

GCE

Biology A

Unit **H020/02**: Depth in biology

Advanced Subsidiary GCE

Mark Scheme for June 2018

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

















Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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Annotations

| Annotation | Meaning |
|---------------------|---|
| DO NOT ALLOW | Answers that are not worthy of credit |
| IGNORE | Statements that are irrelevant |
| ALLOW | Answers that can be ALLOWed |
| () | Words that are not essential to gain credit |
| — | Underlined words must be present in answer to score a mark |
| ECF | Error carried forward |
| AW | Alternative wording |
| ORA | Or reverse argument |
| ----- | Subject-specific expected terms and names that should be used rather than described |
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Marking Annotations

| Annotation | Use |
|---|--|
|  | Benefit of Doubt |
|  | Contradiction |
|  | Cross |
|  | Error Carried Forward |
|  | Given Mark |
|  | Extendable horizontal wavy line (to indicate errors / incorrect science terminology) |
|  | Ignore |
|  | Large dot (various uses as defined in mark scheme) |
|  | Highlight (various uses as defined in mark scheme) |
|  | Benefit of the doubt not given |
|  | Tick |
|  | Omission Mark |
|  | Blank Page |
|  | Level 1 answer in Level of Response question |
|  | Level 2 answer in Level of Response question |
|  | Level 3 answer in Level of Response question |

| Question | Answer | Mark | Guidance |
|----------|--|----------|--|
| 1(a)(i) | <p>Both must be correct for mark</p> <p>U = <u>amino</u> / <u>amine</u> (group) and V = <u>carboxyl</u> / <u>carboxylic acid</u> (group) ✓</p> | 1 | <p>Additional incorrect answer on either line = 0 marks</p> <p>DO NOT ALLOW imino / amide for U</p> <p>ALLOW carboxil / spelling that looks and sounds same DO NOT ALLOW carbonic / carbonyl for V</p> |
| 1(a)(ii) | <p>Both must be correct for mark</p> <p>peptide / amide (bond) and <u>condensation</u> (reaction) ✓</p> | 1 | <p>Additional incorrect answer on either line = 0 marks</p> <p>IGNORE covalent DO NOT ALLOW dipeptide DO NOT ALLOW hydrolysis</p> |
| 1(b)(i) | <p>1 gene / DNA, copied / transcribed, to (m)<u>RNA</u> ✓</p> <p>2 (<i>idea that</i> RNA goes to / translation is at) ribosome(s) / RER ✓</p> <p>3 <u>DNA</u>, is too large to / cannot / is not able to, leave <u>nucleus</u> / cross <u>nuclear</u> envelope / fit through <u>nuclear</u> pores ✓</p> | 2 max | <p>Read all and mark as prose</p> <p>ALLOW used as a template to create / AW, for 'copied to' ALLOW RNA, copies / takes a copy of, gene / DNA DO NOT ALLOW replicated for 'copied'</p> <p>ALLOW ORA '<u>RNA</u>, is small enough to / can / is able to' or just 'RNA leaves nucleus' ALLOW nuclear membrane for 'nuclear envelope' DO NOT ALLOW leave the cell for 'leave nucleus'</p> |
| 1(b)(ii) | <p>90 252 or 90 255 or 90 258 ✓ ✓</p> | 2 | <p>Correct final answer gets 2 marks, even if no working is shown. Wrong final answer (which may include a 90 252 stage in the working) = ALLOW 1 mark for seeing any of these: 327 x 92 x 3 OR 30 084 OR 981</p> |

| Question | Answer | Mark | Guidance |
|----------|--|----------|--|
| 1b(iii) | <p>For answers marked by levels of response:</p> <p>Read through the whole answer from start to finish, concentrating on features that make it a stronger or weaker answer using the indicative scientific content as guidance. The indicative scientific content indicates the expected parameters for candidates' answers, but be prepared to recognise and credit unexpected approaches where they show relevance.</p> <p>Using a 'best-fit' approach based on the science content of the answer, first decide which set of level descriptors, Level 1, Level 2 or Level 3, best describes the overall quality of the answer using the guidelines described in the level descriptors in the mark scheme.</p> <p>Once the level is located, award the higher or lower mark.</p> <p>The higher mark should be awarded where the level descriptor has been evidenced and all aspects of the communication statement (in italics) have been met.</p> <p>The lower mark should be awarded where the level descriptor has been evidenced but aspects of the communication statement (in italics) are missing.</p> <p>In summary:</p> <ul style="list-style-type: none"> • The science content determines the level. • The communication statement determines the mark within a level. | 6 max | <p><i>Communication may be via bullet points, a table of comparisons, labelled diagrams or prose.</i></p> <p>Indicative scientific points may include the following:</p> <p>FIBROUS PROTEINS</p> <p>Properties:</p> <ul style="list-style-type: none"> • insoluble • elongated / long / rods / filaments / ropes / strands • strong / tough • flexible <p>IGNORE size refs / compact / coiled / bond types / hard</p> <p>Functions:</p> <p>Look for the general category or for a named protein or glycoprotein example with supporting detail. Related categories and examples are paired or grouped together:</p> <ul style="list-style-type: none"> • for structure • collagen in, bone / cartilage / connective tissue / tendons / ligaments / skin / blood vessels • fibrin + role described • for protection • keratin in, skin / hair / nails • to give, elasticity / elastic properties • elastin in, (named) blood vessels / alveoli / cartilage • for, contraction / mechanical movement • actin / myosin, in muscle • microtubules in, cilia / flagella / spindle / cytoskeleton |

