OCR
RECOGNISING ACHIEVEMENT

GCE

# Biology

Advanced GCE **A2 H421**

Advanced Subsidiary GCE **AS H021**

# Mark Scheme for the Units

# January 2010

**HX21/MS/R/10J**

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## CONTENTS

## Advanced GCE Biology (H421)

## Advanced Subsidiary GCE Biology (H021)

## MARK SCHEMES FOR THE UNITS


| Unit/Content | Page |
|---|---|
| F211 Cells, Exchange and Transport | 1 |
| F212 Molecules, Biodiversity, Food and Health | 18 |
| F214 Communication, Homeostasis & Energy | 37 |
| Grade Thresholds | 54 |

# F211 Cells, Exchange and Transport

| Question | | | Expected Answers | Marks | Additional Guidance |
|---|---|---|---|---|---|
| 1 | (a) | | 1500 ; | | **ACCEPT** 1400 **and** 300,000 for 1 max only |
| | | | 500 000 ; | 2 | |
| | | | | | |
| 1 | (b) | | ability to see (two) objects (that are close together) as separate objects / AW ;<br>see detail ; | 2 | **ACCEPT** ability to distinguish two objects<br>**IGNORE** clarity / clear |
| | | | | | |
| 1 | (c) | (i) | transports water (up plant) ; | | **ACCEPT** alternative wording for transport e.g. movement<br>**DO NOT ACCEPT** up **and** down<br>**DO NOT ACCEPT** water and sugars |
| | | | transports, minerals / ions, (up plant) ; | | **ACCEPT** alternative wording for transport<br>**IGNORE** ref nutrients / solutes<br>**DO NOT ACCEPT** sugars |
| | | | support (plant / stem / shoot) ; | 1 max | **ACCEPT** keeps plant upright |
| | | | | | |

| Question | | | Expected Answers | Marks | Additional Guidance |
|---|---|---|---|---|---|
| 1 | (c) | (ii) | *Functions:*<br>**F1** (lignin), strengthens / thickens**,** the (xylem) wall **;**<br>**F2** waterproofing (wall) / AW **;**<br>**F3** (improving) adhesion of water (molecules) **;**<br>**F4** (spiral) pattern allows flexibility / stretching / movement**;**<br>**2 max** | | **ACCEPT** support only if in specific context of supporting the xylem wall<br>**ACCEPT** waterproofs cell<br>**DO NOT ACCEPT** adhesion **and** cohesion when used together<br>Flexibility / stretching must ref, *pattern* of lignin laid down i.e. spirals |
| | | | *Explanation:*<br>**E1** prevents collapse of xylem **;**<br>**E2** (water) under tension / at low pressure / negative pressure**;**<br>**E3** reduces (lateral) loss of water, through wall **;**<br>**E4** increases capillarity / AW **;**<br>**E5** prevents stem breaking / AW **;**<br>**2 max** | **3 max** | *Award mark(s) for function and explanation independently*<br>**DO NOT CREDIT** loss of water unqualified |

| Question | | | Expected Answers | Marks | Additional Guidance |
|---|---|---|---|---|---|
| 1 | (c) | (iii) | (pits) allow water to move**,** in / out / between, vessel(s) **;**<br>to bypass blockage **;**<br>supply water to other**,** tissues / (other types) cells / parts of plant **;** | **2 max** | **ACCEPT** lateral movement for 'out'<br>**ACCEPT** bypass air lock<br>**ACCEPT** any named, tissue / cells<br>e.g. to allow water to other tissues 1 mark<br>to allow water out to other tissues 1 mark<br>to allow water out of vessel to other tissues 2 marks |
| | | | **Total** | **10** | |

