UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2010 question paper

for the guidance of teachers

0610 BIOLOGY

0610/31 Paper 31 (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.

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International Examinations

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

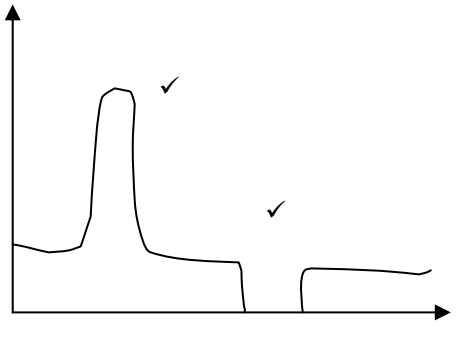
ref./refs. answer makes appropriate reference to

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

AW alternative words of equivalent meaning

MP marking point (number)

Question	Expected Answers	Marks	Guidance
1 (a)	detect / sense / feel / AW, changes (in the environment) / stimuli ; make response(s) / react ;	[max 2]	'a response to a stimulus' = 1 mark IGNORE an example as a definition asked for IGNORE 'sensitive'
(b) (i)	**A** cornea ; **B** iris ; **C** lens ; **D** suspensory ligaments ;	[4]	accept labels on Fig. 1.1 if not on answer lines **D** ACCEPT 'suspendary / suspendory' and other similar misspellings
(ii)	**do not allow any ecf from (b)(i)** *iris* controls / changes / adjusts, amount of light (entering the eye) ; controls / changes / adjusts, the size of the pupil ; protects, retina / light sensitive cells, from, bright / excess, light ; *ciliary muscle contracts to* change, focal length / thickness / shape, of lens ; (brings about) accommodation ; slacken the suspensory ligaments ;	[max 1] [max 1]	**R** 'pupil reflex' **A** circular muscles contract in bright light to protect the retina **A** radial muscles contract in dim light to help vision **A** stop retina from being bleached IGNORE size **A** change how light is refracted in the eye **A** contract and relax to focus the lens **A** relaxes to increase tension in suspensory ligaments
(c) (i)	*if these two responses are given the wrong way round award no marks, but look for ecf in **(d)*** **G** yellow spot / fovea ; **H** blind spot / optic disc ; A optic(al) nerve	[2]	

Question	Expected Answers	Marks	Guidance
(ii)	1 detects light of low <u>intensity</u> ; **A *ora*** 2 converts light to (electrical) <u>impulses</u> ; 3 provides night vision / work at night / work in dim light / 'see in the dark' ; 4 high sensitivity (to light) ; 5 give peripheral vision / described ; 6 gives black and white vision / gives shades of grey ; **A *ora***	[max 2]	 2 **R** signals / messages / pulses 3 **R** 'rods capture light' 4 **A** very sensitive (to light) / more sensitive than cones 5 e.g. not looking directly at object 6 *ora* = 'cannot see colour' / AW
(d)	*allow ecf from **(c)(i)** if G is blind spot and H is fovea* peak at **G** ; nothing at **H** ;  **G** **H**	[2]	look for these two points, ignore the rest of any line(s) drawn by the candidates mark independently 2 marks if only a peak at **G** ACCEPT lines that just go into **H** **R** one vertical line in **G**.
		[Total: 14]	

Question	Expected Answers	Marks	Guidance
2 (a) (i)	any time within the range 06.00 – 06.30 / 6.00 – 6.30 (am) ;	[1]	**A** in **(i)** and **(ii)** if 0600 etc
(ii)	08.00 / 8.00 (am) , 19.00 / 7.00 (pm) ;	[1]	**A** within range 18.45 to 19.00
(iii)	*one of the following* plant (only) respires rate of respiration > rate of photosynthesis no photosynthesis, only respiration ;	[1]	IGNORE anaerobic respiration (in plants) **A** only respire at night **R** 'respires instead of photosynthesises'
(iv)	1 (carbon dioxide) required for photosynthesis / making food / released in respiration ; 2 photosynthesis / food made, in day is greater than, respiration / food use / energy release, at night ; 3 so surplus food produced / surplus energy / growth is possible ; *ora* 2 if rate of uptake during the day and release at night are the same ; 3 no, growth / no surplus / no food / no glucose / no energy ; **A** not enough, for growth / food / glucose / energy	[max 2]	*note that CO_2 is in the question* **R** comments on [CO_2] in atmosphere ACCEPT descriptions of photosynthesis and respiration ACCEPT respiration and photosynthesis might balance
(b) (i)	*award two marks if the correct answer (12.56 / 12.6 / 13) is given if answer missing or incorrect, award one mark for correct working* (95.0 – 84.4 = 10.6) $\frac{10.6}{84.4} \times 100$ 12.56 / 12.6 / 13 ;;	[2]	

