CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

MARK SCHEME for the May/June 2014 series

5090 BIOLOGY

5090/21 Paper 2 (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 should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the May/June 2014 series for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level components and some Ordinary Level components.

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Mark schemes will use these abbreviations:

- **;** separates marking points
- **/** alternatives
- **()** contents of brackets are not required but should be implied
- **R** reject
- **A** accept (for answers correctly cued by the question, or guidance for examiners)
- **AW** alternative wording (where responses vary more than usual)
- **AVP** alternative valid point (where a greater than usual variety of responses is expected)
- **ORA** or reverse argument
- **underline** actual word underlined must be used by candidate (grammatical variants excepted)
- **max** indicates the maximum number of marks that can be given
- **+** statements on both sides of the + are needed for that mark

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Section A			
Question	**Expected Answer**	**Mark**	**Guidance**
1 (a) (i)	red (blood cell) ; absorb / carry / transport oxygen / transport CO_2 ;	[2]	 **R** carry substances **Ig** contain haemoglobin
(ii)	thinner in middle / ref. biconcave ; ref. haemoglobin ; more (haemoglobin) at edges than at centre ; light more easily able to pass through centre ; lack of nucleus ;	[3]	
(b) (i)	**B** – white blood cell (phagocyte) **C** – white blood cell (lymphocyte) ;	[1]	

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(b) (ii)	**problem:** reduced immunity / immune response / less able to fight infection / kill microorganisms or pathogens / more likely to suffer (infectious) disease* ;	[1]	**A** named diseases **R** leukaemia **A** bacteria / virus / fungi **Ig** germs
	explanation: ref. phagocytosis ; ref. antibody production ; microorganisms / pathogens/bacteria/viruses / remain in blood / body / not destroyed ; more likely to succumb to (infectious) disease* AW ;	[3]	Max. 3 for explanations. * accept once only in either place
	Total	**[10]**	

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Question	Expected Answer	Mark	Guidance
2 (a)	carbon dioxide + oxygen ;	[1]	**A** CO_2 and O_2
(b) (i)	thicker in mammals / ora ; by 2.5 times / use of comparative figures ;	[2]	**A** 0.2 µm and 0.5 µm
(ii)	(thinner barrier) results in faster/greater gas exchange / diffusion ; more oxygen supplied / more carbon dioxide removed ; ref. (aerobic) respiration ; ref. increased (respiration) ; ref. muscles ;	[3]	
	Total	**[6]**	

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Question	Expected Answer	Mark	Guidance
3 (a)	peristalsis ; muscles ; circular ; contract ; behind food ; longitudinal ; relax + ref to food ; pushing (bolus / AW) ; wave action / rhythmic ;	[4]	
(b)	less digestion ; of protein ; ref. protease / pepsin ; (enzyme) no / reduced activity ; (stomach) change in pH (if direction stated must be correct) / acidity / less acid ; ref. fewer microorganisms / bacteria / pathogens killed ;	[4]	**A** work best in acid conditions **R** drug neutralises the acid

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(c) (i)	antibiotic ;	[1]	**A** named antibiotic, e.g. metronidazole, tetracycline
(ii)	ref. resistant (bacteria) ; can multiply / reproduce/increase in number (again) ; pain / symptoms can recur / ulcer continues to grow AW ; ref. unable to kill / remove resistant bacteria using same antibiotic / bacteria tolerant / AW ;	[3]	**R** ref. immunity
	Total	**[12]**	

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Question	Expected Answer	Mark	Guidance
4 (a) (i)	root + hair / epidermis ;	[1]	
(ii)	osmosis / diffusion ; high water conc. to low(er) water conc. / down water potential gradient / hypotonic to hypertonic ; through / across partially permeable (AW) ; membrane ;	[3]	**R** active transport
(b) (i)	**(at Y)** (initial) increase in O_2 concentration leads to increase in uptake ; **(at X or Z)** (further) increase in O_2 concentration leads to no increase in uptake ;	[2]	
(ii)	**process during section X:** diffusion ; **process during section Y:** active transport / active uptake ; **explanation:** (during) X / diffusion + passive / not energy-requiring ; (during) Y / active transport + requires energy ; (energy for active transport from) respiration ; respiration requires oxygen ;	[5]	Max. 3 for explanations. **Ig** against concentration gradient
(iii)	rate of (ion) uptake dependent on another / other factor(s) / named factor e.g. temperature / ref. other limiting factor ;	1	
	Total	**[12]**	

