

Mark Scheme for June 2012

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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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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

Subject-specific Marking Instructions

FA in guidance column means: **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**. Apply the same reasoning where the instruction is to mark the first 2 suggestions.

ACCEPT incorrect spellings if they are recognisable **and also** sound the same when pronounced. This **includes** underlined words. If a wrong spelling does not pass these two criteria, read on and **IGNORE** it.
Example - in 1 (a) describing fur pattern, **ACCEPT** “wildcat is stryped” but **IGNORE** “wildcat is stripped” and read on in case other information about fur colour or pattern does get the mark. Similarly **IGNORE** “absorption” in 1 (e) (ii) but read on in case correct description (of adsorption) is given.

CREDIT AW FOR ALL, i.e., credit any alternatively worded statement that conveys the same sense as the mark point. If a particular word or term is essential and no other will do it is underlined.

IGNORE additional vague information or statements that are incorrect but irrelevant, and read on as if this information was not there, unless it **directly contradicts a listed mark point**, in which case the wrong ‘statement’ contradicts the right one, and negates the mark (use annotation **CON**). The exception to this rule is if the instruction is **FA** or **Mark first 2 answers**.

Question		Answer	Mark	Guidance
1	(a)	<p><i>a difference is stated relating to</i></p> <p>fur length ;</p> <p>pattern / colour, of fur ;</p> <p>eye colour ;</p> <p>temperament / tameness ;</p> <p>face shape ;</p>	max 2	<p>Mark the first 2 suggestions (see point 12 above)</p> <p>For each mark point CREDIT</p> <p>EITHER a paired comparison referring to both cats and identifying which has which feature, e.g. “the wildcat has green eyes and the Persian has blue” but allow top / bottom, Fig. 1.1 / 1.2, first and second cat, etc, as identifiers,</p> <p>OR a reference to only one cat but using a comparative adjective ending in ‘-er’ such as “shorter fur on wildcat”, “second one looks tamer” or “second one is more tame”, or, conversely, “wildcat looks less fierce”.</p> <p>IGNORE use of the word different. e.g. “they have different coloured fur” if there is no further statement about how they differ.</p> <p>IGNORE answers that do not attempt to describe a difference at all, e.g. “fur length”.</p> <p>IGNORE albino</p>

Question		Answer	Mark	Guidance
	(b) (i)	selective breeding / artificial selection ;	1	FA (see guidance on page 2) IGNORE evolution DO NOT CREDIT natural selection or speciation
	(ii)	(named type of) mutation / production of new alleles ; sexual reproduction / meiosis / independent assortment / crossing-over ;	1	FA ACCEPT substitution / insertion / <u>base deletion</u> / gene mutation / random mutation as named types of mutation DO NOT ACCEPT chromosome mutation, discontinuous variation
	(c) (i)	(recessive) epistasis ;	1	FA DO NOT ACCEPT dominant epistasis or codominance
	(ii)	BBDD ; BBDd ; BbDD ; BbDd ;	4	CREDIT answers written in any order but look for and tick off answers in the order given
	(iii)	<i>homozygous</i> (individual / cat / genotype with) 2 identical, alleles / version of the gene / forms of the gene ; <i>gene locus</i> position / place / location, of, gene / allele, on chromosome ;	1 1	ACCEPT both, pair or idea of (same on) each for 2 idea ACCEPT same for identical and CREDIT description such as "both alleles either recessive or dominant" DO NOT CREDIT <i>genes</i> for alleles DO NOT CREDIT <i>similar</i> for identical or same CREDIT "where / whereabouts the gene is on the chromosome" CREDIT DNA molecule for chromosome and ACCEPT DNA strand

