## Paper 1 Higher

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| 1(a)(i) | An answer that combines knowledge (1 mark) and understanding (1 mark) to provide a logical description:<br>• (scientists might look for) differences in the structural features of the fossil (1)<br>• and *Ardipithecus ramidus* would be deeper in the rock layer than *Homo* {*habilis*/stone tools} (1) | e.g. *Ardipithecus ramidus* smaller cranial capacity | **(2)** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| 1(a)(ii) | An explanation that combines identification – application of knowledge (1 mark) and reasoning/justification – application of understanding (1 mark):<br>• likely to be out-competed by *Homo erectus* (1)<br>• {for resources essential for survival/due to the presence of a new selection pressure} (1) | accept: named resources<br>accept: named selection pressure, e.g. climate change, environmental change, disease | **(2)** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| 1(a)(iii) | An explanation that combines identification via a judgement (1 mark) to reach a conclusion via justification/reasoning (1 mark):<br>• stone tool B because it is more {sophisticated/worked} (1)<br>• and *Homo erectus* lived more recently than *Homo habilis* (1) | accept: data quoted from the timeline | **(2)** |

| Question number | Answer | Mark |
|---|---|---|
| 1(b) | An answer that combines the following points of application of knowledge and understanding to provide a logical description:<br>• genetic variation means that some plants will be tolerant of drought conditions and these can be selected (1)<br>• cross-pollinate these plants and grow the seeds under drought conditions (1)<br>• select offspring and repeat over several generations (1) | **(3)** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| 2(a)(i) | • radius 10 mm ± 1 mm (1)<br>• area = $\pi r^2$ (1)<br>• area 314 ($mm^2$) (1)<br><br>answer must be to 3 significant figures | if radius outside range but area calculated max 2 marks<br><br>award full marks for correct numerical answer without working | **(3)** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| 2(a)(ii) | An explanation that combines identification via a judgement (1 mark) to reach a conclusion via justification/reasoning (1 mark):<br>• antiseptic 1 has a larger zone of inhibition (1)<br>• so more of *Streptococcus pyogenes* have been killed (1) | ecf from (a)(i) | **(2)** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| 2(a)(iii) | • to provide optimal growth conditions | *S. pyogenes* grow at body temperature | **(1)** |

| Question number | Answer | Mark |
|---|---|---|
| 2(b) | An explanation that combines identification – understanding (1 mark) and reasoning/justification – understanding (1 mark):<br>• the Bunsen burner flame kills all microorganisms on the loop (1)<br>• so only the desired bacteria are transferred to the loop/no unwanted microorganisms spread on the agar plate (1) | **(2)** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| 3(a) | • 830 mm = 0.83 m (1)<br>• 0.83/0.99 = 0.8383… = 0.84 to two d.p. (1)<br><br>OR<br><br>• 0.99 m = 990 mm (1)<br>• 830/990 = 0.8383… = 0.84 to two d.p. (1)<br><br>• Answer must be given to 2 decimal places | award full marks for correct numerical answer without working | **(2)** |

| Question number | Answer | Mark |
|---|---|---|
| 3(b)(i) | B | **(1)** |

| Question number | Answer | Mark |
|---|---|---|
| 3(b)(ii) | Any two of the following points:<br>• similar BMI (1)<br>• same gender profile (1)<br>• similar amount (and type) of exercise (1) | **(2)** |

| Question number | Answer | Mark |
|---|---|---|
| 3(b)(iii) | An answer that combines the following points to provide a plan:<br>• weigh the 40 obese people (1)<br>• half follow the new diet and half keep their normal diet (1)<br>• after a fixed time period re-weigh the 40 people (1) | **(3)** |

| Question number | Answer | Mark |
|---|---|---|
| 4(a) | An explanation that combines identification – understanding (1 mark) and reasoning/justification – understanding (1 mark):<br>• Mendel crossed homozygous tall and homozygous short pea plants and produced all tall offspring (1)<br>• therefore all the offspring had a heterozygous genotype with one tall and one short allele showing that the tall allele is dominant (1) | **(2)** |

