

**MARK SCHEME for the October/November 2010 question paper
for the guidance of teachers**

0610 BIOLOGY

0610/32

Paper 3 (Extended Theory), maximum raw mark 80

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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

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General notes

Symbols used in mark scheme and guidance notes.

/ separates alternatives for a marking point

; separates points for the award of a mark

A accept – as a correct response

R reject – this is marked with a cross and any following correct statements do not gain any marks

I ignore/irrelevant/inadequate – this response gains no mark, but any following correct answers can gain marks.

() the word/phrase in brackets is not required to gain marks but sets context of response for credit. e.g. (waxy) cuticle. Waxy not needed but if it was described as a cellulose cuticle then no mark.

Small underlined words – this word only/must be spelled correctly

ORA or reverse argument/answer

ref./refs. answer makes appropriate reference to

AVP additional valid point (e.g. in comments)

AW alternative words of equivalent meaning

MP marking point (number)

ecf error carried forward

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Question	Expected Answers	Marks	Additional Guidance
1 (a)	broad leaves / <i>Ranunculus</i> does not have narrow leaves / AW ; branched veins / not parallel veins ; flower parts, in 5s / not in 3s ; R 'flowers in fives'	[max 2]	A wide / large surface area A net(work) of veins / reticulate I two cotyledons
(b)	<p>1 (cells of W were) in, the winter / cold / low light / short days / AW ; I refs. to water</p> <p>2 starch, has been used / converted to glucose or sugar / broken down ;</p> <p>3 to provide energy ; R 'produce'</p> <p>4 in respiration ;</p> <p>5 to keep the, plant / cells, alive ; I for growth, etc.</p> <p>6 root has become a source (not a sink) ;</p> <p>7 when there has been, no / few, leaves ;</p> <p>8 so there has been, no / little / less, photosynthesis ;</p> <p>9 ref. to, light / temperature / cold, as limiting factor(s) ;</p>	[max 3]	<p><i>assume answers refer to W unless told otherwise – accept ORA for S</i></p> <p>1 (cells of S were) in summer / warm / high light / AW ; I refs. to water</p> <p>2 starch has been, stored / produced ;</p> <p>8 result of (more) photosynthesis ;</p> <p>6 root is a sink (not a source) ;</p> <p>7 many leaves ;</p>
(c)	<p>1 sucrose / sugar, transported / translocated ; A travels / in phloem</p> <p>2 glucose / monosaccharide ;</p> <p>3 joined together (by chemical bonds) ; R if refers to joining sucrose</p> <p>4 condensation reaction / described ;</p> <p>5 glucose added to growing chain / AW ;</p> <p>6 (starch is a) long / chain, molecule ; A is a polysaccharide</p> <p>7 enzyme provides active site for reaction ;</p> <p>8 enzyme, catalyses / speeds up, the reaction ;</p> <p>9 ref. to lock and key (model) ;</p>	[max 3]	<p><i>if given breakdown of starch award MP6 to 9 only</i></p> <p>A 'join together to make maltose'</p> <p>A polymer / polymerisation</p> <p>A enzyme(s) is/are (biological) catalyst(s)</p>

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Question	Expected Answers	Marks	Additional Guidance
(d)	1 increase in (kinetic) energy ; 2 more, collisions / AW ; 3 between, enzyme / active site, and, substrate / AW ; 4 ref. to optimum temperature / works best at $\approx 30^{\circ}\text{C}$; 5 <u>denatured</u> , at high temperature / above 30°C / above optimum ;	[max 2]	I particles, movement R 'destroyed' / 'killed' / 'damaged'
[Total: 10]			

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Question	Expected Answers	Marks	Additional Guidance
2 (a)	removal from the, body / organism ; R 'from cell' / 'excreted from body' poisons / toxins ; waste products of, metabolism / respiration / deamination / chemical reactions in cells <i>or</i> in the body ; substances in excess (of requirements) / AW ;	[max 3]	A 'substances that cause harm' / 'harmful' <i>toxic waste products of metabolism / AW = 2 marks</i> I routes from body
(b) (i)	too large to go through membrane / pores in membrane too small ;	[1]	I semi-permeable / AW
(ii)	dialysing solution / dialysate, contains <u>glucose</u> ; glucose / sugar, diffuses / moves ; (until blood is) at, correct / normal, concentration ; A amount / level	[max 2]	I refs. to insulin / glucagon, etc. A dialysate has, correct / normal, concentration R 'machine has'
(c) (i)	9 ;	[1]	
(ii)	(240 – 40 =) 200 mg per dm ³ ;	[1]	must have units – A 200 mg/dm ³ <i>or</i> mg dm ⁻³
(iii)	<ol style="list-style-type: none"> 1 decreases during, dialysis / treatment / 'time on machine' ; 2 increases, over next day / until next dialysis / after dialysis ; 3 maximum concentration(s) decreases (over time) ; 4 minimum concentration(s) (after dialysis) decreases (over time) ; 5 difference between max and min decreases ; 6 increase after dialysis is less steep after, day 9 <i>or</i> 10 / treatment 5 ; 7 any comparative data quote giving days and urea concentration(s) ; 8 AVP ; 	[max 3]	<i>do not allow 'urea conc decreases over 17 days'</i> <i>allow fluctuates if MP1 or MP2 not given</i> MP7 A decreases by, 200 mg per dm ³ / 83%, over 17 days A 'at first' and 'at end' for days <i>look carefully at how 4s and 7s are written</i>

