



General Certificate of Education June 2010

Biology

BIOL2

The variety of living organisms

Final

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| <i>Mark Scheme</i> |
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| Question | Part | Sub Part | Marking Guidance | Mark | Comments |
|----------|------|----------|---|------------------------------------|---|
| 1 | (a) | | Helical /spiral/coiled; Compact / description e.g. 'tightly packed'; Insoluble; Prevents osmosis/uptake of water / does not affect water potential / (starch) does not leave cell; Large molecule / long chain; Does not leave cell; | 1 1 1 1 1 1 | 2 max Feature = one mark Explanation = one mark These must be related for both marks but can be in reverse order. Allow idea of compact/helical/spiral/coiled due to bonding for two marks. |
| 1 | (b) | (i) | β /beta Glucose; | 1 | Q Reject alpha glucose |
| 1 | (b) | (ii) | Glycosidic; | 1 | |
| 1 | (c) | | Long/straight/unbranched chains (of glucose); (Joined by) hydrogen bonds; Form (micro)fibrils/(macro)fibrils; Provide rigidity/strength/support; | 1 1 1 1 | 3 max Q Ignore reference to alpha glucose Allow suitable descriptions for last point e.g. 'prevents bursting'; |

| Question | Part | Sub Part | Marking Guidance | Mark | Comments |
|----------|------|----------|---|---------------------|--|
| 2 | (a) | | Endothelium/epithelium; | 1 | Allow endothelial/epithelial Reject - epidermis/endodermis |
| 2 | (b) | | Measurement divided by 8; Allow answer in range of 3-3.3 for two marks; | 1 1 | Correct answer gains 2 marks. |
| 2 | (c) | (i) | Stretches/'expands' under high pressure/when ventricle contracts / systole; Recoils/'springs back' under low pressure/when ventricle relaxes / diastole; Smooths blood flow / maintains blood pressure / reduces pressure surges; | 1 1 1 | 2 max Q References to aorta contracting or relaxing negates marks for stretch and recoil. Stretch and recoil without reference to blood pressure etc. = one mark. Stretch and recoil to smooth blood flow etc. = two marks Ignore references to aorta withstanding blood pressure or not being damaged. |
| 2 | (c) | (ii) | (Muscle) contracts; (Arteriole) constricts / narrows/alters size of lumen / reduces/regulates blood flow (to capillaries); | 1 1 | 'It' in answer = muscle Allow converse (muscle) relaxes and (arteriole) dilates etc / increase blood flow etc. Ignore references to pressure |

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|---|-----|------|---|---|--|
| 2 | (d) | (i) | Large/increase in (total) cross sectional area / friction / resistance; | 1 | |
| 2 | (d) | (ii) | (More) <u>time</u> for exchange of substances; | 1 | |

| Question | Part | Sub Part | Marking Guidance | Mark | Comments |
|----------|------|----------|---|------|---|
| 3 | (a) | | Introns; | 1 | |
| 3 | (b) | | Ile Gly Val Ser; | 1 | |
| 3 | (c) | (i) | Has no effect / same amino acid (sequence) / same primary structure; | 1 | Q Reject same amino acid formed or produced. |
| | | | Glycine named as same amino acid; | 1 | It still codes for glycine = two marks. |
| 3 | (c) | (ii) | Leu replaces Val / change in amino acid (sequence)/primary structure; | 1 | 3 max |
| | | | Change in hydrogen/ionic bonds; | 1 | Q Different amino acid formed or produced negates first marking point. |
| | | | Alters tertiary structure/active site; | 1 | Active site changed must be clear for third marking point but does not need reference to shape. |
| | | | Substrate cannot bind / no longer complementary / no enzyme-substrate complexes form; | 1 | |
| 3 | (d) | (i) | Interphase/ S/synthesis (phase); | 1 | |
| 3 | (d) | (ii) | DNA/gene replication/synthesis occurs / longest stage; | 1 | Allow 'genetic information' = DNA. Allow 'copied' or 'formed' = replication/synthesis |

