2015 Biology

Advanced Higher

Finalised Marking Instructions

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Part One: General Marking Principles for: Biology Advanced 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 <u>always</u> 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 Advanced 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 **<u>underlined</u>** 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 the 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 errors. 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.	A	**1**
2.	D	**1**
3.	B	**1**
4.	C	**1**
5.	A	**1**
6.	C	**1**
7.	D	**1**
8.	A	**1**
9.	B	**1**
10.	B	**1**
11.	C	**1**
12.	A	**1**
13.	A	**1**

Question	Expected Answer(s)	Max Mark
14.	D	**1**
15.	C	**1**
16.	A	**1**
17.	C	**1**
18.	C	**1**
19.	D	**1**
20.	B	**1**
21.	A	**1**
22.	B	**1**
23.	D	**1**
24.	D	**1**
25.	B	**1**

Section B

Question			Expected Answer(s)	Max Mark	Additional Guidance
1	**(a)**		Mutualism/mutualistic	**1**	
1	**(b)**	**(i)**	**(In active peat layer)** At **low** oxygen, methane up to 500 µM **OR** At 0 − 3% oxygen, methane **high** **OR** At 0% oxygen, methane is 490 − 500 µM	**1**	Data needed Unit needed once
1	**(b)**	**(ii)**	(Both methane and oxygen are used up in methane oxidation) oxygen used to convert methane into CO_2 **(1)** (In the moss layer) Methane concentration decreases to 0 − 5 µM **(1)** **OR** oxygen level decreases steeply/about 100 − 30% **OR** both methane and oxygen are decreasing	**2**	
1	**(c)**		(Small) decrease in methane in light **and** increase in methane in the shade **(1)** Difference (between light and shade) is s**ignificant**/error bars don't overlap **(1)**	**2**	
1	**(d)**		Moss **photosynthesis** produces oxygen **OR** Moss **photosynthesis** uses CO_2 produced by the bacteria **(1)** **Bacteria** use oxygen (from the moss) for methane oxidation/CH_4 to CO_2 (which lowers methane output) **(1)**	**2**	
1	**(e)**		More light/more CO_2 (for photosynthesis by moss) **OR** Phytoplankton prevent light reaching moss	**1**	

Question			Expected Answer(s)	Max Mark	Additional Guidance
1	**(f)**	**(i)**	Greenhouse	**1**	
1	**(f)**	**(ii)**	$1{\cdot}8 \times 10^{12}$ tonnes	**2**	1 mark Scale up 8% to 100% $= 2 \times 10^{9}$ to $2{\cdot}5 \times 10^{10}$ 1 mark lost no units
1	**(g)**		Mosses may decline if T increases, resulting in increased methane output	**1**	
				(13)	
2	**(a)**	**(i)**	Any involving **mass/area/unit time** **energy/area/unit time**	**1**	
2	**(a)**	**(ii)**	**A =** temperature **B =** rainfall/precipitation **(both)**	**1**	Units not required
2	**(b)**	**(i)**	Community/organisms alter environment/conditions/habitat which favours **new** community/species/colonisers	**1**	
2	**(b)**	**(ii)**	food web complexity **OR** (ecosystem) stability high biomass diversity of species/habitats/niches **(Any 2 from list)**	**1**	
				(4)	

Question			Expected Answer(s)	Max Mark	Additional Guidance
3	(a)		ammonium (to nitrite) to nitrate by nitrification/nitrifying bacteria/nitrobacteria/named bacteria	1	NH_3 OK for ammonium
3	(b)		(BOD is) **O_2 used** in decomposition/aerobic respiration **AND** bacteria/sewage/organic matter decrease	1	Decomposition = 'micro-organisms', bacteria, decomposers
3	(c)		(Turbidity increases, so) Less light for **photosynthesis** **OR** Sewage contains toxins/substance that kill algae	1	Ammonium / ammonia as named toxin is OK Not pollutant = toxin
3	(d)		Population/abundance used to indicate pollutant/abiotic factor/conditions **(1)** **Favoured** explained as **named species** increasing in relation to 'pollution'/abiotic factor **(1)** **OR** **Susceptible** explained as **named species** decreasing/absent in relation to pollution/abiotic factor	2	Accept presence/absence for abundance
				(5)	

