CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

MARK SCHEME for the May/June 2014 series

5090 BIOLOGY

5090/22 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.

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	Expected Answer	Mark	Guidance
1 (a)	3 named substances, e.g. water salts / ions / named, e.g. Na^+, Cl^-, NH_4^+, Ca^{2+} urea / nitrogenous waste / other named ;	[3]	**A** any other 3 correct substances, e.g. hormones, pigments, enzymes **R** sugar / glucose **A** any three named ions for 3 marks **A** any three named nitrogenous waste products for 3 marks, e.g. creatinine, uric acid
(b)	more protein / ORA ; correct ref. amino acids / ORA ; broken down in / converted by liver / deamination ; less water / more salts / ions + in diet / ORA ; (urine) more concentrated / more urea in (urine) / ORA ;	[4]	**Ig** ref. to specific foods **A** ref. glucose / sugar only with ref. to diabetes

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(c)	drink **A** ; increases volume of / more water in + urine / produces most / lot of / more urine ; water already being lost in sweat / AW ; (sweating) more than usual ; ref. temperature regulation / to reduce body temperature / keep cool / AW ; danger of dehydration / increases thirst / AW ;	[1] [4]	Mark independently of drink named **Ig** ref. heat loss in urine
	Total	**[12]**	

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<table>
<tr><th colspan="2">Expected Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>2 (a)</td><td>
<table>
<tr><th>combination of letters on each occasion</th><th>number of times each combination of letters is recorded</th></tr>
<tr><td>A and A</td><td>20</td></tr>
<tr><td>A and a</td><td>40</td></tr>
<tr><td>a and a</td><td>20</td></tr>
</table>
</td><td>[1]</td><td></td></tr>
<tr><td>(b)</td><td>expected are theoretical or statistical / spinning is random or due to chance ;

disc poorly made / toothpick doesn't pass through middle / AW;

error in counting ;</td><td>[2]</td><td>Ig wind / force of spin
A 'it' is random</td></tr>
<tr><td>(c) (i)

(ii)

(iii)</td><td>parents (cells) / genotypes / gonads or both named ;

meiosis / reduction division / gamete (formation) / fertilisation ;

genes / alleles / chromosomes / gametes ;</td><td>[3]</td><td>

R genotype</td></tr>
</table>

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(d)	Correct alleles, A, B and O (with or without I) ; one disc with A and B and one disc with A and O ; each disc with correct numbers of alleles, i.e. 3 for discs given in question ; representing father and mother ; spin several / many times ; results recorded / counted ;	[5]	 e.c.f. with letters used in point 1 **R** if either parent has wrong alleles
	Total	**[11]**	

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Expected Answer		Mark	Guidance
3 (a)	self (–pollination) ;	[1]	
(b) (i)	(carried by) <u>wind</u> ; pollen to stigma ; of another (wheat) plant / flower ; correct ref. to cross-pollination (now being possible) ;	[3]	**Ig** ref. to animals
(ii)	wind can't carry / can't be carried far / reduced dispersal ; too much dependence on self-pollination / lack of (genetic) variation AW ; wind may not be blowing (over short time period) ; reduces chances of pollination / fertilisation ;	[2]	**R** if ref. to seed / fruit

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(c) (i)	genetic engineering / genetic modification ;	[1]	**Ig** gene transfer / biotechnology
(ii)	(bacteria) fix / convert / change / turn ; atmospheric / soil nitrogen ; (to) ammonium ; (to) nitrates ; (to make) amino acids / proteins ; (nitrates) absorbed / (amino acids or proteins) used by plants ;	[5]	**R** ammonia
	Total	**[12]**	

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<table>
<tr><th colspan="2">Expected Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>4 (a)</td><td>
<table>
<tr><th>structure identified by letter</th><th>name of structure</th><th>carries urine (yes or no)</th><th>carries sperms (yes or no)</th></tr>
<tr><td>F</td><td><u>ureter</u></td><td>yes</td><td>no</td></tr>
<tr><td>G</td><td><u>urethra</u></td><td>yes</td><td>yes</td></tr>
<tr><td>H</td><td><u>rectum</u></td><td>no</td><td>no</td></tr>
<tr><td>J</td><td>vas deferens / sperm duct</td><td>no</td><td>yes</td></tr>
</table>
</td><td>[4]</td><td>1 mark per correct row ;

spelling of <u>ureter</u> and <u>urethra</u> must be correct</td></tr>
<tr><td>(b)</td><td>line drawn across sperm duct ;

line drawn across oviduct ;</td><td>[2]</td><td>R if more than one line drawn on each Fig.– unless across same structure
R if more than one structure cut
Ig skin cuts</td></tr>
<tr><td>(c)</td><td>closes / restricts AW the urethra ;

adverse effect on urination AW ;</td><td>[2]</td><td>Ig ref bladder

Ig refs to pain on urination</td></tr>
<tr><td colspan="2">Total</td><td>[8]</td><td></td></tr>
</table>

