GCE

Biology B

H422/01: Fundamentals of biology

Advanced GCE

Mark Scheme for June 2019

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

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

Subject Specific Marking Instructions

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

26	A	**1**	
27	A	**1**	ALLOW B
28	C	**1**	
29	C	**1**	
30	C	**1**	
	Total	**30**	

Question			Answer	Mark	Guidance
31	**(a)**	**(i)**	17 ✓✓	**2**	(43 000/260 000 000)*100 000 **OR** (44 000/260 000 000)*100 000 = 1 mark **ALLOW** 16.5 or 16.9
		(ii)	use of the data to support any of the marking points ✓ rapid / sudden, reduction in AIDS deaths after introduction of HAART ✓ AIDS diagnoses/deaths already reducing before introduction of HAART ✓ increase in prevalence of HIV infection after introduction of HAART, (following plateau reached ~ 1990) ✓ additional valid points, e.g. reduction in AIDS deaths may be due to reduction in AIDS diagnoses (before introduction of HAART) ✓	**max 4**	**DO NOT ALLOW** 'reduction' alone **ALLOW** AIDS diagnosis reducing from 1993 / AIDS deaths reducing from 1995
	(b)		stigma/responsibility associated with informing, sexual partner(s) / children / health professionals ✓ discrimination from insurers / employers ✓ distress caused by false positive result ✓ conflict for health care professionals between confidentiality and right for sexual partner to be protected from infection ✓ affects decision to have children/continue with pregnancy ✓ additional valid points, e.g. restriction to travel to some countries ✓	**max 2**	**ALLOW** reference to any individual that may have been infected.
	(c)		high mutation rate ✓ variability of antigens (on pathogen surface) ✓ antibodies no longer, complimentary / bind, to antigen ✓ ref to delay between emergence of new strain and development of new vaccine ✓ recombination of / hybrid, strains ✓	**max 3**	

	(d)	**(i)**	live virus may, revert / mutate / become pathogenic ✓	**1**	**ORA** e.g. purified protein cannot mutate
		(ii)	no data at, baseline / week 0 ✓ large error bars ✓ no overall trend (over time) ✓ CD4 cell level not the only indicator of immune health ✓ trial period not long enough (given longevity of the virus) ✓ no control ✓	**max 2**	**ALLOW** large standard deviations **ALLOW** idea of no pattern
	(e)	**(i)**	publishing of data which monitors trends ✓ educate/inform ✓ improve vaccination✓ initiate contact tracing ✓ ensures availability of vaccine ✓ isolation of affected individuals ✓	**max 2**	**ALLOW** ring vaccination
		(ii)	bacteriocidal ✓	**1**	
		(iii)	genetic variation / mutations, are present ✓ acquisition of new mutations over time ✓ antibiotics provide <u>selection pressure</u> ✓ (resistant/most adapted) bacteria survive and multiply ✓ advantageous mutation / allele passed on ✓	**max 3**	
			Total	**20**	

Question			Answer	Mark	Guidance
32	**(a)**	**(i)**	movement through cell walls ✓ entry into cytoplasm at Casparian strip ✓ at endodermis ✓	**max 2**	**ALLOW** ref to outside plasma membrane **ALLOW** enters symplast pathway at Casparian strip
		(ii)	R ✓	**1**	
		(iii)	plasmodesmata, for movement (of sucrose / molecules / ABA) between cells ✓ *companion cell:* many mitochondria, to provide ATP /for active transport (of sucrose into sieve tube) ✓ *sieve tube/element:* no nucleus / named organelles, so more space for flow of, sucrose / molecules / ABA ✓ end walls / sieve plates / pores, to allow movement of sucrose / molecules / ABA ✓	**max 3**	**DO NOT ALLOW** phloem has no nucleus / named organelles
	(b)		increase in water potential of guard cells ✓ water leaves by osmosis✓ guard cells, become plasmolysed / flaccid ✓	**max 2**	**ORA** **ALLOW** Ψ for water potential **ALLOW** guard cells lose turgidity
	(c)		claim is valid because: ABA rises, as water potential of soil decreases / as soil dries out / during water stress ✓ resistance to air flow increases as water potential of soil decreases / as soil dries out / during water stress ✓ correlation / positive relationship between ABA and resistance ✓ claim not valid because: correlation does not prove causal link ✓ only one plant is used/there are no repeats ✓	**max 3**	
			Total	**11**	

