2010 Biology

Advanced Higher

Finalised Marking Instructions

Advanced Higher Biology 2010

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 $7{\cdot}3 \pm 0{\cdot}1$

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

2010 Biology Advanced Higher

Marking scheme

Section A

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

Section B

Question	Acceptable Answer	Mark	Notes	Negates
1 (a)	It/oncogene is **dominant** The mutation/mutated allele is dominant *Mutated* proto-oncogene/mutated proliferation gene are dominant	**1**	Not *proto*-oncogene is dominant, must have *mutated* Must be referring to the question or text, eg *Mutations are dominant* is not the same as *the mutation is dominant*.	
(b) (i)	monolayer/one layer/single layer Confluent/**complete** coverage	**1** **1**	Not *contact inhibition* alone	
(ii)	stimulates cell proliferation/division OR provides/is a source of growth factors/MPF	**1**	Not *nutrients*, not *energy*, not it *is* a growth factor, not stimulates *growth*, not growth hormones	
(c) (i)	The two genes/*EML4* and *ALK* alone/not fused/do not transform cells/produce foci	**1**	*Only fusion gene forms foci* is not enough. Must refer to the two genes alone.	
(ii)	modification of fusion (gene) stops foci formation/transformation modification removes kinase activity	**1** **1**		
(d)	(At zero inhibitor conc. in Fig 2 and Fig 3) both normal and transformed cells start at 10^6 cells and both reach 10^{10} cells by day 7	**1**	Need ideas of change in numbers of cells **and** time scale to get rate; can use *start at same point* **OR** *finish at the same point* instead of one of the cell counts **OR** *in same time* instead of 7 days: two out of three quantifications required.	

Question	Acceptable Answer	Mark	Notes	Negates
(e) (i)	(At day 7, cell number) in absence of inhibitor is 10^{10} and 10^{8} in presence of inhibitor **and** difference of $\times 10^{2}$	**1**	Need to show where data come from, show the calculation **and** show the result – may take different forms	
(ii)	As concentration of inhibitor increases, (rate of) growth/ proliferation decreases Inhibitor reduces growth more in transformed cells than normal cells both 5 mol l^{-1} and 10 mol l^{-1} inhibitor reduce cell **number** relative to 0 mol l^{-1} any 1	**1**	Cell numbers are not decreasing except Fig 3, 10 mol l^{-1} Take *growth* to be increase in cell number	
(iii)	Comparison of final cell numbers OR of numbers at a specified period/time from both graphs	**1**	For day 7, for example: At day 7, 10^{9} for normal and 10^{8} for transformed OR 10x decrease for normal and 100 × for transformed (implicitly day 7) OR increase (10^{6}) to 10^{9} for normal and (10^{6}) to 10^{8} for transformed (implicitly over 7 days)	
(f)	This is the concentration that: • made transformed cells decrease • was effective at killing transformed cells • reduced transformed cell number to 10^{2} • would reduce tumour size any 1 very little effect on normal cells	**1** **1**	Does not kill **all** cells	

Question	Acceptable Answer	Mark	Notes	Negates
2 (a)	peptidoglycan	**1**		
(b) (i)	C1 (of NAM) bonded to C4 (of NAG)	**1**	Penalise once only for reference to glucose	
	OH of C1 is above plane/ring/carbon	**1**		
(ii)	hydrolysis	**1**		
3	1. protein that spans the membrane protein 2. works against concentration gradient/by active transport 3 ATP provides phosphate 4. phosphate attaches to pump/protein/protein phosphorylated 5. phosphorylation/dephosphorylation alters conformation/shape of protein OR description 6. different conformations have different affinity for sodium/ potassium 7. (3) sodium ions (pumped) out of cell and (2) potassium in any 5	**5**	Not channel or carrier Diagrams might be useful here but must be annotated correctly.	