| Question number | Answer | Mark |
|---|---|---|
| 4(b)(i) | An explanation that combines identification – application of knowledge (1 mark) and reasoning/justification – application of understanding (1 mark):<br>• asexual reproduction is a rapid reproduction technique allowing the production of more plants<br>• as there is no requirement for cross pollination/higher crop yield/increased profit | **(2)** |

| Question number | Answer | Mark |
|---|---|---|
| 4(b)(ii) | An explanation that combines identification – application of knowledge (1 mark) and reasoning/justification – application of understanding (1 mark):<br>• introduces variation into the population<br>• which allows for natural selection of fitter plants/increased chance of the population surviving | **(2)** |

| Question number | Answer | Mark |
|---|---|---|
| 4(c)(i) | C | **(1)** |

| Question number | Answer | Mark |
|---|---|---|
| 4(c)(ii) | An explanation that combines identification via a judgement (1 mark) to reach a conclusion via justification/reasoning (1 mark):<br>• genotype is $X^DX^d$/she must have one dominant and one recessive allele (1)<br>• because her daughter must have received the recessive allele and her son has inherited a dominant allele (1) | **(2)** |

| Question number | Answer | Mark |
|---|---|---|
| 5(a)(i) | Any one variable from<br>• temperature<br>• amount of drying<br>• type of potato<br>• age of potato | (1) |

| Question number | Answer | Mark |
|---|---|---|
| 5(a)(ii) | To get an accurate reading of mass | (1) |

| Question number | Answer | Mark |
|---|---|---|
| 5(a)(iii) | An explanation that combines identification via a judgement (1 mark) to reach a conclusion via justification/reasoning (1 mark):<br><br>any **one** identification point from:<br>• there is no change in mass at 0.3 mol $dm^{-3}$ (check once drawn) (1)<br>• this is the isotonic salt concentration in the potato (1)<br><br>**Plus** reasoning/justification<br>• because there is no net movement of water/no salt concentration gradient (1) | (2) |

| Question number | Answer | Mark |
|---|---|---|
| 5(a)(iv) | • repeat the test using intermediate concentrations (between 0.2 and 0.4 mol $dm^3$) | (1) |

| Question number | Answer | Mark |
|---|---|---|
| 5(b) | B | (1) |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| 5(c) | • 68 ÷ 8000 (1)<br>• 0.0085 (1)<br>• 8.5 (μm) (1) | award full marks for correct numerical answer without working | (3) |

| Question number | Answer | Mark |
|---|---|---|
| 6(a)(i) | B | (1) |

| Question number | Answer | Mark |
|---|---|---|
| 6(a)(ii) | TACGTACATGGC | (1) |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| 6(a)(iii) | • $3.33 \times 10^{-10}$ equals 0.33 nm (1)<br>• $0.33 \times 250 = 82.5$ (nm) (1) | maximum one mark if no conversion to nm<br><br>award full marks for correct numerical answer without working | (2) |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| 6(b)(i) | • heterozygous | accept alleles showing heterozygous genotype | (1) |

| Question number | Answer | Mark |
|---|---|---|
| 6(b)(ii) | • correct Punnett square (1)<br><br>• 75% normal fur pigmentation (1) | (2) |

| | A | a |
|---|---|---|
| A | AA | Aa |
| a | Aa | aa |

| Question number | Answer | Mark |
|---|---|---|
| 6(c) | An explanation that combines identification – understanding (1 mark) and reasoning/justification – understanding (1 mark):<br>• both parents must be heterozygous for the recessive allele (1)<br>• so the offspring must inherit the recessive allele from each parent (1) | (2) |

