**UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS**

**International General Certificate of Secondary Education**

# MARK SCHEME for the October/November 2009 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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UNIVERSITY of CAMBRIDGE
International Examinations

**General notes**

Symbols used in mark scheme and guidance notes.

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|---|---|
| / | 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. |
| <u>Small</u> | 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) |

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| Question | Mark scheme | Comments |
|---|---|---|
| **1 (a)** | feature / bacterium / virus / fungus<br>produces spores / ✓ / × / ✓<br>hyphae / × / × / ✓<br>capsule / ✓ / × / ×<br>nucleus / × / × / ✓<br>[3] | one mark per row<br>treat blank spaces and crossed ticks as crosses – if ticks and crosses and blanks in the same row, treat as incorrect<br>allow 'yes' and 'no' for ticks and crosses |
| **(b)** | *treat independently*<br>1 (feeding) hypha(e) **;** **R** roots **ignore** mycelium<br>2 branched / branching **;**<br>3 has a large surface (area) **;**<br>4 grow, over / through / on / into, (named) food / substrate **;**<br>5 produce / release, enzymes **;**<br>6 external / extracellular / described, digestion **;**<br>7 absorb, food / nutrients / products / glucose / AW **;** [3 max] | *fungus may be saprotrophic or parasitic*<br>**ignore** 'roots' when awarding points 2 to 7<br><br>*MP3 refers to fungus not food*<br>**A** 'spread across' food, **A** substrate for food<br>**R** excrete enzymes<br>**R** digestion unqualified, **A** external implied<br>**R** obtain **A** absorbed even if no digestion |
| **(c)** | 1 spores **;**<br>2 carried in the, wind / air / atmosphere **;**<br>**A** sporangium / 'sack' / AW, bursts / opens<br>3 grow, longer / more, (feeding) hyphae / mycelium spreads [2 max] | **A** blown / floats – as suggests in the air<br><br>**A** new mycelium forms / mycelium increases in size<br>*ecf for roots from **(b)*** |
| | **[Total: 8]** | |

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| **2 (a)** | **A** epithelium / (epithelial) lining / single layer of cells **;**<br>**B** lacteal **;** **A** lymph(atic), vessel / duct / tube **;**<br>**C** capillary / blood vessel **;** [3] | **R** epidermis<br>**R** lymph unqualified / lymph(atic) system |
| **(b)** | *microvilli*<br>1 increases / large, surface (area) **;**<br>2 for absorption **;**<br>*mitochondria*<br>3 (for) respiration **;**<br>4 provide, energy / ATP **;** **A** 'cells need energy'<br>5 for active, uptake / transport **;** [4] | **A** diffusion / active transport (into villus)<br>**R** produce / make, energy<br>**A** movement of, vesicles / vacuoles<br>**A** descriptions of AT e.g. against concentration gradient<br>**R** microvilli 'sway' *or* 'waft' / movement of villi |
| **(c) (i)** | 1 longer, shelf life / storage time **;**<br>2 enhances / improves, flavour / taste **;**<br>3 improves / AW, colour / appearance **;**<br>4 improves, texture / AW **;** **A** ref to emulsifiers / 'free running'<br>5 AVP **;** [2 max] | **A** 'food keeps longer' / preserves food / AW<br>**A** refs to preventing decay / 'kills bacteria'<br>**A** prevent / slows, oxidation<br>**A** 'makes food more attractive' / 'stops food separating', comments on consistency<br>e.g. tenderiser |
| **(ii)** | hyperactivity / described (in children) **;** **R** 'poor behaviour'<br>tantrums / mood swings **;**<br>cancer **;** **A** 'they are carcinogenic'<br>migraines / headaches **;**<br>dizziness / nausea / vomiting / diarrhoea **;**<br>allergies **;**<br>asthma / described as breathlessness or AW **;**<br>nettle rash / urticaria / skin rash / eczema / dermatitis **;**<br>rhinitis / runny nose / 'sniffling' **;**<br>damage to fetus / birth defect **;**<br>AVP **;** [4 max] | *there are no marks in **(i)** or **(ii)** for naming food additives; ignore names look for health risks only*<br>**R** obesity, heart disease, tooth decay, circulatory problems, diabetes<br>**A** difficulty with breathing<br>**R** 'addiction'<br>e.g. ulcers *or* liver / kidney / brain / nerve, damage |
| | **[Total: 13]** | |