Question			Answer	Mark	Guidance
33	**(a)**	**(i)**	0.04 ✓✓	**2**	correct use of numbers in formula = 1 mark max unrounded answer (0.0409…) = 1 mark max
		(ii)	error bars equal in height, above and below mean ✓ correctly plotted error bars (4 mini-squares above and below 2.33) ✓	**2**	**ALLOW ECF**
		(iii)	mass of potato influenced by <u>osmosis</u> ✓ at > 0.35 mol dm^{-3} sucrose, decrease in mass because water potential of potato greater than that of sucrose solution ✓ at < 0.35 mol dm^{-3} sucrose, increase in mass because water potential of sucrose solution greater than that of the potato ✓ at ~ 0.35 mol dm^{-3} sucrose, no change in mass because, no net movement of water / water potential of potato and sucrose solution equal ✓	**3**	**ALLOW** Ψ for water potential or vice versa or vice versa **DO NOT ALLOW** statements relating change in mass to gain/loss of water without explanation
		(iv)	Inconsistent / uneven, drying (of potato slices) ✓ ref to stacking/contact between potato slices ✓ different regions of potato sampled ✓ different, shapes / surface area, of slices ✓	**max 2**	**ALLOW** SA:V or SA/V
	(b)		1256/7✓✓ diameter = 24mm / 2 = 12mm = 12000µm 12000 / 600 = 20µm 3.14 x 20^2 = 1256 3.142 x 20^2 = 1257	**2**	**ALLOW** unrounded (1256.637) for 1 mark
			Total	**11**	

Question			Answer	Mark		Guidance
34	**(a)**	**(i)**	volume of oxygen, used / utilised / consumed, (at maximal physical exertion), per minute / hour / any time period ✓ **OR** maximum rate of oxygen, use / utilisation / consumption, (during exercise) ✓	**max 1**		**DO NOT ALLOW** volume of oxygen inspired
		(ii)	cheaper than/no need for, specialist equipment ✓ does not require training / can be carried out by non-experts ✓ non-invasive so safer / reduced risk ✓	**max 1**		
	(b)*		***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):* o *award the higher mark where the Communication Statement has been met.* o *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) An outline of an appropriate method with consideration of exercise type and details of how measurements could be taken. There is reference to measures to increase the validity of the data. Detailed data analysis. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.*	**6**		**Indicative scientific points may include:** **method** • independent variables (exercise intensity/duration/type) and dependent variable (heart rate) • description of exercise type, e.g. treadmill • description of fitness programme • take baseline measurement • use of heart rate monitor or pulse taking

			Level 2 (3 – 4 marks) An outline of an appropriate method with consideration of exercise type OR details of how measurements could be taken. There is reference to increasing the validity of the data. Data analysis is discussed. *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 outline of a method OR details of how measurements could be taken are included. There is some reference to increasing validity OR data analysis. *The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.* 0 marks No response or no response worthy of credit.			• ref to control group **validity** • reduce other variables, e.g. age, gender, smoking status, health status • ref to repeat measurements • ref to sample size • exclusion of individuals with health conditions, e.g. hypertension, asthma • risk / health assessment **data analysis/presentation** • calculation of mean and standard deviation from repeat measurements • calculation of percentage change in VO_2 max or paired *t*-test
	(c)	**(i)**	pO_2 / partial pressure of oxygen, reduced ✓ lower oxygen saturation of haemoglobin ✓	**2**		**ALLOW** hb for haemoglobin
		(ii)	influences, affinity / binding, of oxygen to haem groups ✓	**1**		**ALLOW** example, e.g. heat breaks bonds between oxygen and haem groups, or ref to disruption of secondary and tertiary structure of haemoglobin
	(d)		re-oxygenation of, haemoglobin / myoglobin ✓ balancing / replenishing, hormones ✓ cell repair ✓ converting lactate to, pyruvate / glucose ✓ regenerating ATP ✓ meeting demands of increased metabolism from thermogenesis of brown fat tissue ✓	**max 2**		**ACCEPT** replenishing glycogen
	(e)		(34)b	**2**		