Question			Expected Answer(s)	Max Mark	Additional Guidance
4			1. Parasites need new hosts for completion of life-cycle/reproduction 2. **Direct contact** (between individuals) 3. eg of parasite transmitted this way 4. **Resistant stages** allow survival till new host infected 5. eg of transmission by this mechanism 6. **Vectors** move parasites from one host to another 7. eg of vector transmission 8. Any other transmission type/example 9. A life cycle stage occurs in secondary host	**5**	
				(5)	
5	**(a)**	**(i)**	Condensation	**1**	accept dehydration (dehydration synthesis)
5	**(a)**	**(ii)**	Alpha 1,2 **OR** glucose C1 linked to fructose C2 by alpha link	**1**	
5	**(b)**	**(i)**	Amylose is unbranched **OR** amylopectin is branched	**1**	
5	**(b)**	**(ii)**	they do not affect osmosis/osmoregulation of cells/water movement	**1**	Not **regulate** water movement
				(4)	

Question			Expected Answer(s)	Max Mark	Additional Guidance
6	(a)	(i)	Hydrophilic	1	
6	(a)	(ii)	**Binding** (to receptor) causes ion channel opening/ion flow across membrane **OR** when ACh is **bound** (to it) ion movement occurs	1	**Ion direction** must be correct if mentioned Bind = attach, bond, etc
6	(b)		(neostigmine inhibits acetylcholin**esterase**) so **less/no** ACh broken down/more ACh (remains) **(1)** (vecuronium competes with acetylcholine for receptor sites so) makes its binding more likely when neostigmine is present **OR** increased ACh will 'dilute' vecuronium **(1)**	2	
				(4)	
7	(a)	(i)	Taq/thermostable polymerase	1	
7	(a)	(ii)	single stranded **DNA** complementary to template/target DNA primer anneals/binds to template **(Any one)**	1	template = section of DNA to be amplified
7	(a)	(iii)	(template sequence for PCR must be known) to **design**/**make** correct primers	1	
7	(b)	(i)	Pathogen DNA/fragments will be rare (compared to human)	1	
7	(b)	(ii)	**Idea of** Step 4 eliminating human sequences (so remaining sequences may be from pathogens)	1	
				(5)	

Question			Expected Answer(s)	Max Mark	Additional Guidance
8	**(a)**	**(i)**	1. (eukaryotic cells have) genetic material bound by nuclear membrane/envelope 2. cell functions isolated/compartmentalised by organelles 3. one reference to internal membranes increasing surface area 4. (more area) for enzymes/reactions 5. name of membrane-bound organelle, its function and one feature of structure 6. name of membrane-bound organelle, its function and one feature of structure 7. name of membrane-bound organelle, its function and one feature of structure	**5**	
8	**(a)**	**(ii)**	8. reference to the fluid mosaic model 9. phospholipid bilayer 10. phospholipids have hydrophobic tails and hydrophilic heads 11. stabilisation by hydrophobic interactions **OR** cholesterol 12. integral proteins embedded in membrane 13. peripheral proteins attached to surface	**4**	integral = intrinsic embedded = spans membrane peripheral = extrinsic
8	**(a)**	**(iii)**	14. channels for diffusion (of ions) 15. channels/pumps span membrane 16. (sodium-potassium) pump transports ions against a (steep) concentration gradient 17. (3) sodium ions out and (2) potassium ions in 18. ATP (hydrolysis) provides phosphate 19. phosphate transferred to pump/pump phosphorylated 20. phosphorylation/dephosphorylation changes the conformation of the pump/protein 21. different conformations have different affinities for sodium and potassium 22. phosphorylated protein moves sodium out	**6**	Not pores Not active transport Shape = conformation
				(15)	

