National Qualifications 2017

2017 Biology

Advanced Higher

Finalised Marking Instructions

General marking principles for Advanced 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 always 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) on its own.

(g) Larger mark allocations may be fully accessed whether responses are provided in continuous prose, linked statements or a series of discrete developed points.

(h) In the detailed marking instructions, if a word is **underlined** 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) The assessment is of skills, knowledge and understanding in Biology, so marks should be awarded for a valid response, even if the response is not presented in the format expected. For example, if the response is correct but is not presented in the table as requested, or if it is circled rather than underlined as requested, give the mark.

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

(n) 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.

(o) 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 ureter and urethra
- if the word is a mixture of other biological terms then do not give the mark, eg mellum, melebrum, amniosynthesis.

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

- **identify**, **name**, **give**, or **state**, they need only name or present in brief form;
- **describe**, they must provide a statement or structure of characteristics and/or features;
- **explain**, they must relate cause and effect and/or make relationships between things clear;
- **compare**, they must demonstrate knowledge and understanding of the similarities and/or differences between things;
- **calculate**, they must determine a number from given facts, figures or information;
- **predict**, they must suggest what may happen based on available information;
- **evaluate**, they must make a judgement based on criteria;
- **suggest,** they must apply their knowledge and understanding of Biology to a new situation. A number of responses are acceptable: marks will be awarded for any suggestions that are supported by knowledge and understanding of Biology;
- **account for,** they must give a reason or reasons for a particular action, event, observation, change, or state**.**

Marking instructions for each question

Section 1

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

Question	Answer	Max Mark
21.	A	**1**
22.	B	**1**
23.	D	**1**
24.	A	**1**
25.	D	**1**

Section 2

Question			Expected answer(s)	Max mark	Additional guidance
1.	(a)		As extract concentration increases, the (percentage) increase in cells undergoing apoptosis increases	**1**	Ignore data
	(b)		Digest/break down proteins. **OR** Are proteases/proteinases. **OR** Caspases activate other caspases/ DNAases/aspase cascade.	**1**	
	(c)	(i)	ci8 (+ extract) gives similar levels of apoptosis to extract alone **OR** ci8 (+ extract) has little/no effect on apoptosis **(1)** ci9 (+ extract) results in decrease in apoptosis **(1)**	**2**	Correct use of numbers acceptable eg ci 9 + extract results in 25% decrease
		(ii)	(Level undergoing apoptosis) is lower than in the untreated cells/control	**1**	
	(d)	(i)	350 (%)	**1**	

Question			Expected answer(s)	Max mark	Additional guidance
1.	(d)	(ii)	Cells with 400 units of DNA have replicated (but not divided). **OR** In 4A/treated cells 400 peak is higher than 200. **AND** Shows cells have replicated/not divided/arrested at G2. **OR** In 4B/untreated cells 200 peak is higher than 400. **AND** Shows cells have divided. **(1)** Peak/number of cells with DNA content of 400 units is greater in 4A/ treated cells than in 4B/untreated cells. **(1)**	**2**	

Question			Expected answer(s)	Max mark	Additional guidance
2.	(a)	(i)	Opsin/photopsin (I, II or III)	**1**	
		(ii)	670 nm / it would be beyond the range of detection of all photoreceptors / green (and blue) cones (and rods).	**1**	**Accept:** • **Only** red cones detect light at this wavelength / 670nm so no light detected. • Detected = absorbed = perceived. **Not:** No light absorbed = v low absorption
	(b)		High (degree of) amplification.	**1**	**Accept:** Description of amplification pathway, eg (one photon stimulates/activates) hundreds/ many G proteins which stimulate many enzymes
	(c)		UV/ultraviolet.	**1**	**Not:** numbers

Question			Expected answer(s)	Max mark	Additional guidance
3.	(a)	(i)	Cortisol / it diffuses through cell membrane. **(1)** Binds to receptor which switches transcription on/off. **OR** Binds to a transcription factor. **(1)**	**2**	**Accept:** Passes through = crosses = diffusion Alters gene expression = switches transcription on/off
		(ii)	(Different tissues will have) different responses **to receptor binding.** **OR** (Different tissues will have) different signal transduction pathways. **OR** Different genes switched off/on (in different tissues). **OR** There may be different cortisol receptors.	**1**	
		(b)	Does not have Addison's; Patient 2 cortisol increases by 75 µg per litre at 30 min and increases by 125 µg per litre at 60 min.	**1**	**Accept:** • Patient 2 increases by 75 µg per litre at 30 mins and a further 50 µg per litre at 60 mins. W.r.t between 30 and 60 mins • range of 125 - 130 range of 50 - 55. **Need:** Correct units (µg per litre) at least once.

