2016 Biology

Advanced Higher

Finalised 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 <u>always</u> be assigned in line with these General Marking Principles and the Detailed Marking Instructions for this assessment.

(b) Marking should always be positive. This means that, for each candidate response, marks are accumulated for the demonstration of relevant skills, knowledge and understanding: they are not deducted from a maximum on the basis of 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 must seek guidance from your Team Leader.

(d) Half marks may not be awarded.

(e) Where a candidate makes an error at an early stage in a multi stage calculation, credit should normally be given for correct follow on working subsequent stages, unless the error significantly reduces the complexity of the remaining stages. The same principle should be applied in questions which require several stages of non-mathematical reasoning.

(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 **underlined** 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) If two answers are given where one is correct and the other is incorrect, no marks are awarded.

(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) Content that is outwith the Course assessment specification should be given credit if used appropriately, eg metaphase of meiosis.

(o) 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.

(p) Incorrect spelling is given. Sound out the word(s),
- if the correct term 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.

(q) When presenting data:
- if a candidate provides two graphs or charts in response to one question (eg one in the question and another at the end of the booklet), mark both and give the higher mark
- for marking purposes no distinction is made between bar charts (used to show discrete features, have descriptions on the x-axis and have separate columns) and histograms (used to show continuous features, have ranges of numbers on the x-axis and have contiguous columns)
- other than in the case of bar charts/histograms, if the question asks for a particular type of graph or chart and the wrong type is given, then do not give the mark(s) for this
- where provided, marks may still be awarded for correctly labelling the axes, plotting the points, joining the points either with straight lines or curves (best fit rarely used), etc. The relevant mark should not be awarded if the graph uses less than 50% of the axes; if the x and y data are transposed; if 0 is plotted when no data for this is given (ie candidates should only plot the data given).

(r) Marks are awarded only for a valid response to the question asked. For example, in response to questions that ask candidates to:
- **calculate**, they must determine a number from given facts, figures or information;
- **compare**, they must demonstrate knowledge and understanding of the similarities and/or differences between things;
- **describe**, they must provide a statement or structure of characteristics and/or features;
- **evaluate**, they must make a judgement based on criteria;
- **explain**, they must relate cause and effect and/or make relationships between things clear;
- **identify**, **name**, **give**, or **state**, they need only name or present in brief form;
- **predict**, they must suggest what may happen based on available information; **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.

Marking Instructions for each question

Section 1

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

Question	Answer	Max Mark
21.	A	1
22.	C	1
23.	C	1
24.	D	1
25.	C	1

Section 2

Question			Expected Answer(s)	Max Mark	Additional Guidance
1.	(a)	(i)	Statement relating to quartiles eg 25% lay more than/UQ is 200 eggs eg 50% lay more than 170 eggs **OR** Median value is 170 eggs (laid) eg 75% lay more than/LQ is 125 eggs eg 50% lay between 125 and 200 **OR** Equivalents 'in opposite direction'. **OR** Range of eggs (laid) is between 20 and 240/range of eggs (laid) is 220. **OR** Minimum and maximum values are 20 and 240 eggs (laid). **OR** No. of eggs (laid) is **very** variable. (**Any 2**)	**2**	• no reference to '*eggs*' deduct one mark only **Not:** • average = median • 'average median'
		(ii)	Mean number of eggs laid/it is higher (than the median). **OR** Mean is greater than 90.	**1**	
		(iii)	(Infection) reduces (fecundity)	**1**	Fecundity = no. of eggs laid
	(b)	(i)	Error bars do not overlap.	**1**	
		(ii)	Increases (chance of)/more time for transmission (of parasite). **OR** More time for (parasite) reproduction.	**1**	Transmission = spread/passed on to host. **Not:** • allows transmission • reference to humans **Ignore:** • reference to intermediate/ definitive host

Question			Expected Answer(s)	Max Mark	Additional Guidance
1.	(c)	(i)	Negative correlation between survival and the number of eggs laid. **OR** Mosquitoes that lay smaller numbers of eggs live longer. **(1)** Relationship is more negatively correlated in uninfected mosquitoes. **OR** As fecundity increases the decrease in longevity is greater in uninfected mosquitoes **(1)**	**2**	Accept converse. Accept converse. Accept converse.
		(ii)	Not reliable because many points lie far from the line. **OR** Reliable because a large sample was used.	**1**	

Question			Expected Answer(s)	Max Mark	Additional Guidance
2.	(a)		(Serum) provides <u>growth factor(s)</u>.	**1**	**Negates:** • nutrients
	(b)	(i)	110,000	**1**	
		(ii)	Dead cells are not distinguished from live cells (unless stained). **OR** Small cells difficult to locate. **OR** Numbers obtained are only an estimate. **OR** Time-consuming. **OR** Clumping of cells. **(Any 1)**	**1**	
	(c)		(Thin sections of) tissue. **OR** Whole/unicellular organism. **OR** Parts of organism. **(Any 1)**	**1**	**Not:** • named example of organism • named examples of parts of organisms
	(d)		**Replacement** (with another biological system, eg cell culture). **OR** **Reduction** (in no. used). **OR** **Refinement** (re techniques). **(Any 1)**	**1**	Any description/example should relate to one of the concepts.