Question		Answers	Mark	Guidance
	(iv)	<p>seal : blue : chocolate : lilac ;</p> <p>1 : 1 : 1 : 1 ;</p>	2	<p>IGNORE absence of colons (:)</p> <p>CREDIT phenotypes all correct in any order ACCEPT dark brown for seal ACCEPT light brown for chocolate</p> <p>ACCEPT ratio of 1 : 1 : 1 : 1 as stand alone mark, even if only one, two or three colours stated for phenotypes DO NOT CREDIT fractions, percentages or decimals CREDIT ecf for ratio only if four colours stated e.g. "seal, lilac, chocolate, chocolate" (no mark) followed by ecf "1:1:2"</p>
	(d) (i)	<p><i>type of behaviour</i> innate / instinct(ive) / reflex ;</p> <p><i>characteristic</i></p> <p>automatic ; stereotyped / always performed in the same way ; no previous experience necessary / not learned ; genetic(ally programmed) / AW ;</p>	<p>1</p> <p>max 1</p>	<p>FA for each prompt line</p> <p>IGNORE maternal (as given in question)</p> <p>IGNORE instinctive in characteristic section</p> <p>ACCEPT same in all members of the species ACCEPT unlearned, not taught ACCEPT inherited</p>

Question	Answer	Mark	Guidance									
	<p>(ii)</p> <p>1 whether kittens, survive / breed ;</p> <p>2 whether <u>alleles</u>, change in frequency / passed on / kept ;</p> <p>3 correct reference to selection / how selection acts ;</p> <p>4 AVP ;</p> <p>5 AVP ;</p>	<p>max 2</p>	<p>Markpoints 1–3 are linked within 4 possible contexts. 1 t' refers to good mothering behaviour in the domestic environment (with people helping at the birth of kittens). Or candidates might say what would happen to the good behaviour patterns in the wild. Alternatively, the answer might focus on bad mothering behaviour (not licking the kittens), in either environment.</p> <table border="1" data-bbox="1330 517 2040 1155"> <thead> <tr> <th></th> <th>domestic</th> <th>in the wild</th> </tr> </thead> <tbody> <tr> <td>good mothering</td> <td> <p>1 kittens do, survive / breed</p> <p>2 alleles not necessarily, passed on / kept</p> <p>3 not selected for</p> </td> <td> <p>1 kittens do, survive / breed</p> <p>2 alleles, increase / passed on / kept</p> <p>3 selected for</p> </td> </tr> <tr> <td>bad mothering</td> <td> <p>1 kittens do, (still) survive / breed</p> <p>2 alleles, increase / passed on / kept</p> <p>3 not selected against</p> </td> <td> <p>1 kittens do not, survive / breed</p> <p>2 alleles, decrease or alleles not, passed on / kept</p> <p>3 selected against</p> </td> </tr> </tbody> </table> <p>e.g. linkage (4) of poor mother, genes / alleles, with desirable alleles selected for in domestic cats (5) OR <u>genetic drift</u> (4) in small population (5) OR pleiotropic / multi-effect genes (4) with a desirable effect and this side effect (5)</p>		domestic	in the wild	good mothering	<p>1 kittens do, survive / breed</p> <p>2 alleles not necessarily, passed on / kept</p> <p>3 not selected for</p>	<p>1 kittens do, survive / breed</p> <p>2 alleles, increase / passed on / kept</p> <p>3 selected for</p>	bad mothering	<p>1 kittens do, (still) survive / breed</p> <p>2 alleles, increase / passed on / kept</p> <p>3 not selected against</p>	<p>1 kittens do not, survive / breed</p> <p>2 alleles, decrease or alleles not, passed on / kept</p> <p>3 selected against</p>
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Question			Answer	Mark	Guidance
1	(e)	(i)	<p>1 inbreeding / small or decreasing, gene pool ;</p> <p>2 homozygous recessive (genotypes) ;</p> <p>3 gene / allele , for desired characteristic on same chromosome as problem, gene / allele ;</p> <p>4 selecting for one trait (unintentionally) selects for another ;</p> <p>5 breeders select for looks not health ;</p> <p>6 weaker selection against less healthy animals (than in wild) ;</p>	max 2	<p>ACCEPT decreasing genetic variation</p> <p>IGNORE interbreeding</p> <p>CREDIT good and bad genes, linked / show linkage</p>
		(ii)	<p>1 entrapment / alginate beads / cellulose network ;</p> <p>2 adsorption / carrier bound or stuck to , porous carbon / clay / resin / glass ;</p> <p>3 covalent bonding or cross-linking enzymes to each other and to clay (using glutaraldehyde) ;</p> <p>4 membrane separation or enzyme and substrate either side of partially permeable membrane ;</p>	max 2	<p>Mark the first 2 answers</p> <p>ACCEPT encapsulation, inclusion</p> <p>IGNORE absorption</p>
			Total	21	

