National
Qualifications
2017

2017 Biology

Higher

Finalised Marking Instructions

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General marking principles for Higher Biology

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 detailed marking instructions, which identify the key features required in candidate responses.

(a) Marks for each candidate response must <u>always</u> be assigned in line with these general marking principles and the detailed marking instructions for this assessment.

(b) Marking should always be positive. Marks should be awarded for what is correct and not deducted for errors or omissions.

(c) 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 should seek guidance from your team leader.

(d) There are no half marks awarded.

(e) Where a candidate makes an error in the first part of a question, credit should normally be given for subsequent answers that are correct with regard to this original error. Candidates should not be penalised more than once for the same error.

(f) Unless a numerical question specifically requires evidence of working to be shown, full marks should be awarded for a correct final answer (including units, if appropriate) on its own.

(g) Bulleted lists should not be used for extended response questions. Candidates must respond to the "command" word as appropriate and write extended answers in order to communicate fully their knowledge and understanding. Candidate responses in the form of bulleted lists may not be able to access the full range of available marks.

(h) In the detailed marking instructions, if a word is **<u>underlined</u>** then it is essential; if a word is **(bracketed)** then it is not essential.

(i) In the detailed marking instructions, words separated by / are **alternatives**.

(j) A correct answer can be negated if:
- an extra, incorrect, response is given
- additional information that contradicts the correct response is included.

(k) Where the candidate is instructed to choose one question to answer but instead answers both questions, both responses should be marked and the better mark awarded.

(l) Unless otherwise required by the question, use of abbreviations (e.g. DNA, ATP) or chemical formulae (e.g. CO_2, H_20) are acceptable alternatives to naming.

(m) 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.

(n) Incorrect spelling is given. Sound out the word(s).
- If the correct word is recognisable then give the mark.
- If the word can easily be confused with another biological term then **do not** give the mark eg glucagon and glycogen.

(o) Presentation of data:

- If a candidate provides two graphs, in response to one question, mark both and give the higher score.
- If a question asks for a particular type of graph/chart and the wrong type is given, then full marks cannot be awarded. Candidates cannot achieve the plot mark but **may** be able to achieve the mark for scale and label. If the x and y data are transposed, then do not give the scale and label mark.
- If the graph uses less than 50% of the axes then do not give the scale and label mark.
- If 0 is plotted when no data for this is given, then do not give the plot mark (i.e. candidates should only plot the data given).

(p) Marks are awarded only for a valid response to the question asked. For example, in response to questions that ask candidate to:

- **identify, name, give** or **state**, they need only answer or present in brief form;
- **describe**, they must provide a statement as opposed to simply one word;
- **explain**, they must provide a reason for the information given;
- **compare**, they must demonstrate knowledge and understanding of the similarities and/or differences between topics being examined;
- **calculate**, they must determine a number from given facts, figures or information;
- **predict**, they must indicate what may happen based on available information;
- **suggest**, they must apply their knowledge and understanding to a new situation.

Marking instructions for each question

Section 1

Question	Answer	Mark
1.	A	**1**
2.	C	**1**
3.	C	**1**
4.	D	**1**
5.	A	**1**
6.	B	**1**
7.	B	**1**
8.	A	**1**
9.	A	**1**
10.	D	**1**
11.	C	**1**
12.	B	**1**
13.	D	**1**
14.	C	**1**
15.	D	**1**
16.	B	**1**
17.	D	**1**
18.	C	**1**
19.	B	**1**
20.	A	**1**

