2012 Biology

Advanced Higher

Finalised Marking Instructions

Advanced Higher Biology 2012

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 **underlined** 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 $7\cdot3 \pm 0\cdot1$

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

2012 Biology Advanced Higher

Marking scheme

Section A

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

Section B

Question			Acceptable Answer	Mark	Notes	Negates
1	**(a)**	**(i)**	phosphodiester (bonds) / phosphoester	**1**		
		(ii)	(complementary) base **pairing** + stops the shape unravelling / creates the shape / holds shape	**1**	H bonding is the means of holding the base pairs/shape/double strand together/stabilising the shape. NOT '<u>maintains</u>' the shape	A -T negates
	(b)		Drosha not working miRNA / precursor not processed/cut no (micro)RNA strand for RISC **OR** RISC can't bind (m)RNA (RNA) interference reduced / translation is left on **any 2**	**2**	hairpin = precursor	
	(c)	**(i)**	<u>62.5</u>	**1**		
		(ii)	more KO cells in G1 **and** fewer in S (and G2+M) differences are significant (only) in G1 and S /error bars don't overlap in G1 and S **OR** if comparing only G1 bars or only S bars, then must point out significant difference (for 1 mark)	**1** **1**	comparison can be made via data but data must be correct allow *time* in stages for fraction in stage	

Question		Acceptable Answer	Mark	Notes	Negates

(d)	(i)	(After induction of differentiation)
		• in KO cells it is (generally) lower than normal cells
		• it increases in normal cells (over time)
		• in KO cells + one from below
		    no trend
		    decreases from day 8
		    increases (to day 8) then decreases
		 any 2 from 3
			2	It = expression = level of marker	

	(ii)	in normal cells, as differentiation increases self-renewal decreases OR converse in KO / abnormal cells, **both** processes decrease after day 8 OR in KO / abnormal cells, **both** processes increase to day 8 OR in KO / abnormal cells, self-renewal remains higher and differentiation remains lower **than normal** any 1	**1** **1**	**must** link the two graphs/processes	
(e)		Lactose absent repressor binds to operator	**1** **1**		

	Question		Acceptable Answer	Mark	Notes	Negates
2	(a)	(i)	binding is extracellular / to cell surface / to membrane change in cAMP is inside the cell / intracellular OR change in intracellular signal molecule / second messenger	1 1		
		(ii)	crypsis / camouflage / description of camouflage	1	**Not** mimicry, scaring, looking dangerous, disruptive	if list includes any of the **nots**
	(b)	(i)	(mechanical) support / strength / shape cell movement spindle fibres / separation of chromatids / movement of chromosomes	1	Not *structure*	
		(ii)	tubulin	1		
		(iii)	centrosome / centriole / MTOC	1		
3			1. inhibitors reduce enzyme activity 2. competitive inhibitors resemble substrate 3. (CI) binds to / occupies active site **and** prevents substrate access 4. non-competitive inhibitors / negative modulators bind at a second site / allosteric site 5. non CI / negative modulator alters the shape of the **active site** 6. substrate binding reduced / prevented 7. idea of modulation (of rate) by change in **affinity** of active site for substrate 8. allosteric enzymes involved in regulation of pathways any **5**	5	Not inhibitor the **same** shape as substrate	

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Question			Acceptable Answer	Mark	Notes	Negates
4	**(a)**		probe	**1**		
	(b)		Yes. Fragment from P is shorter because of the deletion Shorter fragment goes further (in the gel) OR DNA with deletion goes further (in the gel)	**1** **1**		
	(c)		polymerase chain reaction / PCR	**1**		
5	**(a)**		bioaccumulation	**1**		
	(b)	**(i)**	30% (or 29.64 or 29.6)	**1**		
		(ii)	run-off from land / leaching / spray + reaches **sea**	**1**		
			through food chain / biomagnifications	**1**		