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Question	Expected Answer	Mark	Guidance
5 (a) (i)	**tree:** producer / 1st / 1 ; **caterpillar:** (primary / 1st order) consumer / herbivore / 2nd / 2 ;	[2]	
(ii)	correct shape ; correctly labelled with names of organisms / trophic levels ;	[2]	
(iii)	base (of pyramid) narrower / correct shape drawn ; ref. relative numbers of consumers ; one tree ;	[2]	**A** labelled on diagram
(b)	*Accept reverse arguments for marking points.* less energy required ; to raise body temperature / keep body warm / thermoregulation ; ref. movement ; ref. less muscle activity/use ; ref. respiration ; more energy available + increase biomass/grow ; (farmer) increased productivity / profit / lower feeding costs / (consumer) lower cost to buy ;	[4]	**lg** ref to predators / disease **lg** ref. energy production animals grow faster AW
	Total	**[10]**	

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Section B			
Question	**Expected Answer**	**Mark**	**Guidance**
6 (a)	maintenance of / constant ; internal environment / conditions within the body ;	[2]	**A** regulating / control **Ig** specific examples
(b) (i)	low temperature detected ; by receptors / sensors on skin ; brain ; *any two corrective mechanisms from* shivering / hairs raised / sweating reduced/stopped / vasoconstriction of blood vessels (**R** of capillaries) ;; temperature rises again ;	[4]	 **A** hypothalamus
(ii)	(colon) water absorbed into blood ; rise / excess (in water content of blood) detected ; excess water excreted / removed / more urine produced AW ; by kidney ; correct ref. ureter / bladder / urethra in correct context ;	[4]	 **A** ref. hypothalamus **A** correct ref. to ADH **A** nephron
	Total	**[10]**	

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<table>
<tr><th>Question</th><th>Expected Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>7 (a)</td><td>
<table>
<tr><th>Mitosis</th><th>Meiosis</th></tr>
<tr><td>2 daughter cells</td><td>4 daughter cells</td></tr>
<tr><td>haploid</td><td>diploid</td></tr>
<tr><td>chromosome number maintained</td><td>chromosome number halved</td></tr>
<tr><td>occurs in all organs / body cells</td><td>occurs in gamete producing organs / named</td></tr>
<tr><td>produces body cells / used in growth</td><td>produces gametes / named</td></tr>
<tr><td>ref. asexual reproduction</td><td>ref. sexual reproduction</td></tr>
<tr><td>no genetic variation in offspring AW</td><td>genetic variation in offspring AW</td></tr>
</table>
</td><td>[4]</td><td>All points must be comparative to gain credit.</td></tr>
<tr><td>(b)</td><td>Father ;

Max 5 from the following:
father is XY / contains Y chromosomes ;

mother is XX / does not contain Y chromosomes ;

father produces sperm with either X or Y (chromosomes) ;

mother produces eggs only with X (chromosomes) ;

sex depends on which sperm fertilises the egg ;

1:1 male : female in offspring / AW ;</td><td>[1]

[5]</td><td>

A marks in Punnett Square</td></tr>
<tr><td></td><td>Total</td><td>[10]</td><td></td></tr>
</table>

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Section C			
Question	**Expected Answer**	**Mark**	**Guidance**
8 (a)	animals cannot manufacture own food / not producers / AW ; (photosynthesis) converts light energy into chemical energy ; (in the form of) carbohydrate (**A** named carbohydrate) ; correct ref. to another dietary component ; ref. carbon cycle / carbon in CO_2 made available to humans ; (humans) eat food / AW ; digested ; assimilated / built up to form other chemicals (in humans) ; provides energy (to humans) ; ref. human respiration ; requires O_2 + from photosynthesis ; CO_2 used in photosynthesis + removal from atmosphere ; ref. farming + livelihood/profit / commercial use of plant products ;	[6]	 **A** as equation **A** ref. to food chains **A** depend on food produced by plants **A** e.g. wood for housing, medicines, etc.

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(b)	**magnesium:** yellow + leaves / stunted growth ; chlorophyll production ; **nitrate:** EITHER stunted growth ; protein synthesis*; OR yellow + leaves ; chlorophyll production*;	[4]	**A** description of stunted growth * reason must match appearance to score both marks **A** ref. to amino acids, etc.
	Total	**[10]**	

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Question	Expected Answer	Mark	Guidance
9 (a)	**bread:** fungus / yeast ; fermentation / (anaerobic) respiration ; CO_2 production + dough rises / improves texture of bread ; **yoghurt:** bacteria/bacterium / *Lactobacillus* ; (milk sugar / lactose) to lactic acid ; (lactic acid) thickens / clots milk / gives sour taste ;	[4]	

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(b)	*Penicillium*; sterilised + prevent contamination AW ; substrate / nutrient medium / culture medium ; protein / amino acids provided ; for growth ; carbohydrate / glucose provided ; for respiration / ref. energy ; supply of oxygen / air ; ref. sparger + bubbles or ref. surface area / paddles + stirring ; ref. control of temp ; ref. control of pH ; extraction / filtration / purification / crystallisation ;	[6]	**A** named carbohydrate **A** 25–45 °C / pH 5–8 if stated
	Total	**[10]**	

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