2013 Biology (Revised)

Higher

Finalised Marking Instructions

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 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

Part Two: Marking Instructions for each Question

Section A

Question			Expected Answer/s	Max Mark	Additional Guidance
1			B	**1**	
2			C	**1**	
3			C	**1**	
4			A	**1**	
5			C	**1**	
6			D	**1**	
7			B	**1**	
8			C	**1**	
9			C	**1**	
10			A	**1**	
11			B	**1**	
12			D	**1**	
13			B	**1**	
14			C		

Question			Expected Answer/s	Max Mark	Additional Guidance
15			B	**1**	
16			C	**1**	
17			A	**1**	
18			B	**1**	
19			D		
20			A	**1**	
21			D	**1**	
22			B	**1**	
23			A	**1**	
24			D	**1**	
25			A	**1**	
26			A	**1**	
27			C	**1**	
28			D	**1**	
29			D	**1**	
30			B	**1**	

Section B

Question			Acceptable Answer/s	Max Mark	Unacceptable Answer	Negates
1	**a**		(Packaging)/(Associated) Protein **OR** Histone	**1**	Histisone	
1	**b**		Hydrogen/H (weak)	**1**		
1	**c**		Thymine **OR** T	**1**		
1	**d**		Antiparallel, phosphates **(both)**	**1**		
1	**e**		Adds/bonds/binds/joins (complementary) nucleotides to DNA/3' end / deoxyribose end/primer	**1**	Joining nucleotides to form a DNA strand/to the template strand	
2	**a**		C U C G **(all four)**	**1**		
2	**b**		P at (end of longer chain at) top of diagram	**1**		
2	**c**		X <u>anticodon</u> **= 1** (Ensures) specific/correct/right/appropriate amino acid is used **OR** (ensure) amino acids are in correct/right/appropriate order/sequence **= 1**	**2**	<u>Not</u> particular	<u>Production</u> of amino acids
3	**a**		Introns are non-coding regions/do not code for protein **AND** exon are coding regions/code for protein	**1**	Expression alone. Have codes/code don't have codes/code	
3	**b**		<u>RNA polymerase</u>	**1**		
3	**c**		(RNA)/(alternative) splicing	**1**		Post-translational modification **OR** any other processes

Question			Acceptable Answer/s	Max Mark	Unacceptable Answer	Negates
3	**d**		(RNA segments which/different parts are) used/treated as introns and those which are used/treated as exons can change / differ **OR** Different exons can be spliced together	**1**	Introns alone By removal of different introns and exons	
3	**e**		Cutting/cleaving/breaking/combining chains/strands **OR** adding phosphate **OR** adding carbohydrate / sugar **(any 1)**	**1**	Post translational modification on its own	
4	**a**		Higher it/the carotenoid content concentration the darker it/the flesh **OR** converse	**1**	Less light transmitted alone Darker flesh causes the higher carotenoid content	
4	**b**	**i**	1:2	**1**		
4	**b**	**ii**	0·35mg	**1**		
4	**b**	**iii**	T Triploids have more than diploids on average **OR** F tetraploids have less than diploids/ triploids **OR** example with correct figures	**1**		

Question			Acceptable Answer/s	Max Mark	Unacceptable Answer	Negates
5	**a**	**i**	368	**1**		
5	**a**	**ii**	140	**1**		
5	**a**	**iii**	1974 - 1976	**1**		
5	**b**		Resistant rabbits survive/ breed/ pass on genes **OR** non-resistant rabbits don't survive/ breed/ pass on genes **AND** Increase in frequency/ higher percentage of/ more common the gene /allele / sequences giving resistance	**1**		
5	**c**		Decrease in the (percentage of the) population / 48% - 39% that are resistant from 1974 – 76 / at the end / last two years / in 1974	**1**		
6	**a**		Allopatric	**1**		
6	**b**		Can no longer interbreed to give fertile offspring **OR** if they breed together offspring would be infertile	**1**		
6	**c**		Zones of hybridisation / hybrid zones	**1**	Border zones	

Question			Acceptable Answer/s	Max Mark	Unacceptable Answer	Negates
7	**a**		Fossil record/fossils **= 1** (Genomic) sequence data **OR** (differences/similarities) in the DNA / gene sequence **OR** Number of nucleotide differences in the sequence **OR** Single nucleotide polymorphism frequency / number **= 1**	**2**	Bioinformatics Mutation rates Molecular clock	
7	**b**	**i**	21 million years BP	**1**		
7	**b**	**ii**	Five species	**1**		
7	**c**		Eukaryotes Archaea Bacteria (All 3 = 2, 2 = 1) -1 for another incorrect answer	**2**		

