to 99 µm/s** µm/s OR µm s^{-1} NOT $µm^{s-1}$	**(2)**

Question Number	Answer	Additional Guidance	Mark
1(c)(ii)	An explanation making reference to the following points: • there is variation about the line / few data points lie exactly on the line (therefore the prediction will not be exact) (1) • the gradient of the line may not remain the same (1)	ALLOW a suggested reason for variation about the line e.g. different numbers of mitochondria in the sperm	**(2)**

Question Number	Answer	Additional Guidance	Mark
2(a)	• correct calculation of magnification (1)	Example of calculation 14mm = 14000µm 14000 ÷ 5 = 2800 **x 2800**	**(1)**

Question Number	Answer	Mark
2(b)	**C** hemicellulose, microfibrils and pectin	**(1)**

Question Number	Answer	Additional Guidance	Mark
2(c)	An answer that makes reference to the following: • there will be no { transcription / mRNA } (therefore ribosomes not required for translation) (1) • no proteins will be synthesised to be processed in endoplasmic reticulum (1)	 ALLOW proteins are provided by/from the companion cell	**(2)**

Question Number	Answer	Additional Guidance	Mark
2(d)(i)	A description making reference to the following: • a pit (in the cell wall) / plasmodesma (1) • the cell wall has only one layer / only primary cell wall present / a strand of cytoplasm (1)	 ALLOW plasmodesmata ALLOW a narrow channel through the cell wall description must match structure named	**(2)**

Question Number	Answer	Additional Guidance	Mark
2(d)(ii)	An explanation making reference to three of the following: • (the micrograph shows that) the CC has many mitochondria whereas the ST has { few / none } (1) • the role of the ST is to provide a channel, so cellular contents are kept to a minimum (1) • the ST has { limited / no } ability to carry out (aerobic) respiration (1) • { ATP / energy } is supplied to the ST from the CC (1)	 ALLOW CC has **more** mitochondria / ST has few**er** mitochondria ALLOW CC is able to respire more ALLOW use of { ATP / energy } for active transport for phloem loading / described	**(3)**

Question Number	Answer	Mark
3(a)	**B** DNA, enzymes and amino acids	(1)

Question Number	Answer	Additional Guidance	Mark
3(b)(i)	• correct calculation of the difference in concentration (1) • correct calculation of the percentage (1)	Example of calculation 2100 – 250 = 1850 1850 ÷ 2100 x 100 = 88% ALLOW 88.1% / 88.10% Answer should be given to no more than 2dp Correct answer with no working gains full marks	(2)

Question Number	Answer	Additional Guidance	Mark
3(b)(ii)	A description that makes reference to the following points: • through the xylem (vessels) (1) • in { water / solution } (1)	 NOT phloem ALLOW via transpiration stream IGNORE ref to active transport	(2)

Question Number	Answer	Additional Guidance	Mark
3(b)(iii)	An explanation that makes reference to the following points: • (a shortage of magnesium ions) limits the production of chlorophyll (1) • lack of { glucose / carbohydrate / cellulose } due to less photosynthesis (1) • (therefore) plant leaves may be yellow / plants may be small (1)	ALLOW a named carbohydrate / sugar ALLOW slow growth, stunted growth, pale leaves, leaves not green IGNORE wilting	**(3)**

Question Number	Indicative content
***3(c)**	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. • use of similar, healthy plants grown in the same conditions up to the start of the experiment • control of the growing environment, e.g. light intensity, temperature • use of growth medium with an adequate concentration of all other necessary ions • measurement of an appropriate specified dependent variable, over the same growing period for all plants • data collection from at least five plants at each concentration of lead, used to calculate mean values • use of different concentrations of lead ions, and a control with no lead • lead concentrations to include 300, 999/1000 and 2000 ppm (boundary concentrations for tolerance categories) • description of how the results would be interpreted to determine the tolerance category

Level	Mark	Descriptor	Additional Guidance
0	0	No awardable content	
1	1-2	A description of the investigation may be attempted but with limited analysis, interpretation and/or evaluation of the scientific information. Generalised comments made. The description will contain basic information with some attempt made to link knowledge and understanding to the given context.	Controlled variables / repeats. Use of tomato plants and lead ions.
2	3-4	A description of the investigation will be given with occasional evidence of analysis, interpretation and/or evaluation of the scientific information. The description shows some linkages and lines of scientific reasoning with some structure.	Level 1 indicators plus one of the following: - use of correct core practical technique - a measurable dependent variable - range of lead concentrations spanning 300-2000
3	5-6	A description of the investigation is given which is supported throughout by evidence from the analysis, interpretation and/or evaluation of the scientific information. The description shows a well-developed and sustained line of scientific reasoning which is clear, coherent and logically structured.	All level 1 indicators, at least 2 indicators from level 2 plus either: - lead concentrations of 300, 999/1000 and 2000 - details of how the results can be used to determine the tolerance category