Question			Expected Answer(s)	Max Mark	Additional Guidance
3.	(a)		Level/quantity of interferon (beta-1b).	**1**	interferon beta-1b = drug
	(b)		Allows (overall) effect of drug on (whole) organism/body to be observed. **OR** Allows (possible) side effects to be seen. **OR** Shows effects on non-target cells. **OR** Nerve cells difficult to grow *in vitro*. **(Any 1)**	**1**	**Not:** • reference to ecological validity
	(c)		Provides results in the absence of the drug. **OR** Gives baseline against which effect of drug can be measured/ compared. **OR** Allows comparison between drug and absence of drug. **OR** Shows drug was responsible for effect. **OR** Allows measurement of psychological effect (of treatment). **(Any 1)**	**1**	**Not:** • presence of drug = treatment

Question			Expected Answer(s)	Max Mark	Additional Guidance
	(d)		Patients may not (remember to) take drug. **OR** Patients may not inject/administer drug correctly/effectively. **OR** May be different numbers in the three groups. **OR** Some patients pulled out (before completing trial) **OR** Not all patients were (MRI) scanned/ no scan data for 0·05 mg. **OR** Patient self-assessment (is subjective/may be recorded incorrectly). **OR** Small sample size. **(Any 1)**	1	
	(e)		Informed consent. **OR** Permission from patient to use results/data. **OR** Right to withdraw. **OR** Confidentiality. **OR** Justification of research. **OR** (Consider possible) risk/harm/side effects to patient. **(Any 1)**	1	

Question			Expected Answer(s)	Max Mark	Additional Guidance
	(f)		Drug prevents/reduces **worsening** of MS/symptoms. **OR** Higher levels of drug more effective. **OR** Drug reduces **new** nerve damage. **(Any 2)**	**2**	Interferon beta-1b = drug **Not only** reference to single data point for conclusions based on Table 1. **For Table 2:** **Accept** reference to single data point but **NOT** dose related trend.

Question			Expected Answer(s)	Max Mark	Additional Guidance
4.	(a)		Hydrophobic/Non-polar	**1**	
	(b)		Alpha-helix turn	**1**	
	(c)		Binding (to one subunit of one oxygen) makes the binding of other oxygen more likely.	**1**	Correct reference to affinity change for binding/release of oxygen. **Not:** • binding to other Hbs
	(d)		At low pressures (below 15-20) there is no difference. **OR** Comparison of (maximum) O_2 saturation at 90/100 pressure units (95 vs 50%). **(1)** At high pressures (15-20 upwards) increase for normal is greater than for sickle cell. **(1)**	**2**	
	(e)		Valine has no charge (on R group) so (haemoglobin) molecules don't repel (one another). **OR** Hydrophobic interactions occur between (R groups of) valines (causing clumping). **OR** Glutamic acid has a charge (on R group) so (haemoglobin) molecules repel. **(Any 1)**	**1**	Interaction between non polar R groups of valines is equivalent to hydrophobic interactions between valines.

Question			Expected Answer(s)	Max Mark	Additional Guidance
5.			1. Cell division requires remodelling of cytoskeleton. 2. Spindle fibres made of microtubules. 3. Composed of tubulin. 4. (Composed of) hollow/ straight rods/cylinders/ tubes. **Maximum 2 from 1 to 4** 5. Attach to chromosomes/ chromatids /centromeres/ kinetochores. 6. Radiate from centrosome/ microtubule organising centre/MTOC. 7. Spindle fibres contract/ shorten. 8. Separate chromatids/ (homologous) chromosomes. **Maximum 2 from 5 to 8**	4	**Pt 6** Radiate = extend = grow = originate = made **Allow** radiate from centriole but **NOT** Grow from/made by centriole.

Question			Expected Answer(s)	Max Mark	Additional Guidance
6.	(a)		Maintaining osmotic balance **OR** Generation of ion (concentration) gradient **AND** one from: • for glucose symport (in small intestine) • in kidney tubules • for maintenance of resting potential (in cells/neurons).	1	**Not:** • maintain osmotic gradient
	(b)		Phosphorylation/conformational change (of pump) **(1)** **Lowers** affinity (for Na^+ ions) **(1)**	2	Conformational change must relate to ATP binding/ phosphorylation.
	(c)		Prevents binding of K^+ ions **(1)** Preventing de-phosphorylation **OR** Prevents (reversal of) conformational change **OR** Affinity for Na^+ ions (remains) low **(1)**	2	

Question			Expected Answer(s)	Max Mark	
7.	(a)	(i)	Aquaporin-(2)/AQP(2)	**1**	
		(ii)	Signal transduction	**1**	
	(b)	(i)	Urine output >3·5 litres (per day) on days without treatment / on day 1/2/5/6. **OR** Correct calculation of urine output per kg body mass on day 1/2/5/6. **AND** Stating value >0·05 litres /kg/day.	**1**	Units required. Eg from: day 1: 10·5/70 = ~0·15 day 2: 10/70 = 0·14 day 5: 8/70 = ~0·11 day 6: 9/70 = ~0·13
		(ii)	Urine production was <3·5 litres/ <0·05 litres per kg on day 3/4. **OR** Urine production was <3·5 litres per day / <0·05 litres per kg per day during treatment. **OR** Correct calculation showing urine output reduced to < critical level on day 3/4. **(Any 1)**	**1**	'on day 3/4' **equivalent to** 'during treatment'.
		(iii)	Failure to produce/lack of ADH.	**1**	

