OCR
Oxford Cambridge and RSA

GCE

Biology B

H422/01: Fundamentals of biology

Advanced GCE

Mark Scheme for November 2020

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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
ECF	Error carried forward
AW	Alternative wording
ORA	Or reverse argument

Subject-specific Marking Instructions

INTRODUCTION

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

You should ensure that you have copies of these materials.

You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

SECTION A

Question	Answer	Marks	AO element	Guidance
1	A	**1**	1.1	
2	D	**1**	1.1	
3	A	**1**	1.1	
4	A	**1**	2.5	
5	A	**1**	1.2	
6	A	**1**	2.1	
7	A	**1**	2.5	
8	C	**1**	1.1	
9	D	**1**	2.1	
10	B	**1**	2.1	
11	D	**1**	2.4	
12	C	**1**	1.1	
13	B	**1**	2.5	
14	C	**1**	2.4	
15	A	**1**	2.4	
16	A	**1**	2.6	
17	B	**1**	1.1	
18	C	**1**	2.4	
19	C	**1**	1.2	
20	B	**1**	1.2	
21	A	**1**	1.2	
22	A	**1**	1.1	
23	A	**1**	1.1	
24	A	**1**	1.1	

25	D	**1**	2.4	
26	D	**1**	1.2	
27	C	**1**	1.1	
28	A	**1**	1.2	
29	B	**1**	1.1	
30	B	**1**	2.5	
	Total	**30**		

SECTION B

Question			Answer	Marks	AO element	Guidance
31	(a)	(i)	oviduct / fallopian tube / uterine tube ✓	1	1.1	
		(i)	C F A E D B ✓✓	2	1.2	all correct = 2 marks any 2 correct = 1 mark
	(b)	(i)	**any 2 from**: complementary to antigen ✓ light and heavy chains ✓ variable region ✓	max 2	1.1	
		(ii)	*region **A**:* bind, hCG / human chorionic gonadotropin ✓ *region **B**:* bind / capture, (hCG)-bound antibodies ✓ *region **C**:* bind / capture, unbound / excess antibodies ✓	3	2.7 1.2	
	(c)		***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	Marks	AO element	Guidance
			Level 3 (5–6 marks) Provides a comprehensive description of data trends including both FSH and oestrogen **and** provides correct explanations for lowering of oestrogen **and** elevation of FSH. *There is a well-developed line of reasoning which is clear and logically structured. All the information presented is relevant and substantiated.* **Level 2 (3–4 marks)** Provides a good description of data trends including both FSH and oestrogen **and** provides some explanation for lowering of oestrogen **and/or** elevation of FSH. *There is a line of reasoning presented with some structure. The information presented is mostly relevant and supported by some evidence.* **Level 1 (1–2 marks)** Provides a basic description of data trends including FSH **and/or** oestrogen but an explanation for these trends may not be given. *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**	3.2 2.6	**Indicative scientific points may include** *Description of data trends*: • decrease in oestrogen • increase in FSH • FSH increases before oestrogen decreases • ref to reaching plateau • ref to threshold reached for menopause • ref to specific data points *Explanations for lower oestrogen*: • less oocytes available / less primordial follicles remain • follicles / oocytes, less likely to develop • less oestrogen secreted, by oocytes / follicles *Explanations for higher FSH*: • follicles less sensitive to FSH • inhibition by oestrogen lost as oestrogen declines / negative feedback • as inhibition lost, FSH levels rise
			Total	**14**		

Question	Answer	Marks	AO element	Guidance

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>32</td><td>(a)</td><td></td><td>advantage (any 1 from):
short(er) generation time / reproduce quickly ✓
small size so ideal for laboratory ✓

disadvantage (any 1 from):
difficult to handle / require killing or anaesthesia ✓
requirement for temperature control ✓</td><td>max 2</td><td>2.3</td><td>ALLOW genome closer to human
ALLOW well characterised morphology / more complex appearance (so more traits can be studied)

ALLOW ref to ethics</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>RrYy ✓</td><td>1</td><td>2.1</td><td>DO NOT CREDIT ambiguously written letters</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>= 1.69 ✓✓✓✓</td><td>4</td><td>2.2</td><td>ALLOW
E correct = 1 mark
O-E & $(O-E)^2$ correct = 1 mark
$(O-E)^2/E$ correct = 1 mark
Σ correct = 1 mark