Question			Expected Answer(s)	Max Mark	Additional Guidance
8	**(b)**	**(i)**	1. composed of (deoxyribo) nucleotides 2. each nucleotide comprises a **deoxyribose** sugar, phosphate group and (nitrogenous) base 3. adenine and guanine are purine bases **OR** cytosine and thymine are pyrimidine bases 4. purine double-ring structure **OR** pyrimidine single-ring structure 5. nucleotides joined by phosphodiester bonds/covalent bonds 6. (phosphodiester) bonds are between deoxyribose/sugar and phosphate 7. A−T by 2 hydrogen bonds **and** C−G by 3 hydrogen bonds 8. strands run in opposite direction/strands are anti-parallel 9. reference to 5'−3' polarity	**6**	
8	**(b)**	**(ii)**	10. (DNA) polymerase enzyme 11. nucleotide strand from DNA template **OR** replication is semi-conservative 12. new nucleotide added at the 3' end/strand forms in 5' to 3' direction 13. ligase forms phosphodiester bonds 14. (ligase) to join DNA fragments (on lagging strand) 15. two copies of the genome created for daughter cells 16. G2 checkpoint assesses success of replication	**4**	
8	**(b)**	**(iii)**	17. proliferation genes/proto-oncogenes **encode proteins** that promote cell division 18. mutation in proto-oncogene forms oncogene **OR** mutations in oncogenes are dominant 19. mutations (in proliferation genes) cause excessive cell division 20. (oncogenes may) cause tumour formation 21. anti-proliferation genes/tumour-suppressor genes restrict cell division **OR** act at (cell cycle) checkpoints 22. mutations in tumour suppressor genes are recessive 23. when both copies are mutated inhibition of cell cycle is lost/G1 checkpoint fails	**5**	
				(15)	

[END OF SECTION B]

Section C

Biotechnology

Question			Expected Answer(s)	Max Mark	Additional Guidance
1	**(a)**	**(i)**	Time taken for cells to increase in size/synthesise enzymes/produce new organelles	**1**	
1	**(a)**	**(ii)**	Exponential/log phase	**1**	
1	**(a)**	**(iii)**	Use a strain of yeast that gives high ethanol yield **OR** Increase the concentration of glucose in the culture medium **OR** Provide optimal conditions **OR** reference to growth rate constant	**1**	
1	**(b)**	**(i)**	$0{\cdot}2 \times 0{\cdot}2 \times 0{\cdot}2 = 0{\cdot}008 mm^3$ $18 \div 0{\cdot}008 =$ **2250**	**1**	
1	**(b)**	**(ii)**	Staining (that sorts viable and non-viable cells)	**1**	
				(5)	

Question			Expected Answer(s)	Max Mark	Additional Guidance
2	**(a)**	**(i)**	Not contaminated by microorganisms **OR** Sterile conditions to prevent contamination	**1**	
2	**(a)**	**(ii)**	Sterilise/autoclave media/equipment **OR** use of personal protective equipment **OR** use of disinfectant on surfaces **OR** work performed in special air flow cabinet (tissue culture hood) with filters to remove microbial contaminants	**1**	
2	**(a)**	**(iii)**	Cells can burst as result of osmosis if in hypotonic solution **OR** cells can shrink if placed in hypertonic solution	**1**	Must be referring to **water** movement
2	**(a)**	**(iv)**	Recipient's cells used, so no foreign **antigens**	**1**	
2	**(b)**	**(i)**	(Cancer cell line) is immortal/can divide indefinitely **OR** primary cell line has a finite lifetime in cell culture	**1**	
2	**(b)**	**(ii)**	Myeloma (cells)	**1**	
				(6)	
3			1. Nitrogenase enzymes carry out N fixation 2. *Nif* genes code for nitrogenase 3. *Nif* genes in plasmid in *Rhizobium* 4. *Rhizobium* specific to legume species 5. *Nod* genes/plasmid determine specificity 6. Transfer plasmids with most effective *Nif* genes to improve rhizobia strains 7. Mutant/modified *Nif* genes do not switch off (in high nitrogen conditions) 8. Increased crop yield with less fertiliser	**5**	
				(5)	

Question			Expected Answer(s)	Max Mark	Additional Guidance
4	**(a)**	**(i)**	Foods with **added** health benefits	**1**	
4	**(a)**	**(ii)**	**Product** – **live cultures** of fermented dairy products **claimed benefit** – anti-cancer/reduce lactose intolerance/reduction in diarrhoea	**1**	probiotic yogurt, probiotic cheese
4	**(b)**	**(i)**	added stanol gave 8 to 24% reduction in LDL/cholesterol, but with no stanol reduction was up to 12%	**1**	other ways of quantifying OK
4	**(b)**	**(ii)**	Reference to overlapping results	**1**	
				(4)	

Section C (continued)

Animal Behaviour

Question			Expected Answer(s)	Max Mark	Additional Guidance
1	**(a)**		Reproductive co-ordination/gender/mate selection (Conveying) competitive status/age/identity Range marking **(Any one)**	**1**	Accept territory
1	**(b)**		**AGS mark** on rough bark **OR** moss-**free** trees **(1)** **urine** mark on the roughest trees **(1)**	**2**	
1	**(c)**	**(i)**	(Scent higher up) suggests larger/dominant individuals.	**1**	
1	**(c)**	**(ii)**	Greater chance of hitting the target.	**1**	
1	**(d)**		Females mark mainly during the mating season (80% of marks) whereas males do not	**1**	
				(6)	

