PEARSON EDEXCEL IGCSE BIOLOGY · 4BI1

# BIOLOGY



## MARK SCHEME

SECTION 2: STRUCTURE AND FUNCTIONS IN LIVING ORGANISMS (PACK 6)

| SCORE | PERCENTAGE |
| --- | --- |
| /300 | % |

STEMUP

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# Mark Scheme

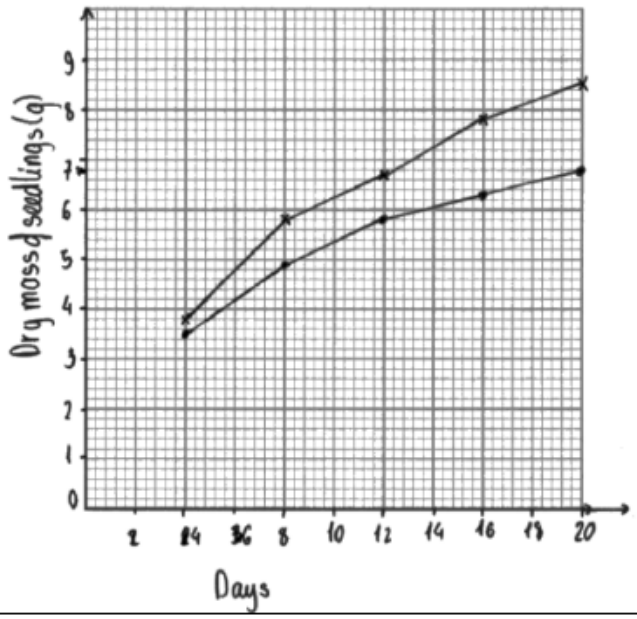
Q1.

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(a)(i)** | An answer that makes reference to two of the following:<br>• light (intensity) / lamp / eq (1)<br>• water volume / watering frequency (1)<br>• mass /weight, of compost (1) | **Ignore** amount<br>**Ignore** fertiliser | **2** |

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(a)(ii)** | An answer that makes reference to two of the following:<br>• water (content) would vary / water increases the mass / adds mass / makes seeds heavier / some seeds would absorb more water than others (1)<br>• so comparison is valid / fair comparison (1)<br>• water is not biomass / dry mass is the true biomass / (dry mass is) organic molecules (1) | **Allow** water changes mass<br>**Ignore** accuracy / reliable<br>**Ignore** fair test alone<br>**Allow** converse for all MPs | **2** |

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(b)(i)** | S – <u>linear</u> scale that takes up at least half of grid **and** right way round (1)<br>L – ruled, straight lines that join points with no extrapolation (1)<br>A – axes fully labelled with units (1)<br>P – all points correct (1)<br>K – key for each line / each line labelled (1) | **Allow** S, L, A if only one line<br><br>Bar chart loses L<br>Axes labels are mass (g) and day | **5** |

| Day | Dry mass of seedlings in g | |
|---|---|---|
| | Without fertiliser | With fertiliser |
| 4 | 3.5 | 3.8 |
| 8 | 4.9 | 5.8 |
| 12 | 5.8 | 6.7 |
| 16 | 6.3 | 7.8 |
| 20 | 6.8 | 8.5 |



| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(b)(ii)** | An answer that makes reference to four of the following:<br>• magnesium ions (increase) chlorophyll / chloroplasts (1)<br>• (so more) photosynthesis (1)<br>• (which produces) carbohydrates / glucose / starch / cellulose / eq (1)<br>• nitrate ions for amino acids (1)<br>• (nitrate / amino acid) for protein (synthesis for growth) (1) | If no other marks, award **one mark** for making chlorophyll <u>and</u> amino acids / protein with no ref to minerals<br><br>**Allow** for enzymes | **4** |

Q2.

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| | An answer that makes reference to six of the following points:<br><br>C range of salt concentration / salty and not salty / salt and no salt (1)<br><br>O same saliva / same amylase (1)<br><br>R repeat investigation (1)<br><br>M1 measure time for starch to disappear/time for glucose to appear/measure concentration of starch (1)<br><br>M2 use of iodine solution / use of Benedict's / use colorimeter (1)<br><br>S1 same concentration of amylase or saliva / same volume of amylase or saliva / same (starting) concentration of starch / same (starting) volume of starch / (1)<br><br>S2 same pH / same temp (1) | M2 test must be appropriate for M1 method<br><br>Ignore 'amount' throughout<br><br>S2 Allow same time if measuring concentration of starch<br><br>Ignore light, $CO_2$, $O_2$ | **6 exp** |
| | | | Total 6 marks |

Q3.

| Question Number | Answer | Mark |
|---|---|---|
| **(a)** | An explanation that makes reference to the following points:<br><br>• produces maltose / glucose (1)<br><br>• turns red / green /yellow/orange /eq (with Benedict's test) (1) | **2 exp** |

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(b)** | An explanation that makes reference to four of the following points:<br>• same/stated volume / concentration of amylase (1)<br>• same/stated mass of bread (1)<br>• same/stated time (before pouring water) (1)<br>• same/stated volume of water (1)<br>• same/stated volume / concentration of Benedict's (1)<br>• same time of heating / same temp for Benedict's test (1)<br>• stated range of temperatures (1)<br>• repeat each temperature / calculate mean time (1) | **Ignore** amount for all<br>**Allow** same size /volume / piece of bread /same type of bread<br>**Allow** same number of drops<br>at least two stated temperatures | **4 exp** |

| Question Number | Answer | Mark |
|---|---|---|
| **(c)** | An answer that makes reference to four of the following points:<br>(increased temperature increases rate)<br>• (due to increased) kinetic energy (1)<br>• (more) movement of molecules / collisions (1)<br>• until optimum temperature (1)<br>• rate decreases at high temperature / digestion stops at high temperature (1)<br>• (because) enzyme denatured / change to active site / no longer binds (1) | **4 exp** |
| | Total 10 marks | |

Q4.

