



2007 Biology

Advanced Higher

Finalised Marking Instructions

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2007 Biology Advanced Higher

Marking scheme

Section A

1.	C	14.	A
2.	C	15.	B
3.	D	16.	A
4.	A	17.	B
5.	C	18.	D
6.	C	19.	B
7.	B	20.	D
8.	A	21.	A
9.	D	22.	D
10.	A	23.	C
11.	D	24.	B
12.	B	25.	B
13.	C		

Marking Instructions

Biology Advanced Higher

Section B

Question	Acceptable Answer	Mark	Notes	Negates	
1	(a) (i)	Exotic/alien (species)	1		
	(ii)	Reduction/population change/elimination/extinction of native species loss of biodiversity OR Competitive exclusion/take over niche OR Alteration of community structure/habitat change	1	<u>Effect</u> is important here, so not 'brings disease' or 'is a predator' or 'eats crops' but ' <i>introduces</i> disease' is ok.	
	(b) (i)	Variable number of trap nights (in each sweep) OR To give a standard/valid/fair/easier way to compare data	1	Fair = valid, Data = numbers or population Not 'for comparison' – need <i>benefit</i> of comparing this way	
	(ii)	Identify the change in the trend/capture rates after September as the mind changing/significant finding	1	September = sweep 5	
		Trend down and up – both quantifications to illustrate In sweeps 1-4 capture rates reduced from 589 to 2 (per 10 000) trap nights showing population decline In sweeps 5-6 capture rates increased to 15 (per 10 000) trap nights showing population increase	2	Sweeps/months + captures	
	(c)	trapping successful (capture rate drops) prior to breeding (in November) OR After breeding begins (in November) population recovers	1	This links breeding period information to the data on population resurgence Trap nights are over more weeks in sweeps 5 and 6, so reference to more trap nights may be error	

Question	Acceptable Answer	Mark	Notes	Negates	
(d) (i)	Percentage cover values (in Table 2) are equivalent to capture frequencies expressed as percentages 1		194 = 192 = 193 36.6 = 37%		
	Illustrative quantification; eg % predicted captures in ebony forest (192/524) x 100 = 36.6 = 37%, Percentage cover = 37%	2			
	37% of 524 = 194 is ok 1				
(ii)	Leucaena forest	1			
(iii)	Larger numbers <i>than expected</i> trapped in weeded forest/ Leucaena forest (both products of human activity) OR correct reference to densities	1			
(e)	Specific toxicity to target organism/avoiding poisoning of/nor not harmful to other species) OR Non-persistent/biodegradable/non-biomagnified	1	Not 'harmless'		
(f)	(Relationship where) one (species/organism) benefits but the other neither benefits nor loses (= unaffected)	1			
(g)	Encourage population increase in natural predator/introduce a predator/other measures to increase death rate or decrease birth rate check baggage etc of visitors/measures to decrease immigration	1			

Question	Acceptable Answer	Mark	Notes	Negates
<p>2 (a)</p> <p>(b)</p> <p>(c)</p> <p>(d)</p>	<p>Detritivores</p> <p>Larger detritivores/invertebrates/organisms (get into the 7mm bag) break down/fragment litter OR more organisms enter the 7mm bag, so more breakdown occurs</p> <p>Increases surface area for decomposer action OR increased surface area increases rate of decomposition</p> <p>In 7mm bag there is both breakdown and decomposition whereas there is only decomposition in the 1 mm bag</p> <p>In 7mm bag there is both internal and external digestion whereas in the 1 mm bag there is external only</p> <p>Minerals/any specific mineral eg nitrate/phosphate etc OR Carbon dioxide OR Heat (energy) OR Water OR humus</p> <p>Degradative/heterotrophic succession</p>	<p>1</p> <p>2</p> <p>1</p> <p>1</p>	<p>NOT: detrivore</p> <p>Any 2 from 4 points</p> <p>Focus is on processes rather than the organisms that get through the mesh</p> <p>NOT: nitrogen, amino acids, methane</p>	
<p>3</p>	<p>1 Regulator – maintains constant internal environment OR Regulator uses homeostatic control</p> <p>2 Osmoregulator defined as organism able to control water balance</p> <p>3 Thermoregulator defined as organism able to keep (body) T constant</p> <p>4 Regulators occupy wider range of habitats</p> <p>5 (High) energy costs of homeostasis/regulation</p> <p>6 Illustrative comment on osmoregulation</p> <p>7 Illustrative comment on thermoregulation</p>	<p>5</p>	<p>Illustrations can be physiological or habitat range, eg about migration of salmon; endothermy</p>	