ALLOW ecf
<table><tr><th>Expected (E)</th><th>O – E</th><th>$(O-E)^2$</th><th>$(O-E)^2$ / E</th></tr><tr><td>180</td><td>-5</td><td>25</td><td>0.139</td></tr><tr><td>60</td><td>-3</td><td>9</td><td>0.15</td></tr><tr><td>60</td><td>3</td><td>9</td><td>0.15</td></tr><tr><td>20</td><td>5</td><td>25</td><td>1.25</td></tr></table></td></tr>
<tr><td></td><td></td><td>(iii)</td><td>no significant deviation from expected results / deviation from expected results due to chance ✓
null hypothesis accepted ✓</td><td>2</td><td>2.2</td><td>ALLOW ecf from Q32bii</td></tr>
</table>

Question			Answer	Marks	AO element	Guidance
	(c)		gene mutation ✓ (autosomal) dominant ✓ insertion (mutation) / (tri)nucleotide / CAG, repeat / stutter ✓ in, huntingtin gene ✓	max 2	2.1	
			Total	**11**		

Question			Answer	Marks	AO element	Guidance
33	(a)	(i)	Benedict's, reagent / test / solution ✓ **any 1 from**: ref to heating reagent ✓ (positive result is) blue / green, to, yellow / orange / brown / brick red ✓ reduction of copper (II) / Cu2+ to copper (I) / Cu^{+} ✓	**max 2**	1.2	**ALLOW** Clinistrip / clinistix **ALLOW** (clinistrip) colour change compared to chart
		(ii)	correct structure in alpha or beta form ✓✓	**2**	1.1	ring structure with one oxygen atom between carbon 1 and carbon 5 = 1 mark
	(b)	(i)	*main area*: (renal) cortex ✓ *precise region*: <u>proximal</u> convoluted tubule ✓	**2**	2.1	
	(c)		no glucose reabsorption at any blood glucose concentration in patients with type 0 FRG ✓ no more glucose reabsorption at blood glucose concentrations greater than 10 mmol dm^{-3} in type A patients ✓ glucose reabsorption in type B patients similar to healthy state ✓	**3**	3.2	
	(d)	(i)	diffusion of water (from blood into filtrate), by osmosis / down water potential gradient ✓	**1**	2.5	**ALLOW** water potential of filtrate is very low so water remains in the filtrate

		(ii)	**any 3 from**: (osmoreceptors in) <u>hypothalamus</u> detect water potential (Ψ) of blood ✓ If low : ADH / antidiuretic hormone / vasopressin, released from <u>pituitary</u> (gland) ✓ insertion of aquaporins into collecting duct cells ✓ more water reabsorbed from collecting duct (by osmosis) ✓ solute concentration of urine increases ✓ water potential of blood increases ✓	**max 3**	1.2	**ORA** for any m.p.
			Total	**13**		

Question			Answer	Marks	AO element	Guidance
34	(a)		*structure **X***: outer membrane **AND** *structure **Y***: inner membrane / crista ✓ *explanation* (**any 2 from**): Y / inner membrane, large surface area for, (respiratory) enzymes / oxidative phosphorylation ✓ double membrane allows accumulation of, H^+ (ions) / protons ✓ generation of, H^+ (ion) / proton / pH, gradient ✓	**max 3**	1.1 2.3	**ALLOW** cristae
	(b)	**(i)**	passage / diffusion, of hydrogen ions / protons, across the inner mitochondrial membrane / via ATP synthase ✓	**1**	1.1	**ALLOW** passage / diffusion, of ions down concentration gradient through a partially-permeable membrane
		(ii)	*Dish B absence of oxygen*. oxygen is (final) electron acceptor ✓ (without oxygen) water cannot be formed ✓ *Dish C low concentration of acid (H^+)*. H^+ / protons, not pumped across inner membrane (through enzyme complexes) ✓ H^+ / proton, gradient not generated (across inner membrane) ✓ ATP synthase not able to generate ATP (through oxidative phosphorylation) ✓	**max 4**	1.2 3.2	**ALLOW** No oxygen therefore there is no final electron acceptor

