Mark scheme

Variation and selection

Biology 0610 · Questions from Paper 3, Paper 4 and Paper 6

Total marks

90

MARKS FOR EACH QUESTION

1	2	3	4	5	6	7	8	9	10	Total
6	7	7	10	6	7	10	11	12	14	**90**

Question 1 [6]

1	**(a)**	more with straight thumb ORA; correct reference to figures for gender e.g. **straight**: 84 males and 87 females / more females / less males **and /or** **hitch hiker**: 12 males and 14 females / more females / less males; independent of their age /AW;	[3]	**A.** correct reference to figures e.g. 171 straight and 26 hitch hiker or approx 87% straight / 13% hitch hiker. **A.** independent of gender; **I.** references to figures or differences in age groups. **A.** varies with age
	(b)	discontinuous variation ; no range of results / only two types /AW; hitch hiker thumb recessive (allele); straight thumb dominant (allele); not linked to sex / gender; not affected by age;	[max 3]	**I.** gene **I.** codominant **I.** Punnett squares
			[Total: 6]	

Question 2 [7]

2(a)	limited number of, phenotypes / categories / groups ; no intermediates / AW ;	**1**	
2(b)	attached or unattached earlobes ✓ foot length gender (male or female) ✓ height tongue rolling ✓ weight ;;;	**3**	deduct one for each additional box ticked
2(c)	is a genetic change ; forms new alleles ; can be caused by ionising radiation ;	**3**	deduct one for each additional line

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Question 3 [7]

3(a)

D / E	adaptive feature	help in survival
D	(canine) teeth large mouth / jaws / beak (long / strong), tail webbed, toes / feet scaly / rough, skin / has scales markings / AW eyes on top of head AVP ;	seize / eat prey swallow / catch / grip large prey swimming / defence swimming prevent dehydration / waterproof for camouflage vision when submerged ;
E	claws / nails / talons beak wings (tail) feathers forward facing eyes AVP ;	catch / tear prey / perching / defence tear / hold food / offence / defence flight / search for prey / hunt / escape predators retain body heat / helps in flight to see prey from a distance ;

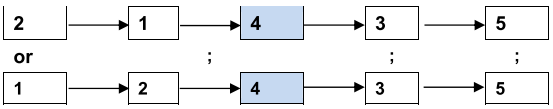
4

feature and reason must match

feature must be **visible**

AW throughout

3(b)



3

1 and 2 at start in either order
3 after 4 (somewhere)
5 at the end

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Question 4 [10]

4 (a) (i)		mitosis / mitotic;	[1]	
(ii)		will all have identical genetic make-up / asexual reproduction happening;	[1]	A – same genotype
(iii)	1	different growing conditions / competition;		Any two – 1 mark each
	2	e.g. light / water / minerals etc;		A – nutrients
	3	damage due to disease / pests;		
	4	original tubers of different sizes;		
	5	age of tubers / time since planting;	max [2]	
(b) (i)	1	sexual reproduction happening;		Any three – 1 mark each
	2	male gametes / pollen can come from any plant;		
	3	gametes / pollen may vary as formed by meiosis;		
	4	different combinations of genes / alleles possible;	max [3]	A – ref to self / cross pollination

(ii)	1	select plants with desired characteristics / breed the two varieties with one another / OWTTE;		Any three – 1 mark each
	2	isolate flowers;		A – remove anthers, carpels
	3	remove stamens from some / stigmas from others;		A – ref to genetic modification; A – AVP for GM
	4	cross pollinate;		
	5	collect seeds;		
	6	grow plants to check success;		
	7	select next generation of plants / discard any without one of the features;		
	8	repeat process;	max [3]	
			[Total: 10]	

Question 5 [6]

5(a)(i)	*Geospiza* ;	**1**
5(a)(ii)	*any five from:* natural selection ; variation (in beak shapes) ; mutation / description ; those birds with, selective advantage / unique beak shape, more likely to find food and survive ; the birds that survive reproduce ; pass on their alleles ; continues over many generations ; AVP ;	**5**

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Question 6 [7]

6(a)	dry / AW ;	**1**	
6(b)(i)	discontinuous ;	**1**	
6(b)(ii)	limited number of phenotypes / three categories ; no intermediates / discrete / separate categories / AW ; caused by genes only ; bar chart (has gaps) ;	**2**	
6(c)	thickness / length / width / mass / concentration of pigment / volume / surface area, of any leaf feature / density of stomata / number of, veins / chloroplasts / spikes ;;	**2**	**A** concentration for density
6(d)	measured different leaves ; change in (named) environmental (feature) ; adapted to environment ; leaves / plant, have, grown / older ; AVP ;	**1**	**A** mutation

Question 7 [10]

7(a)	inherited ; survive (and) reproduce / breed / produce offspring ;	**2**	either order
7(b)	*any two from:* curled / rolled, leaf ; inner surface is folded ; hairs / AW ; few / sunken, stomata **OR** stomata in, pits / AW ; thick cuticle ;	**2**	
7(c)(i)	0.001276 / 1.276 × 10^{-3} (mm) ;	**1**	
7(c)(ii)	cellulose ;	**1**	
7(c)(iii)	*any one from:* swollen / thick (stem) **OR** water storage / succulent ; chloroplasts / site of photosynthesis ; thick (waxy) cuticle ; AVP ;	**1**	**A** wide stem
7(d)	*any three from:* *species 1:* 1 roots, shallow / close to the surface **OR** spread, out(wards) / over a wide area (of the soil surface) ; 2 to absorb water immediately after rainfall / from the (soil) surface ; *species 2:* 3 deep / long (vertically), root ; 4 to absorb, ground / deep, water (in the soil) ;	**3**	