| Question | Part | Sub Part | Marking Guidance | Mark | Comments |
|----------|------|----------|--|------|--|
| 4 | (a) | | Light (intensity) / temperature / air movement / humidity; | 1 | |
| 4 | (b) | | Prevent air entering / continuous water column; | 1 | Allow answer in context of shoot, xylem or potometer. |
| 4 | (c) | | Distance and time; | 1 | Reject 'amount bubble moves' |
| | | | Radius/diameter/area (of capillary tube); | 1 | |
| 4 | (d) | | (used to provide) turgidity/support/description of; | 1 | 2 max |
| | | | (used in) photosynthesis / (produced in) respiration; | 1 | |
| | | | Apparatus not sealed/'leaks'; | 1 | |
| 4 | (e) | (i) | Returns bubble (to start); | 1 | |
| 4 | (e) | (ii) | Increases reliability (of results) / anomalous result can be identified; | 1 | Q Ignore references to validity/precision/accuracy etc. |

| Question | Part | Sub Part | Marking Guidance | Mark | Comments |
|----------|------|----------|---|---------------------|--|
| 5 | (a) | | (Different) form/type/version of a gene / different base sequence of a gene; | 1 | |
| 5 | (b) | | Two/sister <u>chromatids</u> ; Due to <u>DNA</u> replication; Joined by a <u>centromere</u> ; | 1 1 1 | 2 max |
| 5 | (c) | (i) | Crossing over; Exchange (of alleles) between chromatids/chromosomes; | 1 1 | Negate first marking point for answers which refer to independent segregation. Chiasma/chiasmata = first marking point |
| 5 | (c) | (ii) | Is infrequent/rare; | 1 | References to it being 'random', 'occurs by chance' or 'doesn't always occur' should not be credited without a clear idea that it is rare or infrequent. |
| 5 | (d) | (i) | Three chromosomes shown; One from each homologous pair; | 1 1 | For first mark point allow drawings showing three chromosomes as single or double structures. |
| 5 | (d) | (ii) | 8; | 1 | |

| Question | Part | Sub Part | Marking Guidance | Mark | Comments |
|----------|------|----------|--|---------------------|--|
| 6 | (a) | | Most closely (related) to chimpanzee / most recent common ancestor; Least (related) to dogfish / least recent common ancestor; | 1 1 | Allow 'chicken is second' to chimpanzee as equivalent to second mark point. Allow answers which compare similarity in DNA/genetic material. Marks should not be awarded for answers which only compare amino acid sequences without any indication of relationships. Allow 'monkey' for chimpanzee and 'fish' for dogfish |
| 6 | (b) | | Is present in all eukaryotes; | 1 | |
| 6 | (c) | | Reference to base triplet/triplet code / more bases than amino acids / longer base sequence than amino acid sequence; Introns/non-coding DNA; Same amino acid may be coded for / DNA code is degenerate; | 1 1 1 | 2 max Different (base) triplets code for same amino acid = 2 marks Reject different amino acids are formed/produced. Ignore reference to codon. |

| Question | Part | Sub Part | Marking Guidance | Mark | Comments |
|----------|------|----------|---|--|---|
| 7 | (a) | | <p>Loading/uptake/association of oxygen at high $p.O_2$;</p> <p>In lungs (haemoglobin) is (almost) fully saturated / in lungs haemoglobin has a high affinity for oxygen;</p> <p>Unloads/releases/dissociates oxygen at low $p.O_2$;</p> <p>Unloading linked to higher carbon dioxide concentration;</p> | <p>1</p> <p>1</p> <p>1</p> <p>1</p> | <p>3 max</p> <p>Allow converse for second marking point in tissues i.e. haemoglobin has low affinity / releases most of its oxygen.</p> <p>Mark for haemoglobin having high affinity for oxygen must be 'in lungs'.</p> |
| 7 | (b) | (i) | Larger the mammal the more to the left/steeper/'higher' is the curve / the higher the affinity for oxygen; | 1 | <p>Allow converse.</p> <p>Ignore references to Bohr shift</p> |
| 7 | (b) | (ii) | <p>Smaller mammal has greater surface area to volume ratio;</p> <p>Smaller mammal/larger SA:Vol ratio more heat lost (per unit body mass);</p> <p>Smaller mammal/larger SA:Vol ratio has greater rate of respiration/metabolism;</p> <p>Oxygen required for respiration;</p> <p>(Haemoglobin) releases more oxygen / oxygen released more readily / haemoglobin has lower affinity;</p> | <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> | <p>4 max</p> <p>Allow converse explanation for larger mammals or lower surface area to volume ratio.</p> <p>Allow suitable named mammal as alternative to smaller or larger mammal.</p> |