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| **3 (a) (i)** | *glass tank to max 1*<br>acts as heat filter / absorbs heat from lamp / reduces heat effect of the lamp / AW **;**<br>maintain constant temperature / make sure temperature is not another variable **;**<br>*syringe*<br>reposition the air bubble / return air bubble to top of tubing / put the bubble into the tube **;** [2] | *must be about heat*<br><br>**A** readjust the bubble **R** refs. to water in the tube |
| **(ii)** | 1 plant / photosynthesis, releases / produces, oxygen / gas(e) **;**<br>2 oxygen is, by-product / waste product (of photosynthesis) **;**<br>3 from splitting of water / photolysis **;**<br>4 oxygen comes out of solution / AW **;**<br>5 gas, collects / rises to the top **;**<br>6 (gas) pushes water down the tube / displaces the water **;** [3 max] | **R** oxygen / gas, is product of respiration<br><br>*note that it is the water that is being pushed by the gas collecting at the top of the tube*<br><br>**A** gives pressure to force water down tube |
| **(b) (i)** | 1.4 **;** [1] | |
| **(ii)** | all points plotted accurately **;**<br><br>curved or straight line of best fit / straight lines between points **;**<br>***ignore*** *if line continues beyond first and last points because of* ***(c)(i)***<br>***R*** *if line goes to 0* [2] | <br><br>*allow a straight line of best fit that is close to the plotted points* |
| **(c) (i)** | 6.0–7.0 **;** **R** > 7.0 *allow ecf from the graph if line goes to 0*<br>0–0.6 **;** **R** > 0.6 [2] | ***ignore*** *what is shown by extrapolation on the graph unless awarding ecf from the graph* |
| **(ii)** | 1 (increase distance gives) decrease light (intensity) **;** ORA<br>2 ref. to <u>light energy</u> **;**<br>3 absorbed by, chlorophyll / chloroplast **;**<br>4 light (intensity) is <u>limiting</u> (factor) **;** [3 max] | **A** 'amount of light' in this answer<br>**A** even if 'light' and 'energy' are separated in answer<br><br>*look for word 'limiting' do not allow 'limited'* |
| | **[Total: 13]** | |

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| **4 (a)** | blood passes through heart twice, during one circulation of body / AW **;**<br><br>heart to lungs / pulmonary circulation **AND** heart to rest of body / systemic circulation **;** [1 max] | **R** 'goes through heart twice' unqualified<br>**A** 'one cycle' for one circulation of the body<br>**A** a suitable diagram |
| **(b)** | *max 1 per blood vessel*<br><br>*artery*<br>1 carries blood from the heart / delivers blood to tissues **;**<br>2 withstands / maintains / transports blood at, high pressure **;**<br>3 transports oxygenated blood except pulmonary (artery) **;**<br><br>*capillary*<br>4 exchange of substances to, tissues / cells **;**<br>5 allows diffusion / described as movement of named gas **;**<br>6 allows, filtration / white cells to escape / forms tissue fluid **;**<br>7 allows (re)absorption **;**<br>8 heat, exchange / loss / gain **;**<br><br>*vein*<br>9 transports blood, to the heart / from tissues **;**<br>10 transports blood at low pressure **;**<br>11 transports deoxygenated blood except pulmonary (vein) **;** [3] | <br><br><br>**A** blood, 'out of the heart' / 'to organs' / 'to body'<br><br>**A** …'except to the lungs' for except pulmonary (vein)<br>**R** 'carries oxygenated blood to, organs / tissues (unqualified by ref to from the heart)<br><br>**A** 'from blood' / allows gas exchange<br><br>**R** plasma leaves capillaries<br>**R** 'connects arteries to veins'<br>**R** 'blood goes close to, tissues / cells'<br><br><br>**A** ensures blood flows one way / stops backflow<br>**R** carry blood (to heart) and lungs<br>**A** 'except from the lungs' for except pulmonary (vein) |