| Question Number | Answer | Mark |
|---|---|---|
| **(a)(i)** | The only correct answer is<br><br>**A** is the pancreas<br><br>**B** is not the answer as B is not the pancreas<br><br>**C** is not the answer as C is not the pancreas<br><br>**D** is not the answer as D is not the pancreas | **1** |

| Question Number | Answer | Mark |
|---|---|---|
| **(a)(ii)** | The only correct answer is<br><br>**D** structure produces progesterone<br><br>**A** is not correct as it does not produce progesterone<br><br>**B** is not correct as it does not produce progesterone<br><br>**C** is not correct as it does not produce progesterone | **1** |

| Question Number | Answer | additional guidance | Mark |
|---|---|---|---|
| **(b)(i)** | Calculation method **not marking points**<br><br>convert hormonal speed to m / min<br><br>= 4.2 m per min<br><br>convert hormonal speed to m / sec<br><br>= 4.2÷60 m per sec<br><br>= 0.07 m per sec<br><br>division<br><br>55÷0.07<br><br>= **786 :1** scores 3<br><br>allow 2 sig figs so allow 790:1 scores 3 | Calculation method<br><br>conversion of nerve speed to cm per min<br><br>= 5500 cm per sec<br>= 5500 **x 60** cm per min<br><br>= 330 000 cm per min<br><br>division<br><br>330 000÷**420**<br><br>= 786 : 1 scores 3<br><br>Allow 785.7 to 1 for full marks<br>and all versions of 785.7142857142857 score 3<br><br>allow **1 mark for** ÷ 60 or × 60 **or evidence of multiplying by or dividing by 60** | **3** |

| | | | |
|---|---|---|---|
| | | allow **1 mark for** ÷ 60 or × 60 **or evidence of multiplying by or dividing by 60**<br><br>allow **1 mark for** ÷0.07 or :0.07 or ÷420 or :420<br><br>**allow 2 marks** for 1 to 786 or just number 786 etc<br><br>any rounding errors such as 785:1 scores 2 | |

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(b) (ii)** | A description that makes reference to three of the following:<br>• uses neurones / nerve cells (1)<br>• electrical (1)<br>• goes to target cells only / specific (locus) / eq (1)<br>• (response) is usually short (term) (1) | allow converse for hormones<br>uses plasma/ blood<br>ignore impulse<br>chemical<br>all around body/ different organs<br>(response) longer (lasting)<br>ignore ref to speed | 3 |
| | | | total 8 marks |

Q5.

| Question Number | Answer | Mark |
|---|---|---|
| **(a)(i)** | The only correct answer is<br>C 11<br><br>A is not correct as it does not contain 1<br>B is not correct as it does not contain 6<br>D is not correct as it does not contain 12 | **1** |

| Question Number | Answer | Mark |
|---|---|---|
| **(a)(ii)** | • mitochondrion / mitochondria | **1** |

| Question Number | Answer | Mark |
|---|---|---|
| **(b)** | The only correct answer is<br><br>D ×600<br><br>A is not correct as it is not ×0.06<br>B is not correct as it is not ×0.6<br>C is not correct as it is not ×6 | **1** |

| Question Number | Answer | Mark |
|---|---|---|
| **(c)(i)** | • chloroplast / (sap) vacuole | **1** |

| Question Number | Answer | Mark |
|---|---|---|
| **(c)(ii)** | An answer that makes reference to one of the following points:<br>• nucleoid / circular chromosome / cytoplasm (1)<br>• plasmid(s) (1) | **1** |
| | | **Total 5** |

Q6.

| Question Number | Answer | additional guidance | Mark |
|---|---|---|---|
| **(a)** | A description that makes reference to three of the following points:<br>• crush / grind nut /eq (1)<br>• ethanol / Sudan III (1)<br>• add water (1)<br>• white / emulsion / red (layer) (1) | if add oil -1 to score | **3** |

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(b)(i)** | An explanation that makes reference to two of the following points:<br>• peristalsis (1)<br>• move food along intestine / prevent constipation / helps bowel movement / eq (1)<br>• undigested material / indigestible / cellulose (1) | **ignore** ref to prevent cancer<br>**ignore** helps digestion | **2** |

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(b)(ii)** | An explanation that makes reference the following points:<br>• (nut A) has <u>more</u> iron/protein (1)<br>• (more) haemoglobin (1) | iron for haemoglobin scores 1 | **2** |

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(b)(iii)** | • $16.7 \times 10^{-2} = 0.167$<br>• x 28 = 4.68<br><br>allow 4.676 allow 4.7 | award full marks for correct numerical answer without working<br><br>should be 3 sig figs<br><br>allow one mark for 0.167 **or** one mark for x 28<br>one mark for any version 4676 or 47 or 468 | **2** |

| Question Number | Answer | Mark |
|---|---|---|
| **(c)** | An explanation that makes reference to five of the following points:<br><br>• more foxes (to eat squirrels) / increased predation (1)<br>• foxes eat nuts (so less food) (1)<br>• fewer trees (1)<br>• other species enter woods and feed on nuts /eq (1)<br>• <u>other</u> predators entered woodland (1)<br>• disease / infection (1)<br>• migration / eq (1)<br>• time of year when numbers counted (1)<br>• cold weather / lower temperature (1)<br>• fox increase <u>is more than</u> tree decrease (1)<br>• human impact / hunting (by humans) / eq (1) | **5** |

Q7.

| Question Number | Answer | Mark |
|---|---|---|
| **(a)(i)** | **B** cell wall<br><br>*A is incorrect because it is not the cell membrane*<br>*C is incorrect because it is not mitochondria*<br>*D is incorrect because it is not the nucleus* | **1 comp** |

| Question Number | Answer | Mark |
|---|---|---|
| **(a)(ii)** | **D** starch<br><br>*A is incorrect because it is not chlorophyll*<br>*B is incorrect because it is not glucose*<br>*C is incorrect because it is not glycogen* | **1 comp** |

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(b) (i)** | An answer that makes reference to the following points:<br><br>• A: (chloroplasts absorb light) for photosynthesis / absorb light energy to make carbohydrate / eq (1)<br><br>• B: (nucleus) controls protein synthesis / contains DNA / contains genes / controls cell / eq (1)<br><br>• C: (vacuole) contains cell sap eq (1)<br><br>• D: (cytoplasm) were chemical reactions occur (1) | **Allow** starch / glucose /sugar<br><br>**Allow** maintains turgor / stores water / salts / pigments / toxins<br><br>**Allow** where protein synthesis occurs / respiration occurs / medium for reactions | **4 grad** |

| Question Number | Answer | Mark |
|---|---|---|
| **(b) (ii)** | An answer that makes reference to the following points:<br><br>• contains chloroplasts to absorb light / for photosynthesis eq (1)<br><br>• long / arranged in a vertical plane / large surface area / rectangular shape, to absorb most light / eq (1)<br><br>• large vacuole to store water (1) | **2 grad** |
| | | Total 8 marks |

Q8.

