

Mark Scheme for June 2013

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.













All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

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1. Annotations

Annotation	Meaning
	Correct answer
	Incorrect response
	Benefit of Doubt
	Not Benefit of Doubt
	Error Carried Forward
	Given mark
	Underline (for ambiguous/contradictory wording)
	Omission mark
	Ignore
	Correct response (for a QWC question)
	QWC* mark awarded
	First answer

*Quality of Written Communication

Question		Answer	Marks	Guidance
1	(a)	reduce / slow, flow rate ; repeat process / run milk through again ; test for (named) sugars in milk ;	2	ACCEPT close tap for a time period CREDIT glucose, galactose, lactose, Benedict's test
	(b) (i)	<i>any two from</i> hydrophobic / ionic bond, to (named), solid / support ; covalent bond / cross-link to, (named) substance; membrane separation ; (en)trap / encapsulate / suspend, in (named), matrix ;	2	Mark as prose. IGNORE ref to cross-linking agents ACCEPT 'insoluble material for solid. Suitable solids = clay, carbon, resin, glass, gold, ceramic beads. CREDIT <u>ad</u> sorption (but not absorption) CREDIT carrier bound. CREDIT cross-link them together. Suitable substances = other enzymes, collagen, cellulose. ACCEPT microcapsules Suitable matrix materials = collagen, cellulose, silica gel, hydrogel, but DO NOT CREDIT entangled / alginate
	(ii)	1 (enzyme) can be re-used so reduces cost ; 2 product, pure(r) / uncontaminated ; 3 reduced downstream processing costs ; 4 (immobilised enzyme) works at high(er) temperature ; 5 (immobilised enzyme) works in changed pH ; 6 reaction, can be faster / have higher yield , because can be done at higher temperature ;	4	2 ACCEPT product not mixed with enzyme 3 ACCEPT save money on purifying product 4 CREDIT enzymes not denaturing at increased temperature CREDIT immobilised enzymes thermostable 5 CREDIT enzymes not denaturing in changed pHs 6 This explanation scores mp 4 and mp 6 (unless mp 4 already awarded).
Total			8	

Question			Answer	Marks	Guidance
2	(a)	(i)	C ;	1	Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks
		(ii)	D ;	1	Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks
		(iii)	B / E ;	1	Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks
		(iv)	E ;	1	Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks
	(b)		<p>1 muscles <u>contract</u>, in antagonistic (pairs) ;</p> <p>2 tendons, pull on bone / connect muscle to bone ;</p> <p>3 ligaments, hold bones together / prevent dislocation ;</p> <p>4 cartilage, reduces, friction / wear ;</p> <p>5 synovial membrane secretes fluid ;</p> <p>6 <u>synovial</u> fluid, is a lubricant / allows smooth movement ;</p>	3	<p>1 CREDIT biceps and triceps or flexor and extensor contract</p> <p>IGNORE context of direction of movement</p> <p>4 ACCEPT 'prevents' for reduces</p> <p>5 ACCEPT makes, produces but not 'releases'</p> <p>6 ACCEPT prevents / reduces, friction</p>

Question	Answer	Marks	Guidance
(c)	<p>1 (two parts are) sympathetic and parasympathetic ;</p> <p>2 S has, short preganglionic neurone / long postganglionic neurone / ganglia near(er) spinal cord, but P has, long preganglionic neurone / short postganglionic neurone / ganglia near(er) organ ;</p> <p>3 S uses noradrenaline but P uses acetylcholine (at organ) ;</p> <p>4 S, fight / flight / stress, but P, rest / relaxation / calm ;</p> <p>5 S increases, heart rate / cardiac output / blood pressure, but P reduces this ;</p> <p>6 S increases , speed / rate / depth, of breathing, but P reduces this ;</p> <p>7 S increases airway diameter but P reduces it ;</p> <p>8 S increases blood flow to skeletal muscle but P increases blood flow to gut (smooth muscle) ;</p> <p>9 S for orgasm but P for sexual arousal ;</p> <p>10 S dilates pupils but P constricts pupils ;</p> <p>11 S makes liver release glucose, but P makes liver, store / take up, glucose ;</p> <p>12 P allows, <u>peristalsis</u> / digestion, but S reduces it ;</p>	7	<p>1 If BOTH names are wrong but begin with S and P, DO NOT CREDIT mp1 but allow ECF for mps 2-12</p> <p>2 ACCEPT tissue for organ</p> <p>3 CREDIT norepinephrine for noradrenaline but IGNORE noradrenaline from adrenal gland and IGNORE references to ganglion here</p> <p>6 CREDIT S increases ventilation rate and P slows it</p> <p>8 CREDIT voluntary or striated for skeletal IGNORE ORA</p> <p>11 ACCEPT correct reverse reasoning for glycogen IGNORE sugar 'liver' must be mentioned at least once</p> <p>12 IGNORE 'stops' for S but allow S inhibits</p>
	QWC ;	1	Award QWC if 1 mark awarded for organisation mps 1-3 and 2 marks awarded for functions mps 4-11
	Total	15	

