



GCE

Biology B (Advancing Biology)

Unit **H422/01**: Fundamentals of biology

Advanced GCE

Mark Scheme for June 2018

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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Annotations

Annotation	Meaning
DO NOT ALLOW	Answers which are not worthy of credit
IGNORE	Statements which are irrelevant
ALLOW	Answers that can be accepted
()	Words which are not essential to gain credit
—	Underlined words must be present in answer to score a mark
	Wavy underlined words must be present or similar-meaning words must be present in answer to score a mark.
ECF	Error carried forward
AW	Alternative wording
ORA	Or reverse argument

Marking Annotations

Annotation	Use
	Benefit of Doubt
	Contradiction
	Cross
	Error Carried Forward
	Given Mark
	Extendable horizontal wavy line (to indicate errors / incorrect science terminology)
	Ignore
	Large dot (various uses as defined in mark scheme)
	Highlight (various uses as defined in mark scheme)
	Benefit of the doubt not given
	Tick
	Omission Mark
	Blank Page
	Level 1 answer in Level of Response question
	Level 2 answer in Level of Response question
	Level 3 answer in Level of Response question

Question	Answer	Marks	Guidance
1	A	1	
2	A	1	
3	B	1	
4	C	1	
5	C	1	
6	C	1	
7	D	1	
8	B	1	
9	C	1	
10	D	1	
11	C	1	
12	A	1	
13	B	1	
14	A	1	
15	D	1	
16	C	1	
17	C	1	
18	B	1	
19	D	1	
20	B	1	
21	D	1	
22	C	1	
23	B	1	
24	B	1	
25	D	1	

Question	Answer	Marks	Guidance
26	B	1	
27	D	1	
28	C	1	
29	C	1	
30	C	1	
	Total	30	

Question			Answer	Mark	Guidance
31	(a)	(i)	does not have trisomy 21 ✓	1	AW e.g. 'no excess of chromosome 21' ALLOW <u>only</u> has two of chromosome 21
		(ii)	<p>A ✓ B ✓ C ✓ D ✓</p>	4	ALLOW incorrect proportions of translocated chromosome ALLOW diagrams that do not show centromeric regions DO NOT ALLOW drawings without shading ECF (from A) ECF (from B and C)
	(b)		(meiotic) non-disjunction ✓ any 2 from: failure of <u>homologous chromosomes</u> to separate during meiosis I/anaphase I ✓ failure of <u>sister chromatids</u> to separate during meiosis II/anaphase II ✓ gamete has extra copy of chromosome (21) ✓	max 3	ALLOW for one mark - failure of <u>homologous chromosomes or sister chromatids</u> to separate during meiosis
	(c)	(i)	CVS: placenta amniocentesis: amniotic fluid ✓	1	IGNORE chorionic villus Both required for 1 mark

Question			Answer	Mark	Guidance
		(ii)	1 from: (karyotype) cannot detect gene/allele (mutations) ✓ (karyotype) can only detect changes in chromosome size/shape ✓	1	AW e.g. abnormal base sequence
			Total	10	

Question		Answer	Mark	Guidance
32	(a)	thyroxine regulates metabolic rate / rate of metabolism reduced ✓	1	
	(b)	(i)	2	ALLOW thyrotrophin DO NOT ALLOW thyroxine stimulating hormone
		(ii)	max 3	ALLOW small fluctuations around a <u>set point/norm</u> AW e.g. ref to parameter too high or too low
	(c)	any 2 from: vasoconstriction / narrowing of blood vessels, to reduce heat loss from skin (surface) ✓ shivering / rapid muscle contraction, to generate heat (from respiration) ✓ erection of hairs (on skin) / piloerection, to trap air which insulates ✓	max 2	DO NOT ALLOW 'vasoconstriction of capillaries' DO NOT ALLOW 'prevents heat loss'
	(d)	any 2 from: (ear) closest to/shares blood supply with hypothalamus/ thermoregulatory centre ✓ reading closer to <u>core</u> temperature, skin temperature may be colder/warmer ✓	max 2	
			Total	10

Question		Answer	Mark	Guidance	
33	(a)	climax ✓ plagioclimax ✓ deflected ✓	3		
	(b)	improves soil quality / provides food / shelter, for future species ✓	1	ALLOW ref to production of humus	
	(c)	any 3 from: use of quadrats ✓ (belt) transect / systematic sampling ✓ record type and abundance of plant species ✓ use of key to identify plant species ✓	max 3	ALLOW regular intervals /example of an interval IGNORE stratified sampling	
	(d)	(i)	16% ✓✓	2	ALLOW 15.8% 15.78% = 1 mark max If answer incorrect, '(13 100/83 000) x 100' = 1 mark
		(ii)	snails do not lose energy through heat / snails are, ectotherms ✓	1	ORA 'cattle use more energy to maintain temperature/cows are endotherms' IGNORE ref to small size or slow movement of snails
	(e)*	<p>Summary of instructions to markers: <i>Read through the whole answer. (Be prepared to recognise and credit unexpected approaches where they show relevance.) Using a 'best-fit' approach based on the science content of the answer, first decide which of the level descriptors, Level 1, Level 2 or Level 3, best describes the overall quality of the answer. Then, award the higher or lower mark within the level, according to the Communication Statement (shown in italics):</i></p> <ul style="list-style-type: none"> ○ award the higher mark where the Communication Statement has been met. ○ award the lower mark where aspects of the Communication Statement have been missed. <p>• The science content determines the level. • The Communication Statement determines the mark within a level.</p>			