Question	Acceptable Answer	Mark	Notes	Negates
<p>4 (a)</p> <p>(b)</p> <p>(c)</p> <p>(d)</p>	<p>Increased (intensity of) effect as density increased OR The more flatworms there are <i>per sheep</i>, the lower the rate of egg production <i>per worm</i> OR Increasing competition for resource where this is described as density dependent</p> <p>Transmission to new host OR as a vector OR dispersal</p> <p>Host healthy – parasite harmful but not lethal whereas host unhealthy the parasite may be lethal/bigger infestation</p> <p>Reasonable management practice eg Vaccination, molluscicide, fluke treatment, crop rotation, treatment of food/surroundings/animal to kill parasite/isolation etc</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p>	<p>Must recognise/explain that adult flatworms are <i>per sheep</i>, ie density and not a number of worms</p> <p>NOT: the parasite choosing hosts on the basis of the host health</p> <p>NOT: specific to sheep + fluke Focus on prevention</p>	
<p>5 (a)</p> <p>(b)</p>	<p>Kinase phosphorylates/adds phosphate (the Rb protein) which keeps cells out of the cycle/stops regulatory proteins switching on division/block regulatory proteins that promote proliferation/keeps the brakes on division</p> <p>Mutations in both alleles/copies (of Rb gene) are needed for it to affect cell proliferation whereas proto-oncogenes need one OR Rb protein acts as an inhibitor of/Rb gene inhibits cell proliferation where oncogenes promote OR proto-oncogenes are proliferation genes, Rb genes are anti-proliferation OR Both Rb alleles mutating is recessive effect and proto-oncogene mutation is a dominant</p>	<p>1</p> <p>1</p> <p>2</p> <p>1</p>	<p>Focus on inhibitory effect</p>	

Question	Acceptable Answer	Mark	Notes	Negates
6	<p>(a) Prokaryotic: no nuclear membrane/true nucleus/would have nucleoid no membrane bound organelles no organelles except ribosomes no histones/nucleosomes/chromosomes contain plasmids has wall of peptidoglycan Any two</p> <p>(b) Medium:cytoplasm:vacuole = 1:3:99</p> <p>(c) Pump moves sodium ions out (of cytoplasm) and brings potassium in 1</p> <p>No pump in pm: Sodium concentration in cytoplasm(0.6) is higher than the medium (0.2) OR Na and K are both higher than medium, so not exchanged 1</p> <p>Possible pump at vacuole: Na high in vacuole low in cytoplasm, unlike K 1</p>	<p>1</p> <p>1</p> <p>3</p> <p>1</p>	From prokaryote point of view	
7	<p>(a) It has charge/there is an electric current through the gel/gel is porous</p> <p>(b) The mutation increases the fragment size from allele B2 (both alleles are present because) the digest produced/gel shows two fragment sizes/lengths OR two bands</p> <p>(c) B2B2</p> <p>(d) 1, 3 or 6 Any two</p>	<p>1</p> <p>2</p> <p>1</p> <p>1</p>	<p>DNA has negative charge</p> <p>B2 <i>fragment</i> is bigger than B1 fragment but allele B2 is not bigger than B1</p>	

Question	Acceptable Answer	Mark	Notes	Negates
<p>8 (a) (i) (ii)</p>	<p>control mechanisms of the cell cycle; culturing of mammalian cells.</p> <ol style="list-style-type: none"> 1. checkpoint near/before the end of G1 assesses size 2. ensures sufficient (mass) to form two daughter cells/to allow cell division/for cycle to proceed 3. checkpoint during G2 controls entry to mitosis 4. DNA replication assessed 5. so each daughter cell receives complete genome/copy of DNA 6. mitosis promoting factor/MPF necessary for entry into mitosis 7. MPF is a protein (complex) 8. checkpoint during/in metaphase (of mitosis) controls entry to anaphase/cytokinesis/end of mitosis 9. M checkpoint checks chromosome alignment/ensures each daughter cell receives one chromatid from each chromosome 	<p>6 9</p> <p>max 6</p>	<p>Not at the end of G1</p>	