| Question | Answer | Mark | Guidance |
|----------|---|------|---|
| | <p>Level 3 (5–6 marks) A detailed comparison of the properties and functions of fibrous and globular proteins.</p> <p><i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p>Level 2 (3–4 marks) A comparison of the properties and/or functions of fibrous and globular proteins.</p> <p><i>There is a line of reasoning presented with some structure. The information presented is in the most-part relevant and supported by some evidence.</i></p> <p>Level 1 (1–2 marks) A limited comparison of the properties or functions of fibrous and globular proteins.</p> <p><i>A basic structure and some relevant information is provided, although a clear line of reasoning may not be present. The information is supported by limited evidence and the relationship to the evidence may not be clear.</i></p> <p>0 marks No response or no response worthy of credit.</p> | | <p>GLOBULAR PROTEINS</p> <p>Properties:</p> <ul style="list-style-type: none"> • soluble • spherical / ball-shaped • have, 3D / tertiary / 3o, shape / structure • specific / complementary (to another molecule) • ref. conjugated / contain prosthetic group • temperature / pH, sensitive • hydrophilic on outside <p>IGNORE size refs, compact, round, bond types</p> <p>Functions: Look for the general functional category name or description, or a named protein or glycoprotein example with some supporting detail.</p> <ul style="list-style-type: none"> • enzymes / metabolic role / to catalyse reaction(s) / to lower activation energy • named enzyme + its specific role described • hormones / receptors / for cell signalling • named hormone / insulin + role described • antibody / for immunity / defence against infection • opsonin / antitoxin / agglutinin + role described • fibrinogen in blood clotting • to transport substances across cell membranes • carrier / channel / pump + role described • to transport substances in blood • haemoglobin + role described e.g. carry oxygen • to, package / organise DNA |

| Question | Answer | Mark | Guidance |
|----------|--|----------|--|
| 1(b)(iv) | <p>EITHER</p> <p>1 9300 / 9700 ✓</p> <p>2 <u>deaths year</u>⁻¹ or <u>deaths per year</u> or <u>deaths / year</u> ✓</p> <p>OR</p> <p>3 9.3 / 9.7 ✓</p> <p>4 thousand <u>deaths year</u>⁻¹ or thousand <u>deaths per year</u> or thousand <u>deaths / year</u> ✓</p> | 2 | <p>Correct answer to 2 s.f. with correct matching units = 2 marks</p> <p>ALLOW mark for unit even if no or wrong figure given</p> <p>ALLOW minus sign with number or 'fewer' with unit</p> <p>ALLOW from AIDS / of AIDS in unit</p> <p>ALLOW mp 3 so long as the word thousand appears afterwards or in the units (even if the unit is wrong in another respect)</p> <p>DO NOT ALLOW '9.3 1000 <i>deaths per year</i>' for mp3 (but gets mp 4)</p> |
| 1(b)(v) | <p>(answers must relate to data on graph)</p> <p>1 decrease in new diagnoses, from 1992 / already / began before 1995 ✓</p> <p>2 peak / plateau, in deaths, from 1994 / already / began before 1995 ✓</p> <p>3 no change in / same, (rate of) increase in people living with AIDS, before / after, 1995 ✓</p> | 2 max | <p>ALLOW when, saquinavir / drug / medicine, was introduced for '1995' in mps 1, 2 and 3</p> <p>ALLOW new diagnoses decrease at same time as deaths</p> <p>ALLOW from / since / after, 1993 (instead of 1992)</p> |

