2021 Biology

Advanced Higher

Finalised Marking Instructions

Marking instructions for each question

Section 1

Question	Answer	Mark
1.	A	**1**
2.	B	**1**
3.	C	**1**
4.	A	**1**
5.	B	**1**
6.	D	**1**
7.	B	**1**
8.	B	**1**
9.	D	**1**
10.	B	**1**
11.	D	**1**
12.	D	**1**
13.	C	**1**
14.	C	**1**
15.	A	**1**
16.	B	**1**
17.	D	**1**
18.	A	**1**
19.	C	**1**
20.	B	**1**

Section 2

Question			Expected response	Max mark	Additional guidance
1.	(a)		Long chirp (pulses) have larger amplitude (than short chirps). **(1)** **Accept converse.** Long chirps have single (pulses), short chirps have paired (pulses). **(1)** Long chirp have higher (pulse) frequency. **Accept converse.** **(1)** **Any two**	**2**	Louder ≡ larger amplitude Number does not equal frequency unless time is referred to.
	(b)		High level/near maximum of positive responses **(1)** lower energy expenditure (than 80% or 100%). **(1)**	**2**	**NOT:** highest
	(c)	**(i)**	Parasites consume host resources/ nutrients so less energy available (for song production)	**1**	
		(ii)	Allows them to avoid mating with males of low fitness **OR** More likely to mate with males of high fitness **OR** Presence of song acts as an honest signal	**1**	High fitness ≡ more surviving offspring **NOT:** female recognises parasitised male on its own

Question			Expected response	Max mark	Additional guidance
1.	(d)		(Independent) evolution of similar traits in two unrelated species	**1**	
	(e)	(i)	Flatwing males (responses) are (always) faster **Accept converse.** **OR** Flatwing males vary (more) in their response to different song models	**1**	Shorter response time ≡ faster
		(ii)	Flatwing song preference similar to females **OR** Locate close to most attractive males **OR** More likely to mate with greater numbers of females (1) Selection pressure is high **OR** Flatwing males have a selective advantage **OR** Flatwing (allele) frequency increases (1)	**2**	

Question			Expected response	Max mark	Additional guidance
2	(a)	(i)	It is hydrophobic/non-polar	1	
		(ii)	Binds to specific DNA sequence/ specific sites on the DNA/hormone response element (in the nucleus) **(1)** Acts as a transcription factor/ influences (rate of) transcription/ affects gene expression **(1)**	2	Accept HRE for hormone response element Stimulate/inhibit transcription ≡ influences (rate of) transcription
		(iii)	Each gene will possess hormone response elements/DNA sequences that bind the hormone-receptor complex/transcription factor.	1	**NOT:** that bind testosterone Idea that the hormone-receptor complex can bind to HREs on a number of genes
	(b)		Insulin binds to a receptor on/at the cell's surface **OR** Insulin binds to a transmembrane receptor **OR** Insulin binding activates a kinase enzyme **OR** Insulin binding results in phosphorylation of the receptor **(1)** resulting in a phosphorylation cascade **OR** Phosphorylating other enzymes/ kinases/molecules **(1)**	2	Idea that binding is extracellular **NOT:** signal is transduced on its own

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Question			Expected response	Max mark	Additional guidance
3	(a)	(i)	27	1	Accept answer if not in table Units not required
		(ii)	42	1	Accept answer if not in table Units not required
	(b)	(i)	SDS gives (all) proteins/molecules a negative charge **OR** Proteins denatured **(1)** Separate according to size as they move through an electric field/ move towards a positive electrode (applied to a gel matrix) **(1)**	2	
		(ii)	Western blotting	1	

	Question		Expected response	Max mark	Additional guidance
4.	(a)		GLUT4	**1**	
	(b)	(i)	1. Sodium-potassium pump pumps Na^+ out of cell 2. Sodium-potassium pump generates lower concentration of Na^+ within cell 3. (Glucose) symporter/transporter transports Na^+ down its concentration gradient **OR** Sodium diffuses in via the transporter 4. Alongside/together with glucose (which is transported against its concentration gradient) **Any 3**	**3**	Ignore references to lumen/ epithelial cells
		(ii)	Sugar/glucose concentration in the gut higher than that in the cells (lining the gut) **(1)** so glucose (would only need to be) transported by (facilitated) diffusion **OR** Don't require active transport **(1)**	**2**	Gut $\equiv$ lumen Cells lining the gut $\equiv$ intestinal epithelium cells