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| **(c)** | *allow up to 3 structural points, so must have a function for full marks.*<br>*Functional point is most likely to be MP9*<br><br>1 small / narrow, lumen / space for blood / opening / hole **;**<br>2 thick / big, wall **;**<br><br>3 elastic (tissue / fibres) **;**<br>4 stretches / expands **;**<br>5 recoils **;**<br><br>6 muscle **;**<br>7 flexible to allow expansion / prevents rupture / prevents bursting **;**<br><br>8 fibrous, tissue / outer layer **;** **A** collagen<br><br>9 withstands / maintains, pressure **;** [4 max] | <br><br><br>**R** 'tube' **R** 'small / narrow' unqualified<br>**R** 'cell wall'<br><br><br><br><br><br><br>**A** ref. to pulsate **R** 'contracts to push blood' as implies peristaltic |
| **(d)** | 1 blood fills valve / valve closes (in vein) **;**<br><br>2 to prevent backflow **;**<br>3 blood flows in one direction / towards heart / prevents flowing away from heart **;** [2 max] | **A** correct description of valve action (in vein)<br>**R** closing the vein / 'the vein closes'<br><br>**R** if refer to valves in the heart |
| | **[Total: 10]** | |

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| **5 (a)** | phenotype **;**<br>gene **;**<br>haploid **;**<br>mitosis **;** [4] | |
| **(b)** | *if there is an error in the genetic diagram allow ecf even if final phenotypes are NOT all different as stated in the question*<br><br>$I^A I^o \times I^B I^o$ **;**<br><br>$I^A, I^o + I^B, I^o$ **;**<br><br>$I^A I^o, I^A I^B, I^B I^o, I^o I^o$**;**<br><br>A AB B O **;** *blood types must match genotypes* [4] | **accept**<br>IA, IB and IO for alleles<br>A, B and O for alleles<br>MP2 and 3 in Punnett square<br><br>**ignore**<br>spaces, commas or dots in diploid genotypes<br>very little space between gamete genotypes<br><br>**reject**<br>$I^{AB}$ etc as genotypes for parents or children<br>I without A, B and o |
| **(c)** | 1 two (or more) alleles **;** **R** two blood groups<br><br>2 two / both, are expressed / equally dominant / both dominant / give different phenotype **;**<br><br>3 in heterozygous / described (individual) **;**<br><br>4 AB, $I^A I^B$ (as example) **;** [3 max] | **A** two (or more) implied, e.g. 'neither' / 'each other' / 'both'<br>**ignore** ref to genes<br><br>'neither is fully expressed' = 1 mark for MP1<br>'neither is dominant over the other' = 2 marks<br>**R** ref. to recessive <u>and</u> dominant<br><br>**A** *idea* 'when both alleles are present in the genotype'<br><br>**A** refs. roan cattle, pink flowers as other correct examples |

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| **(d)** | *accept converse statements*<br><br>1 used to treat diabetes (wherever in answer) **;**<br><br>2 insulin the same as human / uses human DNA / human gene / AW **;**<br><br>3 not rejected **;** **A** 'people not allergic'<br><br>4 no risk of, infection / disease (from animals) **;**<br><br>5 GE insulin can be, modified / improved / AW **;**<br><br>6 animals not killed / suitable for vegans **;**<br><br>7 cheaper / more readily available / produced quickly / constantly / large amounts / large scale **;** **R** 'easier'<br><br>8 ref. to bacteria reproduce quickly **;**<br><br>9 increasing numbers of people with diabetes / don't produce insulin **;** **A** don't respond to insulin [3 max] | MP2: e.g. animal insulin is 'foreign' / bovine insulin has three different amino acid residues from human insulin / porcine has only one different / insulin from dead animal, is not the same as human<br><br>amino acid sequence can be modified<br><br>**A** religious / ethical objections to using animals, but **not** to using GE insulin<br>MP7 is related to production<br>**A** animal insulin has to be obtained from animal soon after its death<br><br>**R** refs. to side effects |
| **(e) (i)** | *note that this is 2 marks*<br>plasmid **;**<br>DNA / genes **;** [2] | **R** plasmic / plasma<br>**R** nucleic acid unqualified by DNA |
| **(ii)** | (restriction) enzyme / endonuclease **;** **ignore** restrictive, etc<br>human / insulin, gene / DNA **;** [1] | **R** incorrect enzyme, e.g. ligase<br>**R** gene unqualified |
| | **[Total: 17]** | |

