2014 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			D		
2			A		
3			B		
4			B		
5			C		
6			B		
7			A		
8			C		
9			A		
10			C		
11			D		
12			A		
13			D		
14			B		
15			A		
16			B		

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

Section B

Question			Acceptable answer(s)	Max Mark	Unacceptable answer	Negates
1	**(a)**	**(i)**	True False antiparallel False phosphate **All 3 = 2, 1 or 2 = 1**	 **2**		
1	**(a)**	**(ii)**	1 400 2 132	**1** **1**		
1	**(b)**	**(i)**	Primer	**1**		
1	**(b)**	**(ii)**	Ligase	**1**		
1	**(c)**		RNA polymerase	**1**	polymerase	
1	**(d)**		(alternative) RNA splicing **OR** different segments of primary transcript treated as introns **1** post translation modification **OR** cutting/cleaving/cleavage **and** combining polypeptides **OR** adding phosphate/lipid carbohydrate groups to protein/polypeptide **OR** phosphorylating protein/polypeptide **1**	**2**	mutation splicing alone	
2	**(a)**		thr–glu–-pro–pro	**1**		
2	**(b)**		Substitution	**1**	point mutation	
2	**(c)**	**(i)**	Peptide	**1**	polypeptide	
2	**(c)**	**(ii)**	hydrogen ionic hydrophobic (interaction) disulfide bridge/sulfur bridge Van der Waals **Any**	 **1**	not H	extra wrong information eg hydrogen bonds between bases

Question			Acceptable answer(s)	Max Mark	Unacceptable answer	Negates
2	**c**	**(iii)**	Incorrect/different/wrong order of amino acids (sequence) **OR** change described **AND** gives altered/incorrect/changed/ differed folding/shape **OR** may affect post-translation modification/bonding of haemoglobin	**1**		
3	**(a)**		5:4:8:6	**1**		
3	**(b)**		Error during/failure of/incomplete separation of chromosomes/ chromatids **OR** (complete) non-disjunction **OR** (total) spindle failure.	**1**	failure of cell division error during meiosis	
3	**(c)**		Increased/better/higher/more/ greater yields/seeds/fruit **OR** resistance to disease, drought, frost **OR** superior taste **OR** seedless varieties **OR** increased vigour/faster growth	**1**	larger/bigger/ healthier plants/crop high yield	
4	**(a)**	**(i)**	Pollinator of one species cannot pollinate another **OR** each species/flower can only be pollinated by one pollinator/its own pollinator **OR** no pollen is crossed between species, they have different pollinators	**1**	each species has a different pollinator / only goes to one species	
4	**(a)**	**(ii)**	<u>Sympatric</u>	**1**	Adaptive radiation	
4	**(a)**	**(iii)**	Unable to interbreed/cross-pollinate to produce fertile offspring **OR** example from table described	**1**	breed to produce fertile offspring	
4	**(b)**		eukaryotic vertically sexual **All 3 = 2, 2 = 1**	**2**		

Question			Acceptable answer(s)	Max Mark	Unacceptable answer	Negates
5	**(a)**		Glycolysis	**1**		
5	**(b)**		Converted to/becomes/ produces/forms/turns into/ changed to lactate/lactic acid.	**1**	lactic acid builds up	and CO_2
5	**(c)**		R – hydrogen/H/H_2 **1** Carrier 1 – NAD/NADH/NAD^+ Carrier 2 – FAD/$FADH_2$/FAD^{2+} **Both = 1**	**2**	NADP	
5	**(d)**		S – oxygen/O/O_2 Role – final acceptor of hydrogen ions/electrons **OR** joins with/combines with/ reacts with hydrogen ions **and** electrons to form water/ H_2O	**1** **1**		
5	**(e)**		More/more room for electron transport chains/ATP synthase/hydrogen ions driving ATP synthase **1** More ATP/energy for muscle contraction/movement/ activity **1**	**2**	not muscle cell/ muscle function alone **OR** converse for skin	
6	**(a)**		1·75 g per litre	**1**		
6	**(b)**		10 – 20 hours	**1**		
6	**(c)**		15.75 - 16 hours	**1**		
6	**(d)**		20 g	**1**		

