Mark Scheme (Results)

Summer 2017

Pearson Edexcel GCE Biology (9BI0)
Paper 03 General and Practical Principles in Biology

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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

Question Number	Answer	Additional Guidance	Mark
1(a)	{kills / destroys} bacteria	**Do not accept** causes lysis / affects cell wall synthesis	(1)

Question Number	Answer	Additional Guidance	Mark
1(b)	An answer that makes reference to the following: • there are more types of {penicillin / tetracycline / older antibiotic} (1) • because there has been more time for resistant strains to appear (1) • vancomycin has only one type (1) • because it has taken {a long time / 27 years} for the resistant strains to appear (1) • there is one type of {linezolid / daptomycin / younger antibiotic} (1) • because there has been less time for resistant strains to appear (1)	**Do not accept** immune	(5)

Question Number	Answer	Additional Guidance	Mark
1(c)	A description that makes reference to five of the following: • disinfect surfaces / use benchcoat (1) • work near Bunsen flame / work in a sterile cabinet (1) • flame top of tube (1) • heat wire loop (1) • open lid of Petri dish to a small extent (1) • allow wire loop to cool (1)		**(5)**

Question Number	Answer	Additional Guidance	Mark
2(a)	A description that makes reference to the following: • {fix / pin} the locust (1) • cut body open (1) • submerge under water (1)		**(3)**

Question Number	Answer	Additional Guidance	Mark
2(b)	An answer that makes reference to the five of the following: • need a control with atmospheric air (1) • exhaled air contains {other gases / oxygen / moisture} (1) • exhaled air is warmer which could affect breathing rate (1) • locust should be allowed to recover because {still affected by exhaled air / needs to return to normal} (1) • only one carbon dioxide concentration tested (1) • the experiment should be repeated to see if results are {consistent / not anomalous} (1)	**Accept** need to use a range of carbon dioxide	**(5)**

Question Number	Answer	Additional Guidance	Mark
2(c)	An explanation that makes reference to the following: • {supply / store of / reservoir of} oxygen (1) • so respiration can occur in {large / active} locusts (1)		**(2)**

Question Number	Answer	Additional Guidance	Mark
2(d)	An explanation that makes reference to the following: • they have a large surface area to volume ratio (1) • therefore diffusion is sufficient (1)	**Accept** short diffusion distance	**(2)**

Question Number	Answer	Additional Guidance	Mark
3(a)(i)	• calculate the area of quadrat and calculate the area of grassland to calculate the number of quadrats in grassland (1) • multiply number of quadrats in area of grassland by number of clover (1) **Or** • number of clover plants per m^2 (1) • multiply by total area of grassland in m^2 (1)	<u>Example of calculation</u> $50 \times 50 = 2500\ cm^2$ / $0.25\ m^2$ and $90 \times 45 = 4050\ m^2$ $4050 \times 4 = 16200$ $16200 \times 9 = 145800$ $9 \times 4 = 36$ $36 \times (90 \times 45) = 145800$ Correct answer with no working gains full marks	**(2)**

Question Number	Answer	Additional Guidance	Mark
3(a)(ii)	An explanation that makes reference to three of the following: • use {several quadrats / larger quadrat} (1) • therefore larger area sampled (1) • place quadrats at random / use random number generation (1) • therefore achieve a consistent measure of the mean (1)	**Accept** use of running mean	**(3)**

Question Number	Answer	Additional Guidance	Mark
3(b)(i)	An answer that makes reference to the following: • named abiotic factor	e.g. light / temperature / pH / named mineral / salinity / wind	**(1)**

Question Number	Answer	Additional Guidance	Mark
3(b)(ii)	A description that makes reference to the following: • apparatus (1) • measure {by clover plants / in each quadrat / in same place / at same time of day} (1)		**(2)**