Question			Expected response	Max mark	Additional guidance
5.			1. Proteins enter the lumen (of the RER) 2. Proteins transported to/move in vesicles to the Golgi apparatus 3. Proteins move through the Golgi apparatus 4. (may) be post-translationally modified in the Golgi apparatus 5. Addition of carbohydrate (is the major modification) 6. Packaging into secretory vesicles 7. Secretory vesicles move to/fuse with the plasma membrane 8. Vesicles move along microtubules **Any 5**	**5**	Pt. 5 - Production of glycoprotein ≡ addition of carbohydrate

Question			Expected response	Max mark	Additional guidance
6.	(a)	(i)	60	**1**	
		(ii)	Chromosomes aligned at the equator/metaphase plate	**1**	**NOT**: centre of the cell
		(iii)	Same mean/same (degree of) variation around mean as the population as a whole	**1**	Deviation ≡ same degree of variation
	(b)	(i)	(Cyclins) combine with/activate Cdk	**1**	
		(ii)	(Non-functioning) Rb won't inhibit transcription **OR** Rb won't bind to the transcription factor/E2F **(1)** Proteins needed for DNA replication (constantly) produced **OR** Genes coding for proteins needed for replication (constantly) transcribed **(1)**	**2**	
		(iii)	Less Less	**1**	

Question			Expected response	Max mark	Additional guidance
7.	(a)		Less likely to miss (new) nesting sites **Accept converse.** **OR** Allows all/more breeding/nesting sites to be found	**1**	
	(b)		The changes in population size vary in different parts of the country **OR** Overall peregrine numbers have increased but they have gone down in some areas	**1**	
	(c)	(i)	The decrease has been greater in some areas	**1**	Accept responses with correct numerical data used to exemplify
		(ii)	Tagging/ringing **OR** Radio/satellite tracking **OR** (remote) Cameras	**1**	
	(d)	(i)	Point count	**1**	
		(ii)	Birds wrongly identified **OR** Birds counted more than once **OR** Not all birds seen recorded **OR** Selection bias **OR** False data submitted **OR** Observer effects	**1**	

	Question		Expected response	Max mark	Additional guidance
8.	(a)		Same centromere position **OR** Same sequence of genes/same genes at the same loci	**1**	
	(b)		4	**1**	
	(c)		E. B. F. C. D. A.	**1**	

	(d)		1. Points of contact between non-sister chromatids of homologous chromosomes
			2. Chromatids break and rejoin
			
			   OR
			
			   Crossing over occurs
			
			3. Exchange of DNA between homologous chromosomes/non-sister chromatids
			4. Produce genetically different (recombinant) chromosomes
			
			   OR
			
			   new combinations of alleles
			
			5. Increases genetic variability (of gametes)
			
			                   Any 3
				3	If a candidate includes points 1 and 3 in their response but omits reference to chromatids coming from separate homologous chromosomes then penalise only once.
					Diagram acceptable.
					
					Pt. 3 -DNA $\equiv$ alleles /genetic material NOT: genes

	Question		Expected response	Max mark	Additional guidance
9.	(a)		Reversed sexual dimorphism	**1**	
	(b)	(i)	Gains nutrients from the female **Accept converse.** **OR** Gains benefit in terms of nutrients **OR** Male is degenerate/lacks structures	**1**	Ignore reference to host or harm to female
		(ii)	Both are same species/not different species **OR** Both/females benefit from availability of mates	**1**	Idea of increased reproductive success because of availability of mates
	(c)	(i)	Bacteria gain nutritional benefit from fish **(1)** The fish gain a lure for catching prey/attracting mates **(1)**	**2**	**NOT**: both gain on its own
		(ii)	(To allow the bacteria) to find a (new) fish	**1**	Ignore reference to host
		(iii)	Co-evolution	**1**	**NOT**: Red Queen (hypothesis)