Question			Acceptable answer(s)	Max Mark	Unacceptable answer	Negates
7	(a)		Scales including origin point and enclosed **AND** labels from data table including units (accept seconds and sec for s) **1** Plots **AND** straight line connection **1** *Ignore prediction extension*	**2**	duration of exercise (s)	
7	(b)	(i)	Rate/speed/intensity/difficulty of exercise/pedalling/the bike **OR** resistance/gear/effort **OR** volume of water intake **OR** clothing/area of exposed skin **OR** method of measuring sweat production/description **OR** (length of) recovery period **Any 2 each from a different category**	**2**	Bike Setting of bike Height of seat Person Food intake Air flow Hydration levels Amount of water Oxygen levels Activity during recovery period Water intake alone	
7	(b)	(ii)	Repeat with more subjects/ people/humans/different sexes *at least one other person suggested*	**1**	Repeat alone Repeat experiment Repeat at each duration of exercise	
7	(c)		Same area of skin **OR** per cm^2 of skin used/ measured/taken **AND** size/height/mass/skin surface/ build (of subject) does not matter/could be different	**1**	Different subjects could be compared alone	
7	(d)		0·48 mg	**1**		
7	(e)		Accept any value between and including 0·45 – 0·48 mg per cm^2 per minute.	**1**		

Question			Acceptable answer(s)	Max Mark	Unacceptable answer	Negates
7	(f)	(i)	Enzymes have an optimum temperature/work best at 37^{o}C/ work too slowly at low temperatures/denature at high temperatures/temperature too hot **OR** diffusion faster at higher temperatures **OR** converse	**1**	Certain conditions Optimum conditions Work best at a certain temperature If body too hot	
7	(f)	(ii)	Endotherms/endothermic/ homeotherms/thermoregulators thermoregulation	**1**	regulator	

Question			Acceptable answer(s)	Max Mark	Unacceptable answer	Negates
8	**(a)**		1 – 4	**1**		
8	**(b)**		Enzymes being induced/produced	**1**		
8	**(c)**		Enzyme – 2 **1** Justification – citrate would not be/less citrate would be converted to/changed to intermediates **1**	**2**	Citrate would build up	
8	**(d)**	**(i)**	Precursors/acetyl group/ pyruvate/oxaloacetate **OR** inducers **OR** vitamins/fatty acids/beef extract	**1**	Acids/bases/ buffers Nutrient/food Substrate/glucose Microorganisms Oxygen	
8	**(d)**	**(ii)**	Mutagenesis **OR** recombinant DNA (technology)/genetic engineering/GM **OR** selective breeding	**1**	cross-breeding inbreeding	
9	**(a)**	**(i)**	12000cm^3	**1**		
9	**(a)**	**(ii)**	Metabolic rate/metabolism can be reduced/lowered because less/no food is available.	**1**	rate of respiration	
9	**(b)**		Torpor	**1**		
9	**(c)**	**(i)**	Migration/migratory/migrate	**1**		
9	**(c)**	**(ii)**	Ringing/banding/tagging/colour marking **AND** recovery/control **OR** GPS/satellite tracking **OR** radio-tracking **OR** electronic tagging	**1**		

Question			Acceptable answer(s)	Max Mark	Unacceptable answer	Negates
10	**(a)**		Reflected/bounces back **OR** transmitted/passes through	**1**		other wrong answers
10	**(b)**		Pigment – X **Justification** Absorbs in red and blue(light) best/better/much more/mainly/at a higher percentage/greater/ higher/more efficiently (than pigment Y/than green) **OR** converse for green **Both = 1** *violet not negating*	**1**	Absorbs red and blue light alone Absorbs very little green light High absorption of red and blue light	
10	**(c)**	**(i)**	As wavelength increases to 550nm (%) absorption also increases **1** then decreases **OR** As wavelength increases further/over 550 nm absorption decreases. *nm and 550 needed at least once* *no units = 1* **1**	**2**	Description of pigment X Drops at 680nm Colours instead of wavelengths Increases then decreases	
10	**(c)**	**(ii)**	Would allow absorption/use of light/green light/wavelengths/ colours not absorbed by/reflected from/ transmitted through/not used by/passing through/filtered through/transmitted by larger plants/the canopy/trees / sun plants/higher leaves/leaves above	**1**	Gets light Absorbs green light alone Blocked by By-passes Shines through Leaves alone Plants alone	