Question Number	Answer	Additional Guidance	Mark
3(b)(iii)	An explanation that makes reference to two of the following: • trampled soil has less {water / air / oxygen} (1) • therefore {photosynthesis / respiration / absorption of mineral ions} affected (1) • physical damage to plants / competition from other plants (adapted to compact soil) (1)		**(2)**

Question Number	Answer	Additional Guidance	Mark
4(a)	A description that makes reference to two of the following: • removal of amino group from amino acids / deamination (1) • ammonia combines with carbon dioxide (1) • the ornithine cycle produces urea (1)		(2)

Question Number	Answer	Additional Guidance	Mark
4 (b)	• glomerulus	**Do not accept** incorrect spelling	(1)

Question Number	Answer	Additional Guidance	Mark
4 (c)(i)	• ultrafiltration		(1)

Question Number	Answer	Additional Guidance	Mark
4(c)(ii)	An explanation that makes reference to the following: • proteins are too big to pass through (1) • concentrations of the other molecules or ions are the same in both filtrate and plasma (1) • because they are small enough to pass through (1)		(3)

Question Number	Answer	Additional Guidance	Mark
4(c)(iii)	An answer that makes reference to the following: • calculation of increase in concentration of urea (1) • calculation of increase in concentration of chloride (1) • calculation of how many more times concentrated urea is compared to chloride (1)	<u>Example of calculation</u> 2.0 ÷ 0.03 = 66.7 / 66.67 0.6 ÷ 0.37 = 1.6 / 1.62 66.67 ÷ 1.62 = 41.2 / 41.15 times more 66.7 ÷ 1.6 = 41.7 / 41.69 times more Correct answer with no working gains full marks **ecf** allowed for Mp3 if number in Mp 1 or Mp2 inappropriate rounding	**(3)**

Question Number	Answer	Additional Guidance	Mark
4(c)(iv)	An explanation that makes reference to two of the following: • glucose has been (selectively) reabsorbed (1) • by {active transport / against a concentration gradient} (1) • in the proximal tubule (1)	**Do not accept** absorbed	**(2)**

Question Number	Answer	Additional Guidance	Mark
4(c)(v)	An explanation that makes reference to five of the following: • {sodium / chloride} ions are moved out of the ascending limb by active transport (1) • ascending limb is impermeable to water (1) • this results in a {high(er) concentration / low(er) water potential} in medulla (1) • (loop of Henlé) acts as a counter-current multiplier (1) • the collecting ducts are permeable to water (1) • therefore water moves out (of the collecting ducts) by osmosis (1)		**(5)**

Question Number	Answer	Additional Guidance	Mark
5 (a)	• competitive		**(1)**

Question Number	Indicative content
***5(b)**	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. <u>Modify:</u> - uses yeast - provide glucose to yeast - remove potassium hydroxide / remove gauze - coloured liquid put into tubing - scale / ruler - add oil on top of yeast / glucose mixture / use boiled glucose solution <u>'Use' Method:</u> - use apparatus to measure the carbon dioxide released - use range concentrations of fluoride / plus and minus fluoride - replication carried out - use of control - control species of yeast / mass of yeast / volume of mixture / temperature - allow yeast to acclimatise with the three-way tap open - wait for lag phase to finish before measuring rate of reaction <u>'Significant' - Analysis:</u> - use statistical analysis - t test - volume divided by time / distance divided by time - calculate volume from tube diameter - plot graph of respiration against fluoride concentration - use error bars / calculate standard deviation - calculate mean

Level	Marks	
0	0	No awardable content
1	1-3	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. The discussion will contain basic information with some attempt made to link knowledge and understanding to the given context. **Covers up to 3 ideas with no analysis** **Uses woodlice means Level 1 max**
2	4-6	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. The discussion shows some linkages and lines of scientific reasoning with some structure. **Covers from 4 to 6 ideas including at least 1 analysis** **Inappropriate method eg. yeast and photosynthesis / aerobic respiration / Benedict's / keeping KOH means Level 2 and maximum of 5 marks**
3	7-9	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. The discussion shows a well-developed and sustained line of scientific reasoning which is clear and logically structured. **Covers 7 or more ideas including at least 2 analysis** **Max 8 if no statistical analysis**