| Question | Answer | Mark | Guidance |
|----------|---|----------|---|
| 1(c)(i) | <p><i>(suggestion(S) PLUS reason (R) needed)</i></p> <p>1 S put pencil line / origin / amino acids, higher (than the solvent / 1cm) + 1 R to stop, spots / samples / amino acids, dissolving into / mixing with / touching, <u>solvent</u> ✓</p> <p>2 S put, amino acids / spots / them, further apart / on separate plates + 2 R to stop them, merging / touching / clashing / AW ✓</p> <p>3 S touch plate edges / wear gloves / use forceps / don't touch middle, + 3 R to prevent, contamination / transfer of substances from hands ✓</p> <p>4 S place, lid / cover, over beaker + 4 R to prevent evaporation (of solvent) ✓</p> <p>5 S support the plate / attach plate to beaker + 5 R to keep plate, vertical / still / at constant height ✓</p> <p>6 S use ninhydrin + 6 R to, see / visualise, amino acids ✓</p> <p>7 S repeat and find, mean / average (Rf value) + 7 R to improve, accuracy / check for repeatability / exclude anomalies ✓</p> <p>8 S label, amino acids / spots / samples (in pencil / on beaker) + 8 R to know which is which / avoid confusion ✓</p> | 4 max | <p>Read all and mark as prose. ALLOW paper / chromatogram / gel, for 'plate' IGNORE measure in mm instead of cm ALLOW 'or otherwise x would happen' in place of the reason 'to stop x' throughout</p> <p>ALLOW 1S ORA less solvent / make solvent lower OR make plate / paper, higher DO NOT ALLOW 1S pen / permanent marker, line ALLOW 1R so only bottom of plate touches solvent</p> <p>ALLOW 2S put same distance apart / spread them apart ALLOW 2R ORA so they are, distinguishable / clear</p> <p>ALLOW 3R amino acids / oils for 'substances' ALLOW 3R <i>idea of</i> not damaging, stationary phase / silica gel / alumina / AW</p> <p>ALLOW 4S close beaker / line beaker with filter paper soaked in solvent</p> <p>ALLOW 5S description e.g. use clips / pencil / clamp / rod ALLOW 5R ORA to stop plate, tilting / trembling / moving</p> <p>IGNORE 6S UV / iodine / permanganate ALLOW 'no need, to stain / for ninhydrin, as spots shown up already' (on Fig. 1.4) = 1 mark</p> |

| Question | Answer | Mark | Guidance |
|----------|--|------|--|
| 1(c)(ii) | <p>1 answer must lie within this range:</p> <p>0.1(0) to 0.15</p> <p>AND</p> <p>supporting calculation must be shown, e.g:</p> $\frac{0.65}{4.95} (= 0.13) \checkmark$ <p>2 glutamine ✓</p> | | <p>No mark for figure in correct range unless it also shows the working out of this calculation:</p> $\frac{\text{distance from origin to spot}}{\text{distance from origin to solvent front.}}$ <p>ALLOW figures given in mm</p> <p>ALLOW figures with no unit shown</p> <p>ALLOW variation in measurements taken so long as the final answer falls within the allowed range.</p> <p>ALLOW mp2 even if no attempt is made at working stage</p> |

| Question | Answer | Mark | Guidance |
|-----------|---|----------|---|
| 2(a)(i) | (supraventricular) <u>tachycardia</u> ✓ | 1 | ALLOW tachyarrhythmia ALLOW spelling variants: tachycardic / tacchycardia / tackycardia (to sound same, not 'tr' at start) DO NOT ALLOW trachecardia / tracardia / tracycardia / tracchycardia / trachycardia |
| 2(a)(ii) | <i>calculated cardiac output (in cm³):</i> figure in range from 5333 to 5520 ✓ <i>presentation in standard form:</i> figure in range from 5.3(33) x 10 ³ to 5.5(20) x 10 ³ ✓ <i>units:</i> <u>cm³ min⁻¹</u> OR <u>cm³ / min(ute)</u> OR <u>cm³ per min(ute)</u> ✓ | 3 | Correct answer in standard form gets 2 marks automatically if working not shown for mp 1. ALLOW calculated figure within this range ALLOW up to 3 extra decimal places within this range DO NOT ALLOW rounding error when reducing no. of s.f. ALLOW up to 3 extra significant figures e.g. 5.48571 x 10 ³ ALLOW ECF for any calculated figure outside the allowed range presented in standard form: e.g. 4800 shown as 4.8 x 10 ³ gets mp2 ALLOW ECF if >3 extra d.p. already penalised for mp 1 ALLOW conversion from cm ³ to dm³ so for example: 5.333 / 5.434 / 5.463 / 5.485, x 10⁰ dm³ minute⁻¹ and 5.3 / 5.4 / 5.5, x 10⁰ dm³ min⁻¹ gets 3 marks DO NOT ALLOW beats or letter 'b' in unit |
| 2(a)(iii) | 1 impulse OR (wave of) depolarisation OR wave of excitation ✓ 2 correct ref. atrioventricular node / AV node / AVN ✓ 3 (through / along) bundle of His / Purkyne fibres, to (cause contraction of) ventricles ✓ | 2 max | IGNORE signals / messages / electrical waves IGNORE SAN |