Section 2

Question			Expected answer(s)	Max mark	Additional guidance
1.	(a)		Introns	**1**	NOT- non-coding regions.
	(b)		1,3,4/2,3,4	**1**	Must be in correct order and inversions not acceptable.
	(c)	(i)	Shorter protein/fewer amino acids.**(1)** <u>Stop</u> codon is produced earlier (in the sequence) **(1)**	**2**	NOT- non-functional protein. NOT- protein is short. NOT- stop codon is produced alone.
		(ii)	Every amino acid after the mutation is changed/affected.	**1**	NOT- frame shift mutation alone.
2.	(a)	(i)	12	**1**	
		(ii)	1.1 to 2	**1**	
	(b)		Taq- Takes less time to amplify (sequence)/complete a cycle. **OR** Replicates/cycle/process faster. **OR** Cheaper as less heat is required/temperature is lower. **OR** Taq takes 3 minutes and Pfu takes 4 minutes. **OR** Pfu- Proof reading/corrects errors.	**1**	Incorrect values negate. NOT- ensures no mistakes are made.
	(c)		So it does not denature.	**1**	NOT- so it can work at high temperatures.

Question			Expected answer(s)	Max mark	Additional guidance
3.	(a)		From 2009/from the start it increases from 10% to 66% in 2015. **OR** Over the first 6 years it increases from 10% to 66%. **(1)** Then stays constant (until 2016). **(1)**	**2**	Cannot access any marks if 66 and 2015 not mentioned. Must state % unit at least once to gain full marks. **All** correct values but no % unit = 1. If additional points are correctly described do not negate.
	(b)		Resistant plants survive. **OR** Non-resistant die. **(1)** Pass resistance- • genes/alleles/sequences • to next generation/to offspring/vertically. **OR** Reproduce/breed • and pass on resistance • genes/alleles/sequences. **(1)**	**2**	NOT- pass on characteristic/ traits/resistance.
	(c)		Bacteria can exchange- • genetic material/plasmids • horizontally/in same generation • and charlock cannot/charlock transfers vertically. **OR** Horizontal gene transfer is faster (or converse).	**1**	NOT- horizontal gene transfer is fast.

Question			Expected answer(s)	Max mark	Additional guidance
4.	(a)	(i)	Can only differentiate/specialise/change into- a few types of cell/myoblasts/muscle cells/limited variety of cells/cells of the tissue that it came from (or converse). **(1)**	**1**	NOT- can only differentiate into a limited number of cells without reference to type. NOT- multipotent alone.
		(ii)	Growth/repair/renewal of <u>muscle</u> (tissue). **OR** Increase number of muscle cells for growth/repair (of muscles). **OR** Become muscle cells for growth/repair (of muscles).	**1**	NOT- repair of muscle cells. NOT- growth of muscle cells. NOT- increase number of muscle cells alone.
		(iii)	Does not involve destruction/killing of a (potential) life/embryo.	**1**	
	(b)		Testing/development of drugs/medicines. **OR** Study how diseases develop (or description of development of a named disease). **OR** Study cell growth/cell division/ cell differentiation/gene regulation.	**1**	NOT- descriptions of therapeutic uses. NOT- researching diseases. NOT- study cell processes.

Question			Expected answer(s)	Max mark	Additional guidance
5.	(a)	(i)	550	**1**	
		(ii)	260	**1**	
		(iii)	Last common ancestor (of rats and humans) was more recent (than rats and frogs). **OR** Last/most recent common ancestor of rats and humans was 90 million years ago while rats and frogs was 420 million years ago. **OR** Rats diverged more recently from humans than from frogs.	**1**	
	(b)	(i)	28	**1**	
		(ii)	Any value from 27 to 28	**1**	
	(c)		21	**1**	

Question			Expected answer(s)	Max mark	Additional guidance
6.	(a)	(i)	Protein synthesis / translation / gene expression	**1**	
		(ii)	1650	**1**	
		(iii)	Microbes bacteria/other yeast/other cells may compete with yeast/use up nutrients /compete for resources. **OR** Microbes/bacteria/other yeast/ other cells may reduce productivity / growth/yield of the culture/yeast. **OR** Microbes/bacteria/other yeast/other cells may cause disease/health risks/harm humans.	**1**	NOT- to ensure only yeast grows. NOT- affect growth of the culture/yeast. NOT- prevent health risks without mention of microbes.
		(iv)	Add buffer/acid/alkali	**1**	
	(b)		A Phase - Lag Description -Enzymes induced. B Phase - Stationary Description - Culture becomes depleted of nutrients/substrates/ resources/oxygen **OR** Secondary metabolites produced/build up **OR** Toxic metabolites/waste accumulate	**2**	NOT- enzymes are starting to work. NOT- enzymes are being switched on. NOT- cells are getting used to the environment. NOT- no cell division alone. NOT- birth rate = death rate alone.
	(c)		Introduce genes/sequences that prevent survival (in external environment)/allow them to only survive in lab.	**1**	

