



2015 Biology

Higher

Finalised Marking Instructions

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Part One: General Marking Principles for: Biology 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 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.	C	1
3.	B	1
4.	A	1
5.	D	1
6.	A	1
7.	A	1
8.	D	1
9.	D	1
10.	A	1
11.	C	1
12.	A	1
13.	C	1
14.	D	1
15.	B	1

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

Section B

Question			Acceptable answer(s)	Max Mark	Unacceptable answer	Negates
1	(a)		<p>P Golgi (apparatus/body) OR smooth endoplasmic reticulum/smooth ER/SER</p> <p>Q ribosome/rough ER/RER (Both required)</p>	1	endoplasmic reticulum rough endoplasmic alone	
1	(b)	(i)	<p>more (ATP) made/produced/gained than used/lost/broken down OR overall gain (of ATP) OR profit (of ATP) OR gain (of ATP) outweighs/greater than/more than loss OR 2 (ATP) used/lost but 4 gained/produced/made</p>	1	ATP left over total gained/made alone number made minus number used wrong quantification	
1	(b)	(ii)	<p>matrix of mitochondrion/a cytochrome system/chain hydrogen carrier/transport/transfer system/chain electron carrier/transport/transfer system/chain</p> <p>water AND ATP (All 3 boxes = 2, 2/1 = 1)</p>	2	matrix alone mitochondria alone cytochrome alone oxidative phosphorylation	additional entry eg. oxygen/CO ₂
1	(b)	(iii)	<p>carries/transport/transfers hydrogen (to cytochrome system) OR hydrogen carrier/acceptor/transporter</p>	1	binds/bonds coenzyme	

Question		Acceptable answer(s)	Max Mark	Unacceptable answer	Negates
2	(a)	<p>from 0 – 4%/up to 4%/until 4% uptake/it increases (1)</p> <p>above/after/from 4% uptake/it remains the same/levels out/plateaus (1)</p> <p>NOTE - up to 4% it increases then levels out = 2 no units (%) – lose one mark</p>	2	<p>increases then stays the same</p> <p>levels at 5%</p>	
2	(b)	1440	1		
2	(c)	<p>oxygen needed for respiration so at 0% oxygen/absence of oxygen/no oxygen/anaerobic conditions less energy/less ATP/ATP only from glycolysis</p> <p>OR</p> <p>less respiration so less energy/ATP</p> <p>OR</p> <p>less energy/ATP available from anaerobic respiration</p> <p>OR</p> <p>cytochrome system cannot take place so less energy/ATP</p> <p>OR</p> <p>(ion) gain/uptake from diffusion alone (1)</p> <p>active uptake/transport requires energy/ATP (1)</p>	2	<p>only 2 ATP</p> <p>no/lack of/little energy/ATP</p> <p>ion/potassium uptake</p>	

Question			Acceptable answer(s)	Max Mark	Unacceptable answer	Negates
3	(a)		phospholipid NOTE – ignore bilayer	1	lipid alone	
3	(b)		out of osmosis (Both required)	1		
3	(c)	(i)	gene/allele	1		
3	(c)	(ii)	peptide	1	polypeptide	
3	(c)	(iii)	Translation	1		
3	(c)	(iv)	brings/transport/carries <u>specific</u> amino acid (to ribosome) (1) anticodons match/respond to/are complementary to codons OR mRNA bases/triplets/codons are complementary to tRNA bases/triplets/anticodons (1)	2	unique/correct join to	

Question			Acceptable answer(s)	Max Mark	Unacceptable answer	Negates
4	(a)	(i)	protein /glycoprotein/amino acids NOTE – ignore reference to coats	1		
4	(a)	(ii)	Nucleotides ATP enzymes/RNA or DNA polymerase (Any two 1 mark each)	2	DNA energy amino acids	
4	(a)	(iii)	R protein coats synthesised/made/formed/ manufactured/produced/built/ developed (1) S (new) viruses/protein coats and nucleic acids are assembled OR nucleic acid enters/is surrounded by protein coat (1)	2	protein synthesis formed assembly alone	
4	(a)	(iv)	1. lymphocytes (1) 2. antigens (1)	2		
4	(b)		resin	1		