Question			Acceptable Answer/s	Max Mark	Unacceptable Answer	Negates
8	**a**	**i**	Lead (nitrate/ion) concentration	**1**		
8	**a**	**ii**	Concentration of glucose (solution) **OR** pH **OR** strain / type / species / variety / age of yeast **OR** concentration of yeast	**1**	Size of flask Light intensity Oxygen concentration Same glucose solution Number of yeast cells	
8	**a**	**iii**	Allow the flasks/solution(s)/contents/them/glucose **and** lead solutions/mixtures to reach/heat up to/ cool down to/settle at/ be at an <u>even temperature</u>/correct temperature / required/specific temperature/ appropriate temperature /desired temperature / the same temperature / 20°C /the temperature of the water bath	**1**	Acclimatise Adapt to References to yeast Conditions <u>Constant temperature</u> Optimum	
8	**a**	**iv**	Allow the <u>lead</u> (nitrate) to diffuse into / be taken up by / have its effect on / inhibit /react with/ be absorbed by cells/yeast **OR** allows lead (nitrate) to have its effect on / inhibit respiration **OR** allows lead (nitrate) to have its effect on/inhibit/react with enzymes	**1**		
8	**b**		Axes scales and labels with units **= 1** 11 needed on Y axis OR 0 2 4 6 8 10 12 is OK Decimal points **not** needed on scale Zero(s) required Single zero allowed if obviously both scales Label must include oxygen concentration Mg/l is acceptable Plotting and joining as a straight line **= 1** Points don't need to be visible Ignore Flask B if included but A must be labelled if both plotted Transposed axes **-1**	**2**	Half scale on X axis Half scale on Y loses plot mark	

Question			Acceptable Answer/s	Max Mark	Unacceptable Answer	Negates
8	**c**		As the lead (concentration) increases respiration decreases **OR** (it) decreases/decreased/reduces **OR** inhibition was increased	**1**	Inhibition alone	
8	**d**		(Carbon dioxide / CO_2 is a product of)anaerobic respiration / fermentation	**1**	Anaerobic conditions	

Question			Acceptable Answer/s	Max Mark	Unacceptable Answer	Negates
9	**a**	**i**	**1** Increases from 4·0 - 4·5g to beginning of September / end of August / during August/ in August / in the first month **2** Falls from 4·5 - 1·5g from beginning of September / end of August until beginning of December / end of November. **3** Remains constant (at 1·5g) from beginning of December / end of November to end of January **All 3 = 2, 1 or 2= 1** **NB All correct but no units = 1** **Units only needed once** **At least one reference point needed** **Ignore data beyond end of January**	**2**		
9	**a**	**ii**	60%	**1**		
9	**a**	**iii**	More/plentiful/good food/nectar available **OR** less energy needed to keep warm **OR** more torpor than in winter **OR** using less energy because not migrating	**1**	Eat more food	
9	**b**	**i**	Energy conserved/ saved for flying / migration / flight **OR** energy not wasted so more energy for flying/migration/flight **OR** less energy used in keeping warm so more available for flight	**1**	Energy stored Enough/more energy available for flight Movement/big journeys/ travel More energy needed for migration	
9	**b**	**ii**	0·5 / half / ½	**1**		
9	**c**		$45cm^3$	**1**		
9	**d**		(Individual) marking/mark, tagging, ringing, banding **OR** radio tracking **OR** satellite/GPS tracking **OR** satellite transmitter	**1**		

Question			Acceptable Answer/s	Max Mark	Unacceptable Answer	Negates
10	**a**		Via a plasmid/transformation **OR** transfer of chromosomal DNA / genetic engineering recombinant DNA technology / genetic modification **OR** (DNA) from the environment **OR** horizontal transfer / horizontal inheritance **OR** conjugation **OR** transduction / from a virus **(any 2, 1 mark each)**	**2**	Vertical Mutagenesis/ mutation	
10	**b**	**i**	H7 could cause (food) poisoning	**1**		
10	**b**	**ii**	May be incorrectly folded **OR** may lack (structures for) post-translational modification	**1**	Synthesised Post transcriptional modification Bacteria don't undergo post translational modification	
11	**a**		Using buffers **OR** addition of acid / alkali	**1**	pH sensors Computer controlled fermenter Substances	
11	**b**	**i**	W lag X log/exponential Y stationary Z death **(All 4 = 2, 2/3 = 1)**	**2**	Logging Expo	
11	**b**	**ii**	W / lag			
11	**b**	**iii**	(Cells are dying) because of toxic waste / secondary metabolites accumulating / building up / being produced **OR** running out/ lack of / no nutrients / oxygen / food / respiratory substrate **OR** increasing competition (for food)	**1**	Death rate higher than birth rate Substrate on its own	

