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2009 Biology

Advanced Higher

Finalised Marking Instructions

Advanced Higher Biology 2009

GENERAL MARKING ADVICE: BIOLOGY

The marking schemes are written to assist in determining the 'minimal acceptable answer' rather than listing every possible correct and incorrect answer. The following notes are offered to support Markers in making judgements on candidates' evidence, and apply to marking both end of unit assessments and course assessments.

1.   There are no **half marks**. Where three answers are needed for two marks, normally one or two correct answers gain one mark.

2.   In the mark scheme, if a word is <u>**underlined**</u> then it is essential; if a word is **(bracketed)** then it is not essential.

3.   In the mark scheme, words separated by / are **alternatives**.

4.   If two answers are given which contradict one another the first answer should be taken. However, there are occasions where the second answer negates the first and no marks are given. There is no hard and fast rule here, and professional judgement must be applied. Good marking schemes should cover these eventualities.

5.   Where questions in data are in two parts, if the second part of the question is correct in relation to an incorrect answer given in the first part, then the mark can often be given. The general rule is that candidates should not be penalised repeatedly.

6.   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.

7.   Clear indication of understanding is what is required, so:

   - if a description or explanation is asked for, a one word answer is not acceptable
   - if the question asks for **letters** and the candidate gives words and they are correct, then give the mark
   - if the question asks for a word to be **underlined** and the candidate circles the word, then give the mark
   - if the result of a calculation is in the space provided and not entered into a table and is clearly the answer, then give the mark
   - **chemical formulae** are acceptable eg CO_2, H_2O
   - contractions used in the Arrangements document eg DNA, ATP are acceptable
   - words not required in the syllabus can still be given credit if used appropriately eg metaphase of meiosis

8.   Incorrect **spelling** is given. Sound out the word(s),

   - if the correct item 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 words then **do not** give the mark, eg mellum, melebrum, amniosynthesis

9. **Presentation of data:**

- if a candidate provides two graphs or bar charts (eg one in the question and another at the end of the booklet), mark both and give the higher score
- if question asks for a line graph and a histogram or bar chart is given, then do not give the mark(s). Credit can be given for labelling the axes correctly, plotting the points, joining the points either with straight lines or curves (best fit rarely used)
- if the x and y data are transposed, then do not give the mark
- if the graph used less than 50% of the axes, then do not give the mark
- if 0 is plotted when no data is given, then do not give the mark (ie candidates should only plot the data given)
- no distinction is made between bar charts and histograms for marking purposes. (For information: bar charts should be used to show discontinuous features, have descriptions on the x axis and have separate columns; histograms should be used to show continuous features; have ranges of numbers on the x axis and have contiguous columns)
- where data is read off a graph it is often good practice to allow for acceptable minor error. An answer may be given $7 \cdot 3 \pm 0 \cdot 1$

10. **Extended response questions:** if candidates give two answers where this is a choice, mark both and give the higher score.

11. **Annotating scripts:**

- put a 0 in the box if no marks awarded – a mark is required in each box
- indicate on the scripts why marks were given for part of a question worth 3 or 2 marks. A ✓ or **x** near answers will do

12. **Totalling scripts:** errors in totalling can be more significant than errors in marking:

- enter a correct and carefully checked total for each candidate
- do not use running totals as these have repeatedly been shown to lead to more errors