Question			Expected answer(s)	Max mark	Additional guidance
4.	(a)	(i)	Kinase adds a phosphate to/ phosphorylates (target protein protein changes conformation).	**1**	
		(ii)	(Protein) phosphatase.	**1**	
		(iii)	So that sensitivity to the signal is restored. **OR** So that the (target) protein can respond again.	**1**	
	(b)	(i)	Charge/current (flowing through buffer) separates proteins (in gel) on the basis of size/mass/shape/charge.	**1**	
		(ii)	Antibody labelled (fluorescence/ enzyme). **(1)** Fluorescence/colour/label detected if antibody has bound to PKA (showing its presence). **(1)**	**2**	**Accept:** Colour change = colour detected.

Question			Expected answer(s)	Max mark	Additional guidance
5.	(a)		Species may be elusive. **OR** Disturbance/harm/impact is minimised.	**1**	
	(b)		Systematic (sampling).	**1**	
	(c)	(i)	Long length of river sampled. **OR** 92/many sites sampled. **OR** Large sample size/number of repeats.	**1**	
		(ii)	Only 1 site showed latrines. **OR** No independent replicate.	**1**	
	(d)		**Any two from:** • Latrines may have been washed away. • Some sites not surveyed due to deep water. • 5km between sample sites may miss vole territories. • No evidence that decrease due to predation/mink. **OR** No data for mink population. **OR** Other predators of vole may exist.	**2**	

Question			Expected answer(s)	Max mark	Additional guidance
6.	(a)		Presence of (Sry) gene on the Y chromosome.	**1**	
	(b)		Temperature of (egg) incubation. **OR** Idea: ratio of males to females will alter at different temperatures.	**1**	
	(c)	(i)	Males lack homologous alleles on Y chromosome (so recessive allele always expressed). **OR** Males have one X so recessive allele always expressed. **OR** Males only need one (copy of) recessive allele (to be affected by the disease).	**1**	
		(ii)	X- (chromosome) inactivation is **random**. **(1)** Half the (kidney) cells will have a functional copy of the (ADH) receptor/gene. **(1)**	**2**	**Accept:** working = non-mutated = functional
		(iii)	50 (%)	**1**	

Question			Expected answer(s)	Max mark	Additional guidance
7.	(a)		Ethogram	**1**	
	(b)		(Use start times to) calculate duration of each behaviour to calculate proportion of time spent doing each behaviour.	**1**	
	(c)		Applying human activity/emotions/ traits to animals, so behaviour misinterpreted/conclusions not valid.	**1**	**Accept:** • human activity = perceptions = motivations = inferences
	(d)		Remote recording. **OR** Example such as • use cameras • use camera traps • video footage • satellite.	**1**	

Question			Expected answer(s)	Max mark	Additional guidance
8.			**Any five from** 1. **Parasite** benefits at expense of **host.** 2. Example of parasite. 3. Parasite and host interact closely/frequently. **OR** Parasite and host **co-evolve**. 4. (In co-evolution) change in the traits of one species acts as a selection pressure on the other species. **OR** Idea of evolutionary arms race. 5. (RQ hypothesis states species must) adapt/evolve/change to survive/avoid extinction. 6. Hosts that are better able to resist/tolerate parasites/have greater fitness/survival/number of offspring. **OR** Parasites that are better able to feed/reproduce/find new hosts/ have greater fitness/survival/ number of offspring. 7. Sexual reproduction generates (genetic) variation. 8. (Variation) provides raw material for adaptation/evolution/natural selection.	**5**	**Pt 2:** • To include bacteria/viruses/protists/ platyhelminths/nematodes/ fungi/arthropods • Named egs acceptable • Flat/round worms acceptable.

Question			Expected answer(s)	Max mark	Additional guidance
9.	(a)		Trait disappears in group treated (with antibiotic then hypothesis is supported). **(1)** Compared to a control/ no treatment/no antibiotic group (where no males produced). **(1)**	**2**	**Note**: • Trait = all female offspring. • Trait disappears = idea of males being produced again/ sex ratio restored.
	(b)		Transfer of genetic material (from one bacterium to another) outwith reproduction/within same generation.	**1**	
	(c)		Purpose – to attract males (for breeding). **(1)** Females are competing so only occurs when males are in short supply. **(1)**	**2**	
	(d)		Protect/care for/carry young OR feed young OR build nest. **OR** (Greater) parental care.	**1**	Eggs = offspring = young. **NOT:** • Answers exemplified by *Acraea*. • Just parental investment.

