



2012 Biology

Higher (Revised)

Finalised Marking Instructions

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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 CO₂, H₂O
 - 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 7.3 ± 0.1

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

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Marking scheme

Section A

1.	C	16.	A
2.	B	17.	A
3.	D	18.	D
4.	A	19.	D
5.	B	20.	B
6.	A	21.	B
7.	B	22.	C
8.	A	23.	A
9.	D	24.	D
10.	D	25.	C
11.	B	26.	C
12.	A	27.	B
13.	C	28.	C
14.	B	29.	A
15.	D	30.	C

Section B

Question	Acceptable Answer	Mark	Unacceptable Answer	Negates
1 (a) (i)	1. DNA contains deoxyribose RNA contains ribose 2. DNA contains thymine, RNA contains uracil	2	location chain length one has adenine, one has uracil	
(ii)	Unwinds/unzips the double helix of DNA = 1 Adds/brings in RNA nucleotides to produce RNA/a primary transcript = 1	2	allow hydrogen bond formation	
(iii)	Introns/non-coding regions are removed OR mRNA composed of exons which have been joined together	1	separated from	
(iv)	(mRNA) carries/takes/transfers the (genetic) code/order of bases/copy of DNA/gene from the nucleus to the cytoplasm/ribosomes	1		
(b) (i)	9 hours	1		
(ii)	Human cells are eukaryotic = 1 Actinomycin D would inhibit transcription/stop/prevent protein synthesis/transcription in a human patient/us/people/the human body = 1	2	transcription of proteins	

Question	Acceptable Answer	Mark	Unacceptable Answer	Negates
2 (a)	Separates strands/breaks H bonds between strands/bases OR denatures DNA	1		
(b)	Allow primer to bond/attach/bind/anneal to (separated) strands/target sequence OR primer could bind at higher temperatures	1		
(c) (i)	(DNA/Taq) polymerase	1		
(ii)	Role: Allows a start point for replication/polymerase OR targets the sequence of DNA to be amplified OR polymerase needs a primer to bind = 1 Explanation: starts on both chains (of DNA) OR each primer targets on a different strand = 1	2	there are two different strands	
(d)	7	1		
(e)	Keep everything about the tube the same but leave out the DNA OR list of ingredients with water instead of DNA	1	RNA for DNA	

Question	Acceptable Answer	Mark	Unacceptable Answer	Negates
3 (a) (i)	Genetic information/genes/it/haemophilia/the characteristic/ the condition is passed from parent to offspring/parent to child/down her generations	1		
(ii)	Mother is homozygous and passes it/haemophilia/the allele/ to all the offspring = 1 Offspring do not all have the condition therefore the allele must be recessive OR if it was dominant all offspring would be affected OR only 2 out of 3 affected/2:1 affected = 1	2		
(b) (i)	<i>Name Insertion</i> Description extra nucleotide/base inserted OR deletion a nucleotide/base missing/deleted OR substitution a nucleotide replaced by/substituted by/swapped for a different one.	1	only affects a single codon amino acids	
(ii)	Causes a change in the sequence/order of bases/ nucleotides/amino acids in the protein produced OR changes folding/shape of the protein chain	2		
(c) (i)	Unlimited supply/large quantities/volumes/mass/numbers produced OR no infection issues	1	they can be cultured in large quantities	
(ii)	Protein may not work OR (modified yeast) might appear in/escape to the environment/ pass on the gene into the wild	1		

Question	Acceptable Answer	Mark	Unacceptable Answer	Negates
(iii)	Respect for life OR use as a weapon	1	playing God answer on stem cells	
4 (a) (i)	To allow the apparatus to reach 20°C/pressure to equalise/liquid level to settle/become zero OR snail to acclimatise/get used to temperature/surroundings/environment/respiration to become steady	1	control	
(ii)	(Proves that it is) the snail which causes the changes/coloured liquid to rise/takes up oxygen/affects the outcome	1		
(b) (i)	Oxygen uptake/volume of oxygen taken in	1		
(ii)	Mass/species of snail OR the snail OR volume/concentration of solution to absorb carbon dioxide OR diameter/width of glass tube/scale	1	thickness of tube	
(c)	Scales and labels = 1 Points and lines = 1	2		
(d)	0.004 OR 4×10^{-3} OR 1/250	1		
(e)	Increase (in uptake of oxygen) Enzymes working faster	1		

