



2015 Biology (Revised)

Higher

Finalised Marking Instructions

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Part One: General Marking Principles for: Biology (Revised) Higher

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 specific Marking Instructions for each question.

- (a) Marks for each candidate response must always be assigned in line with these general marking principles and the specific Marking Instructions for the relevant question. 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/Principal Assessor.
- (b) Marking should always be positive ie, marks should be awarded for what is correct and not deducted for errors or omissions.

GENERAL MARKING ADVICE: Biology (Revised) Higher

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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Part Two: Marking Instructions for each Question

Section A

Question	Expected Answer(s)	Max Mark
1.	D	1
2.	D	1
3.	B	1
4.	B	1
5.	C	1
6.	A	1
7.	B	1
8.	B	1
9.	A	1
10.	C	1
11.	C	1
12.	D	1
13.	B	1
14.	C	1
15.	C	1

Question	Expected Answer(s)	Max Mark
16.	B	1
17.	D	1
18.	D	1
19.	A	1
20.	C	1
21.	D	1
22.	D	1
23.	A	1
24.	B	1
25.	C	1
26.	A	1
27.	A	1
28.	B	1
29.	C	1
30.	A	1

Section B

Question			Acceptable answer(s)	Max Mark	Unacceptable answer	Negates
1	(a)	(i)	X – (inorganic) phosphate (group) (1) Y – (organic/nucleotide) base/named base (1)	2		other answers
1	(a)	(ii)	Deoxyribose (sugar)	1	sugar alone sugar-phosphate backbone	
1	(b)	(i)	0 – 20 gives a large decrease 20 – 40 gives a small decrease in activity OR 0 – 20 decreases more quickly (than 20 – 40) OR 0 - 20 gives a larger decrease / 20 - 40 gives a smaller decrease NOTE – must be comparative	1		
1	(b)	(ii)	8	1		
1	(b)	(iii)	(ligase) joins bits/pieces/fragments/sections of the lagging strand/DNA OR joins Okazaki fragments	1	joins nucleotides	
1	(c)		Chloroplast – circular chromosome Prokaryote – circular chromosome and circular plasmid Nucleus – linear chromosome All 3 = 2, 2/1 = 1	2		

Question		Acceptable answer(s)	Max Mark	Unacceptable answer	Negates
2	(a)	<p>increase in stroke volume/volume of blood pumped out of the heart per heartbeat (in patients given the treatment) (1)</p> <p>no effect on heart rate (of patients given the treatment) (1)</p>	2		
2	(b)	1190	1		
2	(c)	<p>embryonic differentiate to form all type of cell</p> <p>AND</p> <p>adult tissue only differentiate into the cell type of the tissue from which they came</p> <p>OR</p> <p>embryonic totipotent/ pluripotent</p> <p>AND</p> <p>adult tissue/multipotent</p>	1		
2	(d)	<p>provide information/understanding/advances in</p> <p>OR</p> <p>for studying cell growth/differentiation/division/aging/gene regulation</p> <p>OR</p> <p>disease development</p> <p>OR</p> <p>for drug testing/studies/development</p>	1	<p>to regrow new tissue</p> <p>to provide new drugs</p>	

Question			Acceptable answer(s)	Max Mark	Unacceptable answer	Negates
3	(a)	(i)	13:1 – 14:1	1		
3	(a)	(ii)	6:1:4	1		
3	(a)	(iii)	<u>disruptive</u>	1		
3	(b)		have horizontal inheritance/gene transfer/plasmid/transfer of genetic material/transfer of DNA OR rapid generation times/reproduce rapidly/short life cycle	1	horizontal reproduction have high yields	
4	(a)	(i)	the longer ago the common ancestor existed the greater the differences in DNA sequence OR converse	1	numbers alone	
4	(a)	(ii)	rhesus monkey	1		
4	(b)		bioinformatics	1		
4	(c)	(i)	Increased chances/likelihood of successful/effective treatment/selection of drug	1	side effects	
4	(c)	(ii)	complexity of (multifactorial) disease OR (identification of) neutral mutations	1	problems related to publication of individual genomes complexity of genome	