| Question number | Answer | Mark |
|---|---|---|
| 7(a)(i) | D | (1) |

| Question number | Answer | Mark |
|---|---|---|
| 7(a)(ii) | C | (1) |

| Question number | Answer | Mark |
|---|---|---|
| 7(a)(iii) | cerebrum | (1) |

| Question number | Answer | Mark |
|---|---|---|
| 7(b) | An explanation that makes reference to: identification – knowledge (1 mark) and reasoning /justification – knowledge (1 mark):<br>• embryonic stem cells can be stimulated to produce cells of the retina (1)<br>• which can be transplanted into a patient's eye to replace the damaged cells (1) | (2) |

| Question number | Answer | Mark |
|---|---|---|
| 7(c) | Any **three** improvements from the following:<br>• vary the time for computer usage (1)<br>• the activity used on the computer must be the same for each person (1)<br>• control the intake of food/drink/drugs before and during the test (1)<br>• repeat the test at different times of the day (1)<br>• repeat the test using more people (1) | (3) |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| 7(d)(i) | • $\frac{0.258+0.685+0.236+0.246+0.268}{5}$ = 0.339 (1)<br>• 339 (ms) (1) | award full marks for correct numerical answer without working | (2) |

| Question number | Answer | Mark |
|---|---|---|
| 7(d)(ii) | • it is the median value | (1) |

| Question number | Answer | Mark |
|---|---|---|
| 8(a)(i) | An explanation that combines identification – application of knowledge (1 mark) and reasoning/justification – application of understanding (1 mark):<br>• fatty acids are formed when the lipids are broken down by lipase (1)<br>• and fatty acids are acidic (so the pH decreases) (1) | **(2)** |

| Question number | Answer | Mark |
|---|---|---|
| 8(a)(ii) | An answer that combines up to a maximum of **two** points to provide a logical description:<br>• as the temperature increases from 20 °C to 37 °C the rate of lipase activity increases (from 0.2 to 0.8) (1)<br>• the rate of lipase activity is optimal at 37 °C (1)<br>• above 37 °C the rate of lipase activity decreases (from 0.8 to 0.1) (1) | **(2)** |

| Question number | Answer | Mark |
|---|---|---|
| 8(a)(iii) | An explanation that combines identification – application of knowledge (1 mark) and reasoning/justification – application of understanding (1 mark):<br>• an increase in temperature above 40 °C causes changes in the shape of the active site of the enzyme (1)<br>• therefore the enzyme becomes denatured and no longer functions (1) | **(2)** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| 8(b)(i) | • mean= 588/5 = 117.6 (1)<br>• rate = 1 ÷ 117.6 (1)<br>• 0.0085 (1) | award full marks for correct numerical answer without working<br><br>accept 1000/$t$<br>accept 10/$t$ | **(3)** |

| Question number | Answer | Mark |
|---|---|---|
| 8(b)(ii) | Any one variable from:<br>• concentration of the enzyme<br>• volume of enzyme solution<br>• volume of starch solution<br>• pH of the solutions | **(1)** |

| Question number | Answer | Mark |
|---|---|---|
| 8(c) | An explanation that makes reference to: identification – knowledge (1 mark) and reasoning /justification – knowledge (1 mark):<br>• the active site of an enzyme has a specific shape because of the order of the amino acids (1)<br>• the substrate must have a shape which is complementary to the active site (1) | **(2)** |

| Question number | Answer | Mark |
|---|---|---|
| 9(a) | An explanation that combines identification – application of knowledge (1 mark) and reasoning/justification – application of understanding (2 marks):<br>• penicillin prevents the bacteria from dividing as they cannot make a new cell wall (1)<br>• because humans cells do not have a cell wall (1)<br>• they are unaffected by penicillin (1) | **(3)** |

| Question number | Answer | Mark |
|---|---|---|
| 9(b) | An answer that combines knowledge (2 marks) and understanding (2 marks) to provide a logical description:<br>• use restriction enzymes to remove the gene and cut the plasmid (1)<br>• use of ligase to join DNA molecules together (1)<br>• cut the gene from the genome of the fungus and extract a plasmid from the bacteria (1)<br>• insert the recombinant plasmid back into the bacteria (1) | **(4)** |