Question			Expected answer(s)	Max mark	Additional guidance
7	(a)		Mitochondria are the site of (aerobic) respiration/electron transport chain/electron transfer chain/citric acid cycle. which produces ATP/releases/gives out energy. **(1)** Pumps/active transport/transporting salt requires ATP/energy. **(1)**	**2**	
	(b)		So that enzymes are at their optimum activity/temperature. **OR** High diffusion rates.	**1**	NOT - enzymes have an optimum temperature NOT- so enzymes don't denature.
	(c)		Regulators have a wider/larger range of niche(s)/ ecosystems/environments/habitats. **OR** Regulators have more niche(s)/ecosystems/environments/ habitats. **OR** Conformers have a narrower/smaller range of niche(s)/ ecosystems/environments/habitats). **OR** Conformers have fewer niche(s)/ecosystems/environments/ habitats. **OR** Conformers have narrow niche(s) and regulators have wide niche(s).	**1**	

Question			Expected answer(s)	Max mark	Additional guidance
8.	(a)	(i)	Time of exposure (to oxygen); Temperature; Volume of blood; Surface area of blood exposed; Age of blood; pH.	**1**	Additional wrong answers negate.
		(ii)	40	**1**	
		(iii)	More haemoglobin is bound to oxygen at lower oxygen level/between 20 and 60 units. **OR** Haemoglobin is more likely to bind to oxygen at lower oxygen/between 20 and 60 units. **OR** They have 24% of haemoglobin bound to oxygen at 20 unit compared to 20 units/lowest oxygen. **OR** They have 70% of haemoglobin bound to oxygen compared to 50% at 40 units. **OR** They have 90% of haemoglobin bound to oxygen compared to 80% at 60 units.	**1**	NOT- more haemoglobin is bound to oxygen alone.
	(b)		More red blood cells/EPO. **OR** Increased lung capacity / more capillaries / more alveoli. **OR** Increased myoglobin (in muscle cells).	**1**	NOT- produce more blood cells. NOT- more blood vessels.

Question			Expected answer(s)	Max mark	Additional guidance
8.	(c)		Description– Two atria and two ventricles **(1)** Explanation – Prevents oxygenated and deoxygenated <u>blood</u> mixing. **OR** No mixing of <u>blood</u> so only oxygenated blood is pumped round body. **OR** Oxygenated and deoxygenated <u>blood</u> kept separate. **(1)**	**2**	NOT- 4 chambered heart. NOT- double complete circulatory system alone. NOT- prevents mixing of blood alone. If correct description and explanation responses are in the same section, award 1 mark.

Question			Expected answer(s)	Max mark	Additional guidance
9.	(a)	(i)	Concentration of copper sulfate (solution)	**1**	
		(ii)	Same experimental set up but with (same volume of) water in place of copper sulfate / 0 $moll^{-1}$ copper sulfate. **OR** Full description of tube contents ($10cm^3$ hydrogen peroxide, $5cm^3$ water/0 $moll^{-1}$ copper sulfate, paper disc soaked in catalase).	**1**	NOT- 'same experimental set up without copper sulfate' alone.
		(iii)	Water bath/incubator/oven	**1**	
		(iv)	One disc/test tube/experiment used at each concentration/solution. **OR** Experiment was not repeated at each concentration.	**1**	NOT- only done once. NOT- experiment was not repeated and average taken alone.
	(b)	(i)	Labels and scales correctly added. **(1)** Points plotted correctly and line drawn with ruler. **(1)**	**2**	If axes are transposed but points are plotted correctly award 1 mark.
		(ii)	150	**1**	
	(c)		As the concentration of copper sulfate increased the activity of catalase decreased/inhibition of catalase increased. **OR** The activity of catalase decreased/inhibition of catalase increased as the concentration of copper sulfate increased.	**1**	NOT- as the concentration of copper sulfate increased the time for disc to rise increased.