Question			Answer	Mark	Guidance
2	(a)	(i)	<p>T mitochondrion / mitochondria ;</p> <p>U Z line ;</p> <p>V myofibril;</p>	3	<p>FA for each line</p> <p>ACCEPT nucleus</p> <p>CREDIT zwischenscheibe line</p> <p>CREDIT myofilaments</p> <p>ACCEPT actin and myosin</p>
		(ii)	sarcomere ;	1	<p>FA</p> <p>DO NOT CREDIT 'sacromere' (section 12 spelling rules apply)</p>
		(iii)	<p>energy storage ;</p> <p>hydrolyses / breaks down , to glucose ;</p> <p>(glucose / glycogen, for) respiration / to make ATP ;</p> <p>glycogen insoluble / glucose would exert osmotic effect ;</p>	max 2	<p>IGNORE just 'provides energy' or source</p> <p>ACCEPT converted to glucose, provides glucose</p>
		(iv)	1.2 / 1.3 ; ;	2	<p>Correct answer = 2 marks</p> <p>If answer is incorrect then ALLOW 1 mark for correct working - 52 mm or 52 000 μm or 5.2 cm \div 42 000</p> <p>If answer is not correctly rounded to 1dp ALLOW 1 mark for unrounded answers, e.g.for 52 mm - 1.238095 or 1.23</p> <p>ACCEPT measurements in range 51–53 mm and corresponding unrounded figures - 1.21428 or 1.21 or 1.261904 or 1.26</p>

Question		Answer	Mark	Guidance
2	(b)	<p><i>A band</i> stays the same / no change ;</p> <p><i>H zone</i> decreases / shorter / smaller ;</p> <p><i>I band</i> decreases / shorter / smaller ;</p>	3	ACCEPT disappears
	(c)	<p>1 (<i>fewer</i>) Ca²⁺ / calcium ions, bind to troponin ;</p> <p>2 (<i>fewer</i>) troponin (proteins) change shape ;</p> <p>3 (<i>fewer</i>) tropomyosin (proteins) move aside ;</p> <p>4 (<i>fewer</i>) binding sites on actin available ;</p> <p>5 (<i>fewer</i> actin-myosin) cross bridges / links, form / AW ;</p> <p>6 power stroke <i>reduced</i> / AW ;</p> <p>7 actin filaments pulled past myosin with <i>less</i> force ;</p> <p>8 ref. pH and denaturing of proteins ;</p> <p>QWC – at least two given mark points also indicate idea in bold italics ;</p>	max 5	<p>'Fewer' not needed to award mps 1 to 5 but is required twice for QWC. ACCEPT less / decreased for 'fewer'. ACCEPT mps 1-5 if event described said not to occur at all but don't award QWC green spot for this.</p> <p>1 IGNORE 'reduced ability of Ca²⁺ to bind' for QWC</p> <p>2 "Troponin does not change shape as much" gets mp 2 but not QWC</p> <p>4 ACCEPT thin filament for actin ACCEPT actin-myosin binding sites or binding sites for myosin heads, available / exposed</p> <p>6 IGNORE reduction in force of contraction DO NOT ACCEPT fewer power strokes</p> <p>7 IGNORE reduction in force of contraction</p> <p>8 ACCEPT description e.g. "H⁺ changes protein's 3D structure" and allow reference to enzyme or to ATPase</p>
		Total	17	