			wider H zone ✓ wider, isotropic / I, band ✓ longer sarcomere ✓			**ACCEPT** Z lines further apart / greater distance between M and Z lines
	(f)		….C….. ….A….. ….E….. ….B….. ….D….. ✓✓	**2**		any 2 correct = 1 mark
			Total	**17**		

Question			Answer	Mark	Guidance
35	**(a)**	**(i)**	same DNA sequence in opposite (5' to 3') direction on both strands ✓	**max 1**	**DO NOT ALLOW** sequence that reads the same in 5' to 3' and 3' to 5' directions
	(b)	**(i)**	restriction (enzyme / endonuclease) ✓	**1**	
		(ii)	*similarity* cut at, precise / specific, sites / DNA sequences ✓ cut both strands of DNA ✓ both hydrolyse phosphodiester bonds ✓ *difference* Cas9, is guided / requires gRNA, but restriction enzymes function alone ✓ Cas9, cuts straight / produces blunt ends, but some restriction enzymes produce sticky ends ✓	**max 2**	must have similarity and difference for 2 marks
	(c)		*CRISPR* loss of function / knockout, so no residual gene activity ✓ effect is permanent ✓ CRISPR is specific to a particular DNA sequence / gene ✓ no protein synthesis ✓ *RNAi* some residual gene function / knockdown / ✓ effect not permanent ✓ miRNA not specific to a single gene ✓ ref to low level of protein synthesis ✓	**max 4**	**ALLOW** RNAi not as specific as CRISPR **DO NOT ALLOW** siRNA not as specific as CRISPR
	(d)		exons ✓ introns ✓ splicing ✓	**3**	
			Total	**11**	

Question			Answer	Mark		Guidance
36	(a)	(i)	islet(s) of Langerhans ✓	1		
		(ii)*	***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):* o *award the higher mark where the Communication Statement has been met.* o *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) A detailed discussion of the homeostatic mechanisms that control blood glucose levels, including named biochemical pathways that increase **and** decrease blood glucose. The hormones and hormone-producing cells are correctly identified. *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 of the effect of hormones that regulate glucose levels, including some biochemical pathways that increase or decrease blood glucose. The hormones and hormone-producing cells are identified correctly. *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 may name the hormones and cell types. Some biochemical pathways that increase or decrease blood glucose are discussed.	6		**Indicative scientific points may include:** **homeostatic mechanisms** • ref to significant change from set-point • detected by receptor cells of pancreas • increased blood glucose concentration detected by beta cells • decreased blood glucose concentration detected by alpha cells • negative feedback loop **hormones** • beta / β cells secrete insulin • alpha / α cells secrete glucagon • hormones travel in blood to target tissues / effector cells **effect of hormones** • insulin stimulates liver and/or muscle cells to increase glucose uptake • by upregulating glucose transporters on cell surface • increased rate of glycogenesis / more glucose for cellular respiration / conversion of glucose to fat

			The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear. 0 marks No response or no response worthy of credit.			• reduction in blood glucose <u>concentration</u> • glucagon stimulates glycogenolysis and gluconeogenesis/increases fat metabolism • increase in blood glucose <u>concentration</u>
	(b)	**(i)**	*strategy A* type: 1 **AND** explanation: destruction of pancreatic cells so insulin not produced ✓ *strategy B* type: 2 **AND** explanation: insulin is produced, cells less responsive because of (high fat) diet ✓	**2**		
		(ii)	(oral) glucose tolerance test ✓ fasting (blood) glucose test ✓	**max 1**		**ALLOW** OGTT
			Total	**10**		

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