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(iv)	<p>1 <i>increase</i> (urea) produced in liver ;</p> <p>2 deamination ;</p> <p>3 amino acids ;</p> <p>4 <i>decrease</i> <u>diffuses</u>, out of blood / into dialysate;</p> <p>5 through (dialysis) membrane ;</p> <p>6 ref to concentration gradient / no urea in dialysate ;</p> <p>7 AVP ; e.g. diet changes after day 9 / treatment 5 (less steep increase)</p>	[max 4]	<p>I 'of protein'</p> <p>A diffusion gradient</p>
[Total: 15]			

Question	Expected Answers	Marks	Additional Guidance
3 (a)	$C_6H_{12}O_6$; $2C_3H_6O_3$;	[2]	<p>I word equation I energy / ATP R if 2 is not included for $C_3H_6O_3$ R glucose if oxygen included on left of arrow R if water given on either side</p>
(b)	2.0 / 2 ; 18 ; 36 ;	[3]	<p>A <i>ecf</i> for volume of air per minute = multiple of first two figures in answer</p>
(c)	<p>1 descriptive comment on difference between Fig. 3.1 and 3.2 ; A data quote for any one of the results shown in Table 3.1</p> <p>2 <u>muscle</u> ;</p> <p>3 respire faster ; R breathes faster (as this is for MP1)</p> <p>4 <i>idea that</i> more, energy / ATP, released / needed ;</p> <p>5 <u>aerobic</u> respiration ;</p> <p>6 <i>idea that</i> requires more oxygen ; A ref to more <u>oxygenated</u> blood</p> <p>7 <i>idea that</i> remove more carbon dioxide ;</p> <p><i>change to breathing maintains</i></p> <p>8 pH of blood ;</p> <p>9 oxygen concentration ;</p> <p>10 carbon dioxide concentration ;</p> <p>11 prevents (much) <u>anaerobic</u> respiration occurring ;</p> <p>12 prevents build up of, lactic acid / lactate ; R removes</p> <p>13 prevents oxygen debt ; R repays</p> <p>14 AVP ; e.g. ref. to homeostasis, contraction of muscle</p>	[max 5]	<p>breathing rate, volume of air, ventilation rate e.g. breathe, fast / faster, deeper R heavier</p> <p>A more respiration NOT more glucose R 'energy produced'</p> <p>MP8 – MP10 must have idea of maintaining near constant</p> <p>MP11–13 R refs. to there being an oxygen debt and paying off oxygen debt as question is about <i>during</i> <i>exercise</i> not afterwards, other points especially MP1 to 7 can still be awarded if answer contains refs to oxygen debt unless answer says 'after exercise'</p>

Question	Expected Answers	Marks	Additional Guidance
(d)	<p><i>mark both parts together to max 5 – some points may be awarded in either section</i></p> <p>1 <u>more</u> / <u>faster</u> , respiration in muscles ; <i>pulse rate</i></p> <p>2 pulse rate increases ; 3 <i>idea that</i> more / faster, blood transport to, muscles / lungs ; 4 <i>idea that</i> muscle requires more oxygen ; 5 remove, carbon dioxide from muscles ; 6 remove, lactic acid / lactate, from muscles ; 7 remove heat from muscles ;</p> <p><i>concentration of glucose</i></p> <p>8 concentration of blood glucose, increases / stays the same ; 9 glucose required for, energy / respiration ; 10 for muscle, activity / contraction / to work ;</p>	[max 5]	<p>A heart pumps faster R 'to body'</p> <p>I – (strenuous) exercise</p>
		[Total: 15]	

