



Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

BIOLOGY (US)

0438/43

Paper 4 Theory (Extended)

May/June 2016

MARK SCHEME

Maximum Mark: 80

Published

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 should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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Abbreviations used in the Mark Scheme

- ; separates marking points
- / separates alternatives within a marking point
- **R** reject
- **ignore** mark as if this material was not present
- **A** accept (a less than ideal answer which should be marked correct)
- **AW** alternative wording (accept other ways of expressing the same idea)
- underline words underlined (or grammatical variants of them) must be present
- **max** indicates the maximum number of marks that can be awarded
- **mark independently** the second mark may be given even if the first mark is wrong
- **ecf** credit a correct statement that follows a previous wrong response
- () the word / phrase in brackets is not required, but sets the context
- **ora** or reverse argument
- **AVP** any valid point

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Question	Answer	Mark	Guidance
1 (a)	function	letter	name
	structure that makes sounds	A	larynx
	bone that provides protection for the lungs	E	rib ;
	airway that allows passage of air only into the right lung	J	bronchus ;
	airway that allows passage of air into both lungs	B	trachea ;
	contracts to increase the volume of the thorax	F/G	(F) diaphragm / (G) external intercostal muscle ;
	muscle that contracts to lower the ribcage	K	internal intercostal muscles ;
	site of gas exchange	M	alveoli ;
		[6]	
(b)	keeps, airways / trachea / bronchi, open ; allows (free flow of) air into (the lungs) ; allows flexibility / can breathe even when, bent / swallowing / AW ; AVP ;	[max 2]	I protection
(c) (i)	(aerobic) respiration ;	[1]	R anaerobic respiration
(ii)	rate (of breathing) increases ;	[1]	R it increase A it's faster / deeper

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Question	Answer	Mark	Guidance
(iii)	stimulus (is CO ₂); A acidic / pH, of blood decreases ; (CO ₂ / pH) detected by the brain ; by a receptor ; ref to (named) neurone in context ; brain sends impulses to, (intercostal) muscles / diaphragm / effectors ; (intercostal) muscles / diaphragm / effectors, contract more (frequently) ; negative feedback / homeostasis ; reflex / automatic / involuntary ;	[max 3]	
		[Total: 13]	

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Question	Answer	Mark	Guidance
2 (a) (i)	retina ;	[1]	
(ii)	optic (nerve);	[1]	I sensory neurone
(iii)	(light is) refracted ;	[1]	A description of refraction
(iv)	sensitive to / detect, light ; in low intensity / night ; pass impulse to, <u>sensory</u> neurone / optic nerve ; AVP ;	[max 2]	sensitive in dim light = 2 marks A provides night vision
(b) (i)	gravity ;	[1]	
(ii)	negative / away from (gravity) ; (gravi)tropism / (geo)tropism ;	[2]	

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Question	Answer	Mark	Guidance
(iii)	<p><i>upwards</i> grow towards (where) light (should be); more, light absorbed / photosynthesis ; more growth ; flowers more likely to attract, insects / pollinators ; more likely to, release / shed / disperse, seeds ;</p> <p><i>downwards</i> better, anchorage / AW ; absorb, water / mineral ions ;</p> <p>AVP ; ref to competition / damage</p>	[max 2]	
(iv)	<p>auxins <u>made</u> in shoot tip ; (auxin) <u>spread</u> / move / diffuse ; <i>idea of</i> unequal distribution of auxin ; auxins collect, in <u>lower</u> side of stem ; auxin stimulates (cell) elongation (where it accumulates) ; AVP ;</p>	[max 4]	<p>I found in tip</p> <p>I growth e.g. (by) absorption of water (by osmosis) / ref to turgor pressure (and) stretching of cell walls / statoliths / detect gravity</p>
		[Total: 14]	

Question	Answer	Mark	Guidance									
3 (a)	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="background-color: #cccccc;">gametes</td> <td style="background-color: #cccccc;">X</td> <td style="background-color: #cccccc;">X</td> </tr> <tr> <td>X</td> <td>XX</td> <td>XX</td> </tr> <tr> <td>$\text{Y};$</td> <td>XY</td> <td>XY;</td> </tr> </table> <p>offspring ratio = 1:1/50:50/50% male, 50% female/2:2 ;</p>	gametes	X	X	X	XX	XX	$\text{Y};$	XY	XY;	[3]	
gametes	X	X										
X	XX	XX										
$\text{Y};$	XY	XY;										
(b) (i)	<p>cat 1 $X^bY;$</p> <p>cat 4 $X^BY;$</p> <p>cat 5 $X^BX^B;$</p>	[3]										
(ii)	<p>distinct, phenotypes / coat colours / categories ;</p> <p>no (continuous) range of colour /AW;</p> <p>controlled by genes ;</p> <p>not affected by the, environment /AW/named example ;</p>	[3]	<p>A only orange, black and calico</p> <p>A inherited</p>									
		[Total: 9]										