2009 Biology Advanced Higher

Marking scheme

Section A

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

Question			Acceptable Answer	Mark	Notes	Negates
1	**(a)**		An organism that consumes complex/organic molecules **OR** consumer **OR** feeds on/gets energy from other organisms	1	Not 'can't produce its own food' Not 'nutrients' Not reference to single level of trophic interaction or other concept eg omnivore	
	(b)	**(i)**	wolves cause (herbivores decrease) aspen increase **1** wolf **increase** data (dates or numbers) **and** corresponding aspen data (damage decrease or height increase) **1**	2	Cause and effect must be clear	
		(ii)	**208%** (74 – 24 = 50; 50/24 × 100 = 208·33%)	1		
		(iii)	• high reproduction rate of elk • elk reproduction replaces predation loss • prey consumed were not reproductive • (young) wolves eat other animals • many wolves are young and not hunting yet • more vegetation/food for elk so more survive	1	Any one of bullet points	
	(c)		Older trees more (abundant) in Zion Canyon than in North Creek **OR** not much difference Younger trees **much** more (abundant) in North Creek than in Zion Canyon More older trees than young trees in Zion Canyon **OR** More younger trees than older trees in North Creek	2	Any two from three	
	(d)		• investigators would scare them away/cougars may go into hiding (because cougars are sensitive to humans) • same cougar may be counted twice • sightings not reliable/accurate, (so counting scats is better) • scats more easily spotted than cougars/static • numbers of scats proportional to number of cougars	1	Any one of bullet points	

Question		Acceptable Answer	Mark	Notes	Negates
(e)		In Zion Canyon/where there are tourists, cougars are absent and there are few saplings/cottonwood **OR** In North Creek/where there is no tourism the cougars are present and there are many saplings/cottonwood **1** Tourism started in 1930s (in Zion Canyon) and since then there are few trees **1**	**2**		
(f)	**(i)**	Density dependent	**1**		
	(ii)	**Excessive/high intensity** grazing leads to less diversity because all/most/several/some species are killed **Moderate** grazing increases diversity because dominant species are kept in check/others can now grow/rarer species survive better with less competition/those with basal meristems survive etc **Low intensity** grazing reduces diversity because a single species dominates/outcompetes the others	**2**	Any two	

Question			Acceptable Answer	Mark	Notes	Negates
2	**(a)**	**(i)**	Resisting/tolerating/surviving environmental adversity	**1**	Not waiting for optimum conditions Not *avoiding or escaping* adverse conditions Not surviving *bad weather*	
		(ii)	• reduction in population of native species • extinction • reduction in biodiversity • competitive exclusion • loss of habitat • spread of disease to native plants	**1**		
		(iii)	Herbicide/pesticide/cutting/removal/disease/herbivore	**1**	Not predator Not toxin Biological control = introducing disease/herbivore	
		(iv)	Need to control for 2 or so years to allow dormant seeds to germinate **OR** Cut down/spray plants before flowering for two years **OR** Remove/kill all dormant seeds after vegetation removed	**1**	A 'few years' is acceptable but it is not eradication if you have to do it forever	
	(b)		Reduction in soil quality/erosion/compaction Reduction humus/nutrients/fertility	**1**	acceptable to specify nutrients	
3			1. CO_2 from burning/use of fossil fuels 2. **enhanced** greenhouse effect 3. causes global warming 4. <u>zooxanthellae</u> and coral (symbiosis) is mutualistic 5. as sea temperature increases algae leave the coral 6. coral bleaching	**4**	Any 4	

Question			Acceptable Answer	Mark	Notes	Negates
4	**(a)**		Harmful for both species/organisms involved (in interaction)	**1**	Harmful = reduced fitness/survival If 'harmful' not used, must specify the harm	
	(b)		Resources a species is capable of using in **the absence of competition**	**1**		
	(c)		No two species with same niche can coexist			
			Interspecific competition is intense (because both species have similar fundamental niche)			
			Competitive exclusion has occurred or description of **local** extinction of one of the species	**2**	Any 2	
	(d)	**(i)**	Co-evolution of **host and parasite** **OR** Specificity of **host and parasite**	**1**	Specificity: conditions, structures or resources may be similar in related species but not in unrelated species	
		(ii)	(Direct) contact/vector/resistant stage/secondary host/ vertical	**1**		