Question			Expected Answer(s)	Max Mark	Additional Guidance
8.	(a)		Gamete mother cell	**1**	
	(b)	(i)	Crossing over (at chiasmata) **OR** Breakage and rejoining of DNA/ chromatids (at chiasmata) **(1)** (Leads to) exchange of DNA/ alleles between (homologous) chromosomes **OR** New combinations of/ recombination of alleles (of linked genes) **(1)**	**2**	
		(ii)	independent assortment	**1**	

Question			Expected Answer(s)	Max Mark	Additional Guidance
9.	(a)		(Much) greater proportion (of Mrcaru lizards diet) is plant matter.	1	
	(b)	(i)	(Mrcaru) lizards have micro-organisms to break down plant matter/greater bite force **(1)** **AND** These individuals Are (better) **adapted** to new environment/eating plant matter/ digesting plant matter **OR** Have selective advantage/ increased fitness **(1)**	2	suited ≠ adapted Accept description of *selective advantage*:
		(ii)	Short(er) generation time. **OR** Warm(er) environment/climate/ high(er) temperature. **OR** High(er) selection pressure. **OR** High(er) mutation rate. **OR** Sexual reproduction/horizontal gene transfer. **(Any 1)**	1	
	(c)		Same mean as population as a whole. **OR** Same degree of variation about/ deviation from mean as the population (as a whole). **(Any 1)**	1	

Question			Expected Answer(s)	Max Mark	Additional Guidance
10.	(a)		Sexual dimorphism	**1**	
	(b)	(i)	Males gather/compete in (communal) area/lek (to display) **AND** females assess/choose male **OR** to allow female choice	**1**	
		(ii)	(Display) increases **male's** chance of mating/passing on genes/ reproducing. **OR** (Display) increases **male's** breeding success.	**1**	
		(iii)	(Surviving) offspring have increased fitness/more favourable characteristics. **OR** High/greater number of surviving offspring.	**1**	characteristics = traits = genes = alleles
	(c)	(i)	(Sound) allows communication over (long) distance. **OR** (Sound) overcomes difficulty of limited visibility. **OR** (Sound) allows communication in spite of forest/trees limiting visual signals. **OR** Allows female to locate male(s)/ lek. **(Any 1)**	**1**	
		(ii)	(Dishonest as fake hoots) not indicating male mating success/ fitness. **OR** (Dishonest as fake hoots emitted when) females not present/no mating occurring.	**1**	

Question			Expected Answer(s)	Max Mark	Additional Guidance
11.	**A**	(i)	Costs and benefits of sexual reproduction: 1. males/50% are unable to produce offspring **OR** only females/50% able to produce offspring 2. only half of (each parent's) genome passed on (to offspring) 3. disrupts successful (parental) genomes **OR** (combinations of) beneficial alleles/traits lost 4. increases (genetic) variation 5. (variation) allows evolution/ adaptation (in response to changing environment) 6. (variation allows organism) to keep running in the Red Queen arms race (eg between parasite and host) **Maximum 4 from 1 to 6**	9	produce offspring = reproduce genome = genes = alleles = DNA = genetic information **Pt 2 - NOT:** • traits
		(ii)	Asexual reproduction as a successful reproductive strategy: a. successful genome passed on b. in narrow stable niches c. when recolonizing disturbed habitats d. vegetative cloning in plants **OR** description of suitable example e. parthenogenesis (in animals) **OR** description of example f. (parthenogenesis) where parasite burden is low/climate is cool/parasite diversity is low g. (in organisms using asexual reproduction) horizontal gene transfer allows exchange of genetic material/increased variation h. example of horizontal gene transfer **Maximum 5 from points a to h**		

Question			Expected Answer(s)	Max Mark	Additional Guidance

	B	(i)	Difficulties involved in treatment and control:
			1. endoparasite defined as living within host
			2. rapid antigen change/high antigenic variation
			3. vaccines difficult to design/ produce
			4. (some) parasites difficult to culture (in vitro/laboratory)
			5. similarity between host and parasite **metabolism**
			6. difficult to find drugs only toxic to parasite
			7. difficulty associated with vector control
			   OR
			   indirect transmission
			8. transmission rate high in tropical climate/ overcrowded situations
			9. overcrowding (can occur) in refugee camps/rapidly growing cities (in LEDCs)
			10. difficult/expensive to improve sanitation
			
			Maximum 7 from 1 to 10
				9	

					Pt 8. **Accept:** • spread more rapidly • overcrowding = high population density
		(ii)	Benefits of improved parasite control to human populations: a. reduction in child mortality b. improvements in child development/intelligence c. body uses more resources for growth/development **Maximum 2 from a to c**		

[END OF MARKING INSTRUCTIONS]