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Question	Expected Answers	Marks	Additional Guidance
4 (a)	<p>1 enter, blood / plasma / lymph ;</p> <p>2 infect / enter, white blood cell / lymphocyte / phagocyte / AW ;</p> <p>3 infect, brain / liver / lungs / skin / reproductive system / kidney / gut ;</p> <p>4 cannot reproduce ;</p> <p>5 may be transmitted to another person ;</p> <p>6 e.g. of method of transmission ; R excreted, die</p>	[max 2]	<p>A ref. to antibodies combining with virus</p> <p>A 'attack' / 'invade' white blood cells</p> <p>A 'attack' / 'invade' / enter</p> <p>MP6 A sexual intercourse / in blood / in breast milk / across placenta / needle stab</p>
(b)	<p>1 infects / destroys / kills, phagocytes ;</p> <p>2 destroys / kills / disables, <u>lymphocytes</u> ;</p> <p>3 fewer antibodies produced ;</p> <p>4 ref. to, T lymphocytes / T cells ;</p> <p>5 slow / no / weaker, immune response / response by immune system ;</p> <p>6 <i>idea of increased susceptibility to disease / infection / (named) pathogens ;</i> A viruses / bacteria</p> <p>7 cancers ;</p> <p>8 fungal infections / TB / pneumonia / named disease linked with HIV ; R common cold</p> <p>9 develop AIDS ;</p> <p>10 AVP ;</p>	[max 3]	<p>A no phagocytosis</p> <p>A fewer lymphocytes R 'attacks' / 'damages'</p> <p>A 'immune system not working'</p> <p>A suppresses / damages, immune system</p> <p>A 'can't fight disease'</p> <p>MP3–8 A <i>answers that give role(s) of immune system followed by 'this doesn't happen'</i></p>
(c) (i)	(substance) changes / modifies / affects, (chemical) reactions in the body / how the body works ;	[1]	I category of drug, medicine, specific effects of named drug, etc.
(ii)	<i>antibiotics</i> if 'antibodies' written rather than antibiotic – mark to max 1 are not effective against viruses / only effective against bacteria ; <i>idea that</i> nothing for them to act on ; e.g. cell wall / protein synthesis / cellular structure / capsule	[2]	<p>I viruses inside cells</p> <p>A do not work against viruses</p> <p>A ORA</p> <p>R 'life processes'</p>
[Total: 8]			

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5 (a) (i)	(oxygen concentration) decreases, steeply / AW ; zero / 0%, concentration ; A none / no oxygen more gradual / AW, increase ; increase / returns, to, original / normal / maximum concentration ; A 100% comparative data quote ; A ref. to at least two sampling stations	[max 4]	A rapid decrease / over short distance A slow increase / over longer distance A 'at first' for A , 'at end' for G
(ii)	stonefly (nymph) ;	[1]	
(iii)	rat-tailed maggot and tubifex (worm) ; I midge larva	[1]	A maggot and worm
(iv)	<p>1 number, of species / invertebrates, decreases as oxygen concentration decreases / <i>ora</i> ; A correct ref. to stations A to G</p> <p>2 some cannot survive where there is low oxygen / <i>ORA</i> ;</p> <p>3 bacteria use oxygen (to decompose sewage) ;</p> <p>4 some invertebrates can only respire <u>aerobically</u> / AW ;</p> <p>5 some (named) invertebrates, can respire anaerobically (as well) ;</p> <p>6 ref. to change in other named condition of river ; e.g. temperature / pH / cloudiness / flow rate / river bed / AW</p> <p>7 less food ;</p> <p>8 presence of, poisons / toxins (from sewage) ;</p> <p>9 migrate / move, away ;</p> <p>10 AVP ; e.g. other changes such as increase in aquatic plants / better habitat</p>	[max 3]	<p>MP1 <i>number of different species is in the question, but make sure it is implied in answer</i></p> <p>MP 2 A ora e.g. most/some survive only where there is (lots of) oxygen / few can survive where there is little oxygen</p>

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(b)	<p>1 enzymes / named enzyme ;</p> <p>2 <u>secrete</u> / release / pass out of cells / onto food / <u>extracellular</u> / AW ;</p> <p>3 digest / breakdown, large / complex / insoluble, (molecules) to, small / soluble / simple, (molecules) ;</p> <p>4 cellulose → sugar / glucose ;</p> <p>5 starch → sugar / maltose / glucose ; I further change, e.g. to carbon dioxide / water</p> <p>6 protein → polypeptides / peptides / amino acids ; <i>I further changes e.g. to ammonia, nitrite, etc.</i></p> <p>7 fats → fatty acids (and glycerol) ;</p> <p>8 ref. to respiration ;</p>	[max 4]	<p>R bacteria are enzymes</p> <p>A smaller , simpler</p> <p>A polysaccharides → monosaccharides <i>if name not given</i></p>
(c)	<p><i>mark to max 2 for each</i></p> <p>1 reeds (bed), absorb / take up / use, <u>nitrate</u> (ions) ; I nodules</p> <p>2 diffusion / active transport ;</p> <p>3 use nitrate to make, amino acids / proteins / chlorophyll / enzyme(s) ; denitrifying bacteria / denitrification ;</p> <p>4 nitrate ions converted to nitrogen (gas) ;</p> <p>5 ref. to anaerobic conditions in the reed bed ;</p> <p>6</p>	[max 3]	<p>R if nitrogen absorbed</p> <p>I growth</p> <p>R MP4 if linked to incorrect change to N A even if MP4 incorrect</p>

