OCR
Oxford Cambridge and RSA

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.

Annotations

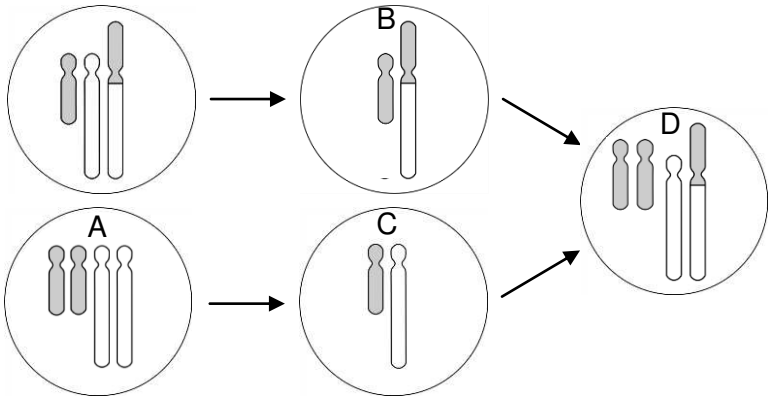
Annotation	Meaning
DO NOT ALLOW	Answers which are not worthy of credit
IGNORE	Statements which are irrelevant
ALLOW	Answers that can be accepted
( )	Words which are not essential to gain credit
___	Underlined words must be present in answer to score a mark
~~	Wavy underlined words must be present or 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
BOD	Benefit of Doubt
CON	Contradiction
	Cross
ECF	Error Carried Forward
GM	Given Mark
	Extendable horizontal wavy line (to indicate errors / incorrect science terminology)
I	Ignore
	Large dot (various uses as defined in mark scheme)
	Highlight (various uses as defined in mark scheme)
NBOD	Benefit of the doubt not given
	Tick
^	Omission Mark
BP	Blank Page
L1	Level 1 answer in Level of Response question
L2	Level 2 answer in Level of Response question
L3	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** only has two of chromosome 21
		(ii)	 A ✓ B ✓ C ✓ D ✓	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 homologous chromosomes to separate during meiosis I/anaphase I ✓ failure of sister chromatids to separate during meiosis II/anaphase II ✓ gamete has extra copy of chromosome (21) ✓	max 3	**ALLOW** for one mark - failure of homologous chromosomes or sister chromatids 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)	**X**: thyrotropin-releasing hormone / TRH ✓ **Y**: thyrotropin / thyroid-stimulating hormone / TSH ✓	2	**ALLOW** thyrotrophin **DO NOT ALLOW** thyroxine stimulating hormone
		(ii)	**any 3 from:** maintain a system around a set point/norm✓ receptors detect change (from set point) ✓ effector(s) produce change/response ✓ to return system to set point/norm ✓	max 3	**ALLOW** small fluctuations around a set point/norm **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 core 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)*		***Summary of instructions to markers:*** *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):* ○ *award the higher mark where the Communication Statement has been met.* ○ *award the lower mark where aspects of the Communication Statement have been missed.* • ***The science content determines the level.*** • ***The Communication Statement determines the mark within a level.***		

Question			Answer	Mark	Guidance	
			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. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **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. *There is a line of reasoning presented with some structure. The information presented is in the most-part relevant and supported by some evidence.* **Level 1 (1 – 2 marks)** Limited explanation of digestion OR correct naming of stomach structures OR reference to microorganisms. *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.* 0 marks No response or no response worthy of credit.	**6**	2.1 2.5	**Indicative scientific points may include:** • 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**		

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>34</td><td>(a)</td><td></td><td>
<table>
<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>
✓✓
</td><td>2</td><td>1 mark per correct row (pathway and location)</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>$C_{16}H_{32}O_2$ + 23 O_2 → 16 CO_2 + 16 H_2O ✓</td><td>1</td><td>ALLOW multiples of the correct balanced numbers.
For example, 2 $C_{16}H_{32}O_2$ + 46 O_2 → 32 CO_2 + 32 H_2O</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>0.70 ✓✓</td><td>2</td><td>16/23 = 1 mark
0.7 = 1 mark
ALLOW ECF from (b)(i)</td></tr>
<tr><td></td><td></td><td>(iii)</td><td>conversion of carbohydrates to lipids ✓</td><td>1</td><td></td></tr>
<tr><td></td><td>(c)</td><td></td><td colspan="3">Summary of instructions to markers:
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):
○ award the higher mark where the Communication Statement has been met.
○ award the lower mark where aspects of the Communication Statement have been missed.
• The science content determines the level.
• The Communication Statement determines the mark within a level.</td></tr>
</table>