| Question Number | Answer | Mark |
|---|---|---|
| **(a)(i)** | The only correct answer is D S<br><br>A is not correct as P does not contain chlorophyll<br><br>B is not correct as Q does not contain chlorophyll<br><br>C is not correct as R does not contain chlorophyll | **1** |

| Question Number | Answer | Mark |
|---|---|---|
| **(a)(ii)** | The only correct answer is C magnesium<br><br>A is not correct as chlorophyll does not contain calcium<br><br>B is not correct as chlorophyll does not contain iron<br><br>D is not correct as chlorophyll does not contain water | **1** |

| Question Number | Answer | Mark |
|---|---|---|
| **(a)(iii)** | A description that makes reference to two of the following points:<br><br>• absorb / trap / captures / eq, light (1)<br><br>• photosynthesis (1)<br><br>• make carbohydrate / make starch / make glucose / eq (1) | **2** |

| Question Number | Answer | Mark |
|---|---|---|
| **(b)** | The only correct answer is C a plant stem growing towards light<br><br>A a plant root growing away from light is not correct<br><br>B a plant root growing downwards due to gravity is not correct<br><br>D a plant stem growing upwards due to gravity is not correct | **1** |

| Question Number | Answer | Mark |
|---|---|---|
| **(c)** | | **3** |

| Role of substance | Name of substance |
|---|---|
| cause positive phototropism | **auxin** |
| digest fat | lipase (1) |
| diffuse across a synapse | neurotransmitter / acetylcholine / noradrenaline / correct named neurotransmitter (1) |
| prevent scurvy | vitamin C /ascorbic acid (1) |

Total = 8 marks

Q9.

| Question Number | Answer | Mark |
|---|---|---|
| **(a)(i)** | The only correct answer is C structure S<br><br>A is not correct as P is not part of digestive system<br><br>B is not correct as Q is not part of digestive system<br><br>D is not correct as U is not part of digestive system | **1** |

| Question Number | Answer | Mark |
|---|---|---|
| **(a)(ii)** | The only correct answer is D structure U<br><br>A is not correct as P is not part of circulation system<br><br>B is not correct as R is not part of circulation system<br><br>D is not correct as S is not part of circulation system | **1** |

| Question Number | Answer | Mark |
|---|---|---|
| **(b)** | The only correct answer is<br><br>B diaphragm contracts and the volume within the rib cage increases<br><br>A is not correct as volume within the rib cage does not decrease<br><br>C is not correct as diaphragm does not relax<br><br>D is not correct as diaphragm does not relax | **1** |

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(c)(i)** | • oxygen 20% (1)<br><br>• carbon dioxide 9900% (1) | (40/200) x 100 = 20%<br><br>(39.6/0.4) x 100 = 9900<br><br>one mark for each correct % | **2** |

| Question Number | Answer | Mark |
|---|---|---|
| **(c)(ii)** | An explanation that makes reference to four of the following points:<br><br>• more carbon dioxide in exhaled air / eq (1)<br>• as produced by / released from respiration (in cells) (1)<br>• transported in (red cells and plasma) to lungs / eq (1)<br><br>• less oxygen in exhaled air / eq (1)<br>• as absorbed by red blood cells / absorbed by lungs / eq (1)<br>• as used / required in respiration (in cells) (1)<br><br>• little change/ no change in Nitrogen (as not absorbed / not required) (1) | **4** |

| Question Number | Answer | Mark |
|---|---|---|
| **(c)(iii)** | An explanation that makes reference to four of the following points<br>• (many) alveoli provide large surface area /eq (1)<br>• blood flow / blood supply / capillaries / maintain(s) diffusion / concentration gradient / eq (1)<br>• capillaries provide blood supply / surround / close to alveoli/ eq (1)<br>• thin (walls) one cell thick / short distance for diffusion eq (1)<br>• moist lining to allow gases to dissolve / pass through / for gas exchange /eq (1) | **4** |

Q10.

| Question Number | Answer | Mark |
|---|---|---|
| **(a)(i)** | An explanation that makes reference to two of the following:<br>• oxygen is required (1)<br>• for respiration (1) | **2** |

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(a)(ii)** | An explanation that makes reference to two of the following:<br>• to kill pathogens / other microorganisms / sterilises the fermenter / eq (1)<br>• to prevent contamination (of the product) / competition (1)<br>• steam condenses to water so does not affect product / taste/ flavour / eq (1) | **Accept** remove bacteria / eq<br>Prevent bacterial contamination = 2 marks | **2** |

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(b)(i)** | A graph that includes:<br>• S scales linear and at least half page and axes the correct way around (1)<br>• A both axes labelled with units (1)<br>• L straight lines joining points (1)<br>• P points correctly plotted (1)<br>• K key / labelled GM and non-GM (1) | Lose line mark for bar chart<br>Units: time in days and mass in kg<br>**Ignore** extrapolation to zero<br>Plots +/- half square | **5** |

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(b)(ii)** | An answer that makes reference to two of the following:<br>• GM fungus grows faster up to 20 days / before day 30 / eq (1)<br>• (but) over 30 days, the non-GM fungus produces a higher final yield / GM fungus starts to level off after 20 days / non-GM fungus produces more over longer time (1)<br>• GM fungus is better if product is required in a shorter time / non-GM fungus is better is product is required after longer time period (1) | **Accept** converse for all MPs<br>**Accept** GM produces more mass over first 20 days / produces more product in short time<br>**Accept** at 30 days GM fungus produces less yield than non-GM / grows slower / non-GM has higher yield over last new days | **2** |

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(b)(iii)** | An answer that makes reference to five of the following:<br><br>*Yes because:*<br><br>1. there is less fat in mycoprotein (1)<br><br>2. there is less cholesterol in mycoprotein (1)<br><br>3. less risk of heart disease / obesity / eq (1)<br><br>4. there is more fibre in mycoprotein so less risk of constipation / moves through gut / gut / eq (1)<br><br>5. mycoprotein has more calcium for bones / teeth / eq (1)<br><br>*No because:*<br><br>6. mycoprotein has less protein (1)<br><br>7. for growth / muscle growth / eq (1)<br><br>8. mycoprotein has less iron so may be a risk of anaemia / less haemoglobin / fewer red blood cells / eq (1) | **Accept** other protein functions | **5** |

Q11.

| Question Number | Answer | Mark |
|---|---|---|
| **(a)** | small fish | **1** |

| Question Number | Answer | additional guidance | Mark |
|---|---|---|---|
| **(b)(i)** | A description that makes reference to three of the following points:<br>• photosynthesis (1)<br>• chloroplasts / chlorophyll (1)<br>• absorbs / traps light /eq (energy) (1)<br>• starch / glucose / carbohydrate (1) | allow formula or from equation | **3** |

| Question Number | Answer | additional guidance | Mark |
|---|---|---|---|
| **(b)(ii)** | An answer that makes reference to two of the following points:<br>• respiration / heat loss (by plant) (1)<br>• cannot digest / egested / not absorbed /eq (1)<br>• uneaten / die / decomposition (1)<br>• excretion (1) | | **2** |

| Question Number | Answer | Mark |
|---|---|---|
| **(c)** | An answer that makes reference to the following points:<br>• increase surface area (1)<br>• enzymes (1) | **2** |
| | Total 8 marks | |

Q12.