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Question	Expected Answers	Marks	Additional Guidance
(d)	<p>1 (methane is) greenhouse gas ; A contributes to the greenhouse effect</p> <p>2 traps / absorbs, heat / infra red (IR) radiation ;</p> <p>3 radiated back towards the Earth's surface / heat kept near surface / prevents heat escaping (to space) / AW ;</p> <p>4 <u>enhanced</u> greenhouse effect ;</p> <p>5 global warming / warming of atmosphere / increase in Earth temperature ;</p> <p>6 any consequence ; e.g. rise in sea levels, melting of ice caps, droughts, flooding, desertification, erosion, etc.</p>	[max 3]	<p><i>methane contributes to enhanced greenhouse effect = 2 marks</i></p> <p>I <i>combustion of methane</i></p> <p>I effects of methane on ozone</p>
[Total: 19]			

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Question	Expected Answers	Marks	Additional Guidance
6 (a)	pollen transferred from, anther / stamen, to stigma ; within same <u>flower</u> / between <u>flowers</u> on same plant ; R if only 'same plant'	[2]	R complete answers given in context of fertilisation R 'single parent'
(b)	<p><i>cross 1</i></p> $I^R I^R \times I^W I^W$ $I^R + I^W$ $I^R I^W ;$ <p><i>cross 2</i></p> $I^R I^W \times I^R I^W$ $I^R, I^W + I^R, I^W ;$ $I^R I^R, I^R I^W, (I^R I^W), I^W I^W ;$ <p>1 <u>red</u> : 2 <u>pink</u> : 1 <u>white</u> ; A 25% red : 50% pink : 25% white A multiples, e.g. 2 red: 4 pink : 2 white</p> <p>R if two different ratios given</p>	[4]	<p>A other notation, e.g. R and r or mixture, e.g. I^R and W. R I^{RR}, etc.</p> <p><i>cross 1</i> 1 mark for parental genotypes, gametes and offspring all correct. Any mistake and no mark awarded.</p> <p><i>cross 2</i> 1 mark for cross genotypes and gametes all correct. Any mistake and no mark awarded.</p> <p>1 mark for giving all three genotypes (on answer line or in the white space e.g. in Punnett square). If correct on answer line ignore any errors in working.</p> <p>1 mark for ratio of offspring phenotypes and colours R if no colours given</p>
(c)	$I^R I^W \times I^W I^W$ $I^R, I^W + I^W ;$ $I^R I^W, I^W I^W ;$ <p>1 (pink) : 1 (white) ; R if two different ratios given</p>	[3]	<p>1 mark for parental genotypes and gametes all correct. Any mistake and no mark awarded.</p> <p>1 mark for offspring genotypes</p> <p>1 mark for ratio (colours not necessary) A if no colours given</p>

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(d)	<p>1 ref. to meiosis ;</p> <p>2 mutation can occur <u>in meiosis</u> ;</p> <p>3 (gives) variation / diversity ; R 'varied species (plural)'</p> <p>4 ref. to, alleles / genes / DNA, from different, plants / parents ;</p> <p>5 allows mutations to be, expressed / AW ;</p> <p>6 allows adaptation to, new conditions / changed environment / AW ;</p> <p>7 (new species) can evolve / allows natural selection to occur ;</p> <p>8 seeds are dispersed ; R dispersed unqualified, R pollen dispersal</p> <p>9 can colonise new areas / AW ;</p> <p>10 less competition (with parent plant / among offspring) ;</p>	[max 4]	<p>R sexual reproduction allows mutations to occur</p> <p>A may allow resistance to disease A 'suited to' / survive / AW for adapted</p> <p>R 'passed on by natural selection' R 'new species are made'</p> <p>A 'go to new areas' or 'spread to new areas'</p> <p><i>competition is in context of seed dispersal not pollen dispersal</i></p> <p>R 'multiply quicker'</p>
[Total: 13]			