| Question | Answer | Mark | Guidance |
|----------|--|----------|---|
| 2(b)(i) | <p><i>assume answer refers to heart 2 unless stated otherwise:</i></p> <p>can see / it has, aorta / (pulmonary) artery / (pulmonary) vein / vena cava / <u>blood</u> vessel(s) ✓</p> | 1 | <p>DO NOT ALLOW coronary artery</p> <p>ALLOW ORA that aorta / (pulmonary) artery / (pulmonary) vein / vena cava / <u>blood</u> vessel(s), not present on heart 1</p> |
| 2(b)(ii) | Z = <u>left ventricle</u> ✓ | 1 | IGNORE cardiac muscle |
| 2(c) | <p>For answers marked by levels of response:</p> <p>Read through the whole answer from start to finish, concentrating on features that make it a stronger or weaker answer using the indicative scientific content as guidance. The indicative scientific content indicates the expected parameters for candidates' answers, but be prepared to recognise and credit unexpected approaches where they show relevance.</p> <p>Using a 'best-fit' approach based on the science content of the answer, first decide which set of level descriptors, Level 1, Level 2 or Level 3, best describes the overall quality of the answer using the guidelines described in the level descriptors in the mark scheme.</p> <p>Once the level is located, award the higher or lower mark.</p> <p>The higher mark should be awarded where the level descriptor has been evidenced and all aspects of the communication statement (in italics) have been met.</p> <p>The lower mark should be awarded where the level descriptor has been evidenced but aspects of the communication statement (in italics) are missing.</p> <p>In summary:</p> <ul style="list-style-type: none"> • The science content determines the level. • The communication statement determines the mark within a level. | 6 max | |

| Question | Answer | Mark | Guidance |
|----------|---|------|--|
| | <p>Level 3 (5–6 marks) A detailed description of the cardiac cycle with references to B, C, and D in Fig. 2.3.</p> <p><i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p>Level 2 (3–4 marks) A description of the cardiac cycle with some references to B, C and/or D in Fig. 2.3.</p> <p><i>There is a line of reasoning presented with some structure. The information presented is in the most-part relevant and supported by some evidence.</i></p> <p>Level 1 (1–2 marks) A basic description of the cardiac cycle with limited reference to B, C and/or D in Fig. 2.3.</p> <p><i>A basic structure and some relevant information is provided, although a clear line of reasoning may not be present. The information is supported by limited evidence and the relationship to the evidence may not be clear.</i></p> <p>0 marks No response or no response worthy of credit.</p> | | <p>Indicative scientific points may include the following: (answers may start at any point in the cycle. IGNORE box A description)</p> <p>B</p> <ul style="list-style-type: none"> • atrial diastole • ventricular diastole • atria relax • ventricles relax • blood flows through, atrioventricular / AV / bicuspid / tricuspid, valve(s) OR ref. to their opening (more) • blood enters atria (passively) • blood enters ventricles (passively) <p>C</p> <ul style="list-style-type: none"> • atrial systole • atria contract • pressure (on blood) in atria increases • blood flows through, atrioventricular / AV / bicuspid / tricuspid, valve(s) OR ref. to their being open • ventricles fill / more blood enters ventricles • volume (of ventricles) increases • pressure (of blood against ventricles) increases • pressure in arteries is, low / at a minimum <p>D</p> <ul style="list-style-type: none"> • ventricular systole • ventricles contract • volume (of ventricles) decreases • pressure (on blood in ventricles) increases • atrioventricular / bicuspid / tricuspid, valves close • semi-lunar valves open • blood flows into aorta • blood flows into pulmonary arteries |

| Question | Answer | Mark | Guidance |
|----------|--|----------|---|
| 3(a) | (using) microtubules / tubulin / motor proteins ✓ | 1 | ALLOW kinesins / dyneins / 'moto' proteins IGNORE spindle fibres, centrioles |
| 3(b) | <p>1 <u>goblet cells</u>, secrete / release / make / produce / form, <u>mucus</u> ✓</p> <p>2 <u>mucus</u> traps, pathogens / microorganisms / bacteria ✓</p> <p>3 ref. phagocytes / neutrophils / macrophages / lysozyme ✓</p> <p>4 <u>cilia</u> / <u>ciliated</u> cells / <u>ciliated</u> epithelium, sweep / brush / waft / move / AW, <u>mucus</u> ✓</p> <p>5 cytoskeleton / microtubules / tubulin, move(s) / make(s) up, the <u>cilia</u> ✓</p> | 4 max | <p>IGNORE excrete</p> <p>ALLOW named example of a lung pathogen IGNORE cilia trap, pathogens / microorganisms</p> <p>ALLOW 'cillia' / other spelling that looks and sounds same DO NOT ALLOW cilia cells</p> |