Question	Acceptable Answer	Mark	Unacceptable Answer	Negates
(f)	Snail/respiration consumes/uses up oxygen/causes liquid to rise = 1 Solution absorbs any CO ₂ made by snail = 1 OR oxygen taken in by snail and CO ₂ made absorbed by solution = 1 Causes gas volume/pressure in/of gas to decrease and liquid rises = 1	2		
5 (a)	X glycolysis Y Citric acid/TCA/Krebs cycle Both = 1	1		
(b)	P oxaloacetate/oxaloacetic acid = 1 Q citrate/citric acid = 1	2		
(c)	Removes hydrogen from/electrons from/oxidises substrate = 1 Causes reduction of NAD/FAD/hydrogen acceptor OR changes NAD to NADH = 1	2		
(d) (i)	High energy electrons	1		
(ii)	ATP synthase	1		
(iii)	Final/last hydrogen/electron acceptor OR combines with hydrogen/electrons to form water	1		

Question	Acceptable Answer	Mark	Unacceptable Answer	Negates
6 (a)	<i>Structure Hair erector muscle</i> Explanation Raises hair = 1 To trap layer of insulating air = 1 OR <i>Sweat gland</i> Less sweat (produced) = 1 Less loss of heat by evaporation of water = 1 OR <i>Blood vessels</i> (Vaso)constriction/narrow = 1 Less heat loss by radiation = 1	2	no sweat no heat loss contract	
(b) (i)	Keeps temperature within tolerable limits/at optimum level/ constant/correct = 1 For enzyme controlled reactions to work best OR for best diffusion rates = 1	2		
(ii)	Any reasonable example eg basking/lying on warm rock/moving into shade	1		
(c)	Salinity/salt concentration OR pH/acidity	1		

Question	Acceptable Answer	Mark	Unacceptable Answer	Negates
7 (a)	T fish R complete double Reptile/amphibian incomplete double All 6 = 2, 4 or 5 = 1	2		
(b)	X inward Y outward Z outward All 3	1		other wrong arrows
(c)	Oxygenated blood is kept separate from deoxygenated blood OR prevents mixing of oxygenated and deoxygenated blood = 1 Cells receive oxygenated blood for respiration/metabolism = 1	2		
8 (a) (i)	Endonuclease/restriction enzyme	1		
(ii)	Ligase	1		
(iii)	Seals/glues/sticks/splices DNA/gene into plasmid	1	inserts	
(b)	Resistance gene has been interrupted/split/broken up/disrupted	1	part removed/changed	

Question	Acceptable Answer	Mark	Unacceptable Answer	Negates
9 (a) (i)	1. Rises from 2.45 tonnes per hectare to 3.60 tonnes per hectare at 60kg 2. Remains level at 3.60 tonnes between 60kg and 80kg 3. Falls to 3.20 between 80kg and 120kg All 3 = 2, any 2/1 = 1	2		
(ii)	0.025 tonnes	1		
(b) (i)	9:11	1		
(ii)	25%	1		
(c)	80kg	1		
(d) (i)	Biological yield	1		
(ii)	50	1		
(iii)	0.8	1		
(e) (i)	Gives maximum/highest/greatest/biggest yield	1		
(ii)	Lowest level needed to give maximum yield OR any further increase does not increase yield further OR reduces pollution/environmental impact compared with 80kg	1		

Question	Acceptable Answer	Mark	Unacceptable Answer	Negates
10 (a)	Deleterious/damaging allele combinations are eliminated (by natural selection)	1		
(b)	Tick/cross with homozygous recessive	1		
(c)	Cold/frost tolerant/resistant OR low compensation point OR hybrid vigour OR fast growing/high yield/disease resistant Any 2	1	harsh conditions	
(d) (i)	Some variety/homozygosity will be produced therefore losing hybrid vigour/ability to grow in cold conditions OR F ₂ genetically variable/diverse	1		
(ii)	Could produce new/better varieties (helpful in future breeding programmes) OR example	1		

Question	Acceptable Answer	Mark	Unacceptable Answer	Negates
11 (a)	Increases the individual's access to food/mates/sleeping station OR first to feed/best food Any = 1	1		
(b)	Grooming/sexual presentation/facial expression/body posture/gesture	1	beating of chest	
(c)	Long period of/extended parental care OR look after/stay with young for many years	1		
12 (a)	Lives and breeds in the wild in its new habitat/ecosystem/ normally	1	adapted	
(b)	They may be free of/have less predators/parasites/pathogens, competitors OR converses	1		
(c)	Out-compete the natives for resources/example OR prey on/eat native species	1		