Question			Acceptable answer(s)	Max Mark	Unacceptable answer	Negates
11	**(a)**		Many/some *E. coli* /bacteria resistant and survive/live/do not die **1** pass on/breed to pass on/ multiply to pass on resistance/resistant trait **OR** favourable/beneficial genes/alleles/characteristics/ mutations to next generation/offspring **1**	**2**	Immune – penalise once Selective advantage Replicating Strong/best/better/ good	
11	**(b)**		Antibiotic – A Justification – there were more/higher percentage of bacteria resistant **OR** higher resistance at the start/initially/at 0 months/ already **Both = 1**	**1**	It begins higher A reached higher resistance quicker Higher resistance throughout After first exposure	pigs

Question			Acceptable answer(s)	Max Mark	Unacceptable answer	Negates
12	**(a)**	**(i)**	Increases from 0·12 g per 100 g in 2005 to 0·14 in 2006. Decreases from 0·14 in 2006 to 0·02 in 2011. Remains constant at 0·02 from 2011 until 2012. **OR** using difference but must have correct reference points **All 3 = 2, 2 or 1= 1, units only required once.** **All figures correct but no units = 1** *extra data not negating*	**2**		
12	**(a)**	**(ii)**	8:1	**1**		
12	**(a)**	**(iii)**	0·0125	**1**		
12	**(a)**	**(iv)**	2·5 kg	**1**		
12	**(b)**	**(i)**	80%	**1**		
12	**(b)**	**(ii)**	Plants/they produce Bt toxin/poison **OR** a toxin/poison is produced So (leaf eating) insects deterred/harmed/killed damaged/repelled **1** so more photosynthesis/energy **OR** greater surface area for photosynthesis/energy for increased yield **OR** growth **OR** seed production **OR** reproduce more **1**	**2**	Substance Gene for toxin Stops/prevents	
12	**(b)**	**(iii)**	25·6 kg	**1**		

Question			Acceptable answer(s)	Max Mark	Unacceptable answer	Negates
13	**(a)**		Will kill/destoy the whole plant/ roots/underground stems **and** so avoid regeneration/ regrowth/ coming back	**1**	affect	
13	**(b)**	**(i)**	Introduced species/they may become invasive/pest **OR** may out-compete native species and reduce biodiversity **OR** may introduce disease/ parasites **OR** may eat/destroy native/other plants **OR** may disrupt food webs/ chains **OR** acts as predators to native species	**1**		confusion with couch grass
13	**(b)**	**(ii)**	chemical biological/ cultural means used **OR** descriptions **Any 2 = 1**	**1**		
14	**(a)**	**(i)**	25	**1**		
14	**(a)**	**(ii)**	9	**1**		
14	**(a)**	**(iii)**	$130 – 132 \times 10^4$ 1.3 – 1.32 million	**1**		
14	**(b)**		**1** allows gene flow between fragments **OR** allows groups/populations to interbreed **OR** increases chance of finding mates **OR** increases number of possible mates **OR** allow movement to other fragments to mate **2** allows movement to other fragments for food **3** allows recolonisation/ re-inhabiting of a new area following local extinction **Any 2, one mark each**	**2**		

Section C

1A

(i)	1	genetic diversity, species diversity, ecosystem diversity **(any 2)**	1
	2	a third component	1
	3	genetic diversity is the number and frequency of alleles/sequences in a population	1
	4	species diversity is the species richness/number of (different) species and relative abundance/proportion of each species	1
	5	species richness is the number of (different) species	1
	6	relative abundance is the proportion of each species	1
	7	ecosystem diversity is the number of different/distinct ecosystems	1
		Any 4 **Max 4 (from 7)**	
(ii)	8	overexploitation	1
	9	example – overhunting/overfishing/deforestation	1
	10	bottleneck effect is loss of genetic variation in small populations/few surviving individuals **OR** removal of keystone species decreases biodiversity	1
	11	habitat fragments/islands/reduced habitat areas have a low species richness/low number of species/species diversity	1
	12	in habitat fragments/islands edge/fringe species outcompete interior/other species	1
	13	invasive species (are naturalised species) which eliminate/ outcompete/prey on native/keystone species (and reduce biodiversity)	1
	14	invasive species may be free of predators/pathogens/disease (which naturally limit their populations)	1
	15	human activities/humans/deforestation/burning fossil fuels cause climate change/global warming **OR** anthropogenic climate change	1
		Any 6 **Max 6 (from 8)**	
		Total	**10**

