OCR
Oxford Cambridge and RSA

GCE

Biology A

Unit **H020/01:** Breadth in biology

Advanced Subsidiary GCE

Mark Scheme for June 2017

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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.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

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Annotations

Annotation	Meaning
DO NOT ACCEPT	Answers which are not worthy of credit
IGNORE I	Statements which are irrelevant
ALLOW or **ACCEPT**	Answers that can be accepted
( )	Words which are not essential to gain credit
__	Underlined words must be present in answer to score a mark
AW	Alternative wording
ORA	Or reverse argument
✓	Mark is awarded
X	Answer incorrect
^	Omission mark
BOD	Benefit of doubt
BP	Blank page
CON	Statement that contradicts a correct statement
●	Use to indicate when part of a mark point has been achieved
ECF	Error carried forward
GM	Mark has already been awarded (given mark)
	Horizontal wavy line to indicate incorrect statements
NBOD	Not giving the benefit of doubt

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.

Question			Answer	Marks	Guidance
			Mark the letter that is in the box. Credit a letter that is clearly the intended answer if the letter in the box is crossed out. Do not credit ambiguous letters, unless the correction is clearly thicker than the original. If there is no letter in the box, credit a very clear indication of the correct answer.		
1			C ✓	1	
2			A ✓	1	
3			D ✓	1	
4			B ✓	1	
5			C ✓	1	
6			A ✓	1	
7			D ✓	1	
8			C ✓	1	
9			C ✓	1	
10			B ✓	1	
11			C ✓	1	
12			A ✓	1	ACCEPT B
13			C ✓	1	
14			A ✓	1	
15			B ✓	1	
16			C ✓	1	
17			A ✓	1	
18			D ✓	1	ACCEPT A
19			C ✓	1	
20			B ✓	1	
			Total	20	

Question			Answer	Marks	Guidance
21	(a)	(i)	***Only credit answers referring to root tips not the root in general*** site of **,** cell division / cell replication / growth ✓ is meristem(atic tissue) ✓ no **,** chlorophyll / chloroplasts **,** present ✓	**2 max**	**ACCEPT** area where many cells are undergoing mitosis **ACCEPT** site of cell reproduction **DO NOT ACCEPT** cell growth **DO NOT ACCEPT** cell repair
21	(a)	(ii)	acetic orcein / methylene blue / toluidine blue ✓	**1**	***Mark the first answer only. If additional incorrect answer given, then 0 marks*** **ACCEPT** phonetic spelling as long as it is not ambiguous **ACCEPT** Nile blue / Acridine orange / Ethidium bromide / Methyl green / Safranine / Leishman's / Crystal violet / Eosin blue / Sybr green / Gram stain / (Eosin and) haematoxylin **DO NOT ACCEPT** stains that are not **,** nucleus / DNA specific **e.g.** Methyl blue / Methyl orange / Congo red / Iodine / Iodine solution / ink / Evans blue / Sudan red

Question			Answer	Marks	Guidance
21	(b)		11.91 µm ✓✓	2	***Correct answer = 2 marks (indicated by 2 ticks) even if no working shown*** **ACCEPT** 11.06 to 12.77 µm **ACCEPT** 1.106×10^{-5} m to 1.277×10^{-5} m [sig figs retained for standard form] ***Otherwise,* Award ONE mark for:** correct final answer without (correct) unit **OR** correct final answer to wrong number of dp or incorrectly rounded **OR** seeing (one graticule division =) 20 ÷ 2.35 = 8.51 **OR** seeing (measurement of nucleus =) 1.3 to 1.5 (graticule / eye piece) units / divisions **or** 1.3 to 1.5 cm **or** 13 to 15 (graticule / eye piece) units / division **or** 13 to 15 mm **OR** diameter = 110.63 to 127.65 µm

Question			Answer	Marks	Guidance
22	(a)		*glycogen is* **1** insoluble **,** so has no effect on **,** water potential / Ψ (of cell) ✓ **2** <u>metabol</u>ically inactive ✓ **3** compact / lots can be stored in a small space ✓ **4** able to store **,** large amounts / lots **,** of <u>energy</u> ✓ **5** (highly branched so) has lots of ends for **,** adding / removing **,** <u>glucose</u> (when needed) **or** can be broken down **,** fast / quickly / rapidly **,** to release <u>glucose</u> ✓	**3**	**ACCEPT** ORA for glucose for **mps 1, 2 3 & 4 only** **1 ACCEPT** insoluble so has no osmotic effect (on cell) **5 IGNORE** ref to surface area **Note:** 'compact so can store large amounts of energy' = 2 marks (mps 3 & 4)

