

**UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS**  
International General Certificate of Secondary Education

**MARK SCHEME for the May/June 2011 question paper**  
**for the guidance of teachers**

**0610 BIOLOGY**

**0610/31**

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.

- Cambridge will not enter into discussions or correspondence in connection with these mark schemes.

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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. answer makes appropriate reference to
- AVP additional valid point (e.g. in comments)
- AW alternative words of equivalent meaning
- MP marking point (number)

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Question	Expected answers	Mark	Additional Guidance
1 (a)	<p><i>from the top</i> capillary ; epithelium / goblet cell(s) ;</p> <p>lacteal / lymph(atic) vessel / lymph(atic) capillary ;</p>	[3]	<p><i>ignore blood vessel</i> <b>ignore</b> any qualification of epithelium e.g. ciliated epithelium <b>R</b> lymph unqualified</p>
(b) 1	<p>(contracts to) move villus ;</p> <p><i>MP 2, 3 and 4 must be linked to the idea of movement</i></p>		<p><b>A</b> side to side / up and down / waves about <b>R</b> 'push the food along', 'support', 'keeps it in place'</p>
2	<i>idea that</i> exposes villus to more food / changes surface area ;		<b>A</b> change the shape
3	increases / helping / AW, absorption ;		absorption must be qualified in some way <b>ignore</b> assimilation
4	increase / maintain, diffusion / concentration, gradient ;		
5	(helps to) empty lacteal / move blood / move lymph ;	[max 2]	
(c)	<p><i>either</i> active transport ; <b>A</b> absorption</p> <p>against concentration gradient / uses energy / needs ATP / ref. to carrier molecules / ref. to protein pumps ;</p> <p><i>or</i> respiration ;</p> <p>used for energy / release of energy ; <b>R</b> produce energy</p>	[max 2]	<p><i>one mark for the process and one mark for the explanation</i></p> <p><i>allow idea that the concentrations are the same (initially) so can't be diffusion / must be active transport</i></p>

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Question	Expected answers	Mark	Additional Guidance
(d) 1 2 3 4  5 6	<i>small intestine</i> <i>idea that glucose, taken up by cells / moved outside bag ;</i> lower water potential outside bag ; <b>A</b> ora water, moves / diffuses, out of bag ; by osmosis ;  <i>Visking tubing</i> no difference in, water potential / concentration ; no (net), osmosis / diffusion of water ; <b>R</b> 'no diffusion'	     [max 3]	<i>if bag not identified assume 'it' is the small intestine</i>
(e) (i)	stomach ;	[1]	
(ii)	small intestine / ileum / duodenum ;	[1]	
(iii) 1 2 3 4 5 6 7	for breakdown of (large / insoluble) food (molecules) / hydrolysis ; (used in) <u>chemical digestion</u> ; solvent / for dissolving, enzymes / named secretion ; solvent / for dissolving, food ; <b>A</b> named small food molecule(s) <i>could be either soluble components of food or products of digestion</i> softens food ; makes it easier to move food (in alimentary canal) / AW ; makes it easier to, chew / swallow / egest ;	     [max 3]	<b>A</b> alkali / bile (salts) / named enzyme(s) glucose / sugar / amino acids / fatty acids / glycerol / vitamins / minerals / ions  <b>A</b> acts as a lubricant
(iv) 1 2 3 4	<i>prevents</i> loss of, large volume of / lots of water ; loss of, ions / salts (in solution) ; diarrhoea ; dehydration / ora ;	   [max 2]	<b>if none of the expected answers accept</b> <b>5</b> any function of water in the body for max 1 e.g. transport / sweating / excretion / solvent / medium for reactions / reactant <b>R</b> 'turgidity of cells' / respiration
<b>[Total: 17]</b>			