Question			Expected Answer(s)	Max Mark	Additional Guidance
10.	**A**		1. Have a social hierarchy which is a rank order. **OR** Has dominant/alpha AND subordinates. 2. Long period with parents/of parental care allows learning of complex behaviour/skills. **OR** Social behaviour/skills. 3. Ritualistic display AND appeasement behaviour occur. 4. Ritualistic/appeasement behaviour/display or correct example reduces conflict/tension/aggression. 5. Form alliances/grooming to raise social status/rank. 6. Behaviour influenced by ecological niche **OR** resource distribution **OR** taxonomic group. **(any 4)**	**4**	NOT- prevents/avoids conflict. NOT- primates influenced by ecological niche/resource distribution/taxonomic group.

Question			Expected Answer(s)	Max Mark	Additional Guidance
10.	**B**		1. Introduced (or appropriate description). 2. They become naturalised species when they are established (in the new area). 3. Spread rapidly. 4. May eliminate/kill off/destroy native/indigenous/original species. 5. Prey on/outcompete/hybridise with native/indigenous/original species. 6. Natural/original predators/ parasites/pathogens/competitors are not present in new area. **(any 4)**	**4**	Accept descriptions of 'established'. NOT- spread alone. NOT- native species decrease/ begin to die out. NOT- compete with native species. NOT- they are free from predators/parasites/pathogens/ competitors in their new area.

Question			Expected answer(s)	Max mark	Additional guidance
11.	(a)	(i)	Transmitted/transmission. **OR** reflection/reflected.	**1**	
		(ii)	Excites <u>electrons</u> (in the pigment/molecule). **OR** Promotes <u>electrons</u> to a high(er) energy state. **OR** Produce high(er) energy <u>electrons</u>.	**1**	
		(iii)	Broadens absorption/action spectrum. **OR** Absorbs more/wider range/variety of wavelengths/ colours (of light). **OR** Allows photosynthesis to happen over more/wider range of wavelength/colours (of light).	**1**	NOT- absorbs more light NOT- absorbs wider range of light. NOT – absorbs different wavelengths.
	(b)		(Photolysis of) water/H_20	**1**	
	(c)		Passes hydrogen to/reduces 3PG/3-phosphoglycerate. **OR** Passes hydrogen to form G3P/glyceraldehyde-3-phosphate. **OR** Reduces intermediate/compound to form G3P/glycealdehyde-3-phosphate.	**1**	

Question			Expected Answer(s)	Max Mark	Additional Guidance
12.	(a)	(i)	Reduced/no photosynthesis. **OR** Leaves are needed for photosynthesis. **(1)** Less energy/glucose/carbohydrate/ respiration for growth. **(1)** **OR** Caterpillars are vectors for disease /spread disease to plants. **(1)** Disease reduces growth. **(1)**	**2**	
		(ii)	Chemicals- kill/harm other species/decrease biodiversity **OR** biomagnify/bioaccumulate **OR** accumulate/build up in organism/food chain/ environment/ecosystem **OR** magnify up the food chain **OR** persist in the environment / ecosystem **OR** create resistant populations/pests **OR** on the crop can be harmful to health. (Or converse of any of the above written in terms of biological control/it) eg 'biological control/it does not kill other species'. **OR** Biological control only kills/targets caterpillars/ one species.	**1**	

Question			Expected answer(s)	Max mark	Additional guidance
12.	(b)	(i)	15	**1**	
		(ii)	The original and modified Bt toxins used together kill more caterpillars than either alone. **OR** Modified Bt toxin kills 65(%) of caterpillars compared to 15(%) in Bt toxin but taken together they kill 80(%).	**1**	NOT- modified Bt toxin kills more than Bt toxin. NOT- modified kills 65% of caterpillars compared to 15% in modified.