Question			Answer	Mark	Guidance
			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. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **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. *There is a line of reasoning presented with some structure. The information presented is in the most-part relevant and supported by some evidence.* **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. *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.* 0 marks No response or no response worthy of credit.	**6**	**Indicative scientific points may include:** **use of respirometer** • time to equilibrate apparatus • control, e.g. glass beads / dried peas • sodium hydroxide (NaOH) / potassium hydroxide (KOH) / soda lime • change in volume due to O_2 consumed • repeat in absence of, sodium hydroxide (NaOH) / potassium hydroxide (KOH) / soda lime / water instead • change in volume due to CO_2 produced minus O_2 consumed • ref to calculation of RQ using changes in volume with AND without, sodium hydroxide (NaOH) / potassium hydroxide (KOH) / soda lime • RQ = (with NaOH + without NaOH) ÷ with NaOH • ref to repeats **controlled variables** • volume / mass, of, glass beads / dried peas • volume of, sodium hydroxide / water • temperature
			Total	**13**	

Question			Answer	Mark	Guidance
35	(a)	(i)	long duration **AND** gradual development / worsening, of symptoms over time ✓	1	**ALLOW** slow onset
		(ii)	**any 1 from**: drug theophylline medical use (treat) COPD / asthma ✓ drug topotecan medical use (treat) (lung) cancer ✓ drug paclitaxel medical use (treat) cancer ✓ drug aspirin medical use reduce/relieve, fever / inflammation / pain / anti-thrombotic ✓ drug quinine medical use (treat) malaria ✓	max 1	correct drug **and** correct medical use = 1 mark **ALLOW** other correct examples of drugs and medical uses e.g. morphine/opiates pain relief
	(b)	(i)	2 / two ✓	1	**ALLOW** II
		(ii)	drug with, same / similar, appearance to real drug but with no effect ✓ to compare with treatment group /to see effect of treatment ✓	2	**IGNORE** references to psychological effect
		(iii)	**any 3 from**: mean decrease in drug group and mean increase in placebo ✓ mean change (in HbA_{1C}) greater with drug than placebo ✓ 0.65% difference in means ✓ more variable changes (in HbA_{1C}) in treatment group ✓	max 3	needs to be comparative statement

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 ✓	1	**DO NOT ALLOW** 1,4-glycosidic
		(ii)	reagent: (potassium) iodide / KI colour: blue-black / blue ✓	1	**DO NOT ALLOW** 'iodine' unless specific 'in potassium iodide'
		(iii)	1.7 ✓✓	2	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 ✓	2	
		(v)	measure the concentration of bacteria in the cultures before soaking the discs ✓ extract the amylase before testing ✓	max 1	
			Total	10	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>37</td><td>(a)</td><td></td><td>
<table>
<tr><th>Cell type</th><th>Name</th><th>Role</th></tr>
<tr><td>R</td><td>squamous epithelial (cell) ✓</td><td>surface for gas exchange ✓
secretion of (pulmonary) surfactant ✓</td></tr>
<tr><td>S</td><td>smooth muscle (cell) ✓</td><td>control of airflow / constriction / dilation, of lumen (of bronchiole) ✓</td></tr>
</table>
</td><td>4</td><td>ALLOW septal cells

DO NOT ALLOW contraction of bronchiole</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>delays onset of, symptoms / disability ✓

comparison of data to illustrate mp1✓
giving up at 65 years does not improve quality of life (already severe disability) ✓
cannot prove any influence on smoking-related death since cause of death not recorded ✓</td><td>3</td><td>ALLOW the earlier the age when giving up, the better the quality of life

ALLOW those already disabled do not recover</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>any 2 from:
person may not begin smoking at age 25 ✓
number of cigarettes per day not recorded ✓
graph does not exceed age 75 ✓
other respiratory conditions / named example e.g. asthma or COPD, affect FEV_1 , not accounted for ✓
smokers may, lie / forget to report symptoms ✓

data based on mean values ✓</td><td>max 2</td><td>ACCEPT any reference to variation in individuals.</td></tr>
<tr><td></td><td>(c)</td><td></td><td>any 3 from:
tilt head back (to open airway) ✓
check airway for / remove, obstructions ✓
pinch nose and seal mouth ✓
blow (gently) into mouth until chest rises ✓</td><td>max 3</td><td></td></tr>
</table>

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**	

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