DRAFT SAMPLE EXAMINATION MARKING KEY STAGE 3

2008/22160

Section One: Multiple Choice [40 marks]

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

Section Two: Short Answers [120 marks]

QUESTION 1. (20 marks)

Question 1	Answers	Marks
(a)	Graph • variables plotted on wrong axes • line graph not used • scales wrong (meaning unequal intervals within a scale unless break marks are used) • axes unlabelled • mistakes in plotting points • no title naming variables and their relationship • no key to lines • graph does not use more than 50% of the space available on the grid on the X axis only OR Y axis extends beyond 150 Note that it is acceptable to either rule lines between points or to draw freehand curves through the points. It is acceptable not to start the Y-axis at 0 to spread the graph evenly over the grid, or to start at 0 but show clear break marks if the axis is broken.	-1 for each incorrect one
	Total	4

Question 1	Answers	Marks
(b) (i)	• 65-75 insects/m^2	1
	• 80 insects/m^2	1
(b) (ii)	• Cages as there is data for before and after that time. • Frames don't know the trend to follow	1 1
	Total	4

Question 1	Answers	Marks
(c)	• Supported • The number insects did not change significantly over the time. • Fish had easy access to these areas. • Fish kept numbers constant. • Cages kept fish out. • The number of insects caught increased over time. • If this was the normal level of insects then fish did reduce the numbers.	1 Any 3 fully explained
	Total	4

Question 1	Answers	Marks
(d) (i)	the area under the frame	2
(d) (ii)	to compare the impact the frame/cage on the number of insects	2
	Total	4

Question 1	Answers	Marks
(e)	• the location on the stream bed covered by the fames and the cages • need to have frames and cages in similar areas as insects may be distributed differently in different parts of the river • Reason eg. central flow or near bank.	1 2 1
	Total	4

QUESTION 2. (20 marks)

Question 2	Answers	Marks
(a) (i)	• the active site on the enzyme is the same shape as the substrate. • the other molecules don't fit into the active site, so no reaction would occur.	1 1
	Total	2

Question 2	Answers	Marks
(a) (ii)	• could occupy to the active site to change its shape to exclude the substrate • could attach to the enzyme to alter the shape of the active site • exclusion of substrate • could attach to substrate so it no longer fits active site of enzyme	1 1 1 1
	Total	4

Question 2	Answers	Marks
(a) (iii)	• enzymes are not changed by reaction • can be used more than once	1 1
	Total	2

Question 2	Answers	Marks
(b) (i)	• chlorophyll in the chloroplasts capture light energy • photosynthesis converts light energy to chemical energy in glucose • glucose energy can be transferred to starch or other molecules in building and storage processes • glucose can go through respiration • energy released from respiration is used to make high energy bonds in ATP • ATP can break down to release energy for other cellular processes e.g. active transport.	1 1 1 1 1 1
	Total	6

Question 2	Answers	Marks
(b) (ii)	• as the concentration of starch increases there is more chance that starch and enzyme molecules will come in contact for a reaction to occur • all enzyme molecules are being used; can only work at a specific rate; limiting factor	2 2
	Total	4

Question 2	Answers	Marks
(b) (iii)	• Graph A • more active sites are available due to more enzymes present so reaction will occur faster.	1 1
	Total	2

QUESTION 3. (15 marks)

Question 3	Answers	Marks
(a)	• high availability of water in soil, but not open water • reference to diagram sighting introduced species alongside open drain and creek	2 2
	Total	4

Question	Answers	Marks
(b)	• herbicide spray -if not selective could also kill native plants • burn - must be controlled, but native plants can cope with fire, so not much impact • mechanical - cut or dig up plants - no impact on existing plants but would allow more space for plants to extend their range	1 1 1
	Total	3

Question 3	Answers	Marks
(c)	• introduced species would spread along the banks of the creek and drain • may reduce open water and water flow. • impact on native flora and fauna - reduced water availability, restricted access to water; • overgrowing breeding areas	1 1 1 1
	Total	4