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| **6 (a)** | carbon ;<br>hydrogen ;<br>oxygen ;<br>nitrogen ;<br>sulfur ; [4 max] | **R** CHONS |
| **(b)** | 1 N / nitrogen, fixation ;<br>2 bacteria / *Rhizobium* ; **R** 'nodules are bacteria'<br><br>3 convert, nitrogen / $N_2$ / AW, into, ammonia / $NH_3$ / ammonium / $NH_4^+$ / amino acid(s) ;<br><br>4 plants use (fixed) nitrogen to make, amino acids / proteins / AW ; [3 max] | N-fixing bacteria = 2 marks<br><br><br>**R** to nitrite / nitrate<br><br>**A** plants use $NH_3$ / $NH_4^+$ |
| **(c)** | 1 (dead plants) eaten by, animals / detritivores / scavengers ;<br>2 e.g. earthworms / termites / AW ;<br>3 ref. their faeces / increase in surface area ;<br><br>4 decay / decomposition ; **A** decomposers<br>5 by, bacteria / fungi / saprophytes / saprotrophs ;<br><br>6 break down proteins to amino acids ;<br><br>7 deamination ;<br>8 ammonia / $NH_3$ / $NH_4$ ; }<br>9 ammonia to <u>nitrite</u> ; }<br>10 <u>nitrite</u> to nitrate ; **A** one mark for ammonia to nitrate<br>11 nitrification / nitrifying bacteria ;<br>12 *Nitrosomonas* / *Nitrobacter* in correct context of nitrification ; [6 max] | <br><br>MP3 must be related to MP1 or 2<br><br>**A** even if linked to incorrect organism<br>**R** if wrong type of bacteria (e.g. N-fixing)<br><br>**A** if in context of MP1 or 2 but do not award twice<br><br>protein → ammonia / AW = 1 mark if 6, 7, 8 not given<br><br>**R** 'nitride' unless qualified by $NO_2^-$<br>**R** nitrate unqualified by nitrite or ammonia |

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| **(d)** | 1 light intensity ;<br>**A** limited sunlight / lack + of sunlight / sunshine<br>2 light duration ; **A** day length<br>3 water / moisture availability ; **A** drought / flood / humidity / soil water<br>4 carbon dioxide, availability / concentration / tension / level ;<br>5 temperature ;<br>6 competition / overcrowding / space / weeds ;<br>7 grazing / herbivores / predation / primary consumers ;<br>8 pests ;<br>9 parasites / disease ;<br>10 use of (inappropriate) herbicides / nearby use of herbicides ;<br>**A** drift of herbicides / weed killers<br>11 pollution / sulphur dioxide / acid rain ;<br>12 soil pH / depth of soil / type of soil / poor soil / oxygen in the soil ;<br>13 wind speed ;<br>14 salt concentration of soil ; [3 max] | **R** heat / warmth<br><br>**R** oxygen unqualified |
| **(e)** | *accept ora with population starting to increase about day 40*<br>1 small population to start with ;<br>2 takes time for eggs to hatch ;<br>3 not enough food / soya bean plants not grown enough / AW ;<br>4 aphids, not sexually mature / cannot breed / finding mates ;<br>5 too cold / too wet / AW (another appropriate weather condition) ;<br>6 ref. to, predators / ladybirds ;<br>7 ref. to, parasites / disease ;<br>8 ref. to, pesticides / insecticides ;<br>9 no immigration ;<br>10 competition (between aphids, with another pest) ;<br>11 AVP ; [3 max] | *do not expect knowledge of aphid biology*<br>***I*** *names of phases (lag, log)*<br>***I*** *'adjusting to surroundings'*<br>refs. to soya must refer to food for aphids<br>**A** few soya plants / competition for food / soya grows slowly<br><br>**R** unfavourable conditions unqualified<br><br>(e.g. correct ref. biotic and abiotic factors) |
| | **[Total: 19]** | |

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