Question			Acceptable Answer/s	Max Mark	Unacceptable Answer	Negates
12	**a**	**i**	Organism which benefits/gains energy /nutrients from the host **AND** damages / harms it **OR** at the expense of it	**1**	Benefits alone	
12	**a**	**ii**	Mutualism / commensalism	**1**		
12	**a**	**iii**	Vector	**1**		
12	**b**	**i**	Population of flies would drop / reduce the number of offspring **= 1** Therefore less flies to transmit disease / act as vectors / fewer flies transmitting / less flies to cause it **= 1**	**2**	Prevent population from increasing No offspring would be produced	
12	**b**	**ii**	Introduce / release / bring in/ add in predator / parasite / disease / pathogen (to population of pest) **OR** examples	**1**	Natural enemies for parasite, predator etc Crop rotation	
12	**b**	**iii**	Introduced predator eats/ eliminates/ wipes out /destroys other organisms/groups of species/ keystone species **OR** becomes invasive / a pest themselves **OR** Reduces biodiversity **OR** Other species which eat the pest/ tsetse fly could be eliminated/affected **OR** Infect other species with a parasite	**1**	Affects other species Destroy/ destruct food web	

Question			Acceptable Answer/s	Max Mark	Unacceptable Answer	Negates
13	**a**		B A C **(all 3 = 2, 1 = 1)**	**2**		
13	**b**		Same age / stage of plant used **OR** planting density /initial number / mass of seeds planted the same / temperature/ sunlight / CO_2 concentration **OR** same fertilizer / pesticide treatment **OR** same irrigation / soil factors / pH / volume of water / fertility of soil etc = 1 Valid reason **= 1** Must state the effect on growth/yield/photosynthesis	**2**		
13	**c**	**i**	0·6	**1**		
13	**c**	**ii**	Coteau Has a higher harvest index **OR** higher economic yield **OR** higher mass of desired product **(both variety and reason)**	**1**	Yield alone	
13	**d**		1. There is a loss of energy between trophic/food chain/feeding levels **OR** 2. Livestock produce less energy per area/volume **OR** 3. Plants produce more energy per area/volume Alternatives to energy = food/biomass	**1**		
14	**a**		Diversity greater on island 2 **= 1** **1.** Nearer mainland **= 1** **2.** Greater area / bigger **= 1** Accept converses	**3**		
14	**b**		Hedgerow can act as a habitat corridor **= 1** Allows species to spread / migrate /move/ go between islands / colonise / access habitat island B / mate / breed / interbreed / interact / exchange genes **= 1**	**2**		

Question			Acceptable Answer/s	Max Mark	Unacceptable Answer	Negates
15	**a**		5 minutes	**1**		
15	**b**		4:1:2	**1**		
15	**c**		Increase number of pigs observed **OR** repeat with different groups/sets of pigs **OR** increase number / length of observations **OR** more frequent observations **OR** repeat at different times of day **OR** repeat using different/ more enclosures	**1**	Repeat the whole experiment Repeat observations made Increase the time Compare to other groups	
15	**d**		Stereotyped / misdirected **OR** failure of sexual/ parenting behaviour **OR** altered levels of activity **OR** ARM/Abnormal Repeated Movement **OR** repeated pointless movements **OR** hyper aggressive behaviour **OR** pacing **OR** eg	**1**	Stereotyping Biting Chewing (bars) Fighting (unless indicating that it is abnormal)	

Section C

1A

(i)	1	light absorbed (for photosynthesis)	1
	2	some light is transmitted / reflected	1
	3	chlorophyll (a) absorbs mainly in the blue and red regions /colours / wavelengths of the spectrum	1
	4	chlorophyll b / carotenoids / accessory pigments extend the wavelengths of light absorbed / broaden/widen the absorption spectrum / absorb light wavelengths/colours not absorbed by chlorophyll	1
	5	chlorophyll b / carotenoids / carotene and xanthophyll / accessory pigments pass energy/electrons onto chlorophyll (a) (**NOT** light energy)	1
	5 a	names of pigments if 3, 4 or 5 not awarded	1
	6	Absorbed/captured) energy excites electrons in pigments / pigment molecules / chlorophyll (Not : Chloroplasts) For points 1,3 and 4 : Penalise -1 once for the use of light captured/trapped as an alternative to light absorbed Point 1 can be scored in addition if points already 3and 4 scored	1
		Max 4 (from 6)	
(ii)	7	(high energy) electrons pass through electron transport chains /electron transport system / cytochrome chain / cytochrome system (to release energy)	1
	8	ATP generated by ATP synthase	1
	9	energy is used for photolysis	1
	10	energy is used to split water to produce / release hydrogen and oxygen	1
	11	hydrogen transferred to/reduces/joins to (coenzyme) NADP **OR** NADPH /$NADPH_2$ is produced	1
	12	oxygen evolved/released OR oxygen produced as a waste product/ by-product	1
	13	ATP is transferred to / used in / needed for / needed in the carbon fixation stage/Calvin cycle (Not : light independent stage / dark stage / stroma)	1
	14	$NADPH_2$ transferred to / used in / needed for / needed in carbon fixation stage / Calvin cycle	1
		Max 6 (from 8)	
		Total	**10**