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(a)** | An explanation that makes reference to two of the following points:<br>• plasmid / virus / bacteriophage / phage / gene gun / eq (1)<br>• transfer (recombinant) / DNA / gene / into organism) eq (1) | allow carry DNA /gene<br>introduce / insert DNA / gene | **2** |

| Question Number | Answer | additional guidance | Mark |
|---|---|---|---|
| **(b)(i)** | Magnesium / Mg<br>Iron / Fe<br>Nitrate / $NO_3$ | $Mg^{2+}$<br>$Fe^{2+}$ / $Fe^{3+}$<br>$NO_3^-$ | **1** |

| Question Number | Answer | additional guidance | Mark |
|---|---|---|---|
| **(b)(ii)** | An answer that makes reference to six of the following points:<br>• C use pulling / method A and weedicide / method B /eq (1)<br>• O uses same species of crop / same crop / plant (1)<br>• R repeat investigation / uses more than one field (1)<br>• M1 measure crop mass / weigh /eq (1)<br>• M2 use quadrats / use sampling / per m² / per unit area / per tray / eq (1)<br>• S1 after **stated** time period / one growing season / eq<br>• S2 (control) temperature / light / carbon dioxide / soil / water / fertiliser / minerals /eq (1) | not amount not yield<br>allow idea of in same region / climate for S2 | **6** |
| | | Total 9 marks | |

Q13.

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

| Question number | Answer | Mark |
|---|---|---|
| (a)(ii) | B | **1** |

| Question number | Answer | Mark |
|---|---|---|
| (b)(i) | A description that makes reference to four of the following points:<br><br>• place leaf in boiling water (1)<br>• place leaf in boiling ethanol (1)<br>• use water bath/safe heating/no naked flame (1)<br>• place leaf in water (1)<br>• place leaf in iodine solution (1)<br>• blue/black indicates starch; orange/yellow indicates no starch (1) | 4 |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| (b)(ii) | A drawing showing the following:<br><br>• white part labelled orange/yellow/no starch (1)<br>• green part labelled blue/black/starch (1) | allow approximate shape | 2 |

| Question number | Answer | Mark |
|---|---|---|
| (c) | A method that includes two of the following points:<br><br>• trace around the leaf/use transparent paper/equivalent (1)<br>• trace around the green part (1)<br>• put onto squared paper (1)<br>• count the number of squares (1)<br>• reference to both sides of leaf being measured (1) | 2 |

Q14.

| Question number | Answer | Mark |
|---|---|---|
| (a)(i) | C | 1 |

| Question number | Answer | Mark |
|---|---|---|
| (a)(ii) | B | 1 |

| Question number | Answer | Mark |
|---|---|---|
| (b)(i) | A description that makes reference to four of the following points:<br><br>• place leaf in boiling water (1)<br>• place leaf in boiling ethanol (1)<br>• use water bath/safe heating/no naked flame (1)<br>• place leaf in water (1)<br>• place leaf in iodine solution (1)<br>• blue/black indicates starch; orange/yellow indicates no starch (1) | 4 |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| (b)(ii) | A drawing showing the following:<br><br>• white part labelled orange/yellow/no starch (1)<br>• green part labelled blue/black/starch (1) | allow approximate shape | 2 |

| Question number | Answer | Mark |
|---|---|---|
| (c) | A method that includes two of the following points:<br><br>• trace around the leaf/use transparent paper/equivalent (1)<br>• trace around the green part (1)<br>• put onto squared paper (1)<br>• count the number of squares (1)<br>• reference to both sides of leaf being measured (1) | 2 |

Q15.

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| (a)(i) | C (X and Z) is the only correct answer<br><br>A is incorrect because the pancreas also produces amylase<br>B is incorrect because the stomach does not produce amylase<br>D is incorrect because the stomach does not produce amylase | | 1 |

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| (a)(ii) | <table><tr><th>Enzyme</th><th>Molecule</th><th>Product</th></tr><tr><td>amylase</td><td>starch</td><td>maltose</td></tr><tr><td>lipase</td><td>lipid</td><td>fatty acids / glycerol</td></tr><tr><td>protease</td><td>protein</td><td>amino acids / (poly)peptide</td></tr></table><br>one mark for each correct row (3) | | 3 |

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(b)(i)** | • calculate mass of lentils that has 1 g of protein<br>100 ÷ 25 = 4 g of lentils has 1 g of protein<br>• scale up to 46 g of protein 46 x 4<br>**184 (2)** | 184 = **two marks**<br>**one mark** for ÷ 25 or ×4 | **2** |

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(b)(ii)** | An answer that makes reference to five of the following:<br>• excess energy may lead to obesity / eq (1)<br>• (excess energy / obesity) increases risk of diabetes / joint damage / heart disease / eq (1)<br>• enough protein / protein is same as RDA, so growth should be normal (rate) / eq (1)<br>• enough vitamin A / vitamin A is same as RDA so no risk of night blindness / eye problems / vision is normal / eq (1)<br>• vitamin C is low so may be at risk of scurvy / eq (1)<br>• calcium is too low so may be at risk of rickets / osteoporosis / eq (1)<br>• enough iron / iron is same as RDA so no risk of anaemia / can make red blood cells / haemoglobin / no problems carrying oxygen (1)<br>• fibre is low so risk of constipation / can't egest / release faeces / eq (1)<br>• data does not list other named dietary components / eq (1) | **max three** for effects with no link to RDA e.g. they will become obese<br>**Allow** puts weight on / get fat<br>**Allow** can build muscle / can grow<br>**Allow** more risk of gums bleeding / connective tissue problems / collagen /have healthy skin<br>**Ignore** waste unqualified | **5** |
| | • no mention of activity levels / sex / age / pregnancy / eq of person (1) | **max three** for descriptions of functions of dietary components with no ref to deficiency e.g. vitamin C is for healthy skin | |