Question 3	Answers	Marks
(d)	Any 2 well described e.g. • national parks • licenses • protected zones etc	2 2
	Total	4

QUESTION 4. (13 marks)

Question 4	Answers	Marks
(a)	• 660 - 670 nm	2
	Total	2

Question 4	Answers	Marks
(b)	• increased absorption of light by chlorophyll a leads to an increase in photosynthesis	2
	Total	2

Question 4	Answers	Marks
(c)	• light energy to chemical energy	2
	Total	2

Question 4	Answers	Marks
(d)	• respiration by plants and animals uses oxygen from the air, reducing atmospheric oxygen levels. • The presence of animals uses the excess oxygen produced by plants.	2 2
	Total	4

Question 4	Answers	Marks
(e)	• Any suitable experiment (3 points needed)	3
	Total	3

QUESTION 5. (10 marks)

Question 5	Answers	Marks
(a)	• hunting - used as a food source by locals and visiting sailor or • agriculture - removal of natural habitat and food sources of tortoises	2
	Total	2

Question 5	Answers	Marks
(b)	• low variability • means that there would be few to survive conditions that differ greatly from current conditions in the future • little possibility of future variation, inbreeding	2 2
	Total	4

Question 5	Answers	Marks
(c)	• few individuals were taken in and bred to produce a large number for release. • this group did not have much genetic variation and now are the basis for the larger population so no significant changes to variation. Other variants died in the natural environment.	2 2
	Total	4

QUESTION 6. (20 marks)

Question 6	Answers	Marks
(a) (i)	• gene probe or antibody method	2
	Total	2

Question 6	Answers	Marks
(a) (ii)	• all cells of the fish are produced from the fertilised egg by mitosis • therefore all would have the fluorescent protein gene. • If inserted into an adult cell, only that cell and its descendants would have the gene eg a patch of skin.	1 1 2
	Total	4

Question 6	Answers	Marks
(a) (iii)	• gene removed from the coral cell using restriction enzymes • placed in plasmid and plasmid taken up by fertilised egg	2 2
	Total	4

Question 6	Answers	Marks
(a) (iv)	• mutation has occurred in the gene • a new protein is produced • this glows green not red due to the different properties of the protein	1 1 2
	Total	4

Question 6	Answers	Marks
(b) (i)	• compare DNA bands of calf with mothers and fathers • all calf bands have to be accounted for in the two parents; those not in mothers profile should be in fathers profile	2 2
	Total	4

Question 6	Answers	Marks
(b) (ii)	• Father 9	2
	Total	2

QUESTION 7. (10 marks)

Question 7	Answers	Marks
(a)	• isolation of different population to stop gene flow	2
	Total	2

Question 7	Answers	Marks
(b)	• comparison of genomes to produce phylogenetic tress • organisms with least differences are most closely related; one with greater differences have been separated the longest.	2 2
	Total	4

Question 7	Answers	Marks
(c)	• natural habitats have all the requirements for existence • under go natural variations to control population health and size and promote natural breeding cycles	2 2
	Total	4

QUESTION 8. (12 marks)

Question 8	Answers	Marks
(a)	• plant cells have cell walls which prevent the cells bursting under the pressure of osmosis. • The mechanical pressure of the cell wall means that when a water molecule comes into the cell, one forced out. • Animal cells only have cell membrane. Osmosis continues because the cell membrane is flexible and so pressure does not build up as in plant cells. • The membrane will burst under the increased pressure.	1 1 1 1
	Total	4

Question 8	Answers	Marks
(b)	• stimulus is a decrease in the concentration of the body fluids - due to water movement into cells by osmosis. • detected by the endocrine gland which produces a hormone • the hormone causes the kidney to produce large quantities of dilute urine • feedback - body fluid concentrations increase.	1 1 1 1
	Total	4

Question 8	Answers	Marks
(c)	• cell membrane is permeable to small molecule • can control the movement of ions through ion channels • can move larger molecules by active transport • lipid soluble and water soluble materials move at different rates through membrane because of phospholipid structure.	1 1 1 1
	Total	4