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Question 8 [11]

8 (a)

5 / 6 RIGHT = 4
4 RIGHT = 3
3 RIGHT = 2
1 / 2 RIGHT =1

0 RIGHT = 0

go to 2	
go to 3	
Aulostomus maculatus	**F**
Gymnothorax moringa	**E**
go to 4	
go to 5	
Dasyatis americana	**G**
Bothus ocellatus	**D**
go to 6	
Epinephelus striatus	**A**
Pseudupeneus maculatus	**C**
Chaetodon capistratus	**B**

[4]

sequence is:

E
G
D
A
C
B

I letters placed in grey blocks

(b) (i) mutation ; [1]

(ii)

1	retina / pigments, adapted for detecting different, colours / wavelengths ;	
2	colours / wavelengths, for different depths ;	
3	fish are adapted to live at different depths ;	
4	as a group fish will occupy a larger habitat ;	
5	blue/red, retinal detector mates with relevant, type / species / AW ;	
6	avoid competition ;	[max 2]

R simple restatement of the question stem

(c)

1	reduces ability of blue fish to find mates ;	
2	reduces reproduction in blue fish ;	
3	number of blue fish, decrease / become rare / extinct ;	
4	gene / allele, for blue, pigment / receptors, not passed on ;	
5	water has less effect on red fish ;	
6	number of red fish increase ;	
7	red fish have less competition (because fewer blue fish) ;	
8	red fish extend their range ;	[max 4]

A reference to ‘shallow’ and/or ‘deep’ water fish in place of blue/red if sufficiently qualified

I idea of differential predation, effect on plant life, etc.

[Total: 11]

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Question 9 [12]

9(a)	(group of) organisms that can reproduce ; to produce fertile offspring ;	**2**	
9(b)	pinna(e) / external ears ; mammary glands / milk glands / production of milk / lactating / suckling / breast feeding / nipples / AW ; diaphragm ; (three) bones in the middle ear ; (four) different types of teeth / two sets of teeth ; sweat glands ; enucleated red blood cells ; uterus / placenta / navel / AW ; AVP ;	**2**	
9(c)	select, parent(s) / sheep / AW, with, fine / thin, hairs (in wool) OR use Merino sheep from South Africa and NZ sheep ; cross them together / use artificial insemination / IVF / AW ; measure / AW, the hairs in the wool of all the offspring ; select offspring with, fine / thin, hairs (in wool) ; cross / AW, offspring together ; continue / repeat, selection and/or breeding ; over many generations ; AVP ;	**5**	max 4 if no reference to quality of wool
9(d)	features are, adaptive / adaptations (for environment) ; caused by / AW, the, environment / surroundings ; competition between individuals for (named) resource(s) ; reference to named selective agent(s) ; slow(er) ; increase in fitness ; explained: ability to survive AND reproduce (in natural environment) ; maintains (genetic) variation / less (genetic) variation in selective breeding ; random mating ;	**3**	

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Question 10 [14]

10 (a)	1 2 3 4 5 6 7 8 9	(red blood cells) get stuck in capillaries / do not flow smoothly / capillaries blocked; reduce , supply of, oxygen / nutrients (to tissues / cells / muscles) ; reduce , removal of, carbon dioxide / wastes, (from tissues / cells / muscles) ; ref to respiration (in tissues) ; cause sickle cell crises ; pain ; increased chance of, thrombosis / blood clotting ; death of tissues / cells ; AVP ;	[max 4]	**ignore** less haemoglobin **A** carries less oxygen / nutrients… **A** carries less carbon dioxide… **I** reduced life expectancy
(b) (i)		allele(s) ;	[1]	
(ii)		H^A , H^S + H^A , H^S ; (H^AH^A , H^AH^S , H^AH^S) $\underline{H^SH^S}$;	[2]	Could be in Punnett square **A** just A and S **A** just S and S
(iii)		0.25 / 25 % / ¼ / 1 in 4 ;	[1]	**I** ratios

(c) (i)	1 2 3 4 5 6 7 8 9 10	malaria, is severe disease / may be fatal ; *idea that it is the* selective agent / ref to natural selection ; H^AH^A / homozygous dominant, susceptible to malaria ; H^AH^S / heterozygous, resistant ; **A** H^SH^S resistant ; H^AH^S survive / H^AH^A more likely to die before have children ; H^AH^S have children and pass on, the allele / H^S ; (if H^AH^S x H^AH^S) 1 in 4 chance of, H^SH^S / homozygous recessive ; 2 in 4 / ½ , have advantage of resistance to malaria ; AVP ; e.g. ref to malarial parasite / AVP ; e.g. ref to transmission of malaria	[max 4]	**A** sickle cell trait / carrier for H^SH^A throughout the answer **R** immune
(ii)	1 2 3 4 5 6 7 8 9	malaria not very serious / not a severe strain of malaria ; people have other genetic protection from malaria ; malaria has only recently spread to these areas / no malaria before; mutation not occurred in populations of these areas ; people with mutation / have sickle cell allele , have not migrated here ; (majority of) population in Australia has not lived there for long ; came from areas where no malaria, is / was, present ; AVP ; AVP ;	[max 2]	 E.g. Thalassemia **A** mutation described **I** gene, for allele
			[Total:14]	

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