Question	Acceptable Answer	Mark	Notes	Negates
4 (a)	contains foreign DNA OR contains DNA from another **species**	**1**	*Genes*/*genetic material*/*chromosomes* acceptable. *Type* acceptable for *species*	
(b)	*Agrobacterium* (*tumefaciens*)/*A. tumefaciens*	**1**		
(c)	selects for plants/cells with the plasmid/resistance gene OR is toxic to (plant) cells with no plasmid/resistance gene surviving (plant) cells now have the desirable/transgene sequence	**1** **1**	Penalise once only if answer refers to bacterial cells	
(d)	bacterial toxin/Bt toxin/insecticide in tomato/other plants herbicide resistance added to in corn/maize/cotton/other plants beta carotene added to/in rice increased shelf life (flavr savr) tomato Trait plus destination	**1**	In 'crop plants': • disease resistance • tolerance of high pH • nutritional inserts Minimum: *disease resistance in plants/crops*	

Question	Acceptable Answer	Mark	Notes	Negates
5 (a)	(In intraspecific, individuals are from the same species so) individuals have the same resource needs/niche OR Converse for interspecific	**1**		
(b) (i)	B	**1**		
(ii)	Any competition is negative OR presence of any competitor reduces time spent feeding/at flower OR **inter**specific more intense than **intra**specific	**1**	General conclusion expected not detail of single bar (eg bar B)	
(c)	Butterfly has other food/nectar sources OR brambles pollinated by other insects/nectar eaten by other insects OR idea that relationship is not intimate/fixed/symbiotic	**1**		

Question	Acceptable Answer	Mark	Notes	Negates
6 (a)	Herbivores eat plants **and** detritivores eat dead/waste material	**1**	*Producers*/*autotrophs*/*leaves* = plants Not *detritivores eat **plant** waste* **OR** *detritivores eat **animal** waste*	
(b) (i)	Comparison of sample 1 and sample 4	**1**		
	at week 6: Sample 1: 11-12 % loss Sample 4: 90% loss 90/12 = 7·5 = > 7	**1**	Possible week 9:if loss is taken to be 13% loss But not week 12: 17% vs 96% = 5·60 **unless** clear discussion of variability of data using error bars	
	OR Compare data from sample 1 and sample 4 Sample 1 has 85% left at 12 weeks and Sample 4 reached 85% remaining by week 1 (roughly) So rate of decomposition is 12 times faster = > 7			
	Single mark options If not comparing Samples 1 and 4 but data correctly show >7 OR **losses** calculated for Samples other than 1 and 4		Eg Sample 1 v 2 using method 2	
(ii)	Error bars/Results overlap **and** • no difference in results for types of gut/amount of decomposition • no **significant** difference OR Wide error bars so results very variable/are less reliable 1	**1**		

Question	Acceptable Answer	Mark	Notes	Negates
(iii)	Material has been through two animal guts **And** idea that fragmentation/surface area increasing (so this sample has the highest rate of decomposition)	**1**	NOT *Greater respiration losses from being through two animals*	
7 (a)	With pollution there are **favoured** and **susceptible** species indicator species defined as those that experience consequences/ are sensitive to a pollutant OR example showing **how** a favoured/susceptible species indicates pollution	**1** **1**	General statement, not example Can be general principle or detailed for named species	
(b) (i)	11, 000, 000	**1**	1.1×10^7	
(ii)	not enough time for diclofenac to reach safe levels or equivalent	**1**	Not bioaccumulation (ie eating lots of carcases), not biomagnification	