| Question | Answer | Mark | Guidance |
|----------|---|------|---|
| 3(c)(i) | <p>(stage) 2 (should say), non-self / not self / foreign ✓</p> <p>(stage) 5 (should be) before 4 / 4 (should be) after 5 ✓</p> | 2 | <p>ALLOW quote to replace stage number 2, e.g. <i>'phagocytes recognise pathogens as non-self'</i> <i>'phagocytes do not recognise pathogens as self'</i> IGNORE non-body</p> <p>ALLOW 4 and 5 are in wrong order / should be reversed / need swapping / should be the other way round / AW</p> <p>ALLOW quote to replace stage numbers, e.g. <i>'phagosome combines with a lysosome before stage 4'</i></p> <p><i>'enzymes from lysosomes digest pathogens after stage 5'</i></p> <p><i>'forms a phagolysosome and THEN destroys the pathogen'</i></p> <p><i>'phagosome and lysosome do not combine AFTER the pathogen is destroyed'</i></p> |
| 3(c)(ii) | <p>minimum of one light chain drawn on outside of heavy chain</p> <p>and</p> <p>label to, light (polypeptide) chain / variable region / antigen-binding site ✓</p> | 1 | <p>GUIDELINES for drawing: Light chain should start at tip of arm of Y and be 25–50% the length of the heavy chain.</p> <p>ALLOW label line not touching if label written near correct region</p> |

| Question | Answer | Mark | Guidance | | | | | | | | | | |
|--|--|----------------|--|--|-----------------|-------------------|--------------|---------------|--------------------|----------------------|---------------|---|--|
| 4(a)(i) | <table border="1" style="width: 100%; text-align: center;"> <thead> <tr> <th data-bbox="309 236 741 341">Important role</th> <th data-bbox="752 236 981 341">Ion</th> </tr> </thead> <tbody> <tr> <td data-bbox="309 346 741 443">Production of nitrate ions by bacteria</td> <td data-bbox="752 346 981 443">NH_4^+</td> </tr> <tr> <td data-bbox="309 448 741 545">Loading of phloem</td> <td data-bbox="752 448 981 545">H^+</td> </tr> <tr> <td data-bbox="309 550 741 647">DNA structure</td> <td data-bbox="752 550 981 647">PO_4^{3-}</td> </tr> <tr> <td data-bbox="309 652 741 750">Cofactor for amylase</td> <td data-bbox="752 652 981 750">Cl^-</td> </tr> </tbody> </table> <p style="text-align: right;">✓ ✓</p> | Important role | Ion | Production of nitrate ions by bacteria | NH_4^+ | Loading of phloem | H^+ | DNA structure | PO_4^{3-} | Cofactor for amylase | Cl^- | 2 | <p>Additional incorrect answer in a cell = 0 marks</p> <p>Symbols must be fully correct</p> <p>all three correct = 2 marks</p> <p>one or two correct = 1 mark</p> <p>none correct = 0 marks</p> |
| Important role | Ion | | | | | | | | | | | | |
| Production of nitrate ions by bacteria | NH_4^+ | | | | | | | | | | | | |
| Loading of phloem | H^+ | | | | | | | | | | | | |
| DNA structure | PO_4^{3-} | | | | | | | | | | | | |
| Cofactor for amylase | Cl^- | | | | | | | | | | | | |
| 4(a)(ii) | <p>at arterial end AND hydrostatic / 4.6, is greater than, oncotic / -3 AND (fluid / plasma) moves, out / from, (capillary) ✓</p> <p>at venous end AND hydrostatic / 2.3, is lower than, oncotic / -3 AND (tissue fluid) moves into (capillary) ✓</p> | 2 | <p>Statements must:</p> <ul style="list-style-type: none"> • name the end of the capillary • make a comparative statement about the two pressures in the capillary (using name or number) • state the direction of movement of fluid. <p>ALLOW bigger / higher / more, for 'greater' ALLOW ORA oncotic / -3, less than hydrostatic / 4.6</p> <p>ALLOW ORA fluid moves into tissues IGNORE osmosis</p> <p>ALLOW smaller / less, for 'lower' ALLOW ORA oncotic / -3, more than hydrostatic / 2.3</p> <p>ALLOW ORA fluid moves, out of / from, tissues IGNORE osmosis</p> | | | | | | | | | | |