Question		Answer	Mark	Guidance										
3	(a)	DNA (combined) from (two) , sources / organisms ;	1	ACCEPT DNA, contains / has inserted in it, DNA or gene from, other / another, organism / species ACCEPT foreign for idea of other source										
	(b)	<table border="1"> <thead> <tr> <th>application of genetic modification</th> <th>vector</th> </tr> </thead> <tbody> <tr> <td>goats making spider silk protein</td> <td>BAC / YAC / virus / liposome</td> </tr> <tr> <td>somatic gene therapy for a recessive human genetic disorder</td> <td>virus / liposome</td> </tr> <tr> <td>plants that express a bacterial toxin that kills insects feeding on them</td> <td><i>Agrobacterium tumefaciens</i>/ (Ti) plasmid / liposome</td> </tr> <tr> <td>bacteria that produce a human protein for therapeutic use</td> <td>BAC / (bacterio)phage / plasmid</td> </tr> </tbody> </table>	application of genetic modification	vector	goats making spider silk protein	BAC / YAC / virus / liposome	somatic gene therapy for a recessive human genetic disorder	virus / liposome	plants that express a bacterial toxin that kills insects feeding on them	<i>Agrobacterium tumefaciens</i> / (Ti) plasmid / liposome	bacteria that produce a human protein for therapeutic use	BAC / (bacterio)phage / plasmid	4	<p>FA in each box</p> <p>DO NOT CREDIT microinjection / electroporation / gene gun (as they are not vectors)</p> <p>IGNORE tumour forming bacterium</p>
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Question		Answer	Mark	Guidance
3	(c)	<p>1 somatic / adult, cell / nucleus ;</p> <p>2 fused with / injected into ;</p> <p>3 empty / enucleate , egg cell ;</p> <p>4 from another goat ;</p> <p>5 <i>idea of</i> electric shock / electrostimulation ;</p> <p>6 this cell or embryo, grown on , in vitro / in tied oviduct ;</p> <p>7 (early) embryo / blastocyst , split ;</p> <p>8 <i>idea that</i> embryos replaced in , surrogate mothers / other females ;</p> <p>9 AVP ;</p>	max 5	<p>1 ACCEPT differentiated or body cell or example, e.g. skin cell, udder cell</p> <p>2 ACCEPT inserted / placed. If term use is "electrofused" gets mp 2 and mp 5</p> <p>4 ACCEPT named (A, B) or numbered goats</p> <p>5 "electrofused" gets mp 2 and mp 5</p> <p>6 ACCEPT in petri dish / test tube culture</p> <p>7 ACCEPT description of an embryo being split, even if produced by wrong method (IVF)</p> <p>8 IGNORE host mothers</p> <p>9 e.g. further detail of any stage of process correct ref. to haploid / diploid , nuclei</p>

Question		Answer	Mark	Guidance
3	(d)	<p><i>advantages</i></p> <p>A1 all offspring will inherit the, (silk) gene / foreign DNA ;</p> <p>A2 all offspring female ;</p> <p>A3 certain / all make , silk / milk / product ;</p> <p>A4 faster / many obtained in a short time ;</p> <p>A5 avoid mating risks ;</p> <p style="text-align: right;">max 3 advantages</p> <p><i>disadvantages</i></p> <p>D1 no genetic variability (in population) / AW ;</p> <p>D2 (so makes goats) more susceptible to, environmental factors / (infectious) disease ;</p> <p>D3 cloned animals may, have shorter life spans / be less healthy ;</p> <p>D4 <i>idea that</i> cloning success rate is very poor ;</p> <p>D5 (more) expensive / needs (more) technology / (more) labour intensive ;</p> <p style="text-align: right;">max 3 disadvantages</p>	5 max	<p>IGNORE disadvantages of breeding given in the first (advantages of cloning) section, i.e. DO NOT CREDIT reverse arguments</p> <p>A5 ACCEPT idea of physical damage or disease transfer</p> <p>IGNORE advantages of breeding given in the second (disadvantages of cloning) section, i.e. DO NOT CREDIT reverse arguments</p> <p>D1 ACCEPT they are all genetically identical</p> <p>D2 IGNORE disease if stated to be genetic</p>
Total			15	