Question	Expected Answers	Marks	Guidance
(ii)	1 (taller plants / more leaves) = more yield ; *2 height* more, flowers / fruits / tomatoes / leaves ; 3 ref to competition for light / access to more light ; 4 *leaves* increase surface area ; 5 more, chlorophyll / chloroplasts ; 6 for, absorption / trapping, of light ; 7 more stomata for uptake of carbon dioxide ; 8 more photosynthesis ; 9 production of more, sugars / food / starch / AW ;	[max 3]	**look for idea of more / increase where indicated in some of the MPs** 1 question says 'affects' so description is OK 2 **A** more space for tomatoes to grow 3 more chance of pollination 9 **R** 'making energy'
(c)	1 planted at same time / same growing period / same age *or* size at planting ; *same* 2 species / variety / strain / type, of plant **;** **R** same seeds unqualified ; 3 soil type ; 4 soil pH ; 5 distance between plants / planting density ; 6 soil water / quantity of water applied / AW ; 7 type of, fertiliser / minerals / nutrients ; 8 quantity of, fertiliser / minerals / nutrients ; 9 ref to protection against, pests / diseases ; 10 AVP **;** e.g. soil, quantity / depth ;	[max 3]	IGNORE light intensity / carbon dioxide concentration / temperature / humidity / air movement **9 A** spraying (named) pesticide
(d)	1 ref to, sensor(s) / thermostat / AW ; 2 computer control / negative feedback / automated control ; 3 ref to, reducing / controlling, effect of <u>limiting factors</u> ; 4 provide (artificial) light (when light intensity is low) ; 5 provide shade ; 6 temperature control / heating / cooling / ventilation / air conditioning ; 7 <u>carbon dioxide</u>, enrichment ; **A** method described ; 8 control humidity / misting ; 9 watering ; 10 soil-less cultivation / hydroponics / described **; A** sterile conditions 11 ref to, fertilisers / minerals / nutrients ; 12 AVP ;	[max 4]	**examples of AVP** protection from, wind / hail / gales / extreme weather easier to control, pests / diseases can control / exclude, (named) grazers easier to control, weeds / competitors **R** ref. to day length / photoperiod **R** use animals to give off carbon dioxide
		[Total: 17]	

Question	Expected Answers	Marks	Guidance
3 (a) (i)	ovulation ;	[1]	
(ii)	one set of chromosomes / one of each pair of chromosomes ; half the number of chromosomes of, (named) body / normal / diploid, cell ; **A** '….of the species' (refers to) product of meiosis ;	[max 1]	**R** 'half' unqualified IGNORE refs to DNA / genes IGNORE n rather than 2n
(b)	<table><tr><th>feature</th><th>egg cell</th><th>sperm cell</th></tr><tr><td>site of production</td><td>ovary / ovaries / follicle(s)</td><td>testis / testes / seminiferous tubules ;</td></tr><tr><td>relative size</td><td>large(r) , ~100 µm</td><td>small(er) ; 40–60 µm</td></tr><tr><td>numbers produced</td><td>one per month / few / AW</td><td>many / AW, all the time ;</td></tr><tr><td>mobility</td><td>needs to be moved *or* moved by, cilia / peristalsis (of oviduct) **A** not mobile</td><td>uses, tail / flagellum *or* can swim *or* description of action of tail (highly) mobile / can move ;</td></tr></table>	[4]	*one mark per row* IGNORE epididymis if testis also give **R** scale bar length (10 µm) for sperm ACCEPT hundreds for egg cell and millions for sperm (if lifetime production) **A** one at a time for number of eggs
(c) (i)	ovary / ovaries / follicle(s) **;** **R** corpus luteum / placenta	[1]	
(ii)	1 (stimulates / causes) repair of the, uterus lining / endometrium ; 2 (stimulates / causes) growth / thickening, of uterus lining / endometrium ; 3 ready for, implantation / receive 'egg' *or* embryo ; 4 inhibits (release of) FSH ; 5 stops, production / release, of more eggs ; 6 stimulates release of LH ; 7 (stimulates / causes) change in cervical mucus ;	[max 2]	**A** womb for uterus **1/2 A** ref. to glands / blood vessels in uterus as equivalent to lining **2 A** builds up / rebuilds for one mark only **R** wall if given *for* lining **R** 'make / create, lining'