Question			Acceptable Answer	Mark	Notes	Negates
6	(a)		**energy loss** (from food chain) **+** via: high metabolic rate / homeothermy / heat / respiration / movement herbivory / food source high in cellulose / uneaten parts / undigested parts	1		
	(b)	(i)	less predation OR more feeding	1		
		(ii)	(further global warming because) shorter winter ice duration reduces krill population density so less faeces to trap carbon (dioxide) from the atmosphere OR faeces (now) decompose OR decomposition begins carbon dioxide returned to atmosphere	1 1		
7	(a)		suspended growth / suspended development / suspended life cycle / **reduced** metabolism	1	Not <u>suspended</u> or <u>halted</u> *metabolism* Not 'dormancy' – need more explanation	
	(b)		(large fields have) fewer hedges / fewer rose plants **so** fewer insects / disrupts life-cycle (increased yield from) less feeding / less disease	1 1		
	(c)		**organism** / species that transfers **parasite** between **hosts**	1	In this case virus = parasite	

Question			Acceptable Answer	Mark	Notes	Negates

8	(a)	(i)	1. definition of niche: (multi-dimensional summary of) resources/requirements of species
			2. fundamental niche is the resources a species is **capable** of using/could use
			3. realised niche is the resources a species actually uses **or** are available in presence of competitors
			4. competition defined as two organisms attempting to utilise same resource
			5. (competition arises) when resources limited
			6. competition is negative for both species
			   OR
			   competition is a negative-negative / (-/-) interaction
			7. eg. of negative outcome/cost (reduced growth, fecundity, population decrease, increased mortality)
			8. intraspecific same species + interspecific different species
			9. intraspecific competition more intense (than interspecific)
			10. because all require same/similar resources
			11. exploitation competition defined as use of resource reducing the supply to others
			12. interference competition is when access to resource is prevented
			13. example of either of above
			14. two **species** with the same/similar niche cannot coexist (in same location)
			15. competitive exclusion arises from interspecific competition/when two **species** competing
			16. (one species will survive and) one species will die out/local extinction
			17. resource partitioning allows exploitation/sharing of different components of a resource
			18. resource partitioning reduces competition
			19. example of resource partitioning
			20. definition of exotic species as introduced /alien
			21. invasive in terms of better competitor/ lacking predators/ lacking herbivores/lacking parasites
			22. eg.of ecological damage caused by named invasive sp.
				15	Accept 'food and habitat' as minimum equivalent to resources
					
					organism = species in 1,2,3,6
					
					19. description required	

Question	Acceptable Answer	Mark	Notes	Negates

8 (b)	**Decomposition**
	1. decomposition is break down of organic matter to inorganic
	  OR decomposition is mineralisation
	2. soil organisms particularly important
	3. detritivores are invertebrates / or eg...
	4. ..that produce humus / that fragment detritus / wastes
	5. increases surface area so speeds up decomposition
	6. enzymes / digestion internal (in detritivores)
	7. decomposers are bacteria and fungi
	8. enzymes / digestion external (from decomposers)
	9. decomposer respiration is final releaser of CO_2
	10. decomposition limited by available nitrogen
	Nutrient cycling
	11. finite supply of nutrients
	12. cycles maintain the supply
	13. uptake / fixation by plants
	14. assimilation, transformation, food chains, and decomposition **(any 2)**
	15. loss of nutrient from ecosystem eg. via leaching
	16. low solubility of P limits phosphorus cycle
	17. decomposition of (organic) N compounds produces ammonium
	  OR decomposition is called ammonification
	18. nitrification is ammonium to nitrite to nitrate
	19. *Nitrosomonas* converts ammonium to nitrite
	20. *Nitrobacter* converts nitrite to nitrate
	21. denitrification is nitrate to N gas
	22. anaerobic / occurs rapidly in waterlogged soil
	23. N fixation: nitrogen gas converted to ammonium
	24. Cyanobacteria (N fixers) are free-living / in soil / in water
	25. Rhizobium in root nodules / legumes
	26. nitrogenase (that does the N fixing) is inhibited by oxygen
	27. leghaemoglobin in nodule reduces oxygen level
	max 10
			ammonia =ammonium
			
			named nutrient = nutrient
			
			13 and 14 are to allow generic description of cycles: the points can be made by referring to the movement of nutrients generally or to specific nutrients.	