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(b)(iii)** | An answer that makes reference to two of the following:<br>• activity / exercise / active lifestyle / sport / job (may affect energy need) / eq (1)<br>• pregnancy (may affect energy need) (1)<br>• different metabolic rate (1)<br>• age (may affect energy need) (1)<br>• sex (may affect energy need) (1)<br>• body mass / weight / (may affect energy need) (1) | **Ignore** size | **2** |

Q16.

| Question Number | Answer | Mark |
|---|---|---|
| **(a)(i)** | The only correct answer is A plasma<br>B is not correct as it is not platelets<br>C is not correct as it is not red cells<br>D is not correct as it is not white cells | **1** |

| Question Number | Answer | Mark |
|---|---|---|
| **(a)(ii)** | **The only correct answer is C P 55% Q 5% R 40%**<br>A is not correct as it is not P 5% Q 40% R 55%<br>B is not correct as it is not P 40% Q 55% R 5%<br>D is not correct as it is not P 55% Q 40% R 5% | **1** |

| Question Number | Answer | Mark |
|---|---|---|
| **(a)(iii)** | An answer that makes reference to one of the following points<br><br>• fewer red blood cells / eq (1)<br>• smaller or lower percentage of layer R / less of layer R /eq (1) | **1** |

| Question Number | Answer | additional guidance | Mark |
|---|---|---|---|
| **(b)** | An explanation that makes reference to four of the following points:<br><br>• <u>phagocytes</u> (1)<br>• (phagocytes) engulf bacteria / viruses / pathogens /eq (1)<br>• <u>lymphocytes</u> (1)<br>• (lymphocytes) produce antibodies (1)<br><br>• (antibodies) specific to the pathogen (1) | phogoctyes produce antibodies scores mp 1 but not mp 4<br><br>allow wbc engulf = 1 mark<br><br>allow wbc produce antibodies =1 mark<br><br>**if no other mp credited** allow 1 mark for wbc destroy / kill pathogens/ bacteria/ virus /eq | **4** |

| Question Number | Answer | Mark |
|---|---|---|
| **(c)** | An answer that includes two of the following:<br>• antibodies (1)<br>• hormone /named hormone (1)<br>• ion / named ion / mineral / eq (1)<br>• digested / food (1)<br>• protein / named protein (1)<br>• amino acid / named amino acid (1)<br>• glucose (1)<br>• carbon dioxide / $CO_2$ (1)<br>• vitamin /named vitamin (1)<br>• urea (1)<br>• cholesterol / fatty acids / glycerol / eq (1) | **2** |
| | | **Total 9 marks** |

Q17.

| Question Number | Answer | additional guidance | Mark |
|---|---|---|---|
| **(a)** | | allow converse for mp 1,3,4, 5, 9 and 10 | **6** |
| | • Fat more in cow's / eq (1) | allow 'too much' | |
| | • Fat could lead to obesity / too many kJ calories / eq (1) | | |
| | • Protein more in in cow's / eq (1) | allow 'too much' | |
| | • Minerals more in cow's / eq (1) | allow 'too much' | |
| | • Carbohydrate less in cow's / eq (1) | allow 'too little in cows ' | |
| | • (too little carbohydrate in cow's) so not enough (quick) energy (1) | | |
| | • Vitamins similar / same (1) | | |
| | • Water the similar / same (1) | | |
| | • Antibodies no (human antibodies ) in cow's (1) | | |
| | • Antibiotics in cow's (1) | | |

| Question Number | Answer | additional guidance | Mark |
|---|---|---|---|
| **(b)** | An answer that makes reference to two of the following points:<br>• (exposure to) sun(light) (1)<br>• named source of vitamin D such as cod-liver oil / oily fish – such as salmon, sardines, herring and mackerel / red meat /liver /eggs / fortified foods – such as most fat spreads and some breakfast cereals (1)<br>• add drops / use supplement / eq (1) | give cod-liver oil (tablets) = mp 2 and 3 | **2** |

| Question Number | Answer | additional guidance | Mark |
|---|---|---|---|
| **(c)** | An answer that makes reference to the following points:<br>• Add biuret (1)<br>• If protein present turns purple / lilac (1) | allow / uristix / clinistix /protein test sticks mp 1<br>and stated colour change mp 2 | **2** |
| | | | Total = 10 |

Q18.

| Question Number | Answer | Mark |
|---|---|---|
| **(a)** | The only correct answer is<br>A it is digested into amino acids<br>*B is not correct as its surface area is not increased by bile*<br>*C is not correct as its pH is not raised by hydrochloric acid*<br>*D is not correct as it is not absorbed by villi* | **1** |

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(b)** | **Component** / **Function**<br>lipid / store of energy<br>vitamin D / bone / teeth / calcium absorption / prevent rickets (1)<br>iron / haemoglobin / red blood cells (1)<br>fibre / peristalsis / move food / prevent constipation (1) | Ignore egestion<br>Helps digestion and prevents constipation = 1 | **3** |

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(c)(i)** | 20% of 1250 = 250<br><br>250 ÷ 50 = 5 (2) | Award full marks for correct numerical answer without working<br><br>Allow one mark for 250 in working | **2** |

| Question Number | Answer | Mark |
|---|---|---|
| **(c)(ii)** | An answer that makes reference to six of the following points:<br><br>• GM salmon grow more / heavier / longer / larger / more mass / grow faster / eq (1)<br><br>• (more) protein provided (1)<br><br>• only need protein in correct amount / only need sufficient protein / only need 50g / too much protein / excess protein / eq (1)<br><br>• balanced diet also needs vitamins / carbohydrate / lipid / minerals / fibre / no idea of other **named** component in salmon (1)<br><br>• one salmon used / not repeated / should use several fish (1)<br><br>• (data) not reliable / result may be anomalous (1)<br><br>• no information on food supply to salmon / temperature / oxygen / pollution (1)<br><br>• protein need depends on age / sex / activity / eq (1) | **6**<br><br>**Mp1 Allow converse** |

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(d)** | An answer that makes reference to the following points:<br><br>• gene / allele (1)<br><br>• restriction / endonuclease (1)<br><br>• ligase (1) | <br><br><br><br>Allow restrictive | **3** |

Q19.