| Question | Answer | Mark | Guidance |
|----------|---|------|---|
| 4(b)(i) | <p>1 inhibitor binds to, allosteric site / enzyme away from active site ✓</p> <p>2 changes, tertiary / 3D, structure of, enzyme / active site / protein OR <u>active site</u> no longer <u>complementary</u> to substrate OR substrate and, enzyme / active site, cannot, bind / fit (together) OR E-S complex cannot form ✓</p> | 2 | <p>ALLOW catalase for 'enzyme' throughout ALLOW hydrogen peroxide / H₂O₂, for 'substrate' throughout</p> <p>ALLOW joins / fits into, for 'binds' ALLOW shown on diagram</p> <p>ALLOW conformation / shape for 'structure' IGNORE denatures</p> |
| 4(b)(ii) | <p>1 downward-sweeping curve showing negative correlation drawn ✓</p> <p>2 x axis label = conc(entration) of copper sulfate in moles dm⁻³</p> <p>AND</p> <p>y axis label = <u>vol(ume)</u> of oxygen (gas produced) in cm³ ✓</p> | 2 | <p>DO NOT ALLOW straight line or plotted points that are not joined. Curve may level off at end. Allow 'dot-to-dot' curve.</p> <p>ALLOW CuSO₄ / copper sulphate, for 'copper sulfate' ALLOW slash before unit / slash or 'per' in the unit / brackets round unit ALLOW variant symbols: M OR moles L⁻¹ OR moles / L OR mol dm⁻³</p> <p>ALLOW O₂ for 'oxygen'</p> |

| Question | Answer | Mark | Guidance |
|-----------|--|----------|--|
| 4(b)(iii) | <p><i>(trend described)</i> 1 as (concentration of) copper, sulphate / ions, increases, (volume of) oxygen / H₂O₂ breakdown, decreases ✓</p> <p><i>(conclusion / inference, about activity of enzyme)</i> 2 copper, sulphate / ions, inhibit(s) / decrease(s), <u>catalase</u> activity ✓</p> <p><i>(detail)</i> 3 at high concentrations / 0.15 / 0.20 EITHER most enzymes, (irreversibly / already) damaged / inhibited OR adding more copper (sulphate / ions) has little effect ✓</p> | 2 max | <p>ALLOW AW for 'decrease' e.g. reduce / decline / drop / fall ALLOW AW for 'increase' e.g. go up / rise / climb</p> <p>ALLOW AW so long as inverse trend is still made clear by use of comparative terms such as: increases / decreases, higher / lower, more / less</p> <p>E.g. <i>'when there is more CuSO₄, less oxygen is produced'</i></p> <p>ALLOW ORA, e.g. <i>'the lower the concentration of Cu²⁺ the higher the volume of oxygen produced'</i></p> <p>IGNORE <i>'disturbs the action of catalase'</i></p> |

| Question | Answer | Mark | Guidance |
|----------|--|----------|--|
| 4(b)(iv) | <p>1 compare / measure / test, catalase activity / oxygen produced ✓</p> <p>2 experimental detail ✓</p> <p>3 further experimental detail ✓</p> <p>4 less, oxygen / catalase (activity), means more, copper / pollution ✓</p> <p>5 use, Table 4 / graph, to estimate copper (ion) concentration ✓</p> | 3 max | <p>IGNORE how much oxygen is in each fish IGNORE how much catalase is in each fish</p> <p><i>experimental detail points:</i> ALLOW AW throughout IGNORE amount throughout</p> <p>i prepare a , catalase / fish / tissue, extract / sample (e.g. ref. pestle and mortar / chopping / liquidiser)</p> <p>ii equal / known / controlled, volume / sized samples (of fish / tissue / extract)</p> <p>iii equal / known / controlled, concentration / volume, of hydrogen peroxide</p> <p>iv measure, volume of, oxygen / gas, in a given time</p> <p>v use gas syringe / collect gas under water</p> <p>ALLOW correct statement of relationship between copper or pollution and oxygen or amount of catalase present or catalase activity even if wrong experiment is done (e.g. adding catalase or copper sulphate to fish) or measuring 'how much oxygen is in fish'</p> |