Question		Answer	Marks	Guidance
3	(a)	metaphase I and metaphase II ; prophase I ; anaphase II ; telophase II ; anaphase I ;	5	Mark the first answer on each prompt line. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks
	(b)	to, halve chromosome number / reduce from 2n to n ; to separate homologous pairs (of chromosomes) and sister chromatids ; because, DNA (previously) replicated / chromosomes are two chromatids at start ;	2	IGNORE all references to mitosis CREDIT 'from diploid to haploid' ACCEPT 'from 46 to 23 chromosomes' IGNORE halve, genetic material / DNA ACCEPT genetic, material / information
	(c) (i)	sequence / order, of bases / nucleotides ;	1	CREDIT base pairs DO NOT CREDIT amino acid sequence
	(ii)	different, primary / secondary / tertiary, structure ; (protein) shorter due to, deletion / stop codon OR longer due to, insertion / duplication ; (protein) unchanged due to, silent mutation / non-coding DNA altered ; (function is) lost / worse / better ;	3	ACCEPT different <u>sequence</u> or <u>order</u> of amino acids ACCEPT different 3D folding or 3D shape for 'silent' CREDIT 'neutral' or a description of more than one triplet coding for one amino acid IGNORE different / altered function ACCEPT idea that change is harmful
Total			11	

Question		Answer	Marks	Guidance																		
4	(a)	<table border="1"> <thead> <tr> <th>biological principle</th> <th>letter</th> </tr> </thead> <tbody> <tr> <td>artificial selection</td> <td>E</td> </tr> <tr> <td>predator-prey interaction</td> <td>G</td> </tr> <tr> <td>apical dominance</td> <td>B</td> </tr> <tr> <td>nitrogen fixation and nitrification</td> <td>D</td> </tr> <tr> <td>reproductive cloning</td> <td>A / F</td> </tr> <tr> <td>positive chemotaxis</td> <td>H</td> </tr> <tr> <td>decomposition</td> <td>C / D</td> </tr> <tr> <td>commercial use of plant hormones</td> <td>F</td> </tr> </tbody> </table>	biological principle	letter	artificial selection	E	predator-prey interaction	G	apical dominance	B	nitrogen fixation and nitrification	D	reproductive cloning	A / F	positive chemotaxis	H	decomposition	C / D	commercial use of plant hormones	F	8	<p>Award 1 mark per row.</p> <p>Mark the first answer in each box. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p>
	biological principle	letter																				
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	(b)	<p>respiration / decomposition / decay / ripening ;</p> <p><u>interspecific competition</u> ;</p> <p>(positive) <u>phototropism</u> ;</p> <p><u>succession</u> ;</p>	4	<p>Mark the first answer on each prompt line. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>ACCEPT metabolism / metabolic reactions</p> <p>DO NOT CREDIT negative phototropism DO NOT CREDIT trophism (as ambiguous with trophic)</p>																		

Question		Answer	Marks	Guidance
	(c)	<p><i>animals = primary consumers</i></p> <p>1 keep animals, warm / indoors ;</p> <p>2 reduce animal movement ;</p> <p>3 feed animals high, protein / energy, food ;</p> <p>4 vaccination / (routine) antibiotics, for animals ;</p> <p>5 selective breeding / genetic engineering, for improved animals ;</p> <p>6 slaughter just before, mature / full size ;</p>	3	<p>2 ACCEPT zero grazing idea</p> <p>3 ACCEPT growth-enhancing food additives</p> <p>4 IGNORE hormones</p> <p>5 ACCEPT description of improvement, e.g. disease resistant, faster-growing, higher yielding</p>
		Total	15	