| Question Number | Answer | Mark |
|---|---|---|
| **(a)(i)** | The only correct answer is B<br>A is not correct as it does not produce hydrochloric acid<br>C is not correct as it does not produce hydrochloric acid<br>D is not correct as it does not produce hydrochloric acid | **1** |

| Question Number | Answer | Mark |
|---|---|---|
| **(a)(ii)** | The only correct answer is D<br>A is not correct as it does not store faeces<br>B is not correct as it does not store faeces<br>C is not correct as it does not store faeces | **1** |

| | Answer | Mark |
|---|---|---|
| **(b)** | An explanation that makes reference to two of the following points:<br>• neutralises acid / eq (1)<br>• optimal pH for enzymes / lipase eq (1)<br>• emulsifies lipid / eq (1)<br>• breaks down (large droplets) into small droplets / eq (1)<br>• increases surface area for enzyme action /eq (1) | **3** |

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| Question Number | Answer | Mark |
|---|---|---|
| **(c)(i)** | An explanation that makes reference to four of the following points:<br>• large surface area (1)<br>• microvilli (1)<br>• capillaries / blood supply to maintain concentration gradient / diffusion gradient (1)<br>• absorb digested food / molecules / vitamins / minerals / correct named molecule / eq (1)<br>• lacteal to absorb fats / correct vitamin / transport fats / eq (1)<br>• thin wall / one cell thick / capillaries close to surface (1)<br>• so short diffusion path / rapid diffusion / rapid active transport (1) | **4** |

| Question Number | Answer | | Mark |
|---|---|---|---|
| **(c)(ii)** | An answer that makes reference to four of the following points:<br>• shorter / few / no villi / microvilli (1)<br>• reduced surface area (1)<br>• less absorption of digested food / molecules / vitamins / minerals / correct example / eq (1)<br>• less glucose / lipid / eq, for energy / respiration / ATP (1)<br>• fewer amino acids for growth / protein synthesis (1)<br>• less vitamins / minerals / named vitamin or mineral for correct function of named vitamin or mineral (1) | Allow sugar for glucose<br>e.g. iron for haemoglobin | **4** |
| | | | Total = 13 marks |

Q20.

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(a)(i)** | B (bronchus) is the only correct answer<br><br>A is incorrect as bronchioles have no cartilage<br><br>B is incorrect as oesophagus leads to stomach<br><br>C is incorrect as there is only one trachea | | **1** |

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(a)(ii)** | An explanation that makes reference to three of the following:<br><br>• (S / (diaphragm)/ it) contracts (1)<br>• flattens / presses down / moves down / less dome shaped / eq (1)<br>• increases volume (1)<br><br>• decreases pressure / air flows in down pressure gradient / eq (1) | **Ignore** more space<br><br>**Allow** low pressure | **3** |

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(b)(i)** | • (cycling) speed (1) | | **1** |

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(b)(ii)** | • conversion of $dm^3$ to $cm^3$ (65 000)<br>• 65 000 ÷ 25<br><br>**2600 ($cm^3$) (2)** | **one mark** for 65 000 **OR** division by 25<br><br>**two marks** for 2600 | **2** |

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(b)(iii)** | An answer that makes reference to four of the following:<br><br>• ventilation (rate) increases (1)<br>• (take in) more oxygen / eq (1)<br>• (release) more energy / ATP / high(er) respiration rate (1)<br>• more / faster muscle contraction (1)<br><br>• volume of air breathed per breath increases as speed increases (1)<br><br>• breathing rate increases from 20 / 25 km per hour / breathing rate does not increase between 0 – 20 km per hour (1)<br><br>• increase in volume of air per breath gets less as cycling speed increases / volume of air per breath stops increasing above 30 km per hour (1) | **Allow** positive correlation between ventilation rate and speed<br><br>**Allow** depth of breathing<br><br>**Allow** up to 20 km per hr increase is due to increased volume of air each breath / depth of breathing<br><br>**Allow** at over 20 km per hr, increase is due to increased rate of breathing | **4** |

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(b)(iv)** | • repeat / calculate average / mean / more cyclists / more people / eq (1) | **Allow** use other people | **1** |

Q21.

| Question Number | Answer | additional guidance | Mark |
|---|---|---|---|
| **(a)** | A description that makes reference to two the following:<br>• biuret (1)<br>• deepest / darker / intensity purple contains most protein (1)<br>• reference to same volume of milk / biuret (1) | allow other quantitative methods such as<br>solidify the milk protein by denaturing (1)<br>mass of the protein (1) | **2 exp** |

| Question Number | Answer | additional guidance | Mark |
|---|---|---|---|
| **(b)** | An explanation that makes reference to two of the following points:<br>• prevent infection / disease (1)<br>• (by destroying / due to) virus / bacteria / pathogen (1)<br>• provides immunity / eq (1) | ignore illness | **2 exp** |

| Question Number | Answer | additional guidance | Mark |
|---|---|---|---|
| **(c)** | An answer that includes two of<br>• use as a source of / for energy / respiration (1)<br>• use as store of energy (1)<br>• insulation / myelin sheath / protection fat around organs/ eq(1) | ignore for warmth | **2 grad** |

| Question Number | Answer | Mark |
|---|---|---|
| **(d)(i)** | lactose | **1 cler** |

| Question Number | Answer | Mark |
|---|---|---|
| **(d)(ii)** | *Lactobacillus / Streptococcus* Allow species names | **1 cler** |

| Question Number | Answer | Mark |
|---|---|---|
| **(d)(iii)** | An explanation that makes reference to two of the following points<br>• sterilise milk / pasteurise (1)<br>• kill bacteria / pathogen / microorganisms (1)<br>• prevent competition (for carbohydrate / sugar) (1) | **2 exp** |
| | | Total 10 marks |

Q22.