| Question | Answer | Mark | Guidance |
|----------|---|----------|--|
| 5(a)(i) | <p>to, protect / conserve, species endangered by trading activities OR to, prevent / restrict, trade in endangered species ✓</p> <p>to, regulate / restrict / reduce , international / cross-border, wildlife trade ✓</p> | 1 max | <p>ALLOW for 'trading activities' and 'trade' the buying or selling of, live animals / body parts such as tusks or ivory / plant bulbs / etc. ALLOW for 'endangered' - threatened / rare / vulnerable ALLOW an example of an endangered species, e.g. '<i>stop people from selling elephant tusks</i>' gets mp 1</p> <p>ALLOW for 'wildlife trade' the buying or selling of, live animals / body parts such as tusks or ivory / plant bulbs. ALLOW for 'international' and 'cross-border' a description such as import from Africa to Europe, etc.</p> |
| 5(a)(ii) | <p>1 ref. 95% (decrease) OR 5% (remain) OR 25 000 (in 2113) ✓</p> <p>2 1250 (in 2213) OR 4 (orders of magnitude) ✓</p> | 2 | <p>Look for two correct stages of working corresponding to mps 1 and 2, irrespective of final answer.</p> <p><i>Exemplar working:</i> There is a 95% decrease in 100 years from 1913 to 2013, so:</p> <p>2113: 500 000 x 0.05 = 25 000 left</p> <p>2213: 25 000 x 0.05 = 1250 left</p> <p>1.25 x 10³ compared to 1 x 10⁷ is <u>4</u> orders of magnitude smaller.</p> |

| Question | Answer | Mark | Guidance |
|----------|---|----------|--|
| 5(b) | <p><i>General statement identifying place and y axis variable plus two of options below:</i></p> <p>in Eastern Africa, poaching / number of illegally killed elephants / percentage of elephants killed illegally, is</p> <p><i>comment or comparison about absolute number</i> 1 (kept) below 60 / lowest / lower (than C/W. Africa) ✓</p> <p><i>identify most recent sustained trend as far as 2015</i> 2 decreasing / less, since 2011 / from 60 to 40 ✓</p> <p><i>figures quote to show trend</i> 3 quote any two figures and years and ref. decrease ✓</p> | 2 max | <p>Mark evidence 1 and 2 together as prose</p> <p>ALLOW AW for 'decrease' e.g.reduce / decline / drop / fall ALLOW AW for 'increase' e.g. goes up / rise / climb</p> <p>ALLOW ORA, e.g: in, Central / Western, Africa, poaching / number of illegally killed elephants / percentage of elephants killed illegally, is</p> <p>1 (mostly) over 60 (or quote of figure over 60) / higher (than E. Africa)</p> <p>2 increasing / more, since 2013 / from, 60 to 82 (W) / 70 to 75 (C)</p> <p>3 quote any two figures and years and ref. increase</p> <p>IGNORE calculated 'by x %' figures</p> |