Question			Expected answer(s)	Max mark	Additional guidance
13.	(a)		14250	**1**	
	(b)	(i)	Test (cross).	**1**	NOT- back cross.
		(ii)	(Some/half would be) low gluten and (some/half would be) ultra low gluten.	**1**	
	(c)		Deleterious/harmful/ disadvantageous alleles would be eliminated/removed by natural selection.	**1**	
	(d)	(i)	Number of grains.	**1**	NOT- amount of grains.
		(ii)	Cultivar- Sloop Justification- Starch content of grains is higher/highest (so may produce more sugar). Cultivar- ULG2 Justification- Amylase activity is higher/highest.	**1**	NOT- starch content is high. NOT- amylase activity is high.

Question			Expected answer(s)	Max mark	Additional guidance
14.	(a)	(i)	7	**1**	
		(ii)	16	**1**	
	(b)		They kill/catch/take down larger/more prey. **OR** Increased hunting success.	**1**	NOT- hunt/tackle larger prey. NOT- kill large prey. NOT- use less energy. NOT- get more food.
	(c)		Increases/ensures/allows the survival of shared genes/DNA. **OR** So that shared genes are passed on to the next generation.	**1**	NOT- kin selection alone.

Question			Expected Answer(s)	Max Mark	Additional Guidance
15.	**A**		1. Occurs in the matrix of mitochondria. 1 2. Pyruvate converted to acetyl (coenzyme A) losing CO_2. 1 3. Acetyl (coenzyme A) combines with oxaloacetate to form Citrate. 1 4. Enzyme controlled. 1 5. ATP is (re)generated/produced. 1 6. CO_2 is released (during cycle). 1 7. Dehydrogenases remove hydrogen (ions) and electrons. 1 8. NAD/FAD becomes $NADH/FADH_2$. **OR** NAD/FAD is reduced. 1 9. NAD/FAD transports hydrogen ions AND electrons to electron transport chain / electron transfer chain/inner mitochondrial membrane/cristae. 1 10. Oxaloacetate is regenerated (or description of regenerated). **OR** citrate forms oxaloacetate. 1 **(any 7)**	**7**	NOT- matrix alone. NOT- ATP is released. NOT - Last stage/ETC. NOT- oxaloacetate is formed alone.

Question			Expected Answer(s)	Max Mark	Additional Guidance
15.	**B**		1. Animals survive adverse conditions/metabolic adversity by dormancy. **OR** All 3 types named (hibernation, aestivation and daily torpor). **(1)** 2. Dormancy is where metabolic rate/heart rate/breathing rate/ body temperature is reduced. **(1)** 3. Dormancy/hibernation/ aestivation/daily torpor conserves/saves energy. **(1)** 4. Predictive dormancy/hibernation occurs before the onset of adverse conditions (or correct description of adverse conditions. **(1)** 5. Consequential dormancy/ hibernation/aestivation occurs after the onset of adverse conditions (or correct description of adverse conditions). **(1)** 6. Dormancy can be predictive or consequential (only award if neither 4 nor 5 not awarded). **(1)** 7. Hibernation occurs in times of low temperatures/winter/cold conditions **AND** aestivation occurs in times of drought/high temperature. **(1)** 8. Daily torpor occurs in animals with high metabolic rates. **(1)** **Max 5 marks from points 1-8** 9. Adverse conditions/metabolic adversity avoided by migration. **(1)** 10. Migration expends/needs energy/has a high metabolic cost. **(1)** 11. Migration is innate and/or learned (both terms required). **(1)** **Max 2 marks from points 9-11**	**7**	NOT- avoid adverse conditions. NOT- 'survive adverse conditions/metabolic adversity by migration'.

[END OF MARKING INSTRUCTIONS]