Question			Answer	Marks	Guidance
22	(b)			3 max	***NOTE*** *answers must be the in context of* ***protein*** *transport.* *Penalise once if a different material (e.g. gene) is transported* to max 2
			1 <u>transport</u> vesicle from RER ✓		
			2 modification / processing / folding ✓		**2** **ACCEPT** example of modification e.g. converted into a glycoprotein **ACCEPT** in context of RER or Golgi
			3 in / at **,** Golgi (body / apparatus) ✓		**3** **IGNORE** SER / smooth endoplasmic reticulum
			4 (packaged into) <u>secretory</u> vesicle ✓		
			5 vesicles move along the cytoskeleton ✓		**5** **ACCEPT** use of motor proteins / chaperones / microtubules
			6 (vesicle) fuses with **,** cell <u>surface</u> / plasma **,** membrane ✓		**6** **ACCEPT** merges with **DO NOT ACCEPT** binds / attaches / dissolves
			7 (secretion occurs by) <u>exocytosis</u> ✓		**7** **DO NOT ACCEPT** exocytosis in context of excretion (rather than secretion) **DO NOT ACCEPT** vesicle being released by exocytosis

Question			Answer	Marks	Guidance
23	(a)		**1** phospholipid bilayer ✓ **2** hydrophilic / phosphate (containing) **,** heads facing **,** outwards / towards external environment **AND** hydrophobic / fatty acid **,** tails facing **,** inwards / away from external environment ✓ **3** proteins / phospholipids **,** free to move (in membrane) ✓ **4** proteins **,** scattered / randomly arranged / spread throughout / here and there (between the phospholipids) ✓	**2 max**	**ACCEPT** mark points 1 and 2 from a clearly labelled diagram **3 ACCEPT** membrane components / molecules **,** free to move **IGNORE** fluid **4 NOTE** 'embedded proteins' is not enough without the random arrangement indicated **IGNORE** mosaic
23	(b)	(i)	(progesterone is) hydrophobic / fat soluble / lipid (molecule) ✓ (so) dissolves in / diffuses through / is not repelled by **,** the <u>phospholipid</u> (bilayer) / <u>hydrophobic</u> tails / <u>fatty</u> <u>acid</u> tails ✓	**2**	**ACCEPT** non-polar / uncharged **IGNORE** small **IGNORE** passes / moves **,** through / across **DO NOT ACCEPT** diffuses through gaps **,** in the phospholipid bilayer / between the phospholipids

Question			Answer	Marks	Guidance
23	(b)	(ii)	water / oxygen / carbon dioxide ✓	1	***Mark the first answer only. If additional incorrect answer given, then 0 marks*** **ACCEPT** correct formulae **DO NOT ACCEPT** incorrect formulae **ACCEPT** (named) alcohol / (other) named steroid hormone / triglyceride / glucose / vitamins / proteins / enzymes / (named) amino acid / anabolic steroid(s) etc (all of which are molecules and can cross the membrane by a passive or active method) **DO NOT ACCEPT** elemental ions (e.g. K^+ / Na^+ / Ca^{2+} etc) element (e.g. sodium / potassium etc)
23	(c)	(i)	channel / carrier / transport / cotransporter **,** proteins ✓	1	**ACCEPT** sodium potassium pump / Na^+ K^+ pump
23	(c)	(ii)	adenine ✓ ribose ✓	2	*In any order* **IGNORE** A **DO NOT ACCEPT** adenosine / other named base **DO NOT ACCEPT** deoxyribose / other named pentose **ACCEPT FOR 1 MARK :** nitrogenous base **and** pentose / 5C sugar