Question			Answer	Marks	Guidance
5	(a)	(i)	<i>idea of tentative / uncertain / developing / advancing / improving / dynamic ;</i>	1	IGNORE change(s), changing, changeable (as given in question)
		(ii)	<p>1 conservation / keep rare plants / save endangered plants ;</p> <p>2 <u>gene bank</u> OR genetic resource / store of alleles ;</p> <p>3 teaching / education ;</p> <p>4 leisure / amenity / visitor attraction / aesthetic value ;</p>	2	<p>Read as prose.</p> <p>1 ACCEPT prevent extinction / maintain biodiversity</p> <p>3 IGNORE 'research' (as given in question)</p>
	(b)	(i)	<p>to, amplify / make (many) copies of, <u>DNA</u> ;</p> <p>(range of) different lengths ;</p>	2	<p>IGNORE refs. to single stranded / coding strand / template strand</p> <p>CREDIT idea of, chain terminating / dideoxy, nucleotides attaching at different points along sequence</p>
		(ii)	<p>to put DNA pieces in size order ;</p> <p>to read, base sequence / order of bases ;</p>	2	<p>IGNORE speed or rate of movement, look for distance or position or pattern, e.g. shortest / lightest / smallest, lengths first or lighter move further and heavier move less far</p> <p>DO NOT CREDIT 'put genome back in order'</p>
		(iii)	<p>to cut (genome DNA) into, small(er) / 750 bp, fragments ;</p> <p>to cut, vectors / BACs / plasmids, (for gene library) ;</p>	2	ACCEPT fragment size in range 500-1000 base pairs

Question		Answer	Marks	Guidance	
	(c)	genome, too big / very large ; accuracy better / fewer errors (with small fragments) ; divide job over, time / different labs ;	2	ACCEPT ORA only, small sections / 750bp, can be sequenced (at a time) CREDIT ORA large sections sequenced less accurately ACCEPT otherwise would take <u>too</u> long / be unmanageable / be impractical IGNORE ref to efficiency	
	(d)	(i)	1 160 000 ; ;	2	Correct answer = 2 marks (no units) CREDIT 1.16 <u>million</u> or 1.16×10^6 If answer incorrect, award 1 mark for $870 \text{ (million)} \div 750$ AWARD 1 max correct answer has inappropriate units (e.g. 1 160 000 Mbp = 1 mark)
		(ii)	(monkey flower) has, smaller genome / fewer Mbp DNA ; fewer lab hours / fewer staff needed / quicker / cheaper ;	2	Read as prose. ACCEPT ORA but must be comparative IGNORE refs to chromosome number ACCEPT ORA but must be comparative
		(iii)	larger (in size) ;	1	ACCEPT bigger / plumper / juicier

Question		Answer	Marks	Guidance
	(e)	<p><i>phylogenetic approach</i></p> <p>no need to test for interbreeding ;</p> <p>ref. common ancestor / <u>monophyletic</u> groups ;</p> <p>can apply to organisms that reproduce asexually ;</p> <p>can apply to, extinct organisms / fossils ;</p>	2	<p>ORA for biological species concept – (importance of members of same species) (inter)breeding to give fertile offspring</p> <p>IGNORE clades</p> <p>ORA for biological species concept – doesn't apply to asexually reproducing organisms</p> <p>ORA for biological species concept – doesn't apply to, extinct organisms / fossils</p>
Total			18	

Question			Answer	Marks	Guidance								
6	(a)	(i)	<table border="1"> <tr> <td></td> <td>Discontinuous</td> <td>Continuous</td> </tr> <tr> <td>Species identified by letter</td> <td>S and T ;</td> <td>R ;</td> </tr> </table>		Discontinuous	Continuous	Species identified by letter	S and T ;	R ;	2			
			Discontinuous	Continuous									
Species identified by letter	S and T ;	R ;											
		(ii)	<p>statement 1 in S and T only ; statement 8 in S and T only ;</p> <p>statements 2 and 3 in R only ; statement 5 in R only ;</p> <p>statements 4 and 7 in T only ; statement 6 in S only ;</p>	6	<table border="1"> <thead> <tr> <th>Species</th> <th>Statement number(s)</th> </tr> </thead> <tbody> <tr> <td>R</td> <td>2 3 5</td> </tr> <tr> <td>S</td> <td>1 6 8</td> </tr> <tr> <td>T</td> <td>1 4 7 8</td> </tr> </tbody> </table>	Species	Statement number(s)	R	2 3 5	S	1 6 8	T	1 4 7 8
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Question	Answer	Marks	Guidance
(b)	<p><i>collection</i></p> <ol style="list-style-type: none"> 1. named equipment for collecting from, dogs / fields ; 2. get, large number / over 100 (fleas) ; 3. use several, dogs / fields ; 4. <i>idea of random sampling</i> (dogs / field) ; <p><i>testing</i></p> <ol style="list-style-type: none"> 5. (named) container ; 6. correct dose / range (of concentrations), tested ; 7. control without flea killer ; 8. delivery method described ; <p><i>processing</i></p> <ol style="list-style-type: none"> 9. leave for set time ; 10. count number of, dead / live, fleas (after testing) ; 11. calculate percentage (frequency) of, alive / dead / resistant / non-resistant ; 	6	<p>1 CREDIT pooter, forceps, tweezers, pipette, (flea) comb, sweep net, sticky traps, light traps (in correct context)</p> <p>5 CREDIT tank, jam jar, boiling tube, petri dish.</p> <p>6 ACCEPT 'dose according to manufacturer's instructions' IGNORE same, volume / concentration</p> <p>8 e.g. flea-killer sprayed / left to evaporate from cotton wool / fed in blood or food</p> <p>9 ACCEPT leave for same amount of time</p> <p>10 IGNORE how many were left, how many were resistant IGNORE identify – must be counting number</p>
	QWC ;	1	<p>Award if the first mark point awarded in each section is <u>in the correct section order</u>.</p> <p>collection 1 to 4 then testing 5 to 8 then obtaining and processing results 9 to 11</p> <p><i>e.g. if the first mark of each section is awarded in the wrong order (such as mp 1, then mp 10, with nothing from the testing section inbetween) then do not award QWC</i></p>
	Total	15	