Question			Acceptable Answer	Mark	Notes	Negates
5	**(a)**	**(i)**	B, C, D, E	**1**		
		(ii)	Hydrophilic			Reference to them being INTRAcellular
			Peptide hormone		Must be type of molecule Not 'hormone such as insulin'	Wrong example – steroids
			Neurotransmitter	**1**		
	(b)	**(i)**	Four ring structure (with variable groups attached)	**1**	Ignore incorrect diagram if text is right. If diagram, ring structure must be correct	
		(ii)	(Affects) fluidity/permeability (of membrane/ phospholipids bilayer)	**1**		
		(iii)	6:1:2	**1**		
6	**(a)**		(Repressor binding to the operator switches) structural gene off/not transcribed/not expressed **OR** no beta galactosidase/lactase/lactose-digesting enzyme made	**1**	Off position is described in question. Level same as Higher, so enzyme name is not essential	
	(b)	**(i)**	Secondary	**1**		
		(ii)	Basic	**1**		
		(iii)	Positive charges (of lysine) interact/bond with/attracted to the negative charges on DNA	**1**	Not hydrogen bonding	

Question		Acceptable Answer	Mark	Notes	Negates
7	**(a)**	50µMl^{-1} (micromoles per litre); 51 OK	**1**	Units required. Answer could be other correct forms	
	(b)	(Competitive) inhibitor occupies active site **and** a higher concentration of/more substrate is needed to reach (half) V$_{max}$ /same rate of reaction	**1**		
	(c)	5x10^{-4}s **OR** other formats	**1**	Not 1/2000 s	

Question	Acceptable Answer	Mark	Notes	Negates
8 A	1. glucose exists in linear and ring forms 2. more of the ring form 3. description of C1 OH group in α position below plane/ring and β above plane/ring 4. glucose monomers join by condensation reaction/ glycosidic bonds 5. diagram of alpha (1,4) bond **OR** beta (1,4) bond **OR** alpha (1,6) bond 6. (side) branches are between C1 and C6 7. starch is found in plants **and** function is **energy** storage 8. two forms of starch – amylose and amylopectin 9. starch has glucose monomers joined by α (1,4) bonds 10. amylose linear/has no (side) branches 11. amylose forms a helix 12. glycogen is found in animals **and** function is **energy** storage 13. glycogen has glucose monomers joined by α (1,4) bonds 14. amylopectin has less branching than glycogen 15. cellulose is found in plants **and** provides support/is structural 16. cellulose has glucose monomers joined by β (1,4) bonds 17. cellulose has glucose molecules inverted every second molecule 18. gives a rigid/straight chain 19. chains form fibrils 20. starch and glycogen are insoluble **and** do not affect osmosis	**15**	Text overrides bad diagram C1 and C4 indicated; OH positions above or below. C6 later as required Not reference only to human	

Question	Acceptable Answer	Mark	Notes	Negates

8 B	1. PCR is used to **amplify** DNA
	2. DNA denatured/melted by heating to about 90ºC
	3. cooled to let primers anneal/attach
	4. primers are short base sequence complementary to sample
	5. primers delimit the copy region
	6. Taq polymerase optimum temperature about 70ºC
	    OR
	    Taq polymerase stable at high temperature
	7. polymerase synthesises complementary strand
	8. cycle repeated 30 or so/many times
	
	9. used for forensics/paternity disputes/testing pedigrees
	10. DNA samples are isolated/purified
	11. samples digested with restriction enzyme/endonuclease
	12. differences between individuals' genomes
	    OR
	    reference to hypervariable repeat sequences/VNTR
	13. fragment lengths of digested DNA varies between
	     individuals
	14. fragments separated by electrophoresis
	15. electric current/electricity passed through gel
	16. DNA has a negative charge/phosphates charged
	17. shorter fragments travel further/faster
	18. fragments blotted onto a filter/membrane
	19. probe is a short chain of single stranded DNA
	20. probe binds to complementary bases on fragments/
	     hybridisation occurs
	21. fragments with probe attached show up
	    OR probe is labelled
	22. Correct description of outcome
		Max 5
		