| Question | Part | Sub Part | Marking Guidance | Mark | Comments |
|----------|------|----------|--|------|---|
| 8 | (a) | | Isolation / quarantine / 'kept separate'; | 1 | 2 max Do not allow improve 'hygiene' or 'cleanliness' without named example such as 'washing hands' use of gloves etc. |
| | | | Screening/testing (of patients/doctors etc); | 1 | |
| | | | Sterilisation of wards/equipment / method to improve hygiene; | 1 | |
| 8 | (b) | | May not all be absorbed; | 1 | 2 max Reference to becoming 'immune' negates last marking point. |
| | | | May be broken down /metabolised/excreted quickly; | 1 | |
| | | | To kill the microorganisms/bacteria; | 1 | |
| | | | Reference to antibiotic resistance; | 1 | |
| 8 | (c) | (i) | P; | 1 | |
| 8 | (c) | (ii) | S; | 1 | |
| 8 | (d) | (i) | Prevents bias; | 1 | |
| | | | Vested interest (of scientists); | 1 | |
| | | | Prevents 'placebo'/positive/negative/psychological effects/'demand characteristics' (in volunteers); | 1 | |

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|---|-----|------|---|---|---|
| 8 | (d) | (ii) | Age; | 1 | 2 max |
| | | | Ethnicity; | 1 | Ignore references to same or different |
| | | | Lifestyle; | 1 | |
| | | | Body mass; | 1 | |
| | | | Health; | 1 | |
| | | | Sex of person; | 1 | |
| 8 | (e) | (i) | Gradual/slight increase followed by rapid/greater increase; | 1 | Allow more detailed descriptions which describe similar trend of gradual increase followed by rapid increase. |
| 8 | (e) | (ii) | 1. No/little resistance shown to drug X; | 1 | max 4 |
| | | | 2. Mutation present (for antibiotic resistance); | 1 | Reference to horizontal gene transmission = neutral |
| | | | 3. Gene/allele for (antibiotic) resistance; | 1 | |
| | | | 4. Bacteria with (antibiotic) resistance survive; | 1 | Reject mark for mutation if context suggests presence of antibiotic causes bacteria to mutate. |
| | | | 5. Vertical gene transmission; | 1 | |
| | | | 6. Frequency of gene/allele (for resistance) increases; | 1 | Resistance is passed on by vertical gene transmission = two marks i.e. points 3 and 5. |

| Question | Part | Sub Part | Marking Guidance | Mark | Comments |
|----------|------|----------|--|---|--|
| 9 | (a) | (i) | Faster/greater/more effective response in children; | 1 | Do not accept children have more haemoglobin |
| 9 | (a) | (ii) | Use line of best fit; Extrapolate/extend line (and read from graph); | 1 1 | Allow calculation using rate of increase per day = one mark. However for both marks this must be linked to line of best fit. |
| 9 | (a) | (iii) | More than one polypeptide chain; | 1 | Allow many polypeptide chains. 'Haemoglobin has four polypeptide chains' must be in correct context to gain mark. |
| 9 | (b) | (i) | Has same <u>water potential</u> ; No (net) water movement / osmosis; Cells will not swell/burst/change size; | 1 1 1 | Allow converse for effect of using distilled water or a concentrated solution. No osmotic lysis = two marks |
| 9 | (b) | (ii) | Pernicious anaemia (cells) greater range/spread/variation of diameters/widths; Some pernicious anaemia (cells) wider than 9 (μm) / some less than 5.5 (μm) / / without pernicious anaemia none more than 9 (μm) / none less than 5.5 (μm); Pernicious anaemia (cells) peak/most frequent at 8.5 (μm) / peak/most frequent at higher diameter / / without pernicious anaemia peak/most frequent at 7 (μm) /peaks at lower diameter; | 1 1 1 | 2 max There are several alternatives for marking points 2 and 3 |

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| 9 | (c) | | <p>1. Mark for general principle of - reduced variety/number of different alleles/DNA / reduced gene pool (in new population);</p> <p>2. Founder effect;</p> <p>3. A few individuals from a population become isolated/form colonies:</p> <p>4. (Genetic) bottlenecks;</p> <p>5. (Significant) fall in size of population</p> <p>6. Selective breeding / artificial selection;</p> <p>7. Using organisms with particular alleles/traits/phenotypes/characteristics;</p> | <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> | <p>6 max</p> <p>The first marking point should not be awarded for 'fewer alleles' unless reduced variety or fewer different alleles is mentioned.</p> |
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