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Expected Answer		Mark	Guidance
5 (a) (i)	photosynthesis / synthesis of carbohydrate / synthesis of protein ; transpiration / water loss / evaporation ; respiration ; translocation ; osmosis / diffusion ; gas exchange ;	[2]	
(ii)	lack of (available) water ; transpiration / evaporation / water loss + reduced ;	[2]	
(b) (i)	stoma(ta) / guard cell(s) ;	[1]	
(ii)	none / fewer on leaves ; passage of O_2 / CO_2 / water <u>vapour</u> / gas exchange ; for respiration / photosynthesis / transpiration ;	[2]	i.e. not just a CO_2 / O_2 / water vapour ref.
	Total	**[7]**	

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Expected Answer		Mark	Guidance
6 (a)	muscles in humans / no muscles in plants ; ref. intercostals / diaphragm ; humans need to keep (constant) supply of O_2 (to blood) / remove CO_2 (from blood) / ref. higher metabolic rate / rate of respiration in humans ; ref. production of (some of their own) oxygen by photosynthesis ; lungs / no lungs ; ref. stomata/spongy mesophyll in plants / not in humans / ref. alveoli in humans / no alveoli in plants ;	[3]	(N.B. intercostal ; muscles ; will score 2 marks)

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(b)	*(High respiration rate)* humans active / move / muscle + action (or described) / ORA ; requires large quantities of / more + energy / ORA ; high body temperature in humans / ORA ; activity of enzymes / high metabolic rate / ORA ; humans complex / named organs, e.g. brain, kidneys, heart ; *(Constant respiration rate)* homeostasis ; temperature constant in humans / thermoregulation ; rate dependent on external temperature in plants ; rate dependent on stage of life cycle, e.g. germination / growing season ;	[7]	**R** humans are larger
	Total	**[10]**	

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	Expected Answer	Mark	Guidance
7 (a)	*Viruses* DNA or RNA **both** must be noted for mark and as possibilities; parasitic / disease causing AW / reproduce only in host cell ; *Bacteria* contain DNA ; saprotrophic / decomposers AW ; ref. binary fission / asexual reproduction / mitosis ; *Comparative points* protein coat / no protein coat ; not truly living / living ; no (cell) wall / (cell) wall ; no spores / forms spores ; no cytoplasm* / cytoplasm ; not affected by / affected by antibiotics ; size comparison ;	[6]	*Accept points on labelled diagrams* **A** harmful / active only in host cell **Ig** loop / strand / RNA **R** protein wall **A** acellular **Ig** composition of the wall ***A** no ribosomes / protoplasm / flagella / plasmid / cell membrane ORA **R** nucleus / mitochondria viruses less than 300 nm – bacteria c. × 50 larger **A** viruses small(er) than bacteria

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(b)	decomposition / decay / putrefaction ; saprotrophic ; release enzymes / ref. external digestion ; insoluble to soluble ; example of macromolecule and breakdown product, e.g. protein to amino acids ; respiration ; CO_2 released + photosynthesis ; water released + later use ; nitrification ; NH_4^+ / NO_2^- / NO_3^{2-} ; salts for plant uptake ;	[4]	 **A** saprophytic **A** named enzyme **R** ammonia / NH_3
	Total	**[10]**	

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	Expected Answer	Mark	Guidance
8 (a)	muscles ; circular ; contract ; behind food ; longitudinal ; relax behind food / contract in front of food ; pushing / forcing / squeezing (bolus / AW) ; wave action / rhythmic ;	[6]	**R** if mention of parts outside of alimentary canal, e.g. trachea **R** if mention of contraction of longitudinal muscles behind food **Ig** moving
(b)	its muscles work on their own ; muscle not arranged in pairs / ORA ; no flexor / ORA ; no extensor / ORA ; no muscle relaxes when it contracts / ORA ; not attached to bones / ORA ; does not cause movement at a joint / ORA ;	[4]	**A** ref. to one muscle
	Total	**[10]**	

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Expected Answer		Mark	Guidance
9 (a) (i)	obesity ; strain on skeleton / effect on joints ; strain on heart / pumps harder / pumps faster ; breathing difficulties ; risk of diabetes ; social implications / example, e.g. bullying, clothing ; atheroma / AW ; high blood pressure ; heart disease / heart attack / other cardiovascular condition / AW ;	[5]	**R** ref. in veins / <u>on</u> arteries **Ig** blood vessels **A** cholesterol
(ii)	poor muscle development ; stunted / poor growth ; heart failure ; lack of / deficiency in one named protein, e.g. haemoglobin / antibodies / enzymes / hormones / thrombin ; AVP, e.g. reduced / deficient RBC production / poor wound healing / poor tissue / cell / organ repair / blood clotting / anaemia ;	[3]	Reference to a **negative** effect required.

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(b)	menstruation ; loss of blood ; haemoglobin ;	[2]	
	Total	**[10]**	

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