Question Number	Answer	Additional Guidance	Mark
4(a)	A description that makes reference to the following: • one aseptic technique (1) • another aseptic technique (1)	e.g. boiling the culture medium before use { 'flaming' / disinfecting } of the instruments keeping lids off for the minimum time working in { updraught of a flame / a flow hood } disinfecting the bench (before or after working) autoclaving used plates IGNORE: 'sterilising' without a technique handwashing, gloves, etc reference to incubation temperature cross taping of plates	**(2)**

Question Number	Answer	Additional Guidance	Mark
4(b)(i)	An explanation making reference to three of the following: • the temperature is warm, increasing the rate of reactions in bacteria (1) • availability of energy source from { tissue / blood } (1) • availability of water for bacterial cell functions (1) • consideration of the role of oxygen (1) EITHER oxygen availability is good, allowing (aerobic) respiration OR oxygen supply is limited, but some bacteria are able to respire anaerobically	ALLOW increasing enzyme activity IGNORE optimum temperature e.g. glucose IGNORE nutrients ALLOW named substance for growth e.g amino acids	**(3)**

Question Number	Answer	Additional Guidance	Mark
4(b)(ii)	A description that makes reference to **four** of the following: • salve must be applied to healthy humans (1) • treat one group of patients with the salve and another group with an existing treatment (1) • neither the doctors nor the patients involved in the trial should know which treatment is being used (1) • participants must be monitored for { side effects / adverse reactions } associated with the salve (1) • compare the outcomes of patients treated with the salve and the control group (1)	ALLOW antibiotics or named antibiotic **NOT a placebo** IGNORE 'double blind' without description	**(4)**

Question Number	Answer	Additional Guidance	Mark
5(a)	• conversion of eel data to µm (1) • calculation of volume of eel egg (1) • correct answer (1)	<u>Example of calculation</u> 1.1 mm = 1100 µm / 0.55 mm = 550 µm OR 0.70 mm^3= 7.0 x 10^8 μm^3 V = 4/3 π 550^3 = 7.0 x 10^8 (μm^3) OR V = 4/3 π 0.55^3 = 0.70 (mm^3) ALLOW 6.9 x 10^8 OR 0.69 7.0 x 10^8 / 1.8 x 10^6 = **389 (times larger)** **ALLOW 385 to 395 (times larger)** ALLOW ECF: division of candidate's calculated volume, as long as eel egg volume is larger Correct answer with no working gains full marks	**(3)**

Question Number	Answer	Additional Guidance	Mark
5(b)	An explanation that makes reference to the following: • a larger egg will contain more lipid droplets (1) • therefore will provide more energy for the development of the embryo (1) • the eel's larger egg is a bigger target for sperm to hit, aiding fertilisation in open water (1)	 ALLOW more resources for the embryo ALLOW greater chance of fertilisation	**(2)**

Question Number	Answer	Additional Guidance	Mark
5(c)(i)	• as adult mass increases, egg diameter decreases OR there is a negative correlation (between adult mass and egg diameter) (1)	ACCEPT converse	**(1)**

Question Number	Answer	Additional Guidance	Mark
5(c)(ii)	An answer that makes reference to four of the following: • this data set includes only a few { species / animals } (1) • the species in the data are from different taxonomic groups (1) • there is no (evidence of) repeats / data for these individuals may not be representative (1) • the reproductive strategy of the species { is likely to influence egg size / should be controlled } (1) • there are other factors that { may affect the egg cell / may affect adult mass / should be controlled } (1)	ALLOW small sample size ALLOW more species needed NOT more groups / amphibians IGNORE ref to different species (alone) ALLOW similar species should be used NOT different kingdoms / phyla ALLOW an example e.g. site of fertilisation, where the embryo develops ALLOW an example of a relevant factor e.g. maternal diet, health, predation risk, age IGNORE height	**(4)**

Question Number	Answer	Additional Guidance	Mark
6(a)	An answer making reference to the following: • cold (1) • dry (1)	 ALLOW frozen, low temperature, **-**20°C (or below) NOT 0°C IGNORE cool ALLOW desiccated, no water, no moisture IGNORE refs to humidity	**(2)**

Question Number	Answer	Mark
6(b)(i)	**C** starch is branched and supplies energy more quickly than cellulose	**(1)**