		Max 10
		
		15
			Not replicate
			Melting = forms two strands
			
			Any correct answer
			
			Or use of mini-satellite	

Section C: Biotechnology

Question			Acceptable Answer	Mark	Notes	Negates
1	**(a)**	**(i)**	ELISA/immunoassay	**1**		
		(ii)	Antibodies are specific to antigens **OR** HSV antigens/epitopes not the same as those for chickenpox	**1**		
		(iii)	Some antibody R-enzyme would be present and react with substrate **1** even though it is not bound to Q **OR** even though no Q is present **OR** even if some Q is present but unattached **2** (to HSV antigen) **1**			
	(b)		Myeloma and (B) lymphocyte/B-cells	**1**	Not tumour; not cancer cells	
2	**(a)**	**(i)**	lactose to lactic acid	**1**		
		(ii)	Pasteurisation **OR** to kill pathogens/naturally occurring bacteria/spoilage bacteria	**1**	Not sterilisation	
	(b)	**(i)**	Two species present/two different types of cell present	**1**		
		(ii)	• culture has become contaminated • pasteurisation process not successful • two bacterial species in added culture	**1**	Any one	

Question			Acceptable Answer	Mark	Notes	Negates

3			**ANY 5** points from:
			
			1. single colony from an agar plate
			2. transfer to (nutrient) broth/liquid culture
			3. purity/(stage of) growth checked by plating on agar/ by microscopy
			4. succession of transfers to increasing volumes
			5. fermenters for larger volumes
			6. and 7. factors for consideration in scaling up
			   • cost
			   • containment of micro-organisms
			   • aseptic transfers
			   • sterilisation of fermenters
			   • abiotic – pH/temperature/oxygen/stirring
			
			     Any two bullets for points 6 and 7
				5	Any 5	

4	**(a)**		Silo (tower)/bunker/pit	**1**		
	(b)		Creates anaerobic conditions (which leads to) **and** lowered pH/acidic conditions/lactic acid **1** **Spoilage** organisms do not grow/are killed **1**	**2**	Not pathogens	
	(c)		*Enterococcus (faecalis)/Lactobacillus (plantarum)*	**1**		
	(d)	**(i)**	Lower free amino acids indicates less protein breakdown	**1**		
		(ii)	(Added bacteria have) no **significant** effect on lactic acid content **OR** If using lactic acid conclusion in d(i) then accept **Significantly** lower free amino acids indicates less protein breakdown	**1**	Must consider how the error bars relate to validity of conclusions	

Section C: Animal Behaviour

Question			Acceptable Answer	Mark	Notes	Negates
1	**(a)**	**(i)**	(Although) Stages 2 and 5 (approx) 25% abundance **OR** proportion similar **1** (Birds made) 75% (approx) of foraging choices for stage 2 flowers (0% for stage 5) **1**	**2**		
		(ii)	maximising <u>energy</u> gain **and** minimising expenditure **OR** maximum **net** gain in <u>energy</u>	**1**		
		(iii)	Stage 2 flowers have greatest availability of nectar **and** these are visited most frequently **OR** As nectar production increases foraging increases	**1**		
	(b)	**(i)**	(Energy) cost of gamete production is greater in females	**1**		
		(ii)	Genes for nest building have effects outside the body of the bird	**1**		
	(c)		Similar/the same	**1**	*Identical* accepted	

Question			Acceptable Answer	Mark	Notes	Negates
2	**(a)**	**(i)**	Most rapid response is (to silk from) unmated females	**1**	Answer relates to male response time	
		(ii)	Latency	**1**		
		(iii)	Frequency/duration/intensity/strength **Any 1**	**1**		
		(iv)	Behaviour may differ from that shown in the wild Other factors/stimuli from natural habitat not present Investigator influences behaviour	**1**		
	(b)		Prevent/reduce chances of being eaten by females **OR** Prevent waste of time/energy in courting unreceptive female/increased chance of mating	**1**		
3	**(a)**		• larger proportion/more likely to be on outside of groups **and** more vulnerable/easier to catch • more spaced out/further away from neighbours **and** more vulnerable/easier to catch • spend less time scanning **and** less likely to detect cheetah **Any 1**	**1**		
	(b)		18 (30% of 80 = 24, 75% of 24 = 18)	**1**		
	(c)		Vigilance	**1**		