Question Number	Answer	Additional Guidance	Mark
6(a)	An answer that makes reference to the following: • correct reading for 2014 and 2015 (1) • correct percentage increase calculated (1)	<u>Example of calculation:</u> 150 and 1240 to 1245 1240 – 150 = 1090 (1090 ÷ 150) ×100 = 727 1245 – 150 = 1095 (1095 ÷ 150) ×100 = 730 **Accept** range 727 to 730 Correct answer with no working gains full marks	**(2)**

Question Number	Answer	Additional Guidance	Mark
6(b)(i)	An explanation that makes reference to the following: • because viruses are {not living / not cells / have no metabolism / have no protein synthesis organelles / lack a cell wall / lack peptidoglycan} (1) • antiviral drugs used because they inhibit replication (1)		**(2)**

Question Number	Answer	Additional Guidance	Mark
6(b)(ii)	An explanation that makes reference to four of the following: • identify mosquitoes that fluoresce (1) • because these mosquitoes are {genetically modified / contain the gene} (1) • allow {those that fluoresce / GM mosquitoes} to interbreed (1) • repeat for several generations (1) • offspring with the gene for fluorescence are selected to produce a population of GM mosquitoes (1)	**Do not accept** eggs	**(4)**

Question Number	Answer	Additional Guidance	Mark
6(b)(iii)	An explanation that makes reference to two of the following: • to prevent (people with Zika) being bitten (1) • therefore preventing {spread of Zika / biting uninfected people / increase in infected mosquitoes} (1) • mosquitoes spread other diseases (1)		**(2)**

Question Number	Answer	Additional Guidance	Mark
6(c)(i)	315		**(1)**

Question Number	Answer	Additional Guidance	Mark
6(c)(ii)	A description that makes reference to the following: • used in translation to make (viral) protein (1) • more RNA is produced (1)		**(2)**

Question Number	Answer	Additional Guidance	Mark
6(d)	An explanation that makes reference to the following: • {hydrolysis / breaking} of peptide bonds (1) • by protease (1)		**(2)**

Question Number	Answer	Additional Guidance	Mark
7(a)	An answer that makes reference to the following: • calculation of q^2 (1) • calculation of p and q (1) • calculation of 2pq (1) • calculation of percentage of carriers (1)	<u>Example of calculation:</u> $q^2 = 0.0004 / 4x10^{-4}$ q = 0.02 and p = 0.98 2pq = 0.0392 percentage of population who are carriers is 3.92% Correct answer with no working gains full marks	**(4)**

Question Number	Answer	Additional Guidance	Mark
7(b)	An answer that makes reference to the following: • (mother is) Cc and (father is) CC (1) • correct gametes from each parent (1) • correct genotypes of offspring are CC and Cc (1) • probability of child being a carrier is 50% / 0.5 / ½ / 1:1 (1)	Minus 1 if same letter not used or more than one letter to represent allele Sex inheritance loses mp1 and loses 1 mark for not using same letter	**(4)**

Question Number	Answer	Additional Guidance	Mark
7(c)(i)	An explanation that makes reference to the following: • 7.0% salt solution {lowers the water potential / is hypertonic / creates a concentration gradient / creates water potential gradient} (1) • therefore water moves in (to mucus) by osmosis (1)	**Accept** out (of cells)	**(2)**

Question Number	Answer	Additional Guidance	Mark
7(c)(ii)	An explanation that makes reference to the following: • use of 0.9% means {no concentration gradient / same concentration / isotonic } (1) • therefore water will not move / no osmosis (1)	**Do not accept** references to pure water	**(2)**

Question Number	Acceptable Answers	Additional Guidance	Mark
8(a)(i)	An explanation that makes reference to the following: • red is absorbed (1) • because of the presence of chlorophyll (1)		(2)