Question			Expected response	Max mark	Additional guidance
10.	(a)		31	**1**	NOT to 1 d.p.
	(b)		The pH of the pond water will have no effect on the growth of algal populations	**1**	
	(c)		Pond water with no algae present	**1**	Accept: filtered/centrifuged pond water NOT: pure water
	(d)		Temperature is a confounding variable **OR** Temperature may affect the growth of algae/the dependent variable	**1**	
	(e)		Unable to achieve no pH	**1**	
	(f)		Idea of repeated measurement of one sample/a single datum point to check measured values are close to each other/to check for variation in measured values	**1**	
	(g)		Sample site distribution not the same for each pond **OR** Ponds are connected/close by/ near each other **OR** No independent replicate **OR** Small sample size **OR** Other confounding variables having an effect/% transmission due to something other than algae **OR** The student did not measure algal population growth **Any 1**	**1**	Accept a description of differences in sampling sites Accept a suitable example of a confounding variable

Question			Expected response	Max mark	Additional guidance
11.	(a)		Virulence	**1**	
	(b)		(The organism/host) where sexual maturity (of the parasite) is reached. **OR** (The organism/host) where sexual reproduction/fertilisation (of the parasite) takes place.	**1**	
	(c)		4.2×10^8 **OR** 420 000 000	**2**	Example of 2 mark calculation: 16% of 75kg = 1.2×10^7 mg $1.2 \times 10^7 \times 35 = 420\ 000\ 000$ Award 1 mark for: 16% of 75 kg = 12 kg / 12 000 g / 12 000 000 mg **OR** 420 or 4.2×10^2 **OR** 420 000 or 4.2×10^5 Accept answers eg 42×10^7
	(d)		Both drugs reduce the number of microfilariae compared to control/ placebo **OR** Ivermectin is more effective than DEC **OR** Neither drug kills all/eliminates microfilariae **OR** Both drugs become less effective over time **Any 1**	**1**	Microfilariae $\equiv$ larvae/parasite NOT: a description of trend

Question			Expected response	Max mark	Additional guidance
11.	(e)		The drugs only kill the microfilariae/ larvae **OR** The drugs do not kill the adults **OR** Drugs are stopping reproduction	**1**	Accept: are more effective on larvae
	(f)		Include more than 30 participants/ increase sample size **OR** Ensure that the treatment groups are the same age range **OR** Include participants that are at the same stage of infection	**1**	Accept: the treatments should be administered in the same way

Question			Expected response	Max mark	Additional guidance
12.	**A**	(i)	Non-specific cellular responses 1. Phagocytes engulf parasites/ pathogens 2. (Store/enclose) within a vacuole 3. Lysosomes fuse with vacuole 4. Hydrolytic enzymes/hydrolases destroy/kill parasite/pathogen **OR** Enzymes digest parasite/pathogen 5. Natural killer cells attach to cells infected with virus 6. Natural killer cells release chemicals that induce apoptosis/programmed cell death 7. Phagocytes **AND** natural killer cells named **Max 3 marks**	**3**	If both pts 1 and 2 not awarded, one mark can be awarded for the term phagocytosis Pt. 2 vesicle ≡ vacuole Pt. 5 parasite ≡ virus Pt. 6 NOT: cell death on its own **Pt. 7 only awarded if pts 1 to 6 not awarded.**
		(ii)	Specific cellular responses a. White blood cells release cytokines if tissue damaged/ infected b. Specific wbc accumulate at site of damage/infection c. Lymphocytes have receptors (on their surface) that recognise antigens d. Binding of antigen to receptor/ lymphocyte selects the lymphocyte to divide e. And produce a clonal population/ clone (of this lymphocyte) f. Some lymphocytes induce apoptosis **AND** others produce antibodies g. Variable region of antibody binds to antigen **OR** variable region of antibody gives it its specificity (for binding antigen) h. Antibody binding results in inactivation of parasite/ destruction by phagocytosis/cell lysis **Any 5**	**5**	Pt. d selects = triggers/induces/causes Pt. h Susceptible to a phagocyte = destruction by phagocytosis

	Question		Expected response	Max mark	Additional guidance

12.	**B**	(i)	Sex determination and sex-linked patterns of inheritance
			
			1. Males are XY/heterogametic AND females are homogametic/XX
			2. *Sry* gene on the Y chromosome
			3. *Sry* determines the development of male characteristics
			4. Y chromosome lacks homologous alleles on the X chromosome
			5. Males have only one copy of sex-linked genes
			
			    OR
			
			    In males, the allele on the X chromosome is expressed
			
			6. Females can be carriers of recessive (sex-linked) alleles
			
			    OR
			
			    Carrier females (of recessive sex-linked traits) are heterozygous
			
			7. Sex-linked (recessive) traits are more common in males
			
			    OR
			
			    Sex-linked alleles in males are always inherited from the mother
			
			                     Any 4
				4	Pts 5 to 7 could be exemplified by genetic notation on parental/ offspring chromosomes, and punnet squares.