Question			Acceptable answer(s)	Max Mark	Unacceptable answer	Negates
5	(a)		112	1		
5	(b)		0800 – 1200 (time of) lowest metabolic rate	1 1	2	low/constant metabolic rate
5	(c)		energy saving/conservation uses less energy OR energy not wasted	1		
5	(d)		dormancy OR hibernation OR aestivation	1	migration	
6	(a)		Same/matching/complementary/sticky ends OR Complementary/matching base sequences	1		
6	(b)		(DNA) ligase	1		
6	(c)		only modified/transformed plasmid/ those with EPO gene bacteria grow/survive in the presence of the antibiotic OR converse	1	transformed plasmids survive	
6	(d)		origin of replication	1		
6	(e)	(i)	lack of post-translational modifications OR it is/protein folded incorrectly	1		
6	(e)	(ii)	use yeast (instead of bacteria)	1		

Question			Acceptable answer(s)	Max Mark	Unacceptable answer	Negates
7	(a)	(i)	22.5	1		
7	(a)	(ii)	as dive depth increases, heart rate decreases / heart rate decreases as dive depth increases	1	as heart rate decreases dive depth increases	
7	(a)	(ii)	(allows) saves/conservation of oxygen to maintain metabolic rate at depth OR blood only pumped to vital organs at depth	1	conservation of energy	
7	(b)		four, double, high All 3 = 2 2 = 1 1 = 0	2		
8	(a)	(i)	feedback inhibition OR end product inhibition OR negative feedback	1	inhibition alone Competitive inhibition non-competitive inhibition	
8	(a)	(ii)	changes shape of active site AND substrate/3PG cannot bind/no longer fits OR prevents/blocks reaction with 3PG	1		
8	(b)		(to ensure enough/there is sufficient) 3-phosphoglycerate for other metabolic reactions	1	answers in terms of serine alone	

Question			Acceptable answer(s)	Max Mark	Unacceptable answer	Negates
9	(a)	(i)	X ADP Y Pi/phosphate Both	1		
9	(a)	(ii)	NAD	1	NADH alone	
9	(a)	(iii)	it is a net/overall energy gain following an energy investment at an earlier stage OR more ATP produced than used/invested earlier OR correct qualification	1		
9	(b)	(i)	increases the surface area for (action of) bacteria/ <i>Lactobacillus</i> OR bursts cells to release more substrate/cell contents for bacterial action	1	increases surface area for reactions/enzymes	
9	(b)	(ii)	acidic conditions/ low pH/ anaerobic conditions/ low O ₂ inhibits/kills other/most bacteria OR inhibits the enzymes of other/most bacteria OR pH/ O ₂ level optimum for <i>Lactobacillus</i> but not for other/most bacteria OR most bacteria need O ₂ but <i>Lactobacillus</i> does not	1		

Question			Acceptable answer(s)	Max Mark	Unacceptable answer	Negates
10	(a)	(i)	1. from 0 – 60 kg per hectare increases from 3 – 8.4 tonnes per hectare 2. remains at 8.4 between 60 and 80 3. between 80 and 100 decreases from 8.4 - 7.9/7.8 All 3 = 2, 2/1 = 1 NOTE - units only needed once; differences acceptable if correct all correct values but no units = 1	2		
10	(a)	(ii)	208 – 216	1		
10	(a)	(iii)	840	1		
10	(b)	(i)	the use of 10/a large number of cattle (in each group/at each feed level)	1	3/multiple groups of cattle sufficient cattle	
10	(b)	(ii)	0.6	1		
10	(b)	(iii)	1. 20 (1) 2. increasing the phosphate/fertiliser (level applied to crop) increases the mass of/growth (of cattle) (1)	2		
10	(c)		energy is lost at each level/step/stage/transfer of a food chain	1		

Question		Acceptable answer(s)	Max Mark	Unacceptable answer	Negates
11	(a)	<ul style="list-style-type: none"> • surface area/shape/size/diameter/ mass of beads • temperature • pH/colour of bicarbonate at start/CO₂ concentration at start • distance/wattage/power of lamp/ light intensity • thickness of filter/glass tube • species/strain/type of alga <p style="text-align: right;">1 each, any 2</p>	2	oxygen concentration size/type of filter/glass tube same glass tube time in colorimeter	
11	(b)	keep everything the same/same set-up/experiment AND leave out/without algae/ <i>Scenedesmus</i> /beads OR replace algae with glass beads/boiled and cooled algae OR contents of tube listed without algae/cells	1	change gel beads to glass beads	
11	(c)	to allow photosynthesis to occur OR to allow the indicator to be affected by CO ₂ / CO ₂ to be used/taken up/removed/photosynthesis	1	for indicator to be affected by/detect changes to acclimatise/ settle/adjust to light to allow light absorption to occur to allow reaction/colour change to take place	