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Question	Expected answers	Mark	Additional Guidance
2 (a)	A – excretion / egestion / defaecation ; B – nitrification / oxidation ;	[2]	R death A 'nitrify' / <b>ignore</b> bacteria
(b) 1 2 3 4 5 6 7 8	root nodules contain, bacteria / <i>Rhizobium</i> ; (bacteria) fix nitrogen / nitrogen fixation / nitrogen fixing ; form, ammonia / ammonium (ions) ; provide, fixed nitrogen / ammonia / amino acids, to rest of, plant ; R via soil (fixed nitrogen etc) needed for growth ; used to make, amino acids / proteins / DNA / RNA / chlorophyll / AW ; (so) nitrogen made available to, animals / other organisms ; AVP ; <i>only for detail of any of the points above</i>	[max 4]	<b>ignore</b> incorrect name or type of bacteria R if root nodules fix nitrogen <b>ignore</b> nitrate / R if occurs in soil <b>ignore</b> 'useful' nitrogen A useable nitrogen <b>ecf</b> provide nitrate to plant if penalised in MP3  R chloroplast <i>do not allow anything for events that occur after bacteria or plants die</i>
(c) 1 2 3 4 5 6 7 8 9 10 11 12 13	<b>proteins in cells</b> enzymes ; control / catalyse, reactions / AW ; e.g. respiration / photosynthesis ; A ref. to any specific reaction(s) (part of cell) membranes ; carrier proteins / description of role allowing movement in and out of cell ; haemoglobin ; transport of, oxygen / carbon dioxide / gases ; making cytoplasm / (cell) growth ; AVP ; e.g. chloroplast / named organelle / providing energy  <b>DNA in cells</b> ref. to, genes / alleles / genetic information / genetic code ; control functions of the cell ; code for proteins ; AVP ; e.g. a specific feature of cells / cell division / mitosis / meiosis	[max 3]           [max 2]	R digestion unless clearly <b>inside</b> cell, e.g. in a phagocyte A protein pumps R antibodies / hormones / collagen / keratin  <b>ignore</b> repair R produce / make energy  R hereditary material / AW A 'sends messages to the cytoplasm' / 'tells the cells what to do' A ref. to mRNA

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Question	Expected answers	Mark	Additional Guidance
(d) 1 2 3 4 5  6  7  8  9	<p><u>eutrophication</u> ;  growth of algae / algal bloom / weed growth ;  reduces light reaching other plants ;  algae / plants, die ;  bacteria, decompose / feed on, dead plants ; <b>A</b> dead animals / 'eat'</p> <p><u>aerobic</u> respiration ; <b>A</b> aerobic bacteria</p> <p>(bacteria cause) oxygen (concentration in water) to decrease ;</p> <p>(so) fish / invertebrates / animals, suffocate / die / migrate ;</p> <p>AVP ; e.g. any further detail or consequence of any of the above marking points, e.g. reduces biodiversity / destroys food chains</p>	[max 4]	<p>e.g. from lack of light / no resources  <b>A</b> decomposers / fungi / microorganisms for bacteria</p> <p><b>R</b> decrease in oxygen if linked to less photosynthesis</p> <p><b>R</b> change in pH / toxins as cause of death</p> <p>must be linked to shortage of oxygen (however caused)</p>
		<b>[Total: 15]</b>	