Question	Acceptable Answer	Mark	Notes	Negates
4	1. agonistic behaviour − all aspects of competitive/ fighting behaviour 2. threat/attack to establish dominance/status (in a social group) 3. appeasement/submissive behaviour terminates attack/inhibits aggression 4. example of appeasement/submissive posture eg sexual presentation in baboons 5. ritualised display allows assessment of opponent/ chances of success 6. (ritualised display) reduces energy expenditure/ reduces fighting or risk of injury 7. example of ritualised display eg roaring/parallel walk in red deer 8. reduced risk of predation in social group (benefit all group membership) 9. increased chance of all individuals/subordinates obtaining food	**5**		

Section C: Physiology, Health and Exercise

Question			Acceptable Answer	Mark	Notes	Negates
1	**(a)**	**(i)**	Weight and height	**1**		
		(ii)	25 – 34 (% = 60, 88, 51, 54, 28)	**1**		
		(iii)	Obesity increases with age	**1**	Either year OK	
		(iv)	Hypertension, (C)HD, diabetes (type 2/NIDDM)	**1**	CHD = CVD or Angina or Stroke or MI	
	(b)	**(i)**	Fat-free mass/lean tissue/muscle conducts electricity **OR** Fat offers resistance/impedes current **1** The higher the impedance/the lower the current **and** the higher the percentage fat **1**	**2**		
		(ii)	Depends on hydration/kidney function Overestimates fat in lean people or underestimates fat in obese people	**1**	Not expensive; not difficult to employ	

Question	Acceptable Answer	Mark	Notes	Negates

2	1. cardiac output (CO) increases
	2. to keep up with demand for oxygen
	3. heart rate and stroke volume increase
	OR
	    equation $CO = HR \times SV$
	4. CO/SV increase from greater distension of ventricle
	OR CO/HR/SV increase from adrenalin
	OR CO/HR increase by sympathetic nerves/stimulation
	5. force of contraction/systolic BP/BP increases
	6. general point about redistribution of blood to muscles
	OR example of redistribution **from choices below**
	    • increased blood flow/vasodilation in skeletal muscle
	    • increased blood flow to heart muscle/through coronary arteries
	    • increased blood flow/vasodilation in skin
	    • reduced blood flow/vasoconstriction in viscera
		4	Any 4	

Question		Acceptable Answer	Mark	Notes	Negates
3	**(a)**	Exercising muscles need oxygen for energy release/ATP production/aerobic respiration The rate that muscles work at depends on the ability to deliver oxygen to them Higher VO2 max indicates higher oxygen consumption/ higher fitness	**2**	Any 2	
	(b)	(The fitness value is) derived by dividing O_2 uptake by body mass **OR** it is **per kg** tissue **OR** quantify using eg dividing max O_2 by body mass	**1**		
	(c)	**2·896** or **2·9** l min^{-1}	**1**		
	(d)	Patient recovering from MI or heart condition Elderly	**1**		

Question		Acceptable Answer	Mark	Notes	Negates
4	**(a)**	Thermic effect of food/Dietary (induced) thermogenesis	**1**		
	(b)	Either sugar increases energy expenditure (Energy expenditure) for sucrose more than glucose Different sugars give different changes in EE	**1**		
	(c)	• difference between sugars is not due to chance/ biological variation • significant difference between glucose and sucrose results • obtained by testing a number of individuals • glucose results more reliable • results are mean values • there is variation between individuals	**1**	Not *accuracy* of results	
	(d)	Direct measures heat output **and** indirect measures oxygen uptake etc	**1**	'it' = indirect	

[END OF MARKING INSTRUCTIONS]