Section C: Biotechnology

Question			Acceptable Answer	Mark	Notes	Negates
1	**(a)**		spleen	**1**		
	(b)		to make the cell line immortal / so that fused cells can divide indefinitely / because myeloma cells are immortal	**1**	OK 'to make the B lymphocytes immortal'	
	(c)	**(i)**	the medium kills them	**1**		
		(ii)	(unfused lymphocytes) divide a number of times and die / are not immortal / have a limited lifespan	**1**	Not 'unable to divide'	
	(d)		1st step selects for desired antibody	**1**		
			2nd step: selection of the cell that makes the (desired) antibody	**1**	B lymphocytes = hybridoma	
			OR for 1 mark (no reference to stage 3) to make sure a single cell type / antibody is present			

Question			Acceptable Answer	Mark	Notes	Negates
2			1. plot growth curve / obtain values of cell numbers over specified time period 2. to identify exponential phase 3. use exponential phase to calculate g 4. g = time for population to double / time for one division 5. growth rate constant (k) = ln2/g 6. k is number of doublings / generations per unit time 7. k is used to optimise growing conditions 8. to maximise enzyme production	**5**	NB: g is a time 0.693/g OK division = doubling	
3	**(a)**	**(i)**	cellulase / pectinase	**1**		
		(ii)	improves clarity / reduces haze / breaks down hemicellulose / removes araban	**1**		
	(b)	**(i)**	(affinity) chromatography	**1**		
		(ii)	the **shape** of the enzyme / active site is specific to (the shape of) the substrate	**1**		

	Question		Acceptable Answer	Mark	Notes	Negates
4	**(a)**		kills (the majority of the) naturally occurring **bacteria** / spoilage **bacteria** / harmful **bacteria** / pathogens	**1**	removes = kills micro-organisms, microbes = bacteria Not 'killing **all** bacteria'	
	(b)	**(i)**	Lactose to lactic acid	**1**		
		(ii)	generates flavour / texture	**1**		
	(c)	**(i)**	10×10^7 **or** 10^8	**1**		
		(ii)	mixed culture grew to 9×10^7 pure to 3×10^7 OR other correct quantification	**1**		

Section C: Animal Behaviour

Question			Acceptable Answer	Mark	Notes	Negates
1	**(a)**		head up / scanning / not drinking or eating	**1**	Not 'keeping an eye out' 'keeping watch'	
	(b)	**(i)**	randomly selected individuals focal sampling (for eg 5 mins) / other sampling strategies ethogram / check list avoid influence by observer / use camouflage, hide etc. video recording /use of camera/ remote telemetry	**1**	Method must be appropriate for studying vigilance. List with error gets no mark	
		(ii)	Vigilance does decrease as group size increases when lions are present (but) When lions are absent the vigilance is not related to group size Lions increase vigilance in smaller groups sizes but not larger (beyond 11) **any 2**	**2**		
		(iii)	Lions present graph depends on one sample of group size 16 OR Some group sizes have no values (8,9,10,13,14,15) OR Some group sizes have only 1 sample (6,7,16) OR Some group sizes have large variation in replicates (3,4)	**1**		

Question			Acceptable Answer	Mark	Notes	Negates
2	(a)		As body size increases so does crater diameter / size	1		
	(b)	(i)	individually characteristic / highly repeatable / outside body / innate / gene expression determines outward behaviour	1		
		(ii)	any built structure; eg nests / homes / traps etc OR behaviours such as herding / shoaling / bird song	1		
	(c)		crater building / coloration / display behaviour	1	or egs of other things that improve the chance of being the mate	
3	(a)	(i)	younger subordinates groomed more frequently OR as age of subordinate increases, grooming decreases	1		
		(ii)	duration / intensity	1	Not **frequency**	
	(b)		reinforce close relationships or alliances / develop bonds / lower dominance threat / maintain social rank / hygiene / courtship any 2	2	OK '**establish** hierarchy'	
	(c)		"… **not necessarily closely related** to the young animals that they help to rear."	1		
			They are not assisting the survival of their own genes OR Altruism generally involves kin selection / close relatives (and this isn't)	1		