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Question	Expected answers	Mark	Additional Guidance
3 (a) 1 2  3 4 5 6 7 8 9 10	(amniotic) sac, contains / secretes, the amniotic fluid ; sac, prevents entry of pathogens (from vagina) ; <b>A</b> 'disease'  <i>amniotic fluid or amniotic sac</i> supports fetus ; protects / cushions, against, damage / sudden movements / bumps / AW ; provides constant temperature / protects against fluctuating temperature ; allows fetus to move ; needed for, bone / muscle, growth / development ; helps, lungs / gut, develop ; collects fetal, urine / waste / excretion(s) ; provides sterile environment / AW ;	[max 4]	<b>A</b> holds  <b>A</b> 'the baby' <b>A</b> 'shock absorber' <b>ignore</b> pH, <b>A</b> 'keeps the fetus warm' <b>A</b> correct / suitable, temperature  <b>ignore</b> egest
(b)  1 2 3 4 5 6 7 8 9 10	<i>functions of the placenta – one mark per line</i>  ref to barrier between blood systems / prevention of maternal and fetal blood mixing ; <i>idea that</i> protection against mother's immune system ; supply of oxygen (to fetus) ; loss of carbon dioxide (from fetus) ; loss of, urea / waste ; <b>R</b> urine protection against, pathogen(s) / named pathogen(s) ; <b>A</b> disease transfer of antibodies (from mother) ; supply of, nutrients / named nutrient(s) ; <b>ignore</b> 'food' supply / removes, water ; secretes, hormone(s) / named hormone(s) ;	[max 3]	award one mark for idea of exchange if no ref. to any substance <b>R</b> breathing  progesterone / oestrogen / HCG
(c)	<b>A</b> – dilates / widens / expands / stretches ; <b>B</b> – contracts ;	[2]	<b>ignore</b> 'relaxes' / 'opens'

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Question	Expected answers	Mark	Additional Guidance
(d)	<p><i>advantages to max 3</i></p> <p>provides, best / complete / most suitable / AW, food ;  easy to digest ;  no additives ;  contains antibodies / ref. to colostrums / provides passive immunity ;  provides protection against, pathogens / diseases / microorganisms ;  further detail, e.g. diseases that the mother has had / common diseases ;  sterile / no risk of infection from, formula milk / bottled milk ;  is at, body / correct, temperature ;  no preparation / always available ;  bonding with mother ;  it's free / 'cheap' ;  reduce risk of allergies ;  protects against, breast cancer / ovarian cancer ;  helps the body to return to 'normal' ; e.g. weight loss / restores uterus  contraceptive effect ;</p> <p><i>possible disadvantages to max 3</i></p> <p>transfer of, viruses / HIV / hepatitis B ;  painful / sore nipples / mastitis ;  stressful / may be embarrassing / AW ;  mother may not be able to produce enough milk ;  cannot see how much baby has consumed ;  task cannot be shared with other parent ;  medications / drugs / alcohol, can pass to baby ;</p> <p>AVP ;</p>	[max 4]	<p><b>A</b> any suitable comment about nutrients  <b>A</b> right composition for humans</p> <p><b>A</b> temporary immunity / AW  <b>A</b> named microorganism(s) <b>R</b> 'fights'  disease</p> <p><b>A</b> less likely to get diarrhoea</p>
		<b>[Total: 13]</b>	