Question			Acceptable answer(s)	Max Mark	Unacceptable answer	Negates
11	(d)	(i)	enclosed scales; Y axis starting at 0 /0.2 and Y axis label as in table; X axis with at least 3 added points (1) accurate plotting and connecting (1)	2		
11	(d)	(ii)	represents/shows/gives/indicates/ measures the rate/amount/efficiency /effectiveness of photosynthesis/how well photosynthesis takes place at each (light) wavelength	1		
11	(e)		>0.36 – 1.0 units (1) uses/absorbs green light/light of 500nm/light not absorbed by/transmitted by <i>Scenedesmus</i> OR more efficient/better at photosynthesis at 500nm/this wavelength (1)	2		
12	(a)	(i)	naturalised	1		
12	(a)	(ii)	no/free of (natural) predators/parasites/ disease/competitors (Any 1)	1		
12	(a)	(iii)	they may become pests/damage the habitat OR they out-compete native species to extinction OR they may become invasive OR they may predate/eat native species to extinction/be endangered	1	they may eat/kill native species	
12	(b)		introduce (natural) predators/parasites/pathogens to control/reduce numbers/eliminate pests	1	alien species	

Question			Acceptable answer(s)	Max Mark	Unacceptable answer	Negates
13	(a)	(i)	intimate/close coevolved relationship between two species	1		
13	(a)	(ii)	(oxpeckers) conserve/save energy in gaining food OR a stable/constant food supply OR gain food easily/reliably (1) zebra have parasites removed which saves energy/resources/nutrients OR prevent/reduces infection/disease transmission (1)	2		
13	(a)	(iii)	mutualism/mutualistic	1		
13	(b)	(i)	have (more) limited metabolism OR they obtain/rely on food/energy/nutrients/resources from hosts OR are degenerate	1		
13	(b)	(ii)	through resistant stages OR through vectors OR by being wind/water borne	1	secondary hosts	

Question		Acceptable answer(s)	Max Mark	Unacceptable answer	Negates
14	(a)	events 4 and 5 (and events 2 and 3)	1		
14	(b)	fossils (evidence/record)	1		
14	(c)	some (groups) survive (mass extinction) AND radiate/speciate/evolve (1) to fill vacant niches/exploit unoccupied habitats (1)	2		
14	(d)	agriculture/farming/ deforestation/road construction/river course alteration/damming (1) increase CH ₄ /CO ₂ level in atmosphere OR increase greenhouse gases OR global warming (1)	2	climate change	

Section C

1A

(i)	1	RNA polymerase unzips/separates/unwinds the double helix/DNA split into two strands/separates two strands NOT splits open/splits DNA	1
	2	hydrogen bonds between strands/base pairs break	1
	3	RNA polymerase aligns/bring in/joins/attaches (free) RNA nucleotides with their complementary bases/nucleotides/partners on DNA (template) /A to U and T to A and C to G/in diagram	1
	4	a primary transcript is produced OR join RNA nucleotides together	1
	5	exons are coding and introns are non-coding regions (of the primary transcript)	1
	6	introns are removed OR exons are retained	1
	7	exons are spliced/joined together to form mRNA/mature transcript	1
		Any 5	Max 5
(ii)	8	tRNA has an anticodon and an amino acid attachment site	1
	9	tRNA binds/joins to carries specific amino acids	1
	10	tRNA carries amino acids to ribosomes	1
	11	anticodons recognise/are complementary/pair with/match codons on mRNA	1
	12	peptide bonds/links form between amino acids	1
	13	there are start AND stop codons	1
	14	a polypeptide/protein forms	1
		Any 5	Max 5
			Total 10