Question			Answer	Marks	AO element	Guidance
	(c)		temperature ✓ affects enzyme activity / high temperature may denature ✓ OR same source of cells ✓ different cells have different respiration rates ✓	max 2	3.4	
	(d)	(i)	colorimetry / colorimeter ✓	1	2.3	**ALLOW** use spectrophotometer / spectrophotometry
		(ii)	**Any 1 from**: any mass e.g. gram / dm^{-3} / mg / µg **OR** any moles or molecules per volume, e.g. nmol cm^{-3} / mmol cm^{-3} / molecules cm^{-3} ✓	1	2.4	**ALLOW** cm^{-3}, dm^{-3} **ALLOW** e.g. g / cm^3
			Total	12		

Question			Answer	Marks	AO element	Guidance
35	(a)		required movement of substances not met by diffusion alone ✓	1	1.1	
	(b)	(i)	sucrose ✓	1	1.1	
		(ii)	hydrostatic pressure ✓ created by, movement of water into the phloem / ✓	2	2.5	
		(iii)	does not produce sucrose and does not store or consume sucrose (from phloem) ✓	1	2.1	**ALLOW** (stem is) responsible for transporting sugars between source and sink **ALLOW** sugars / glucose instead of sucrose
		(iv)	***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***			

			Level 3 (5–6 marks) Provides a comprehensive description of apparatus setup and the method used to measure translocation rate. Methods for **analysis** of data should be described and ways to ensure **validity** should be discussed. *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)** Provides a comprehensive description of apparatus setup and the method used to measure translocation rate. Methods for **analysis** of data **or** ways to ensure **validity** should be discussed. *There is a line of reasoning presented with some structure. The information presented is mostly relevant and supported by some evidence.* **Level 1 (1–2 marks)** Provides a limited description of apparatus setup, which may not include the method used to measure translocation rate. Methods for **analysis** of data and ways to ensure **validity** will not be discussed. *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**	3.3 3.4	**Indicative scientific points may include** *Measurement:* • numbers of drops • volume of sap in drops • over a period of time • repetitions *Apparatus:* • plant with stem (positioned horizontally) • description of use of glass tubes *Variables:* • temperature • suitable range of temperatures / or example • importance of controlled variables e.g same height between tubes, same light intensity, same plant species, same plant height. *Data analysis:* • named statistical test in correct context, e.g. Student's *t*-test or Spearman's rank correlation coefficient • calculation of, averages / means • details of graph plotting
			Total	**11**		

Question	Answer	Marks	AO element	Guidance

36	**(a)**	**(i)**	**P**: prophase **Q**: telophase **R**: anaphase **S**: metaphase ✓✓	**2**	2.5	all correct = 2 marks any 2 correct = 1 mark
		(ii)	(lay down of) cell plate ✓	**1**	1.1	**ALLOW** cell wall formed
	(b)	**(i)**	(72/254)*100 ✓ 28.3% ✓	**2**	2.4	28.35% or 28% = 1 mark
		(ii)	**any 2 from**: crossing over (of homologous chromosomes / chromatids) in <u>prophase 1</u> ✓ independent / random, assortment/segregation of chromosomes in <u>metaphase I/anaphase I</u> ✓ independent / random, assortment/segregation of chromatids in <u>metaphase II/anaphase II</u> ✓	**max 2**	1.2	**DO NOT ALLOW** sister chromatids
	(c)		cell / cytoplasm, shrinkage ✓ nuclear, condensation / fragmentation ✓ phosphatidylserine on <u>outer</u> leaflet / surface, of, <u>cell surface / plasma</u> membrane ✓ <u>cell surface / plasma</u> membrane forms blebs ✓	**max 3**	2.1	**ALLOW** translocation of phosphatidylserine
			Total	**10**		

Question	Answer	Marks	AO element	Guidance

37	**(a)**		**any 1 from**: scientific, journals / papers / reports ✓ scientific, conferences / meetings ✓	**max 1**	1.1	**ALLOW** peer review
	(b)		honesty / trust, required for communication between mother and offspring in mother tongue theory ✓ in mother tongue theory, trust not required on population level ✓ gossip and grooming theory does not require trust (to accept new sounds) ✓	**3**	3.1	
	(c)		**any 2 from**: hand gestures could help clarify meaning of new words / sounds ✓ verbal communication required to explain how to carry out activities with hands ✓ such as, tool making / use of tools / hunting / other examples ✓ bipedalism led to complex manual activities that required language to share ✓ eye contact/facial expression help clarify meaning ✓	**max 2**	2.1	verbal communication to explain how to use of tools = 2 marks
	(d)		(genetic) variation ✓ pressure ✓ natural selection ✓	**3**	1.2	**ALLOW** diversity
			Total	**9**		

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