Question Number	Answer	Additional Guidance	Mark
6(b)(ii)	An explanation making reference to the following: • to produce {glucose / maltose } (1) • which is { soluble / transported / enters cells easily / used in respiration } (1)	 NOT beta-glucose ALLOW converse for starch IGNORE ref to size of molecules	**(2)**

Question Number	Answer	Additional Guidance	Mark
6(c)	An explanation making reference to three of the following: • (some) seeds that have been kept for long periods will { not be useful / no longer grow } (1) • different types of seed lose viability at different rates (1) • therefore regular testing is needed (to ensure seeds are still viable) (1) • seeds from the seed bank can be grown to produce fresh seeds (to replace the old seeds) (1)	IGNORE germination ALLOW different seeds last for different lengths of time ALLOW use the results to {estimate / predict} when {testing / replanting} is needed	**(3)**

Question Number	Answer	Additional Guidance	Mark
6(d)	An answer making reference to **three** of the following: • SGSV conserves genetic diversity of crops (1) • crop varieties kept in SGSV are protected from { natural disasters / drought / mismanagement / economic factors / effects of climate change } (which can threaten varieties grown by farmers) (1) • crop varieties in SGSV may have traits that are useful in the future, such as { drought resistance / pest resistance / disease resistance / tolerance of changing environmental conditions } (1) • SGSV helps to ensure future food security (if crop varieties currently grown were to fail) (1)	NOT increases genetic diversity ALLOW seeds for crop varieties IGNORE protection from diseases / pests IGNORE ref to medicinal uses	**(3)**

Question Number	Answer	Mark
7(a)	**C** physiological adaptation	**(1)**

Question Number	Answer	Additional Guidance	Mark
7(b)	A description that makes reference to: • the polypeptide chain moves through the endoplasmic reticulum then the Golgi apparatus (1) • in the rER, the polypeptide is folded (1) • in the { Golgi apparatus / ER } carbohydrate is added (1) • the { polypeptide / protein } is transported around the cell in a vesicle (1)	This mark may be awarded from the sequence of the answer as a whole. ALLOW secondary structure / tertiary structure / three-dimensional shape is adopted in rER ALLOW sugar (group) for carbohydrate IGNORE exocytosis, secretion	**(4)**

Question Number	Answer	Additional Guidance	Mark
7(c)	An explanation that makes reference to four of the following: • (AFP II) { gene / allele } { activated only in liver cells / deactivated in cells other than liver cells } (1) • transcription (of AFP II) occurs only in liver cells (1) • { translation / protein synthesis } (of AFP II) takes place only in liver cells (1) • the protein is { secreted from liver cells / transported around the body } (1) • (presence of protein in all tissues) prevents { freezing / ice } in all parts of the body (1)	ALLOW "switched on/off" This deactivation could be due to DNA methylation / histone modification Ref to liver cells required only once if context / chain of argument is clear.	**(4)**

Question Number	Answer	Mark
7(d)(i)	**B** 252 million years ago	**(1)**

Question Number	Answer	Additional Guidance	Mark
7(d)(ii)	An explanation that makes reference to three of the following: • (sea) ice is a selection pressure for AFPs / AFPs are advantageous (only) when there is (sea) ice (1) • so AFPs are likely to have { appeared / increased in frequency } during an ice age (1) • the only ice ages since the existence of the ray-fin fish are the Quaternary and Karoo (1) • therefore ray-fin fish producing AFPs are likely to have evolved { in the last 2.6 million years / between 260 and 360 million years ago } (1)	ALLOW AFPs allow fish to survive the ice age ALLOW during the Karoo / Quaternary (ice age)	**(3)**

Question Number	Answer	Mark
8(a)	B – autosomal and linked	**(1)**

Question Number	Answer	Additional Guidance	Mark
8(b)	A description making reference to two of the following: • (in meiosis) homologous chromosomes (carrying alleles for the same genes) are separated from one another (1) • sister chromatids (containing copies of the same alleles) are (also) separated from one another (1) • spindle (fibres) pull the { chromosomes / chromatids } to opposite poles of the cell (1)	IGNORE crossing over IGNORE independent assortment IGNORE reference to stages of meiosis ALLOW split for separated	**(2)**

Question Number	Answer	Additional Guidance	Mark
8(c)	An answer making reference to four of the following points: • combination on same chromosome more likely (1) • but { e+K / H+i } can result from crossing over (1) • H+i are closer together than e+K (1) • greater distance between loci gives greater likelihood of { crossing over / e+K } (1) • the relative chances, from most likely to least likely, are: h+i, E+K, e+K, H+i (1)	ALLOW converse ALLOW E+K / h+i > e+K / H+i	**(4)**

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