Question		Answer	Mark	Guidance
4	(a)	<p><i>fungus</i> long cells / hyphae OR multinucleate OR <u>chitin</u> cell wall ;</p> <p><i>bacterial</i> free DNA / DNA not in a nucleus OR circular DNA (molecule) OR naked DNA / no histones OR peptidoglycan / murein, cell wall OR smaller / 70S / 18nm, ribosomes ;</p>	1	<p>FA for each microorganism IGNORE prokaryotic / eukaryotic (as given in question)</p> <p>ACCEPT no nucleus / nuclear envelope IGNORE loop, plasmids, nucleoid</p>
	(b)	<u>disease-causing</u> (organism) ;	1	

Question		Answer	Mark	Guidance
4	(c)	<p><i>What is biotechnology?</i></p> <p>1 large-scale / industrial / commercial use (of living organisms / enzymes) ;</p> <p>2 to produce , food / named example ;</p> <p>3 detail of , microbe / enzyme , involved ;</p> <p>4 to produce , drugs / named example ;</p> <p>5 detail of , microbe / enzyme , involved ;</p> <p>6 to make , (useful) enzymes / biogas / calcium citrate / for bioremediation / for water treatment / for microbial mining ;</p> <p><i>Advantages of microorganisms</i></p> <p>7 fast, growth / reproduction / products ;</p> <p>8 microbes can be genetically engineered ;</p> <p>9 processes occur at low , temperatures / pressures ;</p> <p>10 low , temp / pressure , cheaper / safer , to maintain ;</p> <p>11 products , pure / easy to separate ;</p> <p>12 grow on unwanted, food / nutrients ;</p> <p>13 AVP ;</p> <p>QWC – balanced account ;</p>	7 max	<p>2 e.g. cheese / yogurt / beer / wine / cider / vinegar / soya sauce / mycoprotein / etc.</p> <p>3 e.g. <i>Lactobacillus</i> / yeast / <i>Fusarium</i> / etc. IGNORE wrong kingdom</p> <p>4 e.g. antibiotic / penicillin / augmentin / insulin</p> <p>5 e.g. <i>Penicillium</i> IGNORE wrong kingdom</p> <p>6 e.g. detergent enzymes, pectinase, sewage treatment, blue technology</p> <p>8 ACCEPT in context of example mps 1 - 6</p> <p>10 CREDIT less energy used for low, temp /pressure</p> <p>11 ACCEPT little downstream processing</p> <p>12 ACCEPT named e.g. whey, starch waste.</p> <p>13 e.g. no animal welfare issues</p> <p>Award QWC if 2 marks awarded from mps 1 – 6 and 2 marks awarded from mps 7 – 13</p>
		Total	11	

Question			Answer	Mark	Guidance
5	(a)	(i)	succession ;	1	FA IGNORE primary / secondary
		(ii)	<u>mineral</u> content ; acidity / pH ; water depth;	2	FA
	(b)		<i>similarity</i> chlorophyll breaks down / leaves change colour ; <i>differences</i> (bog) minerals stay in plant / (forest) minerals in soil ; ora decomposers / fungi / bacteria , not, present / active in bog ; ora for forest	1 2	FA for similarity Mark first two answers for differences ACCEPT named mineral ions in words or correct symbols ACCEPT decomposers / fungi / bacteria, break down leaves in forest
	(c)		decomposers / named decomposers, not, present / active ; waterlogging reduces, air / oxygen ; acidity / low pH , stops (decay) enzymes working ;	2 max	ACCEPT (soil), bacteria / fungi / microbes can't survive or few can survive CREDIT waterlogging produces anaerobic conditions
	(d)		bog / habitat / ecosystem, takes a long time to form / hard to replace ; loss of, biodiversity / rare species ;	2	ACCEPT peat bogs maintain biodiversity
Total				10	