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Question	Answer	Mark	Guidance
4 (a) (i)	iodine solution diffused, into the bag/through the (Visking) tubing ; iodine molecules <u>small</u> (enough to pass through the membrane) ; iodine solution stains starch ora ; no starch diffused, out of the bag/through the (Visking) tubing ; starch molecules too <u>large</u> (to pass through the membrane) ; ref to pore / AW, size ;	[max 4]	I osmosis
(ii)	temperature ; (surface) area ; concentration (gradient)/water <u>potential</u> ; size / type, of molecule ; thickness / distance, across membrane / permeability (of membrane) ; pressure ; (number of) protein, channels / pumps / AW ; energy / number of mitochondria ;	[max 3]	I distance / thickness unqualified
(b) (i)	<i>from muscle cell</i> (produced in) mitochondrion ; diffused ; (diffused) in cytoplasm / tissue fluid / (blood) plasma ; through membrane ; through capillary wall ; <i>from blood:</i> vein / vena cava / pulmonary artery / heart ; travels to lungs ; into alveoli ; exhaled / breathed out / excreted ;	[3]	A red blood cell I exit the body unqualified

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Question	Answer	Mark	Guidance
(ii)	<p>thin, wall / epithelium ; for efficient, diffusion / gas exchange ;</p> <p>small, diameter / lumen ; idea that many capillaries can fit into tissues / capillaries reach (every cell) throughout the body / relative size to red blood cell ;</p> <p>extensive network ; large surface for diffusion ;</p> <p>capillary cells have pores ; to allow substances to pass in and out of the blood easily ;</p>	[max 3]	<p>adaptations must be linked to correct feature max 2 for features only</p> <p>A one cell thick R 'thin cell wall'</p>
(c)	<p>diffusion ; down concentration gradient ;</p> <p>(diffuses) through stoma / stomata ; (through) (intercellular) air space / (between) spongy mesophyll ; into / reached, palisade, mesophyll / cell ; chloroplast ;</p> <p>AVP ; e.g. dissolve / diffuse, through cell wall / cell membrane / cytoplasm</p>	[max 4]	<p>A lower concentration of carbon dioxide inside leaf / ora ;</p> <p>A into guard cell / spongy, mesophyll / cell I chlorophyll</p>
		[Total: 17]	

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Question	Answer	Mark	Guidance
5 (a)	timber / paper, manufacture / AW ; firewood ; <i>clearance for</i> agriculture ; urbanisation / roads / housing / factories / industry / leisure developments ; extraction of minerals / for other natural resources ;	[max 3]	A wood unqualified A fuel
(b) (i)	$118\,545 - 90\,883 = 27\,662$ $\frac{27\,662}{118\,545} \times 100$; 23.3(3459) ; 23 (%) ;	[3]	
(ii)	Indonesia has lost the most forest ora ; 9% (8.7%) compared with 23% in Indonesia ; Indonesian forest has continued to be lost, whereas loss in Malaysia has slowed between 2005 and 2010 ; comparative use of figures with units ;	[max 3]	A 14% more in Indonesia ecf from (b)(i)
(iii)	planted forest, has one (dominant) species / is a monoculture ; loss of <u>biodiversity</u> ; qualification of biodiversity loss ; (plantation) susceptible to pest / disease ; nutrients removed / soils become infertile ; <i>ref to alien / foreign / invasive / non-indigenous species ;</i> AVP ; e.g. vegetation is removed / lower canopy / all immature	[max 3]	e.g. habitats / example / extinction of a species I homes / organisms die A use of chemicals

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Question	Answer	Mark	Guidance
(c)	<p><u>roots</u> die so do not bind the soil ; loss of soil / soil erosion ; silting of rivers ; reduced (soil) fertility ; no trees to absorb the water ; increased risk of flooding ; increased rate of evaporation / land is exposed to drying ; desertification / decreased soil water ; loss of, habitat / places where organisms live / described ; disruption to food chain / described ; endangered / extinction, of species or loss of biodiversity ; AVP ; named example of affected 'land' organism in context / removed trees cause nutrient cycling disruption / lack of decomposition</p>	[max 6]	<p>A landslides A loss of, minerals / ions / nutrients A mudslides A drought / decreased rainfall I home I organisms die</p>
		[Total: 18]	

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Question	Answer	Mark	Guidance
6 (a)	V stomach ; W large intestine / colon / rectum ;	[2]	I intestine unqualified
(b)	breaks up food into small(er) pieces ; without chemical change ; by teeth / muscles ; to mix (with digestive juice) ; increases surface area ; for enzyme action ; speeds up <u>chemical</u> digestion ; easier to swallow ;	[3]	R molecules A without enzymes A mastication / chewing / churning A easier / more effective
(c)	<i>for:</i> positive correlation / as (relative) body mass increases, time in digestive system increases ; any two or more figures from the graph ; <i>against: max 3 from</i> two / one / few / some (species), are outliers / anomalies ; any figure(s) from the graph ; (description of) some mammals do not fit the, pattern / trend ; any example from the graph ; only information about 26 species of mammal / small sample size ; idea about unknown validity ;	[max 4]	units must be quoted at least once e.g. either outlier quoted
		[Total: 9]	