Question	Answer	Mark	Guidance
	<p>Level 3 (5 – 6 marks) A detailed explanation of digestion, production of fatty acids and protein degradation, with reference to named stomach structures and the role of microorganisms.</p> <p><i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p>Level 2 (3 – 4 marks) A good explanation of digestion, possibly without mention of fatty acids and proteins. Correct names and roles of stomach structures but the role of microorganisms may not be included.</p> <p><i>There is a line of reasoning presented with some structure. The information presented is in the most-part relevant and supported by some evidence.</i></p> <p>Level 1 (1 – 2 marks) Limited explanation of digestion OR correct naming of stomach structures OR reference to microorganisms.</p> <p><i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i></p> <p>0 marks No response or no response worthy of credit.</p>	<p>6</p> <p>2.1 2.5</p>	<p>Indicative scientific points may include:</p> <ul style="list-style-type: none"> • digestion of, cellulose / plant material / polysaccharides • by microorganisms / bacteria in, rumen / reticulum • lack of cellulase enzyme in ruminants • production of mono- and disaccharides • conversion of saccharides (sugars) into fatty acids (by other microorganisms / bacteria) • ref to importance of fatty acids as, respiratory substrates / lipid components • secretion of, hydrochloric acid / protease enzymes, in abomasum • digestion of bacterial proteins into amino acids • ref to essential amino acids • microorganisms in rumen are anaerobic / rumen is anaerobic environment
	Total	15	

Question		Answer	Mark	Guidance									
34	(a)	<table border="1"> <tr> <td>Dehydrogenation</td> <td>Krebs cycle</td> <td>mitochondrial matrix</td> </tr> <tr> <td>Oxidative decarboxylation</td> <td>link reaction OR Krebs / TCA / citric acid cycle</td> <td>mitochondrial matrix</td> </tr> <tr> <td>Substrate level phosphorylation</td> <td>glycolysis OR Krebs / TCA / citric acid cycle</td> <td>cytoplasm OR mitochondrial matrix</td> </tr> </table>	Dehydrogenation	Krebs cycle	mitochondrial matrix	Oxidative decarboxylation	link reaction OR Krebs / TCA / citric acid cycle	mitochondrial matrix	Substrate level phosphorylation	glycolysis OR Krebs / TCA / citric acid cycle	cytoplasm OR mitochondrial matrix	2	1 mark per correct row (pathway and location)
		Dehydrogenation	Krebs cycle	mitochondrial matrix									
		Oxidative decarboxylation	link reaction OR Krebs / TCA / citric acid cycle	mitochondrial matrix									
		Substrate level phosphorylation	glycolysis OR Krebs / TCA / citric acid cycle	cytoplasm OR mitochondrial matrix									
✓✓													
(b) (i)	$C_{16}H_{32}O_2 + 23 O_2 \rightarrow 16 CO_2 + 16 H_2O$ ✓	1	ALLOW multiples of the correct balanced numbers. For example, $2 C_{16}H_{32}O_2 + 46 O_2 \rightarrow 32 CO_2 + 32 H_2O$										
(ii)	0.70 ✓✓	2	16/23 = 1 mark 0.7 = 1 mark ALLOW ECF from (b)(i)										
	(iii)	conversion of carbohydrates to lipids ✓	1										
	(c)	<p>Summary of instructions to markers: <i>Read through the whole answer. (Be prepared to recognise and credit unexpected approaches where they show relevance.) Using a 'best-fit' approach based on the science content of the answer, first decide which of the level descriptors, Level 1, Level 2 or Level 3, best describes the overall quality of the answer.</i> <i>Then, award the higher or lower mark within the level, according to the Communication Statement (shown in italics):</i></p> <ul style="list-style-type: none"> ○ award the higher mark where the Communication Statement has been met. ○ award the lower mark where aspects of the Communication Statement have been missed. <p>• The science content determines the level. • The Communication Statement determines the mark within a level.</p>											