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Question	Expected answers	Mark	Additional Guidance
4 (a)	<p><b>A – B</b></p> <p>1 urea (concentration) decreases ;</p> <p>2 water (content) increases / decreases ;</p> <p>3 salt (concentration), decreases ;</p> <p>4 ref to, glucose / sugar ; <i>could be increase, decrease or stays the same</i></p>	[max 2]	<p><b>A</b> 'passes out of blood' / 'passes into blood' / removed / taken out / diffuses in / diffuses out</p> <p><b>A</b> minerals / any named salt or ion</p>
(b)	<p><i>advantages of transplants</i></p> <p>1 long term solution / person no longer needs (regular) dialysis ;</p> <p>2 an example of a disadvantage of dialysis ;</p> <p><b>A</b> pain / tiring / discomfort / takes a long time / fails eventually</p> <p>3 increased freedom / better quality of life / ora ;</p> <p>4 better / more efficient, control of composition of blood ;</p> <p>5 can have wider diet / ora ;</p> <p>6 ref. to cost or economic benefit – to health service or to individual ;</p>	[max 3]	<p><b>A</b> 'doesn't need to go to clinic / hospital'</p> <p><b>MP2</b> is medical issue <b>A</b> any appropriate blood borne disorder</p> <p><b>MP3</b> is social issue</p> <p><b>MP6 R</b> cost unqualified</p> <p><b>A</b> 'dialysis machine available for others'</p>
(c) (i)	<p><math>I^A I^O \times I^B I^O</math> ;</p> <p><math>I^A</math> , <math>I^O</math> + <math>I^B</math> , <math>I^O</math> ;</p> <p><math>I^O I^O</math> , (blood group) O ;</p> <p>(allele) <math>I^O</math> recessive to <math>I^A</math> <u>and</u> <math>I^B</math> ;</p> <p>parents must both, have <math>I^O</math> / O / be heterozygous ;</p> <p style="text-align: right;"><i>accept:</i> AO x BO ;</p> <p style="text-align: right;">A , O + B , O ;</p> <p style="text-align: right;">OO , (blood group) O ;</p> <p style="text-align: right;">(allele) O recessive to A <u>and</u> B ;</p>	[max 4]	<p><b>R</b> one I for the genotypes, e.g. <math>I^{AO}</math></p> <p>gametes must be derived correctly from the parental genotypes</p> <p>written explanation may be written in terms of parents pass on the allele <math>I^O</math></p> <p><b>ignore</b> gene for allele</p>
(ii)	25% / 0.25 / ¼ / 1 in 4 ;	[1]	<b>R</b> a ratio e.g. 1:3
<b>[Total: 10]</b>			

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Question	Expected answers	Mark	Additional Guidance										
5 (a)	$6\text{CO}_2 + 6\text{H}_2\text{O} ; \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 ;$ correctly balanced ; if no marks for the balanced equation allow one mark for correct word equation if given	[3]	<i>correct equation = 3 marks</i> <i>if formulae of molecules are correct but equation is not correctly balanced = 2 marks</i> <i>with one mark for each side of the equation</i>										
(b)	<table border="1"> <thead> <tr> <th>features</th> <th>functions</th> </tr> </thead> <tbody> <tr> <td><b>A</b></td> <td>transparent to allow light to penetrate into the leaf</td> </tr> <tr> <td><b>B</b></td> <td> <i>max one</i>            open / close, stoma(ta) ;            allow movement of, gas(es) / oxygen / carbon dioxide / <u>water vapour</u> ;            allows / controls rate of, transpiration ;  <b>ignore</b> gas exchange / movement of air         </td> </tr> <tr> <td><b>C</b></td> <td>absorbs light / photosynthesis / starch <i>or</i> sugar production ;</td> </tr> <tr> <td><b>D</b></td> <td>buoyancy / floating / diffusion <i>or</i> movement of gas <i>or</i> named gas ;</td> </tr> </tbody> </table>	features	functions	<b>A</b>	transparent to allow light to penetrate into the leaf	<b>B</b>	<i>max one</i> open / close, stoma(ta) ; allow movement of, gas(es) / oxygen / carbon dioxide / <u>water vapour</u> ; allows / controls rate of, transpiration ; <b>ignore</b> gas exchange / movement of air	<b>C</b>	absorbs light / photosynthesis / starch <i>or</i> sugar production ;	<b>D</b>	buoyancy / floating / diffusion <i>or</i> movement of gas <i>or</i> named gas ;	[3]	<i>if more than one function given in a box, take the first answer. If this is contradicted by the second answer then award 0.</i> <b>A</b> controls size of stoma(ta) <b>A</b> for (named) gas to, enter / leave <b>ignore</b> gas exchange <b>R</b> gas(es) in and / or out
	features	functions											
	<b>A</b>	transparent to allow light to penetrate into the leaf											
	<b>B</b>	<i>max one</i> open / close, stoma(ta) ; allow movement of, gas(es) / oxygen / carbon dioxide / <u>water vapour</u> ; allows / controls rate of, transpiration ; <b>ignore</b> gas exchange / movement of air											
<b>C</b>	absorbs light / photosynthesis / starch <i>or</i> sugar production ;												
<b>D</b>	buoyancy / floating / diffusion <i>or</i> movement of gas <i>or</i> named gas ;												