1B

(i)	1	(food security is ability of human population to access) sufficient/enough/correct/right supply/quantity/amount of food	1
	2	sufficient/enough/correct/right quality of food **OR** example	1
	2a	If nether 1 nor 2 scored mention of quantity and quality of food	1
	3	increasing population increases the demand/need for food **OR** food security more difficult to achieve	1
	4	production/supply is sustainable **OR** example	1
	5	does not degrade/destroy natural resources/environment/land on which agriculture depends **OR** example	1
		Any 3 **Max 3 (from 5**)	
(ii)	6	(food production) depends on photosynthesis	1
	7	food production limited by area of crop/land	1
	8	factors which limit/affect photosynthesis include light/temperature/carbon dioxide availability(**any 1)**	1
	9	second factor	1

10	high-yielding/polyploid cultivars **OR** GM/selectively bred organisms increase food production **OR** example described	1
11	pests eat/damage crops/livestock **OR** weeds compete with crops **OR** disease/parasites kill/damage crops/livestock	1
12	vetinary care/pesticides/fungicides/herbicides/insecticides **OR** biological control/cultural methods control pests/weeds/diseases	1
13	increased irrigation/water availability/multiple cropping/agricultural machinery/fertilizers increases food production	1
14	livestock produce less food per unit area than crops due to energy loss at each trophic level	1
15	livestock can be grazed/raised/kept on habitats/land not suitable for crops	1
	Any 7	**Max 7 (from 10)**
		Total 10

2A

1	stem cells are unspecialised/undifferentiated cells (in animals)	1
2	capable of cell division/mitosis **OR** can divide	1
3	can become more stem cells	1
4	(products of cell division) can differentiate/specialise	1
5	embryonic stem cells can differentiate into/give rise to/become/ specialise into all cell types **OR** are totipotent/are pluripotent	1
6	adult/tissue stem cells can differentiate into/give rise to/become/ specialise into more limited cell types **OR** are multipotent	1
7	adult/tissue stem cells replenish cells needing to be replaced **OR** cells which are worn out/damaged/diseased/dead cells/tissue	1
7a	if 5,6 or 7 not awarded 1 mark can be awarded for naming adult/tissue and embryonic stem cells	1
8	Differentiated/specialised cells produce protein/express genes characteristic of that cell type **OR** example	1
	Any 5 **Max 5 (from 8)**	
9	can be used to repair/replace damaged/diseased/dead organs/tissues	1
10	Example eg bone marrow/corneal transplant	1
	1 or 2	
11	ethical issue – requirement to alleviate suffering another ethical issue – requirement to conserve life/living embryos another ethical issue – requirement to obey laws/regulations	
	Any 1	1
12	Another one	1
	1 or 2	
	Any 3 **Max 3 (from 4)**	
C	Divided into sections on stem cells, uses, then ethical issues In any order At least 3 marks on stem cells At least 1 mark on uses At least 1 mark on issues At least 5 marks scored	
	All	1
R	No detailed mention of meristems or details of protein synthesis At least 5 marks scored	
	Both	1
	Total	**10**

2B

1	genomics is study of/sequencing of genomes/DNA/bases/nucleotides	1
2	has been undertaken with in disease causing organisms/pest species/ models for research **OR** example	1
	Either **Max 1 (from 2)**	
3	phylogenetics is use of DNA/gene sequence data	1
4	to study evolutionary relatedness/relationships of living organisms	1
5	sequence divergence gives estimates of time since lineages/ phylogenetic groups diverged	1
6	eg divergence of the three domains of life/names	1
7	used with fossil evidence to determine the main sequence of events in evolution/construct phylogenetic trees	1
8	example; emergence of cells/last universal ancestor/photosynthesis etc **OR** divergence from common ancestor	1
9	shows genetic/genome/sequence conservation across different lineages/groups	1
	Any 5 **Max 5 (from 7)**	
10	personal genomics is analysis of an individual human genome	1
11	could lead to/have a role in personalised medicine **OR** medicine suitable for the individual can be worked out **OR** example	1
12	though knowledge of genetic component of susceptibility/likelihood of treatment success **OR** example	1
	Any 2 **Max 2 (from 3)**	
C	Divided into sections on genomics, phylogenetics and personalised medicine in any order 1 mark on genomics, at least 3 marks on phylogenetics and at least 1 mark on personalised medicine 5 marks scored **All**	1
R	No mention of details of speciation 1 mark on genomics, at least 3 marks on phylogenetics and at least 1 mark on personalised medicine 5 marks scored **All**	1
	Total	**10**

[END OF MARKING INSTRUCTIONS]