Question			Answer	Marks	Guidance
23	(d)	(i)	3.83 ✓✓✓	3	***Mark answer on answer line.*** ***If no answer on answer line then look for a clear 'final' answer in the working.*** ***Correct answer = 3 marks (indicated by 3 ticks) even if no working shown*** **IGNORE** minus sign **AWARD max 2 for correct answer not to 2dp** **or for** $3\frac{5}{6}$ ***If answer is incorrect*** **AWARD** 1 mark for (calculating difference between means): $0.44 - 0.21 = 0.23$ **OR** $0.21 - 0.44 = -0.23$ **AWARD** 1 mark for: $\sqrt{\frac{0.06^2}{10} + \frac{0.18^2}{10}}$ **OR** $\sqrt{\frac{0.0036}{10} + \frac{0.0324}{10}}$ **OR** $\sqrt{0.00036 + 0.00324}$

Question			Answer	Marks	Guidance
23	(d)	(ii)	***If answer to (d)(i) is greater than 2.10 then*** rejected because value of t is higher than critical value ✓ (H_o is rejected so) the difference (between the means) **,** is significant / not due to chance ✓ ***If answer to (d)(i) is less than 2.10 (including negative numbers) then*** accepted because value of t is lower than critical value ✓ (H_o is accepted so) the difference (between the means) **,** is not significant / is due to chance ✓	2	**If no answer for (d)(i), then allow 1 max for correctly stating when to , accept / reject , H_0** **ACCEPT** H_o is rejected because 3.83 is greater than 2.10 **ACCEPT** H_o is accepted because 't value' is less than 2.10

Question			Answer	Marks	Guidance
23	(e)			3 max	***Award marks from any D or E statements but max 2 explain marks (E)*** ***Put just a tick for D marks and green blob by the tick for E marks to ensure max 2 E marks awarded*** **IGNORE** 'as temperature increases' unqualified
			E1 an increase in pigment (leaking out of cells) increases <u>absorbance</u> ✓		**E1** **ACCEPT** as clearly linked ideas
			at low(er) temperature **D2** there is **,** little/ no **,** change in <u>absorbance</u> ✓ **E2** membrane is **,** (still) intact / undamaged ✓		***For D2 and E2*** if temperatures are quoted without 'low(er)' then ^{o}C must be used at least once *any range starting at 0 and ending between 20 and 40^{o}C*
			at high(er) temperature **D3** there is a (steep) increase in <u>absorbance</u> ✓ **E3** (pigment, leaves cells / leaks out when) membrane becomes more permeable / membrane is damaged / membrane disrupted / phospholipids melt / phospholipids move further apart / proteins denature (or described) ✓		***For D3 and E3*** if temperatures are quoted without 'high(er)' then ^{o}C must be used at least once *above 30/40^{o}C* **IGNORE** enzymes denature

Question			Answer	Marks	Guidance
24	(a)	(i)	ribosome(s) ✓	1	***If additional incorrect answer given, then 0 marks***
24	(a)	(ii)	(Eu)bacteria ✓ Archaea(bacteria) ✓	2	*In either order* **DO NOT ACCEPT** bacterium **ACCEPT** phonetic spelling
24	(a)	(iii)	nucleus ✓ DNA with **,** histones / (associated) proteins ✓ linear DNA ✓ (named) membrane bound organelles ✓ 80s ribosomes ✓	2 max	***Mark the first two answers but*** **IGNORE** multicellular **DO NOT ACCEPT** microtubule / cytoskeleton / centriole **IGNORE** chromosome **IGNORE** chloroplast **ACCEPT** large(r) ribosomes
24	(b)		**1** scientific **,** conferences / meetings ✓ **2** peer review / approving the work for publication / publication in (reputable) scientific journal ✓ **3** replication of work (by others to see if the same results are obtained) ✓ **4** look for more (supporting) evidence (e.g. from other peoples' work / investigating other molecules) ✓	2 max	**2 ACCEPT** analysing the procedures and data of the investigation **3 ACCEPT (others)** repeat the experiments **4** Other molecules could include cytochrome C