Question Number	Acceptable Answers	Additional Guidance	Mark
8(a)(ii)	An explanation that makes reference to the following: • {chlorophyll / leaf pigment} was present (1) • because some cells are damaged / discs not washed (1)		(2)

Question Number	Answer	Additional Guidance	Mark
8(a)(iii)	An explanation that makes reference to the following: • ethanol {disrupts / damages / dissolves / affects} the phospholipid (1) • therefore the membrane {becomes more permeable / allows pigment out} (1)		(2)

Question Number	Answer	Additional Guidance	Mark
8(b)	An answer that makes reference to the following: • starts at 0.05 absorbance value (1) • flat line along 0.05 absorbance value (1)		**(2)**

Question Number	Answer	Additional Guidance	Mark
8(c)	An answer that makes reference to five of the following: • use leaves of {same age / same position on plant} because this affects concentration of pigment (1) • obtain leaf discs from the same part of the leaf because this affects concentration of pigment (1) • use same {cork borer / size of leaf disc / diameter of leaf disc} because this affects concentration of pigment (1) • use same temperature because temperature affects the rate of diffusion (1) • use same volume of ethanol so chlorophyll is diluted the same (1) • replicate each ethanol concentration to {see if results are consistent / identify anomaly / to calculate standard deviation / allow statistical test} (1) • wash discs to remove pigment (1)		**(5)**

Question Number	Answer	Additional Guidance	Mark
9(a)	An explanation that makes reference to four of the following: • {seed viability / germination} high in metal containers (1) • glass containers have similar properties to metal containers (1) • because {metal / glass} containers keep {air / moisture} out (1) • therefore seed water content is kept below 8% (1) • can see through glass without removing lid (1)	**Accept** converse for paper / cellophane	**(4)**

Question Number	Answer	Additional Guidance	Mark
9(b)	• to produce valid (measure of seed viability / results / data)	**Accept** allows identification of anomalous result **Do not accept** if in list	**(1)**

Question Number	Answer	Additional Guidance	Mark
9(c)	• difference calculated • how many times better calculated with units	<u>Example of calculation:</u> 90 – 16 = 74 74 ÷ 2 = 37 % $year^{-1}$ or 74 ÷ 24 = 3.08 % $month^{-1}$ / 3.1 % $month^{-1}$ / 3 % $month^{-1}$	**(2)**

Question Number	Answer	Additional Guidance	Mark
9(d)(i)	An explanation that makes reference to the following: • {viability test / germination} requires similar conditions as the country (1) • because germination is affected by {temperature / pH / light intensity / wavelength / humidity / vernalisation} (1) • if correct conditions not used seeds would not germinate even if viable (1)	**Accept** other relevant abiotic factor	**(3)**

Question Number	Answer	Additional Guidance	Mark
9(d)(ii)	An explanation that makes reference to the following: • because flowering is affected by {day length / photoperiod / light and dark period} (1) • because flowering involves {phytochrome / P_R / P_{FR}} (1)	**Accept** florigen	**(2)**

Question Number	Answer	Additional Guidance	Mark
10(a)	An answer that makes reference to five of the following: • use range of at least five concentrations of (sucrose / salt) solution (1) • use equal {size / length / shape / surface area to volume} of pieces of carrot and potato (1) • control carrot and potato {age / part of tissue / temperature} (1) • pieces of carrot and potato submerged in the solutions for the same time (1) • carrot and potato pieces weighed before and after and dried (1) • plot graph of mass change against (salt / sucrose) concentration and use to compare where line cuts x-axis for carrot and potato (1)	**Accept** locate isotonic point	**(5)**

Question Number	Answer	Additional Guidance	Mark
10(b)	An explanation that makes reference to three of the following: • *Salicornia* has {higher salt concentration / lower water potential} than the mud (1) • because salt taken up by active transport (1) • therefore water is taken up by osmosis (1)		**(3)**