Question	Acceptable Answer	Mark	Notes	Negates
8 A (i)	***control of species that reduce yield***	**7**	**Number ticks**	
(ii)	***monoculture***	**8**		
(i)	1. yield reduced by competition/disease/damage/herbivores 2. (any of above) controlled by reducing populations (to maximise food production) 3. weeds are competitors for the crop's resources 4. herbicides used to kill other plants/weeds 5. alternative methods of reducing weeds, eg hoeing, interplanting, (herbicide-tolerant) transgenics 6. more resources for the crop (increases yield) OR eg of resource – nitrate, light, space 7. insects (damage crops by) eating plant parts 8. insecticides reduce insect populations/kill insects OR (Bt) transgenic OR biological control OR barrier 9. herbivores removed or kept out (eg scarers, netting, fencing) 10. parasites/fungi/viruses reduce yield by causing disease 11. fungicides prevent/kill fungi 12. example of ecological impact of these activities	**7**	Allow *pesticide* to be equivalent to *insecticide/fungicide* but **not** herbicide Allow *crop rotation* once in correct context at marks 5, 8 or 11. Allow *transgenics* more than once if correct details given. max 7	
(ii)	13. cultivation of one species/crop (to exclusion of others) 14. to meet the demand/needs of increasing population 15. removal of hedgerows allows increased field size 16. reduces species diversity (eg predators) 17. reduces stability of ecosystem OR increases susceptibility to pathogens 18. mechanisation increases efficiency of cropping/planting 19. reduce food costs/increases profit 20. may damage soil structure/increase compaction OR may have negative impact on soil condition 21. cultivation of single species depletes particular nutrients 22. need for fertiliser/use of inorganic fertiliser (improves yield) 23. but can cause knock on pollution problems/eg of effect	**8**	Transfer of marks between (i) and (ii) but be aware of the max marks per section max 8	

Question	Acceptable Answer	Mark	Notes	Negates
8 B (i)	***energy fixation and primary productivity***	**5**		
(ii)	***fossil fuels and air pollution***	**10**		
(i)	1. energy fixed/light to chemical in photosynthesis 2. (photosynthesis carried out) by autotrophs/producers 3. productivity is **rate** of accumulation of biomass OR productivity is mass units per area per time 4. primary productivity supports higher trophic levels 5. GPP is total yield of organic matter/total energy fixed 6. NPP is biomass remaining after producer respiration OR equation 7. appropriate management/choice of biomass crop 8. explanation of role of biomass in the energy debate OR relevant comment about 'carbon footprint'/neutrality	**5**	max 5	
(ii)	9. fossil fuels are finite/non-renewable (energy) resources 10. need to be conserved 11. biofuels are alternative sources of energy 12. fossil fuels are **burned** 13. gases released SO_2/NOx/CO_2 14. these cause acid rain 15. effect of acid rain in ecosystems (eg forest damage, pH in lakes, etc) 16. CO_2 (from combustion) **enhances** greenhouse effect 17. cause global warming/climate change 18. changes abundance or distribution of species (general point) OR example **other than** zooxanthellae 19. zooxanthellae and polyps/coral are symbiotic/mutualistic 20. and coral bleaching link to temperature rise 21. methane and CFCs other important greenhouse gases not from fossil fuels	**10**	Not other alternative sources Not *contributes to greenhouse effect* need idea of 'adding to' eg Lichens and acid gas max 10	Methane, CFCs

Section C: Biotechnology

Question	Acceptable Answer	Mark	Notes	Negates
1 (a) (i)	Nif/nitrogen-fixing genes	**1**		
(ii)	nitrogen converted to ammonia/ammonium (symbols OK)	**1**		
(b)	Nitrogenase activity declines with length of treatment	**1**		
	No significant difference between 10 and 20 days	**1**		
	There is a (significant) decrease in activity is from 20 to 30 Any 2			
2	*Response to antigens* 1. antigens are recognised by B-lymphocytes OR antigens activate B-lymphocytes 2. multiplication (of B-lymphocytes) in spleen/immune system 3. antibodies are produced 4. antibody binds/forms complex with antigen OR antibodies are specific *Application* 5. (highly purified) antigen injected into animal 6. bleeding of animal OR red blood cells removed from blood sample 7. reinjection (with antigen) increases response 8. polyclonal serum produced OR antibodies prepared from serum	**5**		