Question			Answer	Marks	Guidance
25	(a)	(i)	(new DNA molecule comprises) one **,** original / old / parent **,** strand and one new strand ✓ each strand (of DNA molecule) acts as a template strand (for a new double helix) ✓	1 max	**DO NOT ACCEPT** 'DNA strand' instead of 'DNA molecule'
25	(a)	(ii)	**E1** (DNA) helicase ✓ **F1** unzips the DNA molecule / breaks hydrogen bonds (between complementary bases) / separates the (2) strands ✓ **E2** DNA polymerase ✓ **F2** forms phosphodiester bonds / joins (adjacent) nucleotides / forms sugar-phosphate backbone ✓ ***Also creditworthy*** **E3** gyrase ✓ **F3** unwinds / uncoils **,** the DNA ✓	4 max	**Mark the first 2 enzymes mentioned** **NOTE only award the function mark when linked to the correct enzyme** **IGNORE** ligase **F1 IGNORE** unwinds the DNA molecule **E2 DO NOT ACCEPT** RNA polymerase **F2 DO NOT ACCEPT** forms H bonds **ACCEPT** checks for errors (in nucleotide sequence)

Question			Answer	Marks	Guidance
25	(b)		*tube with generation 1* shows (new) DNA / band **,** contains **,** light nitrogen / N^{14} **,** **and ,** heavy nitrogen / N^{15} ✓ *tube with generation 2* (new) DNA / band **,** made from only **,** light nitrogen / N^{14} ✓ so a **,** light / N^{14} **,** strand of DNA must be a **,** template / parent strand **,** for the new molecule ✓ *tube with generation 10* (highest band gets thicker because) more of the DNA is made from only **,** light nitrogen / N^{14} ✓	**2 max**	Marks can be awarded from suitably labelled / annotated diagrams **ACCEPT** shows that (new) DNA is a hybrid ***Could be credited in context of generation 10 instead (but only award once)***

Question			Answer	Marks	Guidance
26	(a)		**1** temperature ✓ **2** pH ✓ **3** concentration of **,** protein / gelatine ✓ **4** volume / mass / surface area **,** of **,** protein / gelatine ✓ **5** volume of **,** protease / bromelain / enzyme ✓ **6** same source of **,** enzyme / gelatine ✓ **7** same reaction end point ✓	**3 max**	***IGNORE*** *the numbered prompt lines and mark the 1st 3 distinct variables, whether they are on the same line or on separate lines.* **3 IGNORE** amount of **,** protein / gelatine **IGNORE** substrate **4 IGNORE** substrate **5 IGNORE** amount of **,** protease / bromelain / enzyme **DO NOT ACCEPT** enzyme concentration **6 ACCEPT** use the same (type of) **,** pineapple / gelatine **7 ACCEPT** **'**stop the time when completely broken down' **DO NOT ACCEPT** measure for the same time
26	(b)	(i)	1 / time **or** 1 ÷ time ✓	**1**	**ACCEPT** 1 / seconds **or** 1 ÷ seconds
26	(b)	(ii)	**1** (SD) shows spread (of data) around the <u>mean</u> ✓ **2** <u>all</u> **,** data / concentrations **,** have small SD ✓ **3** (so) little variation in repeats / high repeatability ✓ **4** as concentration increases the SD increases (in first 4 concentrations) ✓ **5** (so) as concentration increases repeatability decreases ✓	**2 max**	**IGNORE** reliability / accuracy **IGNORE** ref to 'results' **4 ACCEPT** 0.01% deviated the least **and** 0.075% deviated the most **5 ACCEPT** greater variability of repeats at higher concentrations

Question			Answer	Marks	Guidance
26	(c)			3 max	**IGNORE** reliability / accuracy **ACCEPT** 'bromelain' or 'protease' for 'enzyme' throughout
			1 as enzyme concentration increases the rate (of digestion) increases because **,** more ESCs formed / more active sites available ✓		**1 IGNORE** ref to successful collisions
			2 as the enzyme concentration increases the **,** concentration / availability **,** of substrate remains the same ✓		
			3 <u>rate</u> **,** plateaus / levels off **,** because **,** many active sites are empty / lack of substrate ✓		**3 DO NOT ACCEPT** ref V_{max} reached
			4 substrate <u>concentration</u> is limiting ✓		
			5 at high(er) concentrations the **,** error bars overlap / SD increases **,** so any difference in the data may be uncertain ✓		**5 ACCEPT** 'SD bars' for 'error bars' **DO NOT ACCEPT** 'range bars' *Uncertainty may be expressed as:* Greater (potential) error in measuring shorter times The rate of digestion may not plateau at high(er) concentrations There may be no difference between the rate at high(er) concentrations We can't tell if there is any difference in the rates at high(er) concentrations
			Total	**50**	

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