		(ii)	X-inactivation a. In females/XX one X chromosome is inactivated b. (inactivation) is random c. (X chromosome inactivation) happens early in development d. (X chromosome inactivation) prevents a double dose of gene products e. double dose of gene products could be harmful f. carriers less likely (than males) to be affected by harmful alleles/deleterious mutations g. half of the cells (in a tissue) will have a working/functional copy of the gene **Any 4**	**4**	

[END OF MARKING INSTRUCTIONS]

General marking principles for Advanced Higher Biology

This information is provided to help you understand the general principles you must apply when marking candidate responses to questions in this paper. These principles must be read in conjunction with the detailed marking instructions, which identify the key features required in candidate responses.

(a) Marks for each candidate response must **always** be assigned in line with these general marking principles and the detailed marking instructions for this assessment.

(b) Marking should always be positive. Marks should be awarded for what is correct and not deducted for errors or omissions.

(c) If a specific candidate response does not seem to be covered by either the principles or detailed marking instructions, and you are uncertain how to assess it, you should seek guidance from your Team Leader.

(d) There are no half marks awarded.

(e) Where a candidate makes an error in the first part of a question, credit should normally be given for subsequent answers that are correct with regard to this original error. Candidates should not be penalised more than once for the same error.

(f) Unless a numerical question specifically requires evidence of working to be shown, full marks should be awarded for a correct final answer (including units) on its own.

(g) Larger mark allocations may be fully accessed whether responses are provided in continuous prose, linked statements or a series of discrete developed points.

(h) In the detailed marking instructions, if a word is <u>underlined</u> then it is essential; if a word is **(bracketed)** then it is not essential.

(i) In the detailed marking instructions, words separated by/are alternatives.

(j) A correct answer can be negated if:
• an extra, incorrect, response is given;
• additional information that contradicts the correct response is included.

(k) Where the candidate is instructed to choose one question to answer but instead answers both questions, both responses should be marked and the better mark awarded.

(l) The assessment is of skills, knowledge and understanding in Biology, so marks should be awarded for a valid response, even if the response is not presented in the format expected.
For example, if the response is correct but is not presented in the table as requested, or if it is circled rather than underlined as requested, give the mark.

(m) Unless otherwise required by the question, use of abbreviations (eg DNA, ATP) or chemical formulae (eg CO_2, H_2O) are ACCEPTable alternatives to naming.

(n) If a numerical answer is required and units are not given in the stem of the question or in the answer space, candidates must supply the units to gain the mark. If units are required on more than one occasion, candidates should not be penalised repeatedly.

(o) Incorrect spelling is given. Sound out the word(s),
- if the correct word is recognisable then give the mark
- if the word can easily be confused with another biological term then do not give the mark, eg ureter and urethra
- if the word is a mixture of other biological terms then do not give the mark, eg mellum, melebrum, amniosynthesis.

(p) Marks are awarded only for a valid response to the question asked. For example, in response to questions that ask candidates to:
- **identify**, **name**, **give**, or **state**, they need only name or present in brief form;
- **describe**, they must provide a statement or structure of characteristics and/or features;
- **explain**, they must relate cause and effect and/or make relationships between things clear;
- **compare**, they must demonstrate knowledge and understanding of the similarities and/or differences between things;
- **calculate**, they must determine a number from given facts, figures or information;
- **predict**, they must suggest what may happen based on available information;
- **evaluate**, they must make a judgement based on criteria;
- **suggest,** they must apply their knowledge and understanding of Biology to a new situation. A number of responses are ACCEPTable: marks will be awarded for any suggestions that are supported by knowledge and understanding of Biology;
- **account for,** they must give a reason or reasons for a particular action, event, observation, change, or state**.**