Question			Expected answer(s)	Max mark	Additional guidance
10.	(a)		Epidemiology/epidemiological.	**1**	
	(b)		(Epidemics/outbreaks/measles) occurring (roughly) every 2 years.	**1**	**Accept:** Up one year and down the next
	(c)		As vaccination (uptake) increases, cases decrease.	**1**	
	(d)	(i)	Articles evaluated by experts **in the field.**	**1**	**Accept:** Academic = scientist =expert
		(ii)	With larger number of susceptible individuals. **OR** Number of immune individuals falls below the herd immunity threshold. **AND** Infection more easily transferred/ spread/transmitted.	**1**	
		(iii)	(In Swansea) as vaccinations go down number of cases increases.	**1**	
	(e)		Herd immunity.	**1**	

Question			Expected answer(s)	Max mark	Additional guidance
11.	A	(i)	**Any three from** 1. Tertiary structure is a folded polypeptide/3D shape. 2. Shape/structure/conformation/folding determined by **One from:** • order of amino acids/R groups • R-group interactions • primary structure. 3. **Two** R-groups named from: • basic/positively charged • acidic/negatively charged • polar • hydrophobic/non-polar. 4. Named types of interactions. **One from:** • ionic bonds • hydrogen bonds • van der Waals interactions (London dispersion forces) • disulphide bridges • hydrophobic interactions. 5. One other named from Pt 4.	**9**	Protein = polypeptide

Question			Expected answer(s)	Max mark	Additional guidance
11.	A	(ii)	**Any six from:** a. Hydrophilic/polar (R) groups (mostly) at the surface of a soluble protein. b. (Soluble protein) found in the cytoplasm. c. (In soluble proteins) hydrophobic groups may cluster at the centre (of protein). d. Correct reference to membrane structure (with hydrophilic and hydrophobic regions). e. Membrane proteins are integral or peripheral (both terms needed). f. (Some integral proteins are) transmembrane + one example from: • channels • transporters • receptors. g. W.r.t. integral proteins: idea of hydrophobic R groups interacting with hydrophobic region of membrane. **OR** Hydrophilic R groups interact with cytoplasm/extracellular environment. h. Peripheral proteins have fewer hydrophobic R groups interacting with the phospholipids. **OR** Peripheral proteins have hydrophilic R groups interacting with hydrophilic heads of phospholipids/membrane proteins.		**Pt d.** Accept labelled diagram **Pt e.** Intrinsic = integral Extrinsic = peripheral

Question			Expected answer(s)	Max mark	Additional guidance
11.	B	(i)	**Any two from:** 1. Membrane has hydrophilic and hydrophobic regions. 2. Polar/charged/hydrophilic substances can't cross/pass through (membrane). **OR** Hydrophobic/non polar substances can cross/pass through (membrane). 3. Oxygen/carbon dioxide/water pass through. 4. Protein channels/pumps/transporters needed for hydrophilic/polar/charged substances to cross.	9	

Question			Expected answer(s)	Max mark	Additional guidance
11.	B	(ii)	**Any seven from:** a. Channels/pumps/transporters are transmembrane. b. Control ion concentrations **OR** Create/maintain concentration gradients. c. Different cell types/cell compartments have different channel/transporter proteins **OR** example. d. Movement through channels is passive/by diffusion/down a concentration gradient. e. Transporter proteins change conformation (to transport molecules across membrane). f. Conformational change in **active transport** requires energy from (hydrolysis of) ATP. g. Ligand-gated channels opened/closed **by binding of signal molecules/ligand.** h. Voltage-gated channels opened/closed **by changes in ion concentration.** i. **One from:** **Na/KATPase** • Maintains osmotic balance in animal cells • Generates ion gradient for glucose symport • Generates and maintains resting potentials in neurons • Generates ion gradient in kidney tubules. **OR** **Aquaporin 2 /AQP2** • Transports water in the collecting duct. **OR** **GLUT4** Transports glucose in fat/muscle cells. j. Second example from i.	**7**	

[END OF MARKING INSTRUCTIONS]