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Question	Expected answers	Mark	Additional Guidance
(c) 1 2 3 4 5 6 7 8	large air spaces / large spongy mesophyll ; <b>A</b> alternatives for large for, buoyancy / floating ; leaves float ; efficient at absorbing light / 'gets more light' / AW ; stomata in upper, surface / epidermis ; <b>A</b> ora diffusion / movement, of gas / gases (from the air) ; <b>R</b> 'stops entry of water' thin cuticle ; no need to reduce water loss by transpiration ;	[2 max]	<i>mark first 'way' only</i> <i>marking points are in pairs – only one pair is needed to gain the two marks</i> <b>ignore</b> gas exchange in this question  <b>A</b> 'top of the leaf' / 'at top' <b>R</b> transpiration ref.  <b>ignore</b> ref. to stomata on lower surface and uptake of water
(d) (i)	<i>effect of decreasing concentration of magnesium salt</i> fewer plants / smaller number of plants / reduction in number / less (asexual) reproduction ; <b>R</b> ref. to survival  <i>data quote</i> number of plants from two stated concentrations with unit ;  plants, were yellow / had yellow spots (at lower concentrations) / ora ; ref. to yellow spots at 0.15 or 0.10 / nearly all yellow at 0.05 mg dm <sup>-3</sup> ;	[max 3]	must be a clear statement that this is about the number of plants, do not accept numbers alone for this point  <b>A</b> 'highest' and 'lowest' concentrations without units
(ii) 1 2 3 4	magnesium required for making <u>chlorophyll</u> ; <u>chlorophyll</u> gives (leaves) green colour / without <u>chlorophyll</u> (leaves) are yellow ; less photosynthesis / cannot produce (much), food / glucose ; (so) less, food / glucose / AW, therefore less growth ;	[max 3]	<b>A</b> 'magnesium is needed for chlorophyll' <b>A</b> (less magnesium) less chlorophyll is made  <b>A</b> 'no photosynthesis' <b>R</b> chlorophyll is needed for photosynthesis <b>A</b> 'no food, therefore no growth'
<b>[Total: 14]</b>			

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6 (a) (i)	<i>either</i> insects 1 and 2, are in the same <u>genus</u> / have the same <u>generic</u> name ; (both have) <i>Vespula</i> ; <i>or</i> insect 3 is in a different <u>genus</u> ; (its name is) <i>Callicera</i> ;	[max 2]	<b>ignore</b> any references to the species
(ii)	<i>insects 1 and 2</i>  have two pairs of wings ; have antennae that are, long(er) / same shape / thick ; have small(er) eyes ; have stripes / have a pattern / have similar markings ; any correct reference to size ; e.g. 'they have similar size' AVP ; e.g. similar shape of abdomen	[max 2]	<b>R</b> any feature of 1 and 2 that is said to be 'similar' unless qualified <b>A</b> four wings <b>R</b> two wings <b>A</b> 'feelers' / bent shape  <b>R</b> stripes on thorax  <b>R</b> similar shape unqualified
(b)	predators / other animals, mistake it for, <i>Vespula</i> / <i>V. flavopilosa</i> ; predators / other animals, recognise, warning appearance / stripes / AW ; 'fear of' painful sting / frightened of being stung ; do not eat it / avoid it / do not attack it / do not go near it ;	[max 2]	
(c) 1 2 3 4 5 6 7 8	<u>mutation</u> ; gives stripes ; (some) stripey insects were not, eaten / killed (by, predators / other animals) ; survived ; to, breed / reproduce / mate ; pass on the allele(s) for stripes (to next generation) ; <b>A</b> gene(s) non-stripey insects, did not survive / became extinct / died out ; (natural) selection ; <b>A</b> ref. to selected for / selected against	[max 5]	<b>R</b> camouflage
<b>[Total: 11]</b>			