edexcel

Mark Scheme (Results)

Summer 2016

Pearson Edexcel GCE
in Biology Spec B (8BI0) Paper 01
Core Cellular Biology and Microbiology

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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.

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	Additional Guidance	Mark
1(a)	A (anther)		**(1)**

Question Number	Answer	Additional Guidance	Mark
1(b)	D (7,7)		**(1)**

Question Number	Answer	Additional Guidance	Mark
1(c)	D (nucleus Q divides by mitosis to form nuclei R and S)		**(1)**

Question Number	Answer	Additional Guidance	Mark
1(d)	B (one)		**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
2(a)(i)	An explanation that makes reference to the following: • because the formula for glucose is $C_6H_{12}O_6$ (1) • therefore 72 + 12 + 96 (=180) (1)	Allow description e.g. 6 carbons 12 hydrogen and 6 oxygens Allow both marks for 6x12 + 12x1 + 6x16 (=180)	**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
2(a)(ii)	• molecular mass for two glucoses added together (1) • molecular mass for water subtracted (1)	<u>Example of calculation</u> 180 + 180 = 360 360 - 18 = 342 Correct answer gains full marks with no working	**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
2(b)	An answer that makes reference to the following: • ribose is a {pentose / pentagon / 5 carbon sugar / 5 C } and glucose is a {hexose / hexagon / 6 carbon sugar / 6 C } (1) • formula for ribose is $C_5H_{10}O_5$ and the formula for glucose is $C_6H_{12}O_6$ (1)	Allow correct structures drawn out Allow ribose has 2 less H **and** 1 less O accept converse Allow molecular mass of ribose is 150 and molecular mass of glucose is 180	**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
3(a)	An explanation that makes reference to the following: • water molecules are polar (1) Any **two** from the following: • therefore form hydrogen bonds (1) • therefore are cohesive (1) • which results in a (net) inward force at its surface (1)	Allow dipolar Allow description hydrogen slightly positive and oxygen slightly negative Reject hydrogen positive or oxygen negative IGNORE adhesion Allow description e.g. at air water interface more hydrogen bonding is into the water	**(3)**

Question Number	Acceptable Answer	Additional Guidance	Mark
3(b)(i)	• the correct calculation of force (1) • division by 20mm or multiplied by 50 (1) • answer expressed correctly in standard form with suitable units (1)	<u>Example of calculation</u> 0.00002 x 9.8 = 0.000196 0.000196 ÷ 20 = 0.0000098 (Nmm^{-1}) 0.000196 x 20 = 0.0098 (Nm^{-1}) Allow ECF from calculation of force Correct answer with units scores all 3 marks 9.8 x 10^{-6} Nmm^{-1} 9.8 x 10^{-3} Nm^{-1} Allow 9.8 x 10^{-6} N Correct answer but incorrect units or no units scores 2 marks	**(3)**

Question Number	Acceptable Answer	Additional Guidance	Mark
3(b)(ii)	An explanation that makes reference to the following: • the surface tension is above 0.070 ($N\,m^{-1}$) (1) • which is greater than the force exerted by the pond skater (1) • even if temperatures were hotter (than 15°C) the surface tension of water would still be greater (1)	Allow figure between 0.070 and 0.074 for interpretation of warm day Consequential error from part (i)	**(3)**

Question Number	Answer	Additional Guidance	Mark
4(a)	A (condensation reaction forming an ester bond)		**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
4(b)(i)	A description that makes reference to the following: • (overall) increase in temperature increases the fluidity (1) • between the solid-like state and the fluid-like state (a small increase in temperature) has a greater increase in fluidity (1)	Allow positive correlation Ignore references to rate, rapid Allow steeper gradient, dramatic increase	**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
4(b)(ii)	An answer that makes reference to four of the following: • unsaturated fatty acids have a lower melting point than saturated fatty acids (1) • shorter saturated fatty acid chains have a lower melting point (1) • an increase in the number of double bonds lowers the melting point (1) • so membranes with a higher proportion of {unsaturated fatty acids / more double bonds / shorter chains} would be more fluid at lower temperatures (1) • both these factors could influence the fluidity but without temperature values on the fluidity graph, no definite conclusion can be made (1)	Allow converse statements Allow fewer carbons in chain Should be linked to one of the previous mark points	**(4)**

Question Number	Acceptable Answer	Additional Guidance	Mark
5(a)	An explanation that makes reference to the following: • solutes / named solute (1) • because they are less dense than 1.09 (gcm^{-3}) (1)	e.g. glucose, enzymes, ATP, amino acids, protein, lipids, vitamins, mineral ions and fragments of cell membrane Allow oxygen / carbon dioxide if qualified Ignore sodium chloride, sucrose, sugar and salt	**(2)**