Question		Acceptable answer(s)	Max Mark	Unacceptable answer	Negates
5	(a)	surface area/shape/size/diameter/ mass of beads temperature pH/colour of bicarbonate at start/CO ₂ 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	
5	(b)	keep everything the same/same set-up/experiment AND leave out/without algae/ <i>Scenedesmus</i> OR replace algae with glass beads/boiled and cooled algae OR contents of tube listed without algae	1		
5	(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	
5	(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		
5	(d) (ii)	represents/shows/gives/indicates/measures the rate/amount/efficiency/effectiveness of photosynthesis/how well photosynthesis takes place at each (light) wavelength	1		
5	(e)	>0.36 – 1.0 units (1) 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		

Question			Acceptable answer(s)	Max Mark	Unacceptable answer	Negates
6	(a)		14 14 7 (All 3 = 2, 2/1 = 1)	2		
6	(b)	(i)	1. (pairing of) homologous chromosomes/homologous pairs (form) 2. crossing over/recombination/ 3. independent/random assortment has occurred (Any 2, 1 each)	2	Homologous chromatids chiasmata	
6	(b)	(ii)	ovary OR anther	1	stamen carpel ovule	

Question			Acceptable answer(s)	Max Mark	Unacceptable answer	Negates
7	(a)	(i)	Carrier	1		
7	(a)	(ii)	50%	1		
7	(a)	(iii)	<p>males have only one X chromosome and if they inherit a recessive allele on it they will be affected/have the condition/be red-green colour deficient</p> <p>OR</p> <p>males only require one recessive allele to be affected/have the condition/be red-green colour deficient</p> <p>AND</p> <p>females require two recessive alleles to be affected</p> <p>OR</p> <p>females have two X chromosomes so that a recessive allele on one of them could be masked by the dominant allele on the other</p>	1		
7	(b)		<ul style="list-style-type: none"> • substitution • inversion • deletion • insertion <p style="text-align: right;">(Any 2)</p>	1	Frameshift	

Question			Acceptable answer(s)	Max Mark	Unacceptable answer	Negates
8	(a)	(i)	17	1		
8	(a)	(ii)	80	1		
8	(a)	(iii)	125 : 1	1		
8	(b)		bring down/kill/catch larger prey OR less energy used per individual more energy gained per individual OR more successful hunts OR More food/energy gained per individual than by hunting alone	1	large prey hunt larger prey less energy used alone answers based on social/dominance hierarchy	
8	(c)		a rank/pecking order OR each animal has a rank within the group OR some (wolves) <u>dominant</u> and some (wolves) are <u>subordinate</u> OR There is an alpha animal and subordinates	1	role/position within the group	

Question			Acceptable answer(s)	Max Mark	Unacceptable answer	Negates
9	(a)	(i)	water moves into/enters the guard cells (by osmosis) AND they become turgid/gain turgor	1		and stomata closes
9	(a)	(ii)	allows CO ₂ to enter leaf/plant (for photosynthesis) OR transpiration provides water (for photosynthesis)	1	traps CO ₂ gas exchange O ₂ to leave transpiration alone	
9	(b)	(i)	270	1		
9	(b)	(ii)	10 (± 0.5)	1		
9	(b)	(iii)	expressed per cm ² /unit area AND so plants/leaves of different sizes/surface areas can be compared OR differences in size/surface area of plants/leaves don't matter/affect results	1		
9	(c)		transports/provides/supplies nutrients/minerals OR supplies water for photosynthesis/photolysis OR cooling OR for support/turgor (Any 1)	1	temperature control	

Question		Acceptable answer(s)	Max Mark	Unacceptable answer	Negates
10	(a)	1. melanic/dark variety camouflaged/blend in/less easy to see 2. reduces predation/reduces selection pressure/less likely to be eaten (by small birds) 3. melanic/dark variety survive to pass on favourable/beneficial genes/alleles/characteristics OR converses for light variety <p style="text-align: right;">(3 = 2, 2/1 = 1)</p>	2		
10	(b)	they could interbreed/breed together/reproduce together to produce/give fertile young/offspring	1		