1B

(i)	1	in context of altruism use of donor **and** recipient	1
	2	altruistic behaviour harms **and** benefits / increased survival or descriptions of examples	1
	3	reciprocal altruism involves reversal of roles at a later stage / favour returned or a description of reversed roles	1
	4	reciprocal altruism often occurs in social animals/social insects **OR** mention of the prisoner's dilemma	1
	5	altruism is (more) common between kin / related individuals / kin selection is altruism between kin	1
	6	donor can benefit indirectly (through shared genes)	1
	7	increased chance of shared / their genes surviving / being passed on (in recipient's offspring)	1
		Max 5 (from 7)	
(ii)	8	primates have a long period of parental care / spend a long time with their parent(s)/ look after young for a long time	1
	9	this gives opportunity to learn complex social skills	1
	10	(social) primates use ritualistic display / appeasement (behaviour) to reduce conflict/aggression / ease tension	1
	11	any one example of appeasement / alliance forming / ritualistic behaviour e.g. grooming / facial expression / body posture / sexual presentation	1
	12	second example of appeasement / alliance forming / ritualistic behaviour	1
	13	individuals form alliances which increase social status **OR** Social hierarchy exists	1
	14	complexity of social structure is related to ecological niche / resource distribution / taxonomic group	1
		Max 5 (from 7)	
		Total	**10**

2A	(i)	1	(glycolysis is the breakdown of) glucose to pyruvate	1
		2	(2) ATP used to phosphorylate **intermediates** (in glycolysis)	1
		3	this is an energy investment phase	1
		4	ATP produced / generated / made in a pay off stage	1
		4a	Net gain of ATP **OR** 2 ATP used and 4 gained **Award 4a only if points 3 and 4 not awarded**	1
			Max 3 (from 4)	
		5	if oxygen is available / in aerobic conditions pyruvate progresses to the citric acid cycle	1
		6	pyruvate is converted / broken down to an acetyl group	1
		7	acetyl group combines with coenzyme A	1
		8	acetyl (coenzyme A) combines with oxaloacetate to form citrate	1
		9	citric acid cycle is enzyme controlled / used dehydrogenases.	1
		10	ATP generated/synthesised/produced/released (at substrate level) in the citric acid cycle	1
		11	carbon dioxide released (from the citric acid cycle)	1
		12	oxaloacetate is regenerated	1
		13	NAD/NADH/$NADH_2$/FAD/FADH/$FADH_2$ transports electrons / transports hydrogen ions (to electron transport chain / next stage)	1
			Max 5 (from 9)	
		C	logical order of presentation in two clear sections At least 2 marks on glycolysis and 3 on citric acid cycles Both	1
		R	no detailed mention of electron transport chain or fermentation At least 2 marks on glycolysis and 3 on citric acid cycle Both	1
			Total	**10**

2B	(ii)	1	activity depends on flexible / dynamic shape of enzyme molecules	1
		2	(there is an) affinity of the substrate for active site	1
		3	induced fit	1
		4	active site orientates reactants	1
		5	activation energy (of transition state) lowered	1
		6	products have low affinity for active site	1
		7	substrate and product concentration affects direction and rate of reactions **OR** describe the effects of increasing substrate concentration as increasing/speeding up/driving forward the rate of the reaction **No penalty for coherence for a concentration graph in inhibition section**	1
		8	enzymes act in groups / multi-enzyme complex	1
			Max 5 (from 8)	
		9	(in) competitive inhibition	1
		10	there is a resemblance between the substrate and the inhibitor **OR** inhibition is reduced by increase in substrate concentration	1
		11	(in) non-competitive inhibition	1
		12	the active site shape is changed **OR** the affinity of substrate for enzyme is lowered	1
		13	(there can be) product inhibition / feedback inhibition / eg / description	1
			Max 3 (from 5)	
		C	divided into sections (no penalty for concentration graph for inhibition scoring point 7 at least 3 marks on action and 2 on inhibition Both	1
		R	no detailed metabolism eg respiration pathways at least 3 marks on action and 2 on inhibition Both	1
		Total		**10**

[END OF MARKING INSTRUCTIONS]