Question			Answer	Marks	Guidance
7	(a)	(i)	<p>(both) to, avoid / counter, (abiotic) stress ;</p> <p>(both) to avoid, being eaten / predation ;</p> <p>(both) to access resources ;</p>	2	<p>Mark the first 2 reasons</p> <p>CREDIT to avoid named stressors e.g. cold, heat, dryness, humidity or unfavourable conditions only CREDIT descriptions relevant to both animals (avoiding a stressor) and to plants (closing stomata, wintering underground, etc). IGNORE survival and dangers unqualified</p> <p>only CREDIT descriptions relevant to both animals (being consumed, being preyed upon) and to plants (being grazed, herbivory).</p> <p>only CREDIT descriptions relevant to both animals (get food) and plants (obtain light, minerals, water)</p>
		(ii)	<p><i>all points must show a clear comparison between mammals (M) and plants (P)</i></p> <p>1 (M) made in <u>endocrine</u> glands versus (P) made in many plant tissues ;</p> <p>2 (M) move in blood versus (P) move, in xylem / in phloem / from cell to cell ;</p> <p>3 (M) act on, a few / specific / target, tissues versus (P) act on most tissues / can act in cells where produced ;</p> <p>4 (M) act <u>more</u> rapidly ; ORA</p>	3	<p>2(P) ACCEPT diffusion / through plasmodesmata, for 'from cell to cell'. ACCEPT by translocation / in transpiration stream IGNORE mass flow</p> <p>4 must be comparative e.g. respond faster in mammals</p>
	(b)	(i)	<p>inherited / passed to offspring / passed (down) from parents ;</p> <p>(caused by) <u>mutation</u> / <u>allele</u> ;</p>	2	ACCEPT in context of condition or gene

Question		Answer	Marks	Guidance
	(ii)	<p><u>gene</u> / <u>allele</u> ;</p> <p>(DNA) <u>ligase</u> ;</p> <p>transgenic / transformed ;</p> <p>antibiotic(s) ;</p> <p>(gene / DNA / fluorescent / radioactive) <u>probe</u> ;</p>	5	<p>Mark the first answer on each prompt line. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>ACCEPT recombinant / GE / GM</p> <p>CREDIT named antibiotic e.g. ampicillin, tetracycline</p>
	(c)	<p>fat soluble / non-polar / uncharged / hydrophobic ;</p> <p>(so can move directly through) phospholipid bilayer ;</p>	2	<p>ACCEPT through phospholipids / through phospholipid membrane</p> <p>DO NOT CREDIT through pores</p>

Question	Answer	Marks	Guidance
(d)	<p>EITHER</p> <p>1 (<i>lac</i>) <u>repressor protein</u> ;</p> <p>2 (repressor protein) changes shape when bound to lactose ;</p> <p>3 (with lactose) lifts off <u>operator</u> allowing, transcription / gene expression / binding of RNA polymerase to promoter ; ORA</p> <p>4 β-galactosidase / enzyme(s) / structural gene(s) ;</p> <p>OR</p> <p>5 homeotic / homeobox / hox (genes) ;</p> <p>6 gene product / protein / transcription factor, binds to DNA ;</p> <p>7 gene product / protein, starts transcription / is a transcription factor ;</p> <p>8 many genes affected / controls body plan ;</p>	4	<p>Mark the first example.</p> <p>3 ORA without lactose the protein binds to the <u>operator</u> stopping, transcription / gene expression / binding of RNA polymerase to promoter DO NOT CREDIT mp 3 if ref. made to DNA polymerase or DNA replication</p> <p>4 CREDIT lactose permease</p> <p>6 CREDIT homeobox domain / homeodomain, binds to DNA</p> <p>7 ACCEPT controls / regulates / stops, transcription</p> <p>8 CREDIT controls, development / segmentation</p>
	Total	18	

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