Question			Acceptable answer(s)	Max Mark	Unacceptable answer	Negates
11	(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 (All 3 = 2, 2/1 = 1) NOTE - units only needed once; differences acceptable if correct all correct values but no units (1)	2		
11	(a)	(ii)	208 – 216	1		
11	(a)	(iii)	840	1		
11	(b)	(i)	the use of 10/a large number of cattle (in each group/at each feed level)	1	3/multiple groups of cattle	
11	(b)	(ii)	0.6	1		
11	(b)	(iii)	1. 20 (1) 2. increasing the phosphate (fertiliser level applied to crop) increases the mass of/growth (of cattle) (1)	2		
11	(c)		phosphate need for ATP/ADP/Pi for respiration ATP/DNA/nucleotides for cell division ATP/DNA/RNA/nucleotides for protein synthesis ATP/ADP/Pi/RuBP/GP/NADP for photosynthesis (must match) (Any 1)	1		

Question			Acceptable answer(s)	Max Mark	Unacceptable answer	Negates
14	(a)	(i)	when mink present there are fewer water voles/water voles numbers decrease/water voles are present at fewer sites OR when mink are absent there are more water voles/water vole numbers increase/water voles are present at more sites	1	answers in terms of %mink or voles answers in terms of a relationship eg as the mink increase the voles decrease	
14	(a)	(ii)	125	1		
14	(a)	(iii)	disease/food (supply)/competition	1	territory	
14	(a)	(iv)	decreases (1) increases (1)	2		
14	(b)		(they could be) pollution indicators OR (they supply) food/raw material OR (they may be) pest species	1	pollution alone indicator species alone examples alone examples alone absence of natural predator	

Section C

1A

- (i)
- | | | |
|---|---|---|
| 1 | nitrogen is a component of/needed for amino acids | 1 |
| 2 | nitrogen is a component of/needed for polypeptides/proteins | 1 |
| 3 | nitrogen is a component of/needed for bases/nucleotides/nucleic acids/DNA/RNA | 1 |
| 4 | nitrogen is a component of/needed for ATP/enzymes/chlorophyll | 1 |
| 5 | role of any named substance ie ATP (respiration or energy for cellular processes/eg); enzymes (speed up/control metabolic/chemical reactions); chlorophyll (photosynthesis); DNA (cell division); RNA (protein synthesis) | 1 |
| 6 | any nitrogen deficiency from
chlorosis/yellow leaves
red leaf bases
long roots
growth reduced/decreased/restricted/retarded/stunted | 1 |
| 7 | another deficiency | 1 |
| 8 | magnesium is a component of/needed for chlorophyll | 1 |
| 9 | magnesium deficiency results in chlorosis/yellow leaves | 1 |
- Max 5 for nitrogen**
- Any 6** **Max 6**
- (ii)
- | | | |
|----|---|---|
| 10 | vitamin D important in/needed for calcium absorption in the intestine | 1 |
| 11 | rickets/osteoporosis is the result vitamin D deficiency
OR
vitamin D prevents rickets/osteoporosis | 1 |
| 12 | calcium needed for blood clotting | 1 |
| 13 | calcium is a component of/needed for bones/teeth NOT shells | 1 |
| 14 | iron is a component of/needed for
haemoglobin
some enzymes
hydrogen carrier or cytochrome (system) | 1 |
| 15 | another role of iron from above | 1 |