Question Number	Answer	Additional Guidance	Mark
5(b)	C (lysosome, Golgi apparatus)		**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
5(c)	An explanation that makes reference to the following: • nucleus / ribosomes (1) • because they are {largest / most dense} (1)	Reject nucleolus Allow more dense than 1.22 or more dense than mitochondria or similar Allow contains very dense material Must be in context of an organelle not listed on the table	**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
5(d)	An explanation that makes reference to the following: • use smaller intervals in of (sucrose) density (1) • rough endoplasmic reticulum is {more dense / has ribosomes } (1)	Allow use gradient between e.g. 1.15 and 1.19 Allow converse	**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
6(a)	An explanation that makes reference to the following: • growth / repair / asexual reproduction (1) • because this needs {genetically identical cells / clones / cells with the same number of chromosomes } (1)	Ignore repair damaged cells or cell growth (unless qualified by a suitable cell type such as a muscle cell) Allow replace cells	**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
6(b)	An explanation that makes reference to the following: • DNA {synthesis / replication} (1) • therefore DNA (content) doubles (1) • (new) chromatids are formed (1) • but the number of chromosomes stays the same (1)		**(4)** **EXP**

Question Number	Answer	Additional Guidance	Mark
6(c)	• cytokinesis		**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
6(d)(i)	• fraction of cells in anaphase (1) • length of anaphase in minutes calculated (1)	<u>Example of calculation</u> 2 ÷ 246 1380 x (2 ÷ 246) = 11.22 minutes Allow 11 / 11.2 Correct answer with no working gains full marks	**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
6(d)(ii)	• calculation of 8% (1) • subtraction of calculated value from 11.22 (1)	Allow ecf from 6(d) (i) <u>Example of calculation</u> (11.22 x 8) ÷ 100 (11.2 x 8) ÷ 100 (11 x 8) ÷ 100 11.22 - 0.898 = 10.32 / 10.3 / 10 11.2 – 0.896 = 10.30 / 10.3 / 10 11 – 0.88 = 10.12 / 10.1 / 10 Correct answer with no working gains full marks	**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
6(d)(iii)	An explanation that makes reference to two of the following: • the student may have selected a different part of the root tip OR different plants had different {age / rates of growth / mitotic index / rates of respiration / genes} (1) • it is difficult to identify the correct stage of mitosis (1) • not many cells will be in anaphase OR variation due to {chance / error} will have a large effect on the calculated value (1)	Allow different growing conditions e.g. light , temperature e.g. late anaphase can be confused with early telophase, early anaphase can be confused with metaphase Allow only two cells found in anaphase / small sample size	**(2)**

Question Number	Acceptable Answers	Additional Guidance	Mark
7(a)	A response that makes reference to the following: • conclusion one is justified as the height of the columns for the three inhibitors are lower than the control column (1) • conclusion two has no information given about time (1) • conclusion three {(could be) justified as the range bar is the longest / is not justified as the range bar is shorter in proportion to the mean} (1) • conclusion four is not justified as there is no information given about {numbers of pollen grains used / numbers of pollen grains that germinated} (1)	Allow the use of the term 'valid' Allow error bar, confidence limits or standard deviations for range bar Allow conclusion one not justified because there is an overlap between act D and control range bar	**(4)**

Question Number	Acceptable Answers	Additional Guidance	Mark
7(b)(i)	An explanation that makes reference to the following: • because there was some mRNA in the pollen grain (1) • so some {translation / protein synthesis} can take place (1)	Allow some mRNA can still be made e.g. if act D was a competitive inhibitor or transcription not completely inhibited Allow pollen tubes may already have the proteins they need for growth	**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
7(b)(ii)	A description that makes reference to four of the following: • mRNA attached to the ribosome (1) • tRNA is attached to a (specific) amino acid (1) • tRNA anticodon binds to mRNA codon (1) • peptide bonds form between amino acids (1) • process involves {start / stop} codons (1)	Reject amino acid**s** Allow {complementary base pairing / hydrogen bonds} between tRNA and mRNA	**(4)**

Question Number	Acceptable Answer	Additional Guidance	Mark
7(b)(iii)	A description that makes reference to two of the following: • formation of a peptide bond (1) • between an amino group and carboxyl group (1) • by a condensation reaction (1)	Allow amine and carboxylic acid and formulae Allow release of a water molecule	**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
8(a)	• different {version of / form of} a gene (1)	Ignore different type of gene Allow found at the same locus on a chromosome Ignore sequence of DNA that codes for a protein	**(1)**