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(a)(i)** | An explanation that makes reference to two of the following:<br>• less pressure / reduced heart volume / less blood pumped (each beat) (1)<br>• less oxygen pumped to muscles (1)<br>• less respiration (1) | **Accept** lower stroke volume<br>Less oxygenated blood to muscles = 2 marks | **2** |

| Question Number | Answer | Mark |
|---|---|---|
| **(a)(ii)** | only one copy of an allele is needed to affect the phenotype / an allele that is always expressed (1) | **1** |

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(a)(iii)** | A genetic diagram that shows:<br>• parent genotypes of Hh and hh (1)<br>• gametes as H or h and h (or h) (1)<br>• offspring as Hh, hh (1)<br>• offspring in correct ratios (of 1:1) and phenotypes correctly identified (1) | **Accept** other letters<br>Ecf maybe for mp2 and 3 | **4** |

| Question Number | Answer | Mark |
|---|---|---|
| **(a)(iv)** | 0.25 / ¼ / 25% | **1** |

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(b)** | An answer that makes reference to two of the following:<br>• recessive alleles are not always expressed (in the phenotype) / recessive alleles are not expressed in heterozygous individuals / only expressed when homozygous / eq (1)<br>• dominant alleles are always expressed (in the phenotype) / are expressed when one is present / eq (1)<br>• cats with a dominant allele can be prevented from breeding / cats with a recessive allele cannot always stopped from breeding / eq (1) | **Accept** recessive alleles are hidden when a dominant allele is present / recessive alleles are only expressed when homozygous<br>**Accept** possession of one dominant allele means that the phenotype is identified / dominant alleles are always identified in phenotype | **2** |

Q23.

| Question Number | Answer | Mark |
|---|---|---|
| **(a)(i)** | • A sensory / afferent (1)<br>• B relay / association (1)<br>• C motor / efferent (1) | **3 grad** |

| Question Number | Answer | | Mark |
|---|---|---|---|
| **(a)(ii)** | An explanation that makes reference to the following points<br><br>• neurone A / sensory / afferent (+ impulse) (from receptor) to CNS / spinal cord / relay neurone / neurone B (1)<br><br>• (synapses with) neurone B / relay / association / (+ impulse) (from receptor neurone A) to motor / efferent / neurone C<br><br>• neurone C / motor / efferent (+ impulse) to effector / muscle | must have impulse once to score 3 marks<br><br>allow signal message for 2 max | **3 exp** |

| Question Number | Answer | additional guidance | Mark |
|---|---|---|---|
| **(b)(i)** | An explanation that makes reference to two of the following points<br><br>• measure the distance (from hand to spinal cord and or brain to other hand) (1)<br><br>• for each student / all students in ring (1)<br><br>• measure time taken (for student A to feel hand being squeezed / eq) (1)<br><br>• divide distance by time (1) | ignore count number of students<br><br>allow 'how long it took' | **2 exp** |

| Question Number | Answer | Mark |
|---|---|---|
| **(b)(ii)** | An explanation that makes reference to two of the following points<br><br>• may be underestimate / too slow / method adds time / delay / eq (1)<br><br>• not a reflex so need to allow decision making / role of brain / reaction time /eq (1)<br><br>• as delay occurs at each synapse (1) | **2 exp** |
| | | Total 10 marks |

Q24.

| Question Number | Answer | additional guidance | Mark |
|---|---|---|---|
| **(a)** | A description that makes reference to the following points:<br>• iodine (1)<br>• blue black / blue / black /eq (1) | <br><br><br>allow purple | **2** |

| Question Number | Answer | Mark |
|---|---|---|
| **(b)(i)** | The only correct answer is B fungus<br>A is not correct because it is not a bacterium<br>C is not correct because it is not a protoctist<br>D is not correct because it is not a virus | **1** |

| Question Number | Answer | Mark |
|---|---|---|
| **(b)(ii)** | The only correct answer is A amylase<br>B is not correct because it is not digested by ligase<br>C is not correct because it is not digested by lipase<br>D is not correct because it is not digested by protease | **1** |
| | Total 4 marks | |

Q25.

| Question Number | Answer | Mark |
|---|---|---|
| **(a)(i)** | An explanation that makes reference to 3 of the following points.<br><br>• (sulfur dioxide) released dissolves in water (vapour) (1)<br>• forms sulfuric acid (1)<br>• acid rain (1)<br>• causes damage to plants / deforestation / eq (1)<br>• breathing problems for humans / animals / eq (1)<br>• death of fish /aquatic organisms / eq (1) | **3** |

| Question Number | Answer | additional guidance | Mark |
|---|---|---|---|
| **(a)(ii)** | • less burning / use of fossils fuels / named fossil fuel / low sulfur fuel / named example of alternative to using fossil fuels / eq (1) | allow examples<br><br>use public transport / use wind power / cycling / electric/hybrid vehicles / etc | **1** |

| Question Number | Answer | additional guidance | Mark |
|---|---|---|---|
| **(b)** | An answer that makes reference to 6 of the following points.<br>• C with and without $HCO_3$ / changes concentrations of $HCO_3$ (1)<br>• O use same species / age / size / strain / type of seedling /eq (1)<br>• R repeat (for each concentration of $HCO_3$) (1)<br>• M1 measure / yield / height / mass / count number of leaves / number of plants that germinate / eq (1)<br>• M2 after stated time 48 hours + (1)<br>• S1 control light / $CO_2$ / temperature /eq (1)<br>• S2 control compost / water / humidity / moisture /minerals / fertiliser/ volume of solution / eq (1) | not just same time for M2 | **6 Exp** |
| | | Total = 10 | |

Q26.

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(a) (i)** | An explanation that makes reference to two of the following:<br>• (Flask B) as (mouthpiece) connected to long tube in flask B / (mouthpiece) connected to flask A is shorter / eq (1)<br>• (Flask B) tube (from mouthpiece) in limewater / tube in liquid in flask B / causes bubbles (in limewater) in B / not in liquid / draws air in flask A / eq (1)<br>• cannot inhale in flask B as limewater would be sucked in / would get mouthful of liquid / Flask A for inhalation as no liquid drawn up eq (1) | No credit if identify flask A<br>air into limewater<br>limewater not breathable | **2** |

| Question Number | Answer | additional guidance | Mark |
|---|---|---|---|
| **(a) (ii)** | An explanation that makes reference to two of the following:<br><br>• (Limewater) in flask A stays clear / no change / <u>less</u> cloudy / goes cloudy slowly / eq (1)<br><br>• (Limewater in) flask B goes (more) cloudy / milky / cloudy quicker / (1)<br><br>• as less carbon dioxide in inhaled / atmospheric air / (more) carbon dioxide in exhaled / eq (1)<br><br>• due to respiration (1) | allow stays clear<br><br>cloudy in both flasks scores 1<br><br>no credit for changes colour<br><br>or<br><br>cloudy (in both) as contains $CO_2$ also scores 1 | **2** |

| | | | |
|---|---|---|---|
| | | ignore no $CO_2$ in inhaled | |

| Question Number | Answer | Mark |
|---|---|---|
| **(a) (iii)** | • Sodium hydrogen-carbonate / sodium bicarbonate (solution)/ hydrogen-carbonate / bicarbonate indicator (1) | **1** |