Section C

1A

(i)	1	stems cells are unspecialised/undifferentiated cells (in animals)	1
	2	stem cells (continue to) divide	1
	3	differentiate/develop into specialised cells/different cells for different functions	1
		OR differentiated cells cannot return to an undifferentiated state/change into other cell types	
	4	there are adult and embryonic stem cells	1
	5	embryonic stem cells differentiate into all cells types	1
	6	tissue/adult stem cells differentiate into cells which need to be replaced	1
	7	adult stem cells give rise to more limited cell type	1
	8	following differentiation a cell only expresses certain genes	1
	9	that produce proteins characteristic of that cell type	1
	10	example of a stem cell source	
			Max 7
(ii)	11	stem cell research provides information on cell process	1
	12	example of 11 ie cell growth, differentiation, gene regulation	1
	13	therapeutic use includes repair of damaged/diseased organs/tissue/cells/eg	1
		OR eg of the use eg diabetes, Parkinson's disease, leukemia, skin graft, corneal graft, bone marrow transplant	
	14	stem cell research must be/is often regulated	1
	15	example of an ethical issue related to stem cell research embryos could develop into humans	1
		OR method of avoiding the issues	
		OR the use of induced pluripotent stem cells/nuclear transfer techniques	
			Max 3
			Total 10

1B

(i)	1	organisms show (genomic) variation (upon which natural selection acts)	1
	2	natural/sexual selection is non-random	1
	3	(causes) increase in frequency of certain genetic sequences/genes/alleles	1
	4	these sequences/alleles increase survival	1
		OR	
		survival of the fittest/best suited to their environment	
	5	(survivors) pass on their favourable/beneficial gene sequence/alleles/ characteristics to offspring/next generation	1
	6	deleterious/damaging sequences/alleles/genes/characteristics are reduced in frequency/removed from the population	1
	7/8	stabilising selection (and explanation)	1
		directional selection (and explanation)	1
		disruptive selection (and explanation)	1
		(Any 2)	
	9	sexual selection	1
	10	over many generations/a long time	1
	11	individual with favourable/beneficial characteristics/genes/alleles survive to breed/reproduce	1
		Max 7	
(ii)	12	genetic drift is random increases and decreases in frequency of sequences/alleles/genes	1
	13	particularly in small populations	1
	14	results of neutral mutations	1
	15	(or as results of the) founder effect/principle	1
	16	founders of new populations have gene sequences which are not representative of the whole population/are in abnormal percentages of the whole population	1
		Max 3	
		Total	10

2A

1	photosynthetic pigments/chlorophyll absorb/capture light/have specific absorption spectra	1
2	absorbed/captured/trapped energy/light excites electrons in pigment molecules/chlorophyll	1
3	chlorophyll a and b and carotenoids mentioned	1
4	chlorophyll b/carotenoids/accessory pigments extend the range of wavelengths absorbed/absorb light wavelengths not absorbed by chlorophyll	1
5	pass energy to chlorophyll	1
		Max 3
6	high energy electrons transferred along electron transport chain	1
7	electron transfer chains release energy to regenerate/produce ATP	1
8	ATP synthase OR ADP + Pi → ATP/ATP made	1
9	photolysis (occurs)	1
10	water split into oxygen and hydrogen	1
11	hydrogen transferred to NADP OR NADP reduced	1
12	ATP used in carbon fixation/passed to Calvin cycle	1
		Max 5
C	Divided into clear sections/sub-headings Must have 1/2 points on absorption/capture Must have 3/4 points on conversion Must have at least 5 points	1
R	No detail on carbon fixation given Must have 1/2 points on absorption/capture Must have 3/4 points on conversion Must have at least 5 points	1
	Total	10

2B

1	symbiosis relationship/association between two different species	1
2	coevolution/coevolved	1
3	parasites gain energy/resources/nutrients	1
4	host is harmed by/made weaker by these losses OR one benefits and the other is harmed	1
5	parasites can have limited metabolism	1
6	often cannot survive outside host/reproduction requires host OR obligate	1
7	transmission/transfer method to new host or vector eg direct contact/resistant stage	1
8	secondary hosts as vector	1
9	eg of parasite and host	1
		Max 5
10	mutualism involves benefit for both species	1
11	interdependent relationship OR one cannot live without the other	1
12	example of mutualism	1
13	benefits to one described	1
14	benefits to other described	1
		Max 3
C	Divided in sections/sub-headings Must be 3/4 points on parasites Must be 1/2 points on mutualism Must have at least 5 points	1
R	No mention of non-symbiotic relationships Must be 3/4 points on parasites Must be 1/2 points on mutualism Must have at least 5 points	1
	Total	10

[END OF MARKING INSTRUCTIONS]