Section Three: Extended Response [40 marks]

Question 1: answer 2 parts of question 1

Question 1	Answers	Marks
(a)	Statement of problem - lack of particular enzyme Function of the enzyme Effects of lack of enzyme - cellular level; external symptoms eg. 1. Haemophilia - lack of enzymes for clotting factors for blood fibrin is not produced and no blood clot form on wound wound does not stop bleeding 2. Tay-Sachs - lack of enzyme that prevents the build up of fatty deposits in cells fatty deposits build up in CNS and other tissues damages nervous system causing mental retardation and lack of motor control 3. PKU - lack of enzyme to break down phenylalanine phenylalanine builds up in blood and other tissues causes mental and physical retardation	1 3 3 3
	Total	10

Question 1	Answers	Marks
(b)	Founder population of rats had a high proportion of blue alleles Processes to increase the proportion of blue eye alleles Non-random mating selection for blue eyes selection for blue eye allele - confers some benefit	2 2 2 2 2
	Total	10

Question 1	Answers	Marks
(c)	Each of the following discussed with respect to natural, agricultural and urban ecosystems energy requirements for different ecosystems amount of recycling biodiversity removal of wastes inputs	 2 2 2 2 2
	Total	10

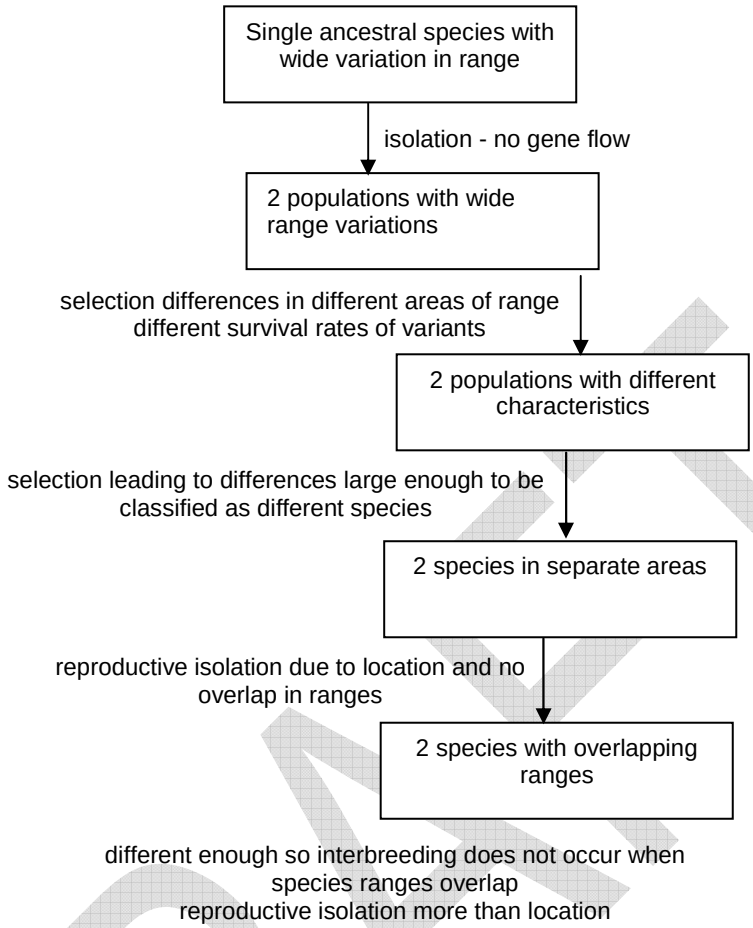
Question 1	Answers	Marks
(d)	Behavioural - burrowing - low temperature, high humidity → reduce temperature stress and water loss - huddling when cold - reduces individuals energy needs - feeding at night/early morning - select optimum temperature for foraging → reduce heat stress; food contains high amount of water from dew. Physiological - eat food high in carbohydrates/lipids → produce large amounts of metabolic water - very efficient kidney with long loop of Henle → produces small amounts of highly concentrated urine - produce very dry faeces - can tolerate large internal temperature range - about 5oC so heating/cooling mechanisms don't begin quickly → saves energy and water.	5 5
	Total	10