	<ol style="list-style-type: none"> 10. cells grown under aseptic conditions and one example 11. mammalian cells need growth factors OR complex growth medium 12. (provided in medium by) addition of serum/FBS 13. any 2 ‘simple’ components from salts, amino acids, vitamins, glucose, water 14. antibiotics added to prevent bacterial growth 15. use of proteolytic enzyme to release cells from source tissue 16. (normal) cells need surface to adhere to/need anchorage (converse for tumour cells) 17. cells spread/flatten out (then) 18. mitosis/divide until growth is confluent 19. (normal) cells grow as a monolayer 20. normal cells divide a certain number of times then die 21. tumour/mutated cells used because they are ‘immortal’/unlimited division 22. single cells isolated and cultured to give clones/cell lines 23. application of cell culture: tissue for skin grafts; antibody production; cell lines for research 	max 9	<p>Point 16: “normal” must be inferred if not stated.</p>	
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Question	Acceptable Answer	Mark	Notes	Negates
(b) (i) (ii) (iii)	the structure of phospholipids	6	Ignore chemical errors at this stage	
	the composition of the plasma membrane	3		
	functions of membrane proteins	6		
	1. diagram or description of head, tail, hydrophobic, hydrophilic			
	2. phospholipid has glycerol, 2 fatty acids and phosphate			
	3. glycerol structure shown correctly or described (carbons 1,2,3, and OH attached)			
	4. (fatty acids and phosphate joined by) ester bonds to glycerol			
	5. ester bonds shown or described as condensation reaction between -OH of acid and -OH of alcohol (between OHs of glycerol and acidic ends of fatty acids)			
	6. fatty acids hydrophobic			
	7. (usually) one saturated one unsaturated			
	8. choline attached to phosphate			
	9. phosphate (and choline are) soluble/hydrophilic/polar	max 6		
	10. model of membrane is described as <i>fluid mosaic</i>			
	11. description or diagram of bilayer showing orientation of phospholipids – hydrophobic (tails) and hydrophilic (heads) labelled			
12. proteins shown/described as integral (intrinsic, transmembrane) and peripheral (extrinsic)				
13. lipid bilayer held together by hydrophobic interactions				
14. presence of cholesterol/cholesterol affects membrane fluidity	max 3			

	<ul style="list-style-type: none"> 15. attachment to cytoskeleton 16. attachment to extracellular/matrix proteins 17. junctions between cells/adhesion to each other 18. transport of materials across membrane/into and out of cell or organelles 19. channels/carriers facilitate/speed up/enhance passively/by diffusion/or concentration gradient idea 20. pumps/sodium-potassium pump for moving ions OR pumps are proteins for active transport 21. membrane-bound enzymes 22. receptors for (hydrophilic) cell signals/hormones 23. glycoprotein/or description of structure for cell-cell recognition 	max 6		
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Section C: Biotechnology

Question	Acceptable Answer	Mark	Notes	Negates
<p>1</p> <p>(a)</p> <p>(b)</p> <p>(c) (i)</p> <p>(ii)</p>	<p>Sterilise air in/equipment/medium Aseptic transfers Pure inoculum</p> <p>(Cold water flowing through it) cools fermenter to keep the temperature low/constant/regulated OR fermentation/respiration generates heat so cold water is needed</p> <p>Subtilisin/amylase, cellulase, pectinase (polygalacturonase) lactase/B-galactosidase, invertase/sucrase, restriction enzymes</p> <p>Chymosin/rennin substitutes/glucanase/amyloglucosidase</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p>		
<p>2</p>	<p>1. requires down-stream processing Separation of cells to obtain cell free solution 2. By flocculation – to precipitate cells OR using (ultra)filtration/centrifugation/pass culture through bed of silica Extraction of antibiotic from medium 3. In (organic) solvent if soluble OR any one from adsorption/ion exchange/chemical precipitation by addition of compounds/reverse osmosis/dialysis if not solvent-soluble 4 Concentration to obtain crude solute/product by removal of solvent/liquid 5. Concentration by distillation OR ultrafiltration/membrane filtration OR (vacuum) evaporation OR drying 6. Purification: separation by chromatography OR crystallisation 7. Naming three stages without description Any five</p>	<p>5</p>	<p>Separation idea is at two stages; cells from the medium and, later, pure product from crude extract</p>	