Question Number	Answer	Additional Guidance	Mark
8(b)(i)	B (metaphase I, prophase I)		**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
8(b)(ii)	A description that makes reference to three of the following: • homologous chromosomes line up (1) • chiasmata form (1) • break in {DNA / chromatid / chromosome } occurs (1) • genetic information exchanged between {chromatids} (1)	Ignore crossing over and prophase I Allow reference to bivalent Allow description of chiasmata e.g. chromatids overlap	**(3)**

Question Number	Acceptable Answer	Additional Guidance	Mark
8(c)	An answer that makes reference to the following: • there is a negative correlation between genome size and chromosome number (1) • and a negative correlation between genome size and recombination rate (1) • there is a positive correlation between chromosome number and recombination rate (1) • identification of examples that do not fit the trend (1)	e.g. animals with genome size of 3000 show the greatest variability in chromosome number	**(4)**

Question Number	Acceptable Answer	Additional Guidance	Mark
9(a)	An explanation that makes reference to the following: • specific shape to fit the {substrate / succinate} (1) • lowers the activation energy (1) • so two hydrogens can be removed / a double bond formed between the carbons (1)	Allow complementary in shape / interaction of R groups and substrate / conformational change / induced fit Allow forms an {enzyme substrate complex / stable intermediate compound}	**(3)**

Question Number	Acceptable Answer	Additional Guidance	Mark
9(b)(i)	An explanation that makes reference to the following: • because it has a similar {structure / shape} / both ends of the molecule have a COO^- group (1) • therefore it can {fit / bind} into the active site / act as a competitive inhibitor (1)		**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
9(b)(ii)	A drawing that shows the following: • the four oxygens drawn in the active site in the correct position (1)	Two must be =O and two must be $-O^-$ in the same position as the succinate binding i.e. $-O^-$ then =O then $-O^-$ then =O all joined by CH_2 (see original diagram on page 28)	**(1)**

Question Number	Answer	Additional Guidance	Mark
9(b)(iii)	B		**(1)**

Question Number	Indicative content
9(c)	Answers will be credited according to candidates' 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. • concentrations of solutions not controlled / volume not controlled eg beaker • measuring cylinders used to measure volumes of succinate / 15 cm^3 of water should have been added to the beaker in the experiment without inhibitor • concentration will affect rate of reaction because of collisions between substrate and enzyme active site • temperature not controlled • use a water bath to keep the temperature constant • enzyme could be denatured or rate of reaction changes with kinetic energy • pH not controlled • use a buffer • pH affects shape of active site and therefore rate of reaction • initial rate of reaction should have been measured • add methylene blue before adding the dehydrogenase / use colorimeter • substrate concentration will fall with time therefore rate will be lower • measuring end point is subjective • use a colorimeter • improve the accuracy of the quantitative data • only one concentration of malonate was used • at least four concentrations of malonate should have been used • so that the type of inhibition can be identified

	• only three concentrations of succinate used • at least five concentrations of succinate should have been used • so that an accurate line could be drawn onto the graph • separate experiments not repeated • repetition of each experiment • so you can {calculate a mean average / deal with anomalies / statistical analysis}	
Level	**Marks**	
0	0	No awardable content
1	1-2	Demonstrates isolated elements of biological knowledge and understanding to the given context with generalised comments made. Vague statements related to consequences are made with limited linkage to a range of scientific ideas, processes, techniques and procedures.
2	3-4	Demonstrates adequate knowledge and understanding by selecting and applying some relevant biological facts/concepts. Consequences are discussed which are occasionally supported through linkage to a range of scientific ideas, processes, techniques and procedures.
3	5-6	Demonstrates comprehensive knowledge and understanding by selecting and applying relevant knowledge of biological facts/concepts. Consequences are discussed which are supported throughout by sustained linkage to a range of scientific ideas, processes, techniques or procedures.

Additional Guidance

Level 1 response = two issues that could affect validity identified OR two suggestions made on how to improve the validity which are not related to any issues identified [e.g. two random points from indicative contents met]
Level 2 response = at least three suggestions made on how to improve the validity related to specific issues identified [e.g. at least three pairs from the indicative content]
Level 3 response = a range of suggestions made on how to improve the validity related to specific issues identified with some appreciation on the impact of the {issue / improvement} on the data obtained [e.g. at least two triplets with some additional indicative content]

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