Question	Expected Answers	Marks	Guidance
(d)	*if in vitro fertilisation is described mark to max 1* 1 semen / sperm, is collected from, male / donor / sperm bank ; *even if IVF described* 2 inserted into, vagina / cervix / uterus / womb / oviduct ; 3 near time of ovulation / at fertile time ;	[max 2]	**R** a / single / one, sperm
		[Total: 11]	

Question	Expected Answers	Marks	Guidance
4 (a) (i)	1 NO_x / oxides of nitrogen ; 2 vehicle / car, exhausts / fumes / emissions / gases / AW ; 3 burning fossil fuels in houses / burning forests ; 4 volcanic eruptions / snow melt ;	[1]	IGNORE air pollution unqualified **R** ref. to carbon dioxide 2 **R** cars unqualified 4 **A** volcano(es) unqualified
(ii)	1 leaves / trees / producers / vegetation / plants, harmed / damaged / killed ; 2 trees more likely to get diseased ; 3 bark is damaged ; 4 roots killed ; 5 (sensitive species of) lichens killed ; 6 (named) microorganisms killed ; bacteria / fungi / AW 7 soil pH decreases / soil becomes more acidic ; **A** soil erosion 8 aluminium ions become mobile ; 9 nutrients / named example(s), leached ; 10 food chains / food webs disrupted / AW ; 11 loss of habitat / less biodiversity / extinction of species ;	[max 2]	1 **A** destroyed 1 IGNORE corroded / eroded 9 **A** 'acid dissolves nutrients' 11 **A** fish eggs fail to hatch / death of animals
(b)	1 use, alternative / renewable / green / AW , sources of energy ; **A** example(s) nuclear power / wind power / wave power / solar power / hydrogen power 2 use low sulfur fuels ; 3 reduce use of coal ; 4 flue gas desulfurisation / 'use scrubbers' / chimney electrostatic precipitators / neutralise waste gasses with lime ; 5 catalytic converters ; 6 provide / use, more public transport ; 7 car sharing / car pools / reduce use of cars / hybrid cars / electric cars / use biofuels ; 8 walking / cycling ; 9 reduce food miles / AW ; 10 AVP ; e.g. (named) international treaty for <u>reducing acid rain</u> **R** fewer factories	[max 2]	4 **R** abbreviation (FGD) on its own or unqualified 7 **R** fewer cars unqualified 10 international treaties e.g. Sulphur Emissions Reduction Protocol / Convention on Long-Range Transboundary Air Pollution,

Question	Expected Answers	Marks	Guidance
(c)	*look for positive features, not absent ones apart from unsegmented* unsegmented / not segmented / shell / (muscular) foot ;	[1]	IGNORE soft body
(d) (i)	frogs / black-fly larvae ;	[1]	
(ii)	clams / snails / molluscs ;	[1]	
(iii)	1 enzymes do not function (well) / AW ; 2 acid damages, shells / scales / skin ; **A** only external tissues 3 calcium ions not available for shells / difficult to make shells ; 4 aluminium in solution, toxic to fish / fish die ; 5 acid / low pH, kills fish ; 6 fish produce (lots of) mucus ; 7 blocks gills ; 8 AVP ;	[max 2]	1 **A** enzymes denatured 2 **A** acid dissolves shells IGNORE consequences for food chain
		[Total: 10]	