Question			Answer	Mark	Guidance
6	(a)	(i)	larger territory / greater distance between neighbours = lower predation ;	1	ACCEPT ora - smaller territory / smaller distance = higher predation DO NOT CREDIT descriptions wrong way round
		(ii)	<p>1 great tit numbers, oscillate / rise and fall ;</p> <p>2 (weasel predation) helps keep great tit numbers stable ;</p> <p>3 predation (by weasels) is <u>density-dependent</u> ;</p>	2 max	IGNORE weasel population size ACCEPT keeps great tit numbers moderate
	(b)	(i)	<p><i>two areas</i> as a control / for comparison / to see the effect of removal of starfish ;</p> <p><i>same size</i> to make test, valid / fair / unbiased ;</p>	2	IGNORE reliable, precise, accurate CREDIT 'as a valid control' = 2 marks
		(ii)	<p><u>interspecific</u> competition ;</p> <p>(competition from) , barnacles / mussels ;</p> <p>for, algae / space ;</p> <p>barnacles / mussels , no longer eaten by starfish ;</p>	2 max	IGNORE intraspecific competition ACCEPT description e.g. barnacles / mussels, eat food of, limpets / chitons IGNORE food
		(iii)	<p>sponges outcompeted (by , barnacles / mussels) ;</p> <p>less, prey / food / sponges, for nudibranchs to eat ;</p> <p><i>idea of specialist feeder</i> ;</p>	2 max	IGNORE 'sponge population decreases' alone (as given in question) CREDIT nudibranchs only feed on sponges
Total				9	

Question			Answer	Mark	Guidance
7	(a)	(i)	polar and brown bear ;	1	
		(ii)	<i>no because</i> one, more closely related to / in same group as , raccoons and one , to / with, bears / AW ;	1 max	DO NOT CREDIT answer if in context of yes
	(b)	(i)	knowledge , tentative / uncertain / subject to change ; to re-test / check, hypotheses / results ;	2	IGNORE incomplete, new technology IGNORE to validate
		(ii)	<p>1 <i>idea that</i> haemoglobin could be , an <u>adaptation</u> (to the environment) / an <u>adaptive</u> feature ;</p> <p>2 <i>idea that</i> low oxygen partial pressure is selective agent or both subject to the same selection pressure ;</p> <p>3 (haemoglobin of both) has high oxygen affinity / dissociation curve shifted to left ;</p> <p>4 convergence / similarity not due to shared ancestry ;</p>	3 max	<p>3 ACCEPT haemoglobin can uptake O₂ at low partial pressure</p> <p>4 ACCEPT description e.g. “changes happen to both independently” IGNORE “red and giant panda may not be closely related” (as given in question)</p>

Question		Answer	Mark	Guidance
	(c)	<p>step 2 PCR / polymerase chain reaction ;</p> <p>step 3 genetic modification / genetic engineering ;</p> <p>step 4 electrophoresis ;</p>	3	<p>FA on each line</p> <p>ACCEPT gene cloning / transformation</p> <p>ACCEPT (gel) chromatography</p>
	(d)	<p>triplet code or 3 bases = 1 amino acid ;</p> <p>525 ;</p> <p>3 bases are , stop / (chain) termination , codon ;</p>	3	DO NOT CREDIT triplet makes amino acid
	(e)	(i)	ox ;	1 FA
		(ii)	<p>1 genetic code is degenerate ;</p> <p>2 more than 1, triplet / codon, for same amino acid ;</p> <p>3 silent / neutral, mutations ;</p> <p>4 <i>idea that</i> DNA, changes more than / is more different to, protein ;</p>	3 max 1 ACCEPT redundant 2 DO NOT CREDIT 'make' the same amino acid 4 ACCEPT polypeptide / amino acid sequence ACCEPT nucleotide sequence for DNA
			Total	17

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