Question	Acceptable Answer	Mark	Notes	Negates
3	(a) Total count – living and dead/all cells included Viable count – only living cells OR colonies where each has arisen from one living/viable cell comparison needed	1	Comparing trends quantification	
	(b) Culture B grows rapidly/exponentially to limit/max/constant. Culture C increases at lower rate and does not reach a maximum. B maximum is at 120 mins and 150×10^6 cells C 30×10^6 cells at 120 mins / 140×10^6 at end/220 mins	2		
	(c) (i) 80min = 50 cells, 100 min = 100 cells so $g = 20 \text{ min} = 0.333 \text{ hr}$ $k = 0.693 / 0.333 = 2.08 / 2.079 / 2.1$	1		
	(ii) k will decrease	1		
	(d) (CAP/activator protein is activated by cAMP) • activated CAP binds (to DNA)	1		
	• β -galactosidase gene transcribed OR CAP therefore exerts positive control	1		

Question	Acceptable Answer	Mark	Notes	Negates
4	(a) Resistance is lost Tetracycline resistance gene would be disabled bacteria taking up the plasmid would not be resistant	1	NOT: Flavr savr	
	(b) These colonies contain the modified plasmids	1		
	Because they have ampicillin resistance but not tetracycline resistance OR	2		
	They grow on plate X but not on plate Y	1		
(c)	Transfer of nif gene/nitrogenase gene/enhancing nitrogen fixation Insecticidal plants Frost resistance Transfer of bacterial toxin to protect from insect damage Bovine somatotrophin (BST). Any one	1		

Section C: Animal Behaviour

Question	Acceptable Answer	Mark	Notes	Negates
<p>1</p> <p>(a)</p> <p>(b)</p> <p>(c)</p>	<p>Ethogram</p> <p>Example: pout/grin/fear/begging/excitement Explanation: relating animal behaviour to human experience/attributes/motives</p> <p>Grooming/sexual presentation/sexual intercourse/appeasement gesture</p>	<p>1</p> <p>1</p> <p>1</p>	<p>NOT: preening</p>	
<p>2</p> <p>(a)</p> <p>(b)</p> <p>(c)</p>	<p>Black eyebar provokes/has increased attacks per minute/rate and orange spots a reduction</p> <p>Black eyebar model: attacks increase to 3.6/min (or by 80%) Orange spot model: decreased to 1/min (or by 50%)</p> <p>Neither response showed any delay (latency)</p> <p>With both models, normal level reached in same time (32/33 min)</p> <p style="text-align: right;">Any 2</p> <p>Orange spots alone suggest egg laying, so no threat OR Retreating male would show this pattern, so no threat</p> <p>Increased reproductive success/more chance of fathering offspring/greater access to females</p>	<p>2</p> <p>1</p> <p>1</p>		

Question	Acceptable Answer	Mark	Notes	Negates
(d)	(Dimorphic because) territorial males different in appearance from female OR (Not dimorphic because) non-territorial male resembles female OR Some males resemble females and others don't	1		
(e)	Genetic influence – fish reared alone still responded to black eyebar model (or male of same species) with attack 1 Environmental/learned influence – fish reared by another species show attack response towards male of foster species 1	2	genetic = innate = instinctive	

Question	Acceptable Answer	Mark	Notes	Negates
3	(a) Improved chances of survival of young	1	NOT: survival alone or protection NOT: survival of species	
	(b) Mimicry/camouflage/masquerade	1		
	(c) Gape acts as <u>sign stimulus</u> (for host to feed young cuckoo) OR Releaser causes host to follow <u>fixed action pattern</u> and (feed young cuckoo)	1		
	(d) (Reciprocal altruism is) providing help to another and being repaid later	1		
	but in this case there is no repayment to the host	1		
	OR Altruism has costs to one that improve survival of another (as here)	1	2	
	but reciprocal altruism would require both partners to benefit	1		
	OR Reciprocal altruism has costs to both	1		
	but here no cost to cuckoo	1		