Question	Acceptable Answer	Mark	Notes	Negates
4	1. Sign stimuli / releasers are signals that elicit **specific** response 2. FAP is automatic / stereotyped / species specific response 3. (FAPs are) under genetic control / innate 4. (FAPs are) resistant to change (by learning) OR once initiated goes to completion 5. Series of releasers / FAPs can produce complex behaviour 6. (Herring) gull adult has red spot on bill (releaser) 7. Elicits (FAP of) chick pecking at spot 8. (Then releases) parent provides food	**5**	Other examples to illustrate the releaser-FAP-releaser sequence are possible for points 6, 7 and 8.	

Section C: Physiology, Health and Exercise

Question			Acceptable Answer	Mark	Notes	Negates
1	**(a)**		systolic = 120 and diastolic = 70 OR Systolic/diastolic OR systolic and diastolic pressures *in mmHg*	**1**		
	(b)		narrowing / obstruction / loss of elasticity	**1**		
			increases resistance OR force on artery wall increases pressure OR to keep the same flow (rate) the BP goes up	**1**		
	(c)	**(i)**	40.7%	**1**	40.741, 40.74, 41 OK not 40.740	
		(ii)	(with exertion) heart's demand for oxygen increases / heart rate increases but diastole shorter OR time for O_2 delivery shorter OR lower coronary circulation / oxygen to cardiac muscles	1 1	Cardiac = heart	
	(d)		5 **or** 10mg **significantly** better than control	**1**		
2	**(a)**		Not obese. BMI = 27 **and** less than 30/obesity cut-off	**1**	ignore dp	
	(b)	**(i)**	mass and **volume**	**1**	mass = weight not 'weight under water'	
		(ii)	used in (Siri) equation OR (495/density) – 450	**1**		
	(c)		underestimates fat	**1**	not 'underestimates fat **distribution'** or 'underestimates obesity'	

	Question	Acceptable Answer	Mark	Notes	Negates
3	**(a)**	improve / increase HDL:LDL improve / increase HDL reduces LDL / reduces triglycerides / reduces cholesterol	**1**	Check ratio is correct	
	(b)	increases glucose uptake (in muscle and fat cells) increases number of **active** receptors increases number of glucose transporters (in target cells) increases (enzymes for) glycogen synthesis any 2	**2**	Functioning/working = active Q is about 'loss of sensitivity' so answer can't be 'increases sensitivity' – need **how**	
	(c)	starting / fasting insulin concentration is reduced by exercise (1) + correct quantification (1) OR starting / fasting insulin concentration is reduced equally at both exercise levels + correct quantification OR (in response to same food intake) both exercise levels result in lower insulin production than control + correct quantification OR insulin increases less after exercise + correct quantification OR as the level of exercise increased the insulin response to the meal decreased + correct quantification	**2** **Any one of these**	**Quantification**: include time and comparison between control and exercise	

Question	Acceptable Answer	Mark	Notes	Negates
4	Discuss the contribution of exercise to a weight-control programme. 1. individual overweight because energy in > energy out 2. exercise increases energy out / gives negative energy balance 3. exercise leads to weight loss / fat loss 4. exercise (may not alter weight) may increase muscle / alter balance between muscle and fat 5. BMR increase causes increased energy output OR more lean tissue so higher BMR 6. the effect of exercise on body mass may decrease as fat decreases 7. reference to exercise programme: frequency, duration, intensity and type of exercise (any one)	**4**	Not 'burning fat'	

[END OF MARKING INSTRUCTIONS]