Question	Acceptable Answer	Mark	Notes	Negates
3 (a)	Uniformity in terms of: • clones/genetic • growth rate • ripening • harvesting time • yields • taste any 1 high-yielding disease free/virus free economical	**2**		
(b)	light intensity/temperature/humidity/nutrients/pH/water content	**1**	Any two	
(c) (i)	treatments are an improvement on the control OR example OR as concentration of regulators increase the explants increase	**1**	 Accept either differentiated or mean shoots results	
(ii)	(At 0·5 IAA + 5·0 kinetin) 58 × 28 = 1624 shoots = highest yield	**1**	+2·5 kinetin 66 × 20 = 1320 shoots	

Question	Acceptable Answer	Mark	Notes	Negates
4 (a)	competition with gut pathogens OR control pathogens OR reduce diarrhoea anti-cancer activity reduction of blood cholesterol reduced lactose intolerance	**1**		
(b) (i)	direct count would include living and dead OR dilution plating gives viable count OR alternative comparisons, eg **live** bacteria needed so need **viable** count	**1**		
(ii)	prevent contamination/maintain aseptic technique	**1**		
(iii)	only count between 30 and 300 OR enough to be accurate and not too many to count	**1**		
(iv)	Correct value 6×10^{10} plate to bottle 4 = 6×10^3 dilution factor from bottle 1 to bottle 4 = **10^4** ($10^2 \times 10 \times 10$) scaling 0·1 cm^3 sample from 100 cm^3 in carton = 10^3 Plate ----------> bottles ----------> carton 60 in .1 × 100 = 6000 × 10 × 10 × 100 × 1000	**2** **1** **for any one correct stage**	Dish C: (60 colonies per 0·1 cm^3) 60×10^6 colonies per 0·1 cm^3 (taking into account dilution factor) $(60 \times 10^6) \times 10^3$ per 100 ml 6×10^{10} in carton = > suggested level Only one mark possible if plates B OR D used	

Section C: Animal Behaviour

Question	Acceptable Answer	Mark	Notes	Negates
1 (a)	Background/height/tree species/type of woodland etc	**1**	Must relate to placement	
(b)	B or E	**1**		
(c)	(B was expected to give best survival but) Little difference between B and C OR C is effective yet has only one spot/has 'no eyes' (E with two 'eyes' was expected to give high survival but) Increase in number of spots increases survival F-E-D (24/48hrs) (A, the control has no contrast and) In all treatments survival is higher than control B-C-D have highest contrast and highest survival Appropriate quantification	**2**	Any 2	
(d)	Mimicry/Batesian mimicry/Mullerian mimicry Crypsis/camouflage Masquerade Disruptive coloration Aposematic/warning coloration	**1**		

Question	Acceptable Answer	Mark	Notes	Negates
2	1. Hierarchy is system of (social) ranking 2. Established by fighting/maintained by threat or ritualised display 3. Reduced aggression/fighting (once established) 4. Increased protection/better chance of survival 5. Co-operative hunting/all group members get food 6. Division of labour/opportunities for learning	**4**	Not alpha male and the rest; must have different ranks. Ignore energy answers Not *know your place* idea Any 4	
3 (a)	Ethogram	**1**		
(b) (i)	Sexual dimorphism	**1**		
(ii)	To attract females/to permit female choice/to elicit response from females	**1**		
(c) (i)	Brother-sister matings OR Mating (only) between closely related fish OR Prevent dispersal/keep all family individuals in the same area	**1**		
(ii)	Reduces breeding success OR less fertilisation and less hatching	**1**		
	Inbreeding causes: increased expression of disadvantageous/lethal/recessive genes increased homozygosity/inbreeding depression	**1**		