| Question | Answer | Mark | Guidance | | | | | | | | | | | | | | | | | | | | | | | | |
|------------------|--|----------------|----------------|-----|-----------|------------------|---|----------------|-------|--------------|---|----------------|-------|------------|---|----------------|-------|------------------|---|----------------|-------|--|--|------------|----------------|---|---|
| 6(a)(i) | <table border="1" data-bbox="300 309 1050 588"> <thead> <tr> <th>Species</th> <th>n</th> <th>n/N</th> <th>$(n/N)^2$</th> </tr> </thead> <tbody> <tr> <td>Meadow buttercup</td> <td>6</td> <td>$6/24 = 0.250$</td> <td>0.063</td> </tr> <tr> <td>Common daisy</td> <td>7</td> <td>$7/24 = 0.292$</td> <td>0.085</td> </tr> <tr> <td>Red clover</td> <td>3</td> <td>$3/24 = 0.125$</td> <td>0.016</td> </tr> <tr> <td>Ribwort plantain</td> <td>8</td> <td>$8/24 = 0.333$</td> <td>0.111</td> </tr> <tr> <td></td> <td></td> <td>$\Sigma =$</td> <td>0.275 ✓</td> </tr> </tbody> </table> <p data-bbox="300 624 562 655">$1 - 0.275 = \underline{0.725}$ ✓</p> <p data-bbox="300 692 562 756"><i>final answer to 2 s.f.</i> 0.73 ✓</p> | Species | n | n/N | $(n/N)^2$ | Meadow buttercup | 6 | $6/24 = 0.250$ | 0.063 | Common daisy | 7 | $7/24 = 0.292$ | 0.085 | Red clover | 3 | $3/24 = 0.125$ | 0.016 | Ribwort plantain | 8 | $8/24 = 0.333$ | 0.111 | | | $\Sigma =$ | 0.275 ✓ | 3 | <p data-bbox="1370 209 2148 272">Correct final answer of 0.73 = 3 marks, even if working (and intermediate figures 0.275 and 0.725) not shown</p> <p data-bbox="1370 309 1977 373">CALCULATIONS TO MORE OR FEWER D.P ALLOW any figure within each range:</p> <p data-bbox="1370 410 1951 442">$\Sigma =$ from 0.271 to 0.276 to more or less d.p.</p> <p data-bbox="1370 478 1984 510">$1 - \Sigma =$ from 0.724 to 0.729 to more or less d.p</p> <p data-bbox="1370 547 1765 579">final answer = 0.72 OR 0.73</p> <p data-bbox="1370 616 1888 679">CALCULATIONS USING FRACTIONS ALLOW these options for first 2 mps:</p> <p data-bbox="1370 716 1704 748">$\Sigma = 158/576$ OR $79/288$</p> <p data-bbox="1370 785 1756 817">$1 - \Sigma = 418/576$ OR $209/288$</p> <p data-bbox="1370 853 1659 885">WORKING ERRORS</p> <p data-bbox="1370 890 2123 1086">ECF to max 2 for a final answer to 2 s.f. after one class of error in working somewhere, e.g. in the n/N stage or the $(n/N)^2$ stage or in adding up the Σ sum or in subtracting the answer from 1.</p> <p data-bbox="1370 1123 2130 1187">If final answer is not given to 2 s.f. after one class of error in working, then ECF as above to max 1.</p> <p data-bbox="1370 1224 2130 1323">ALLOW a final answer slightly below or above correct answer (0.71 – 0.79) 2 marks ECF by assuming 1 error at one stage.</p> |
| Species | n | n/N | $(n/N)^2$ | | | | | | | | | | | | | | | | | | | | | | | | |
| Meadow buttercup | 6 | $6/24 = 0.250$ | 0.063 | | | | | | | | | | | | | | | | | | | | | | | | |
| Common daisy | 7 | $7/24 = 0.292$ | 0.085 | | | | | | | | | | | | | | | | | | | | | | | | |
| Red clover | 3 | $3/24 = 0.125$ | 0.016 | | | | | | | | | | | | | | | | | | | | | | | | |
| Ribwort plantain | 8 | $8/24 = 0.333$ | 0.111 | | | | | | | | | | | | | | | | | | | | | | | | |
| | | $\Sigma =$ | 0.275 ✓ | | | | | | | | | | | | | | | | | | | | | | | | |

| Question | Answer | Mark | Guidance |
|----------|--|----------|---|
| 6(a)(ii) | (point / frame) <u>quadrat(s)</u> ✓ | 1 | Additional incorrect answer = 0 marks IGNORE random number, generator / calculator |
| 6(b) | <p><i>YES reasons why it would, work / be successful: 2 max</i></p> <p>Y1 <u>detergent</u>, breaks / disrupts, (cell) membrane(s) / nuclear envelope OR <u>detergent</u>, releases contents of, cell / nucleus ✓</p> <p>Y2 <u>salt</u>, helps DNA, shed water / precipitate ✓</p> <p>Y3 <u>protease</u> breaks down, histones / proteins around DNA / proteins attached to DNA ✓</p> <p><i>NO reasons why it would not, work / be successful: 2 max</i></p> <p>N1 cell walls not broken by, abrasion / grinding / blender ✓</p> <p>N2 no RNAase added to remove RNA (from DNA / chromatin) ✓</p> <p>N3 no, alcohol / ethanol, added to, precipitate DNA ✓</p> <p>N4 temperature not low to reduce, enzyme activity / DNA break down ✓</p> | 3 max | <p>IGNORE additional unlikely ideas throughout e.g. detergent breaks cell wall, salt disrupts membranes.</p> <p>ALLOW protease separates DNA from, protein / chromatin</p> <p>ALLOW ORA for N1-N4, e.g. action, should be / ought to be / needs to be, done to... e.g. N1 <i>'plant should be crushed to break cell walls'</i></p> <p>N3 ALLOW as reason <i>'to separate DNA from, solution / water / aqueous phase'</i></p> |
| 6(c) | <p>(species evenness is) low / uneven / not even / poor / not high</p> <p>AND</p> <p>many / large, number OR abundance OR population of, leather jackets / meadow ants / two species / some species, but, not many / only a few / small number of / hardly any / small population of, click beetles / wireworms / two species / other species ✓</p> | 1 | <p>ALLOW comparatives e.g. a lot more ants than wireworms, ants much more common than click beetles</p> <p>ALLOW dominated by (mostly) leatherjackets and ants / 2 species</p> <p>IGNORE comparative pairs of figures that lack a qualification like 'only' to show which figure is small(er) IGNORE percentage figures unqualified by description</p> |

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