Question	Mark scheme		Guidance
5 (a) (i)	*high temperature* denature enzymes ; kill bacteria ; to give optimum temperature (for, enzymes / bacteria) ;	 [max 2]	 **R** 'kills enzymes' **R** 'denatures bacteria'
(ii)	respiration is anaerobic ; lactic acid, produced ; **A** lactate / formula	[2]	IGNORE carbon dioxide *treat MPs independently*
(iii)	**A** named example of a food additive ; colouring ; preservative / stabiliser / emulsifier / antioxidant ; flavouring / (artificial) sweetener ; thickening agent ;	[max 1]	IGNORE international numbers / E-numbers **R** any food nutrient(s) **A** 'conservants'
(b)	*description* 1 sigmoid (growth curve) *or* lag phase + exponential/log + stationary 2 phase ; 2 little/no growth, rapid growth, no growth / 'leveling off' ; *explanation* *lag phase* 3 small number of bacteria ; 4 produce, proteins / enzymes / DNA ; **A** builds up energy/food stores *exponential phase* 5 binary fission / asexual reproduction ; 6 no limiting factors / no competition / plenty of food / plenty of resources ; *stationary phase* 7 death rate = 'birth' rate ; 8 resources / food, used up ; 9 <u>pH</u> not, favourable / optimum ;	 [max 5]	*marking points may be taken from labels and annotations on the graph* **R** 'adapting to the environment' 5 population doubles every time bacteria divide 6 IGNORE ref. *to* temperature 8 **A** factors now limiting / competition for food / oxygen used up / toxins built up

Question	Expected Answers	Marks	Guidance
(c)	1 conditions not favourable ; 2 cannot compete with *S. thermophilus* **; *ora*** 3 cannot increase until pH, falls / changes **; *ora*** 4 cannot increase until <u>oxygen</u> concentration decreases **; *ora*** 5 grows slower than *S. thermophilus* ; 6 takes longer to, adapt / feed ; 7 fewer *L. bulgaricus* to start with ; *8 idea that* substance / condition, provided by *S. thermophilus* ;	[2]	**R** direct feeding of *L. bulgaricus* on *S thermophilus* **8 A** *S. thermophilus* changed the environment to allow for growth of *L. bulgaricus*
		[Total: 12]	

Question	Mark scheme		Guidance
6 (a) (i)	*any two suitable examples* flood ; tsunami / tidal wave ; monsoon ; volcanic eruption **;** **A** volcano(es) earthquake ; typhoon / hurricane / storm / cyclone ; fire ; drought **;** crop / animal, disease ; **R** disease unqualified plague of pests of, crops / animals **;** (e.g. locusts) AVP ;	[max 2]	 **R** snowstorms / tornadoes / landslides / avalanches / mudslides
(ii)	drought ; soil erosion ; desertification ; salinity of soils ; global warming ; rise in sea levels ; AVP ;	[max 1]	**R** volcanoes / volcanic eruptions **R** famine **R** drying up of land
(b)	1 overall increase (over the time period of Fig. 6.1) ; 2 natural disasters, fluctuates / described / irregular ; 3 human induced, increase ; 4 comparative data quote for named cause *or for* total causes ; 5 sudden onset increase / ora ; 6 economic factors increase / ora ; 7 comparative data quote for same cause ;	[max 5]	2 increase + decrease is minimum 4 with year and number of shortages for each quote 7 as for 4

Question	Mark scheme		Guidance
(c)	1 land needed for, building / urbanisation / AW ; 2 (so) not enough land to grow crops ; 3 increase in food production damages land ; 4 salination ; 5 desertification / erosion ; 6 overgrazing ; 7 not enough water ; 8 *idea that* increase in demand for food makes food too expensive for poorer people to buy ; 9 richer nations take more of food / food crops exported (for foreign currency) / agricultural land used for, cash crops / non food crops ; 10 difficult to distribute food ; 11 increased competition / conflict, if food production stays the same while population increase ; 12 AVP **;** e.g. food production does not keep up with population growth, increase population leads to increase pollution	[max 3]	3 **A** overcultivation 7 disruption to water supply *or* e.g. such as dams
(d)	1 suitable named crop plant or domesticated animal ; 2 suitable feature to improve ; 3 select individuals for breeding ; 4 select offspring that show improvement ; 5 use these for future breeding / AW **;** **A** 'repeat the process'	[max 4]	**R** genetic modification **R** 'cows bred together' **A** cattle with high milk yield are bred together / high yielding corn are bred together = 3 marks **R** cow for milk x bull for meat
(e)	transfer of, a gene / an allele, from one species to another ; **A** 'type of organism' *or* 'from one variety to another'	[1]	
		[Total: 16]	