Question	Acceptable Answer	Mark	Notes	Negates
4 (a) (i)	High-learning flies die younger/shorter life span	**1**		
(ii)	(On average/in either group) females live longer than males OR Greater reduction in life span/longevity for females (in high-learning group)	**1**		
(iii)	Much longer life span in primates OR Learning has bigger role in primate behaviour OR Learning benefits outweigh the costs in primates	**1**		
(b)	Irreversible/difficult to reverse Environmental component/object in environment Critical time period (after hatching/birth) Object (of attachment) followed to exclusion of others	**2**	Focus is on the learning process, not consequences such as survival or aberrant sexual behaviour. Any 2	

Section C: Physiology, Health and Exercise

Question	Acceptable Answer	Mark	Notes	Negates
1 (a)	3+ hours/endurance levels of exercise results in lower (resting) heart/pulse rate than **the others** 3+ hours/endurance levels of exercise results in greater left ventricle mass than **the others** athletic heart defined as increased LV thickness **and** increased SV/lower (resting) pulse Any 2 OR any one of above AND error bars show 3+ hours is the only significant difference or error bars overlap	**2**	Not general increase or decrease	
(b)	stroke volume	**1**	Only	
(c)	Increased LV mass	**1**		
(d)	less plaque/atheroma build up/atherosclerosis better lipid profile/higher HDL:LDL ratio/higher HDL/lower LDL better myocardial circulation lower (resting) BP lowers risk of MI/stroke	**1**	Not *lower resting HR* or *greater stroke volume*	

Question	Acceptable Answer	Mark	Notes	Negates
2	1. Pancreas senses glucose (in blood) 2. insulin secretion/production (increases) when glucose is high 3. insulin increases glucose uptake by liver/muscle/cells 4. insulin **promotes** glycogen synthesis/conversion of glucose to glycogen 5. insulin increases the number of glucose transporters (in cell membranes) 6. obesity leads to/is a risk factor for NIDDM (Type 2 diabetes) 7. obesity/NIDDM leads to insulin resistance/loss of sensitivity to insulin/fewer **active** receptors 8. reduced entry of glucose into cells 9. (in NIDDM) insulin concentration initially increases	**5**	*Obesity* term not essential but overweight is not enough Any 5	
3 (a)	bone mass/density is increasing in this period OR to increase bone density (before age-related loss) OR weight bearing activity is likely to be high	**1**	Not storage of Ca Not maintenance idea	
(b)	reference to menopause around this age/oestrogen starts to decline/women start to lose bone mass rapidly/when osteoporosis (most likely) starts	**1**	Not *reduce risk of osteoporosis*	
	may counteract/slow down (age-related/oestrogen-related) losses OR maintain bone density/mass OR Delay onset of osteoporosis	**1**		

Question	Acceptable Answer	Mark	Notes	Notes
4 (a) (i)	measures heat output/loss	**1**		
	in **insulated** chamber/environment OR measure energy required to keep chamber temperature constant	**1**		
(ii)	volume of air breathed	**1**	Not *volume* of oxygen	
	% oxygen breathed in and % of oxygen in air out OR difference in percentages	**1**	% = proportion, concentration	
(b) (i)	838.3 kJ	**1**	838.30 kJ	
(ii)	Select foods with biggest deviation from 20·20 kJ (starch or protein)	**1**	For starch diet, calculated error is 4·63% low (21·18 – 20·20/21·18) × 100 = 4·63%	**OR** • 20.20/single value x100 • show all lie within range 95-105%
	correct calculation of either extreme (as fraction of single food value) starch (low) = 4·63% protein (high) = 4·94%	**1**	For a protein diet, calculated value is 4·94% high (19·25 – 20·20/19·25) × 100 = 4·94%	
	OR 5% limits from 20.20 are 19·19 kJ to 21·21 kJ 1 **and** conclude/show all four are in range 1		glucose = 0·77/20·97 = 3·67% high fat = 0·53/19.67 = 2·69% low	
	OR 4 deviations calculated correctly by other methods 1 **and** conclude all four are in range 1			

[END OF MARKING INSTRUCTIONS]