1B (i)	1	(point) mutations are random changes in DNA sequences/genes/alleles/the genome	1
	2	point mutation name AND description; substitution, insertion, deletion – in terms of bases/nucleotides/names/letters	1
	3	another point mutation name AND description; substitution, insertion, deletion – in terms of bases/nucleotides/names/letters	1
	3b	If 2 or 3 not awarded - all names but no/incorrect descriptions offered	1
	4	amino acid sequence/order changes OR protein structure changes/protein altered OR protein not made OR protein non-functional NOT protein different	1
	5	point mutations are important in evolution	1
	6	regulatory sequence mutation can alter gene expression	1
	7	splice site mutations can alter the mature mRNA OR result in exon removal OR result in introns remaining present	1
		Any 5	Max 5
(ii)	8	chromosome mutation can involve changes to chromosome number/structure	1
	9	name AND description; translocation, deletion, inversion, duplication in terms of genes/alleles/sections of chromosome/pieces of chromosome	1
	10	another name AND description; translocation, deletion, inversion, duplication in terms of genes/alleles/sections of chromosome/pieces of chromosome	1
	10b	If 9 or 10 not awarded – all four names but no descriptions offered	1
	11	errors during the separation of chromosomes/non-disjunction/spindle failure during cell division/ meiosis/mitosis/gamete formation	1
	12	polyploidy is the possession of (a) complete extra set(s) / double/triple the number of chromosomes OR a whole genome duplication	1
	13	polyploidy is important in (high speed) evolution of human food crops OR uplication provides material upon which natural selection can work/is important in evolution	1
	14	polyploid crops/plants/egs show desirable features/higher yields/other egs	1
		Any 5	Max 5
			Total 10

2A

- | | | |
|---|---|---|
| 1 | inner membrane has cristae/large surface area | 1 |
| 2 | membranes have protein and phospholipid | 1 |
| 3 | proteins act as/are pores/pumps/electron carriers | 1 |
| 4 | some proteins are enzymes | 1 |

Any 3

Max 3

- | | | |
|----|---|---|
| 5 | dehydrogenase enzymes release hydrogen ions AND electrons | 1 |
| 6 | NAD(H)/FAD(H ₂)/coenzymes carry hydrogen AND (high energy) electrons to (the electron transport) chain | 1 |
| 7 | high energy electrons cascade/are pushed through/pass down the chain/cytochromes producing/creating releasing/energy | 1 |
| 8 | energy used to pump H ions through/across the inner membrane | 1 |
| 9 | H ions move/return/pass/go through ATP synthase OR return flow of H ions rotates ATP synthase | 1 |
| 10 | ATP produced by ATP synthase | 1 |
| 11 | oxygen is final electron/hydrogen acceptor | 1 |
| 12 | oxygen combines with H ions AND electrons to form water | 1 |

Any 5

Max 5

C information grouped
At least 2 marks on mitochondrial membranes
At least 3 marks on electron transport chain
At least 5 marks scored

All four

1

R no detailed mention of glycolysis/citric acid cycle
At least 2 marks on membranes
At least 3 marks on electron transport chain
At least 5 marks scored

All four

1

Total 10

2B

1	lag phase (of slow growth) when enzyme induction occurs	1
2	log phase of exponential growth/ maximum/fastest rate of growth OR phases of exponential growth	1
3	stationary phase when secondary metabolites produced/culture becomes depleted	1
4	death phase when toxic wastes accumulate/nutrients/resources in short supply/lack of substrates	1
4b	All stages named	
	Any 3	Max 3
5	growth is influenced by growth medium AND environmental conditions	1
6	they require an energy source AND raw material/simple chemical compounds for synthesis	1
7	energy comes from substrate/example or light	1
8	some microorganisms can produce all the complex substances required for growth AND others need some complex substances included in their growth medium	1
9	some fermentations require precursors/inducers/inhibitors	1
10	culture conditions require sterility/asepsis/aseptic techniques	1
11	control of /the optimum/the right temperature AND oxygen level	1
12	control of pH by buffers OR acids and alkalis	1
	Any 5	Max 5
C	logical order and in sections at least 2 marks on pattern of growth at least 3 marks on culture conditions 5 marks scored	
	All four	1
R	no detailed mention of microorganism structure or respiration / genetic engineering at least 2 marks on pattern of growth at least 3 marks on culture conditions 5 marks scored	
	All four	1
		Total 10

[END OF MARKING INSTRUCTIONS]