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(b)** | An answer that makes reference to four of the following:<br>• diaphragm contracts (1)<br>• diaphragm flattens / moves down /eq (1)<br>• (external) intercostal muscles contract (1)<br>• rib cage raised / moves out (1)<br>• volume (of chest cavity / thorax) increases (1)<br>• pressure in (chest cavity / thorax) decreases / reduces (1)<br>• air drawn into lungs / lungs inflate /eq (1) | ignore volume of lungs | **4** |

Q27.

| Question Number | Answer | Mark |
|---|---|---|
| **(a)(i)** | A one<br><br>*B is incorrect because it is not three*<br>*C is incorrect because it is not four*<br>*D is incorrect because it is not eight* | **1 comp** |

| Question Number | Answer | Mark |
|---|---|---|
| **(a)(ii)** | D nine<br><br>*A is incorrect because it is not one*<br>*B is incorrect because it is not three*<br>*C is incorrect because it is not eight* | **1 comp** |

| Question Number | Answer | Mark |
|---|---|---|
| **(a)(iii)** | C 0.5<br><br>*A is incorrect because it is not 0.0*<br>*B is incorrect because it is not 0.25*<br>*D is incorrect because it is not 1.0* | **1 comp** |

| Question Number | Answer | Mark |
|---|---|---|
| **(a)(iv)** | 0.125 / 12.5% / 1/8 | **1 cler** |

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(b)** | • 64 ÷ 500 000 × 100<br>• = 0.013 or 1.3 x $10^{-2}$ | Award full marks for correct numerical answer without working<br>Allow 0.0128<br>Allow 1.28 x $10^{-2}$<br><br>Award one mark for correct working if final answer incorrect<br><br>64 ÷ 500 000 × 100<br><br>or<br><br>evidence of 128 or 13 in working | **2 grad** |

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(c)** | An explanation that makes reference to three of the following points:<br><br>• reduced ability to exercise / can't run fast / tires easily (when exercising) / tires faster (when exercising) (1)<br><br>• less oxygen coming from lungs (1)<br><br>• less oxygen to body / muscles (1)<br><br>• less respiration / less energy / more anaerobic respiration/ lactic acid present (1) | Ignore 'less oxygen' unqualified | **3 exp** |
| | | | Total 9 marks |

Q28.

| Question Number | Answer | Mark |
|---|---|---|
| **(a)** | A description that makes reference to four of the following points:<br>• boil leaf in water / eq (1)<br>• boil in ethanol (to remove chlorophyll) (1)<br>• hot water bath / kettle / turn off Bunsen / eq (1)<br>• soak in water (to rehydrate / allow diffusion) (1)<br>• add iodine solution (1)<br>• blue black / eq (leaf uncovered) starch present / yellow / eq no starch (leaf covered) (1) | **4** |

| Question Number | Answer | additional guidance | Mark |
|---|---|---|---|
| **(b)(i)** | An answer that makes reference to four of the following points:<br>• **increasing carbon dioxide increases rate /eq (1)**<br>• **$CO_2$ required / substrate (for photosynthesis)/ eq (1)**<br>• **greater higher (in rate) at high light intensity / eq (1)**<br>• **light required / provides energy for photosynthesis/ eq (1)**<br>• **increase is same from 0.00 to 0.02 / first two readings / eq ( in both light intensities) (1)**<br>• **levelling at (high light intensity) due to temperature / number of chloroplasts / amount of chlorophyll/ eq (1)** | **correct ref to $CO_2$ limiting factor**<br>allow converse<br>light limiting/ eq factor<br>ref to temperature limiting factor | **4** |

| Question Number | Answer | Mark |
|---|---|---|
| **(b)(ii)** | An answer that makes reference to one of the following points:<br>• use more bulbs / change bulb / wattage / use dimmer / filters / eq (1)<br>• change distance (1) | **1** |

| Question Number | Answer | Mark |
|---|---|---|
| **(b)(iii)** | • (number of) bubbles (per minute) / rate of photosynthesis / rate of oxygen production / eq | **1** |

| Question Number | Answer | Mark |
|---|---|---|
| **(b)(iv)** | • same type / species / mass / number of leaves / length / size same piece of plant / eq | **1**<br>**Grad** |
| | | Total = 11 marks |

Q29.

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(a)** | An explanation that makes reference to the following points:<br>• moves up / increases (1)<br>• water enters /<br>water passes through membrane (1)<br>• sucrose is a concentrated solution /<br>sucrose has a low(er) water potential /<br>high water potential to low water potential /<br>down a water potential gradient /<br>dilute to concentrated (1) | Mp3 Allow high conc. to low conc. of <u>water</u> / down water conc gradient | **3** |

| Question Number | Answer | Mark |
|---|---|---|
| **(b)** | An explanation that makes reference to the following points:<br>• use water bath / use Bunsen (1)<br>• use scale / measurements (on tube)/ ruler / (use pen to) mark tube (1)<br>• use clock / timer / stopwatch (1) | **3** |

Q30.

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(a) (i)** | An answer that makes reference to two of the following:<br>• volume / 5cm³ of fruit juice (1)<br>• volume / 5cm³ of Benedict's (1)<br>• temperature / use 70°C (1)<br>• time / for 3 minutes (1) | Ignore amount / concentration / mass | **2** |

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(a) (ii)** | B C D A (2) | B D C A = 1 | **2** |

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(a)(iii)** | An explanation that makes reference to three of the following:<br>• use 5cm³ / same volume of each (sugar) solution **and** use 5cm³ / same volume of Benedict's (1)<br>• heat at same temperature **and** for 3 minutes / heat at 70°C **and** for 3 minutes (1)<br>• match / compare <u>colour</u> of sugar solutions with fruit juices / eq (1) | use the original/ same method alone = 1 only if mp1 or mp2 are not awarded | **3** |

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(b) (i)** | An answer that makes reference to two of the following:<br>• (sugar) provides energy (1)<br>• respiration (in bacteria) (1)<br>• produce acid / low(ers) pH (1) | Mp1 Ignore food | **2** |

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **(b) (ii)** | An explanation that makes reference to two of the following:<br>• develop obesity / overweight (1)<br>• sugar provides energy / joules / calories (1)<br>or<br>• (type 2) diabetes (1)<br>• increase in <u>blood</u> glucose/sugar / insulin no longer works (1)<br>or<br>• CVD / heart disease / stroke (1)<br>• sugar converted to fat / fat deposits in arteries (1) | Only credit 1 health risk<br>Can only earn 2 marks if risk and explanation are linked (from same pair)<br>Mp4 Ignore not enough insulin | **2** |