Question	Answer	Mark	Guidance
	<p>Level 3 (5 – 6 marks) A detailed discussion that includes the measurement of volume changes with and without sodium/potassium hydroxide and an appreciation that these measurements are used together to calculate RQ. There are descriptions of multiple controlled variables.</p> <p><i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p>Level 2 (3 – 4 marks) A good discussion that includes the measurement of volume changes with sodium/potassium hydroxide. There is at least one description of a controlled variable.</p> <p><i>There is a line of reasoning presented with some structure. The information presented is in the most-part relevant and supported by some evidence.</i></p> <p>Level 1 (1 – 2 marks) A limited discussion that includes the measurement of volume changes with sodium/potassium hydroxide only OR at least one description of a controlled variable.</p> <p><i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i></p> <p>0 marks No response or no response worthy of credit.</p>	6	<p>Indicative scientific points may include:</p> <p>use of respirometer</p> <ul style="list-style-type: none"> • time to equilibrate apparatus • control, e.g. glass beads / dried peas • sodium hydroxide (NaOH) / potassium hydroxide (KOH) / soda lime • change in volume due to O₂ consumed • repeat in absence of, sodium hydroxide (NaOH) / potassium hydroxide (KOH) / soda lime / water instead • change in volume due to CO₂ produced minus O₂ consumed • ref to calculation of RQ using changes in volume with AND without, sodium hydroxide (NaOH) / potassium hydroxide (KOH) / soda lime • $RQ = (\text{with NaOH} + \text{without NaOH}) \div \text{with NaOH}$ • ref to repeats <p>controlled variables</p> <ul style="list-style-type: none"> • volume / mass, of, glass beads / dried peas • volume of, sodium hydroxide / water • temperature
	Total	13	

Question		Answer	Mark	Guidance
				DO NOT ALLOW greater range
	(iv)	any 2 from: error bars overlap ✓ no evidence of permanent drug effect / 3 months not long enough ✓ group size too small / need more participants ✓ disease severity may be different among patients / example of other variables to control ✓ idea that uncertainty as to whether reduction (in HbA _{1c}) in treatment group is great enough ✓	max 2	AW
		Total	10	

Question		Answer	Mark	Guidance
36	(a)	bond between any H and any O on separate molecules ✓ labelled hydrogen bond / H bond ✓ (delta/δ) + charges on H atoms AND (delta/δ) – charges on O atoms ✓	3	ALLOW charges on a single water molecule
	(b)	(i)	α-1,4-glycosidic ✓	DO NOT ALLOW 1,4-glycosidic
		(ii)	reagent: (potassium) iodide / KI colour: blue-black / blue ✓	DO NOT ALLOW 'iodine' unless specific 'in potassium iodide'
		(iii)	1.7 ✓✓	1.73 = 1 mark
		(iv)	disc soaked in pure amylase ✓ to show amylase is responsible for colour change ✓ OR disc soaked in water only ✓ to show colour change is, due to amylase / not due to moisture of the disc ✓	
		(v)	measure the concentration of bacteria in the cultures before soaking the discs ✓ extract the amylase before testing ✓	max 1
			Total	10

Question		Answer	Mark	Guidance									
37	(a)	<table border="1"> <thead> <tr> <th>Cell type</th> <th>Name</th> <th>Role</th> </tr> </thead> <tbody> <tr> <td>R</td> <td><u>squamous</u> epithelial (cell) ✓</td> <td>surface for gas exchange ✓ secretion of (pulmonary) surfactant ✓</td> </tr> <tr> <td>S</td> <td><u>smooth</u> muscle (cell) ✓</td> <td>control of airflow / constriction / dilation, of lumen (of bronchiole) ✓</td> </tr> </tbody> </table>	Cell type	Name	Role	R	<u>squamous</u> epithelial (cell) ✓	surface for gas exchange ✓ secretion of (pulmonary) surfactant ✓	S	<u>smooth</u> muscle (cell) ✓	control of airflow / constriction / dilation, of lumen (of bronchiole) ✓	4	<p>ALLOW septal cells</p> <p>DO NOT ALLOW contraction of bronchiole</p>
Cell type	Name	Role											
R	<u>squamous</u> epithelial (cell) ✓	surface for gas exchange ✓ secretion of (pulmonary) surfactant ✓											
S	<u>smooth</u> muscle (cell) ✓	control of airflow / constriction / dilation, of lumen (of bronchiole) ✓											
	(b)	(i)	<p>delays onset of, symptoms / disability ✓</p> <p>comparison of data to illustrate mp1 ✓</p> <p>giving up at 65 years does not improve quality of life (already severe disability) ✓</p> <p>cannot prove any influence on smoking-related death since cause of death not recorded ✓</p>	3	<p>ALLOW the earlier the age when giving up, the better the quality of life</p> <p>ALLOW those already disabled do not recover</p>								
		(ii)	<p>any 2 from:</p> <p>person may not begin smoking at age 25 ✓</p> <p>number of cigarettes per day not recorded ✓</p> <p>graph does not exceed age 75 ✓</p> <p>other respiratory conditions / named example e.g. asthma or COPD, affect FEV₁, not accounted for ✓</p> <p>smokers may, lie / forget to report symptoms ✓</p> <p>data based on mean values ✓</p>	max 2	<p>ACCEPT any reference to variation in individuals.</p>								
	(c)		<p>any 3 from:</p> <p>tilt head back (to open airway) ✓</p> <p>check airway for / remove, obstructions ✓</p> <p>pinch nose and seal mouth ✓</p> <p>blow (gently) into mouth until chest rises ✓</p>	max 3									

Question			Answer	Mark	Guidance
			wait for chest to fall and then repeat ✓ check pulse after two breaths ✓ repeat if pulse present / if not present, perform cardiopulmonary resuscitation / CPR ✓		
			Total	12	