Question	Acceptable Answer	Mark	Notes	Negates
4	<ol style="list-style-type: none"> 1 Define as (rapid) identification/attachment with another individual/object 2 During narrow time period/in critical period 3 Occurs after birth/hatching 4 Results in following one individual to the exclusion of others 5 Is a learning process/not innate/has environmental component 6 Difficult to reverse/irreversible 7 Adaptive significance/benefit in terms of protection of young/finding food 8 Adaptive significance/benefit in terms of sexual behaviour 	5		

Section C: Physiology, Health and Exercise

Question	Acceptable Answer	Mark	Notes	Negates
<p>1 (a)</p> <p>(b)</p> <p>(c) (i)</p> <p>(ii)</p>	<p>Blood glucose level is higher after fasting/at the start Blood glucose level is elevated throughout the test period/ for longer For B the BGL rises faster Maximum value reached later in the test period Higher maximum value Any two</p> <p>Glucagon leads to a breakdown of glycogen to increase glucose</p> <p>Being overweight/obesity</p> <p>Increased sensitivity to insulin increase in the number of (active) insulin receptors (on the cell membrane) increased blood flow to muscle exercise reduces body weight/fat exercise increases metabolism increase in enzyme activity for glucose storage Any two</p>	<p>2</p> <p>1</p> <p>1</p> <p>2</p>	<p>Comparison between A and B, so need comparative words NOT: reference to ‘return to normal’</p> <p>NOT: implying glucagon is an enzyme</p> <p>NOT: reference to lipid profile</p>	
<p>2 (a)</p> <p>(b)</p>	<p>$BMR = 0.062 \times 75 + 2.036 = \underline{6.686/6.69/6.7}$ MJ/day</p> <p>(In indirect calorimetry oxygen consumption is) used in a mathematical formula/calculation/work out the energy released OR (indirect calorimetry) assumes a relationship between oxygen consumption and energy expenditure OR direct calorimetry measures the heat produced</p>	<p>1</p> <p>1</p>	<p>Must have units</p>	

Question	Acceptable Answer	Mark	Notes	Negates
(c)	<p>1 Body size/mass/weight – heavier people have a greater BMR (because they have more tissues)</p> <p>2 Body composition – the more lean tissue a person has/ more muscular the higher the BMR</p> <p>3 Age – BMR falls with age OR children have a higher BMR weight for weight than adults</p> <p>4 Sex – BMR higher in males because they have more lean/muscle tissue/females tend to have more body fat/adipose tissue</p> <p>5 Nutritional status (diet) – BMR reduced by low energy intake/fasting/dieting</p> <p>6 because lean tissue is more active metabolically (per kg) than adipose [<i>applied to either 2, 4 or 5</i>]</p> <p>7 age effect is due to changing body composition OR due to decrease in activity per kg of body tissue OR due to energy cost of growing/since they are actively growing</p>	5	<p>BMR is a measure the energy need of an individual, not per kg tissue.</p> <p>Not total energy expenditure, so reference to energy costs of activity, pregnancy and climate are additional energy demands</p>	
3	<p>(a) (i) (Maximum) oxygen uptake and body mass</p> <p>(ii) Maximum stroke volume and maximum heart rate</p> <p>(b) Left ventricular mass has increased (to 300g)</p> <p>(c) Record heart rate with graded exercise and extrapolate to theoretical max HR OR interpolate theoretical max HR on graph of HR against oxygen uptake</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p>		<p>More than two</p> <p>More than two</p>

Question	Acceptable Answer	Mark	Notes	Negates
4 (a)	Modifiable: diet, smoking, activity level, obesity, stress (Any two)	2	(Non-modifiable: age, gender, heredity, race)	
(b)	110 (mm Hg)	1		

[END OF MARKING INSTRUCTIONS]