| Question number | Indicative content | Mark |
|---|---|---|
| *9(c) | Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme.<br><br>The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant.<br><br>**AO1 (6 marks)**<br><br>• bacteria reproduce rapidly generating a large population<br>• there is variation among a bacterial population<br>• some bacteria develop a resistance to antibiotics through mutation<br>• antibiotic treatment exerts a selection pressure<br>• bacteria resistant to antibiotics survive<br>• antibiotic resistance inherited<br>• non-resistant bacteria do not survive<br>• levels of antibiotic resistance in a population of bacteria increase | **(6)** |

| Level | Mark | Descriptor |
|---|---|---|
| | 0 | No rewardable material. |
| Level 1 | 1–2 | • Demonstrates elements of biological understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail. (AO1)<br>• Presents an explanation with some structure and coherence. (AO1) |
| Level 2 | 3–4 | • Demonstrates biological understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. (AO1)<br>• Presents an explanation that has a structure which is mostly clear, coherent and logical. (AO1) |
| Level 3 | 5–6 | • Demonstrates accurate and relevant biological understanding throughout. Understanding of the scientific ideas is detailed and fully developed. (AO1)<br>• Presents an explanation that has a well-developed structure that is clear, coherent and logical. (AO1) |

| Question number | Answer | Mark |
|---|---|---|
| **10(a)** | An explanation that combines identification – application of knowledge (1 mark) and reasoning/justification – application of understanding (1 mark):<br>• the CD4+ count is significantly below the normal range because the HIV has destroyed the {white blood cells/CD4+ cells} (1)<br>• so the person is more susceptible to opportunistic infections and classified as having AIDS (1) | **(2)** |

| Question number | Indicative content | Mark |
|---|---|---|
| *10(b) | Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme.<br><br>The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant.<br><br>**AO2 (6 marks)**<br>• isolate an antigen from the pathogen which causes the STI<br>• inject the antigen into a mouse/rodent<br>• collect lymphocytes producing an antibody to the STI antigen<br>• fuse the B-lymphocyte with a myeloma cell<br>• production of a hybridoma<br>• hybridoma produces a monoclonal antibody against the antigen of the STI<br>• attach the monoclonal antibody to coloured bead/indicator<br>• incorporate into a test strip. | **(6)** |

| Level | Mark | Descriptor |
|---|---|---|
| | 0 | No awardable content |
| Level 1 | 1-2 | • The explanation attempts to link and apply knowledge and understanding of scientific enquiry, techniques and procedures, flawed or simplistic connections made between elements in the context of the question. (AO2)<br>• Lines of reasoning are unsupported or unclear. (AO2) |
| Level 2 | 3-4 | • The explanation is mostly supported through linkage and application of knowledge and understanding of scientific enquiry, techniques and procedures, some logical connections made between elements in the context of the question. (AO2)<br>• Lines of reasoning mostly supported through the application of relevant evidence. (AO2) |
| Level 3 | 5-6 | • The explanation is supported throughout by linkage and application of knowledge and understanding of scientific enquiry, techniques and procedures, logical connections made between elements in the context of the question. (AO2)<br>• Lines of reasoning are supported by sustained application of relevant evidence. (AO2) |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **10(c)** | An explanation that combines identification – understanding (1 mark) and reasoning/justification – understanding (3 marks):<br>• a single strand of messenger RNA is transcribed from the gene in the nucleus (1)<br>• messenger RNA molecule binds to the ribosome (1)<br>• the triplet code from the mRNA is matched by a complementary tRNA anticodon at the ribosome (1)<br>• tRNA transfers amino acids to the polypeptide chain in a specific order (1) | to gain maximum marks the process must be in a logical sequence | **(4)** |