For full marks, at least 1 from each of 10 – 11, 12 – 13 and 14 – 15

Max 4

Total 10

1B				
	(i)	1	genes code for enzymes	1
		2	Phenylalanine is involved in a metabolic pathway OR described OR shown in diagram of pathway	1
		3	PKU involves/is caused by a (gene) mutation/inborn error of metabolism	1
		4	in PKU the enzyme which converts/beaks down phenylalanine (to tyrosine) is faulty/absent/non-functional	1
		5	phenylalanine builds up/not broken down/not converted OR phenylalanine produces toxic product/phenylpyruvate	1
		6	(toxic product) damages nervous system/brain OR causes learning difficulties/mental retardation NOT tumours	1
			Any 3	Max 3
	(ii)	7	regulator gene produces/codes for repressor molecule/protein/substance/the repressor	1
		8	lactose is the inducer	1
		9	when lactose is present it binds/joins with the repressor molecule/protein/substance/the repressor	1
		10	operator switches/turns on structural gene/gene for β -galactosidase NOTE – must be clearly stated	1
		11	structural gene codes for/allows production of/allows synthesis of/produces lactose-digesting enzyme/ β -galactosidase NOTE – needs to be a link between structural gene and enzyme eg. ...structural gene turned on and/so/then lactose-digesting enzyme made OR ...structural gene turned on. Lactose-digesting enzyme made.	1
		12	when lactose is absent the repressor molecule/protein/substance/the repressor binds to operator	1
		13	operator switches/turns off structural gene/cannot switch/turn on structural gene OR operator prevents/blocks transcription of structural gene OR structural gene remains switched/turned off	1
		14	lactose-digesting enzyme / β -galactosidase not synthesised/produced/made	1
		15	saves energy/resources/ATP/amino acids (for <i>E. coli</i>)	1
			Any 7	Max 7
				Total 10

2A	1	genes are located/found using gene probes OR gene/chromosome mapping OR chromosome banding NOT COVs/recombination values	1
	2	endonuclease(s)/restriction enzymes cut/cut out/remove DNA/genes from chromosome/donor	1
	3	endonuclease(s)/restriction/same enzymes cut/cut open NOT cut pieces out of bacterial plasmids	1
	4	ligase(s) seals/sticks/inserts/glues/splices genes into plasmid/ bacterial genome	1
	5	plasmids inserted into bacteria	1
	6	bacteria cultured/grown/allowed to reproduce/multiply	1
	7	one example of product eg growth hormone/GH or insulin or can be used to produce GM crops/organisms Any 5	1 Max 5
	8	somatic fusion overcomes sexual incompatibility (between plants) OR used when two species cannot interbreed/reproduce together	1
	9	(so that) characteristics/features/phenotypes of two (separate) species can be combined	1
	10	cell walls removed/broken down/destroyed/digested using cellulase	1
	11	protoplast obtained	1
	12	protoplasts fuse/combine/join Any 3	1 Max 3
	C	information grouped under genetic engineering and somatic fusion At least 3 marks on genetic engineering At least 2 marks on somatic fusion At least 5 marks scored All four	 1
	R	no mention of details of selective breeding or hybridisation At least 3 marks on genetic engineering At least 2 marks on somatic fusion At least 5 marks scored All four	 1
		Total	10

2B

1	salt water bony fish are hypotonic/at a higher water concentration/lower salt concentration than their environment/surroundings OR environment hypertonic/at a lower water concentration/higher salt concentration than the fish NOTE – content not equivalent to concentration	1
2	lose (NOT excrete/secrete) water through gills	1
3	water lost by osmosis/from high to low water concentration	1
4	leads to dehydration/cell death	1
	Any 2	Max 2
5	drink sea/salt water OR drink water from their environment/surroundings	1
6	remove/excrete/secrete/get rid of salt via chloride secretory cells in gills	1
7	by active transport/actively/against the concentration gradient	1
8	glomeruli are small	1
9	kidneys have few glomeruli	1
10	kidneys have low/slow filtration rate	1
11	small/low volume/amount of urine produced	1
12	urine concentrated/hypertonic	1
	Any 6	Max 6
C	divided into problems and adaptations at least 1 mark on problems at least 4 marks on adaptations 5 marks scored All four	1
R	no detailed mention of fresh water fish at least 1 mark on problems at least 4 marks on adaptations 5 marks scored All four	1
	Total	10

[END OF MARKING INSTRUCTIONS]