Question 2: answer 2 parts of question 2

Question 2	Answers	Marks
(a)	Climate change - species die out slowly from the north edges of the range - can change range southward as areas become more suitable Fragmentation - no movement possible because of isolated area surrounded by agricultural areas - whole populations die out - reduces genetic diversity of species Species loss - species with narrow ranges will die out before finding a way to move south - lack of diversity in the remaining small populations to cope with changes - isolated populations too small to be viable	2 2 2 2 2
	Total	10

Question 2	Answers	Marks
(b)	Gaps model - movement of materials in osmosis and diffusion is through holes in the membrane - size of the holes is important to movement of materials - no energy input is required - the composition of the membrane does not impact on this movement Complex model - lipid and water soluble materials move differentially through the membrane - active transport and facilitated diffusion require specific structures in cell membrane to occur eg. protein channels - active transport requires energy input Structure of membrane - phospholipid layer - protein channels	2 1 1 1 1 1 1 1 1 1
	Total	10

Question 2	Answers	Marks
(c)	- definition of transpiration - required for temperature control - need to balance water output for temp control with water input from roots Transpiration Transport mineral nutrients to leaves Provide water for photosynthesis Temperature control - evaporation Moist surface for gas exchange Allows exchange of gases through stomata No energy expended by plant (passive) Stomata open - processes of water loss, cell turgidity controlling size of opening Disadvantages of transpiration Water loss – dehydration Decreased photosynthesis (stomata closed) Wilting No temperature control if stomata closed	1 1 1 4 3
	Total	10

Question 2	Answers	Marks
(d)		2 2 2 2 2
	Total	10

BIOLOGICAL SCIENCES
SAMPLE EXAMINATION STAGE 3
MAPPING OF CONTENT

Unit 3A	Questions	Unit 3B	Questions
Ecosystems: biodiversity and sustainability		**Ecosystems: biodiversity and sustainability**	
Biodiversity		**Conservation**	
• biodiversity in terms of genetic, species and ecosystem.	MC1 MC4 ER1c	• rationale for the effective conservation of biodiversity within natural ecosystems	
Ecosystems		• conservation projects and strategies for maintaining biodiversity and the prevention of extinction including:	MC10 MC14 MC15 SA3c SA7c ER2a
• differences between types of ecosystems ▪ input and outputs ▪ amount of recycling ▪ stability and flux ▪ productivity.	MC11 MC12	▪ genetic strategies e.g. gene/seed banks, captive breeding programs, DNA profiling, development of new strains ▪ environmental strategies e.g. biological control, reafforestation, introduced species, pest control ▪ management strategies e.g. national parks, protected zones, licences, open seasons.	SA3d
Environmental issues and human impact		**Continuity of species**	
• causes and consequences of the following environmental issues including two in detail: ▪ salinity ▪ deforestation ▪ desertification ▪ eutrophication ▪ biomagnification ▪ the enhanced greenhouse effects ▪ ozone depletion ▪ agricultural practices e.g. over-grazing, over-cropping, fertiliser use ▪ urbanisation e.g. sewage disposal, land clearing, exotic garden plants.	MC3 MC5 MC6 SA3 ER2a	**DNA** • replication of DNA • protein synthesis • cloning and genetic modification of organisms.	
The functioning organism		**Recombinant DNA techniques** • recombinant DNA technology ▪ use of probes ▪ restriction and lipase enzymes ▪ vectors and bacterial plasmids.	SA6aii,iii,iv
Photosynthesis • the chemical equation of photosynthesis • factors affecting the rate of photosynthesis.	SA2bi SA4a,c,d	**Applications of DNA technologies** • genetic modification of organisms • recombinant DNA technology and DNA identification technology in ▪ agriculture ▪ environmental conservation ▪ pharmaceuticals.	SA6ai SA6bi,ii SA7b
Respiration • anaerobic and aerobic pathways of cell respiration (no details of mitochondrial structure required) • factors affecting the rate of cellular respiration.	MC2 MC8 MC18	**Variation** • significance of meiosis • sources of variation including ▪ gene mutation ▪ the independent assortment	
Energy transfer • importance of ATP and ADP cycles for cell functioning.			
Control of cellular activities • active transport of materials	SA8c		