Question			Expected Answer(s)	Max Mark	Additional Guidance
2	(a)	(i)	Proximate cause **AND** explanation re trigger stimuli/physiological mechanism **OR** what is happening immediately rather than on evolutionary time-scale	1	
2	(a)	(ii)	Anthropomorphism	1	
2	(a)	(iii)	Hygiene function/removal of parasites **OR** Reinforcing social relationships/forming bonds or alliances **OR** Lowers dominance threat	1	**Not** 'establishing' dominance
2	(b)		Primate life-span **longer** (**than** invertebrates) **(1)** Longer time for learning new behaviour in primates but not in invertebrates **OR** Invertebrate behaviour is largely innate and there is less need for parental care **OR** Fewer offspring in primates (than invertebrates) allows for greater investment in learning **(1)**	2	
				(5)	

Question			Expected Answer(s)	Max Mark	Additional Guidance
3			1. Mimicry: resembling a noxious species 2. Crypsis/camouflage: blending into background 3. Masquerade: where animal looks like another object 4. Disruptive camouflage: breaks up outline 5. Warning coloration: bold colours indicating toxic 6. Vigilance: scanning for predators 7. Escape responses: moving away from predator 8. Other relevant strategy, eg related to groups 1 mark each for term **AND** description	**5**	
				(5)	
4	**(a)**		As number of mates per male increases, the number of surviving offspring (per female) increases (Higher survival with larger number of mates due to) greater access to food resources/quality of territory	**2**	
4	**(b)**		Food/resources available for the **energy** cost of defence	**1**	
4	**(c)**		Whichever system gives the greater number of surviving offspring	**1**	
				(4)	

Section C (continued)

Physiology, Health and Exercise

Question			Expected Answer(s)	Max Mark	Additional Guidance
1	**(a)**		Systolic (pressure) **OR** (pressure from) ventricular contraction	**1**	
1	**(b)**		Age/gender/race/genetics	**2**	
1	**(c)**	**(i)**	Between 5·0 to 5·3%	**1**	
1	**(c)**	**(ii)**	reduces the BP at all salt levels **(1)** the reduction in BP increases as salt intake increases **(1)**	**2**	
				(6)	
2			**Description** 1. (Training) increases LV mass/heart mass **OR** causes cardiac hypertrophy 2. Cardiac muscle strength increases 3. (Cardiac) muscle fibres thicken/number of contractile elements increases 4. (Leading to) larger stroke volume (at rest and during exercise) 5. Higher **maximum** cardiac output/volume per minute 6. Greater **maximum** HR/lower heart rate at rest/shorter recovery time **Explanation** 7. Improved delivery of **oxygen** to (skeletal) muscle **(Point 7 plus any four from 1 – 6)**	**5**	size OK for mass heart = cardiac Abbreviations OK: CO = cardiac output HR = heart rate
				(5)	

Question			Expected Answer(s)	Max Mark	Additional Guidance
3	**(a)**		Volume and mass	**1**	
3	**(b)**		Used in formula/Siri equation	**1**	If only formula given then must be correct % fat = (495/density) – 450
3	**(c)**		BIA + current + body fat offers resistance/impedes current Skinfold thickness + calipers + several sites/refer to table W:H ratio + circumference at waist and hips + waist ÷ hip MUC + measure mid upper arm circumference + refer to standard table	**1**	BIA = bioelectrical impedance analysis **Not** BMI
				(3)	
4	**(a)**	**(i)**	Increases glucose uptake by **cells**/increases the number of glucose transporters **(1)** **Promotes** conversion of glucose to glycogen/glycogen synthesis **(1)**	**2**	Absorb = uptake **Not** implication that insulin acts as an enzyme Not convert/cause/'brings about'
4	**(a)**	**(ii)**	Obesity	**1**	Not 'being overweight'
4	**(b)**	**(i)**	Glucose decreased when **sitting was broken up** with walking/activity **(1)** No significant difference between light and moderate intensity walking **(1)**	**2**	
4	**(b)**	**(ii)**	Duration/frequency	**1**	
				(6)	

[END OF MARKING INSTRUCTIONS]