across the cell membrane • models for the structure and function of the cell membrane • models of enzyme action including lock and key, induced fit, activation energy changes • catalytic and specific nature of enzymes • effect of temperature and pH on enzyme action • importance of enzymes in biological processes, including the control of biochemical pathways e.g. respiration, photosynthesis and protein synthesis. **Homeostatic mechanisms** • the principles of homeostasis and negative feedback. **Homeostasis in animals** • factors affecting water balance ▪ water inputs ▪ water loss • temperature regulation ▪ endothermy/ectothermy ▪ mechanisms of heat loss/gain ▪ avenues of heat loss/gain ▪ adaptations—structural e.g. large ears, fur, blubber; behavioural e.g. burrowing; physiological e.g. blood flow ▪ surface area to volume ratio (SA:Vol) • links between water balance, salt balance, temperature regulation and excretion. **Homeostasis in plants** • water balance ▪ water absorption ▪ transpiration and stomata • temperature regulation ▪ adaptations—structural e.g. leaf covering and shape (SA:Vol); physiological e.g. tolerance limits, wilting. ## Working as a biologist **Planning and conducting biological research** • design, analyse and evaluate ethical experiments and investigations • design and conduct an investigative study in the local environment • conduct cytological or biochemical testing e.g. factors affecting enzymes, photosynthesis or biological membranes	MC7 MC16 ER2b SA2a SA2bii,iii MC17 ER1a MC20 SA8b SA8a MC19 ER1d SA8a ER2c	of chromosomes ▪ crossing over during meiosis ▪ random mating. **Isolation** • barriers to gene flow. **Selection** • process of natural selection leading to change in characteristics of a population e.g. pesticide resistance, bird beaks, flowers and pollinators • selective pressures leading to change or extinction e.g. loss of habitat, predation • practical application of artificial selection e.g. the selective breeding of animals and crops. **Speciation/evolution** • gene pools • changes in allele frequency due to: ▪ natural selection ▪ sexual selection ▪ the founder effect ▪ genetic drift. **Evidence for evolution** • evolutionary relationships between groups using physiological, molecular and genetic features in phylogenetic trees • evidence for evolution including: ▪ fossils ▪ homologous structures ▪ comparative anatomy ▪ embryology of vertebrates ▪ comparative biochemistry and genetics. ## Working as a biologist **Planning and conducting biological research** • design an investigation for a hypothesis developed from the research area • devise a safe investigation involving a number of variables • use of microscopy techniques • standard scientific techniques and SI units • critique of a published reviewed biological sciences study. **Evaluating and communicating as a biologist** • environmental and ethical considerations associated with	SA5a,b,c SA7a ER1b ER2d MC1 SA5b,c ER1b ER2d MC13 SA7b ER2d SA4e MC8 MC9 SA1a,bi,c,di,dii SA2bii,iii SA4b

• use of microscopy techniques. **Evaluating and communicating as a biologist** • interpret results in terms of cellular chemistry and processes • use of various media to communicate findings e.g. time lapse photography, video recording, building models or poster/PowerPoint presentations.		practices of biotechnology • limitations of design • implications and issues associated with the possible application of their findings • defend or debate findings • challenge others' interpretations of data, using evidence and biological knowledge • reflecting on own beliefs and that of others in the light of evidence • influence of biological research on decision-making and management of biological systems • implications for careers and commercial applications of biological research.	SA1bii,e SA2bii,iii ER2b