| Question | | | Expected Answers | Marks | Additional Guidance |
|---|---|---|---|---|---|
| 2 | (a) | (i) | collection / group, of cells (of one or more types) ; | 2 max | **IGNORE** ref similar cells |
| | | | (cells), working together **OR** with, common / same, function ; | | **ACCEPT** a group of cells with a function = 2 marks |
| | | | specialised (cells) ; | | **DO NOT CREDIT** differentiated |
| | | | | | |
| 2 | (a) | (ii) | squamous / ciliated ; | 1 | **ACCEPT** endothelium / columnar<br>**DO NOT ACCEPT** cilia, goblet cell, ciliated *cells* |
| | | | | | |
| 2 | (b) | | (organ is) a collection of tissues / named tissues ; | 2 | Look for idea of more than one tissue<br>**ACCEPT** two or more correctly named tissues from: epithelium, elastic, glandular, smooth muscle, blood, nervous, cartilage, connective |
| | | | (working together) to enable gas exchange / AW ; | | **DO NOT ACCEPT** perform a function unqualified – we want to know *what* function (can be named or described)<br>**DO NOT ACCEPT** respiration<br>**IGNORE** breathing |

| Question | | | Expected Answers | Marks | Additional Guidance |
|---|---|---|---|---|---|
| 2 | (c) | (i) | (*release of energy*) mitochondria **;** | 1 | |
| | | (ii) | *(movement of cilia)* cytoskeleton **;** | 1 | **ACCEPT** mitochondria if not used in **(i)** |
| | | (iii) | *(secretion of mucus)* Golgi (vesicle) **;** | 1 | **ACCEPT** cytoskeleton if not used in **(ii)**<br>**ACCEPT** Golgi body / apparatus<br>**DO NOT ACCEPT** Golgi vessel |
| | | | **Total** | 8 | |

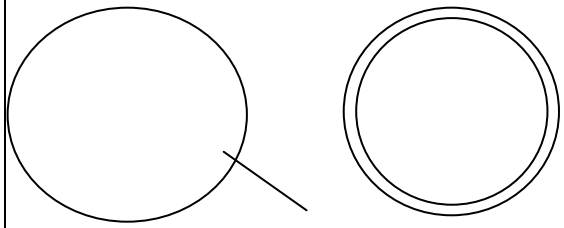
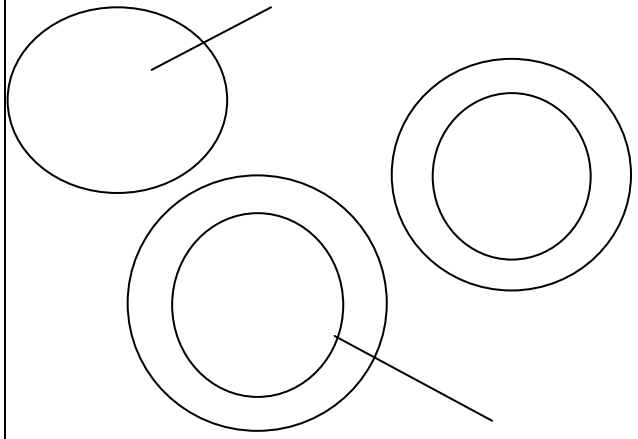
| Question | | | Expected Answers | Marks | Additional Guidance |
|---|---|---|---|---|---|
| 3 | (a) | | partially / selectively **;**<br><br>(facilitated) diffusion **OR** osmosis **;**<br>plasma **;**<br>phospholipids **;**<br>cholesterol **;** | **5** | **DO NOT ACCEPT** semi<br>**ACCEPT** differentially<br><br>**ACCEPT** plasma cell |
| | | | | | |

| Question | | | Expected Answers | Marks | Additional Guidance |
|---|---|---|---|---|---|
| 3 | (b) | | | | ***Look for <u>description</u> not list of functions*** |
| | | | **1** (acting as) **antigens ;** | | *Do not credit repetition of same point* |
| | | | **2** identification / **recognition**, (of cells) as**,** self / non-self / AW **;** | | **ACCEPT** foreign for non-self |
| | | | **3 cell signalling** / described **;** | | **ACCEPT** description e.g. communication *between* cells / cell responds to, chemical / signal, *from another cell* |
| | | | **4 receptor** / binding site, for, **hormone** / (chemical) signal / (medicinal / named) drugs **;** | | **ACCEPT** description of *attachment process* for receptor / binding site<br>**DO NOT ACCEPT** molecule unqualified<br>**ACCEPT** binding site for foreign antigen |
| | | | **5** ref. to **receptor** / binding site / trigger, on transport proteins / AW **;** | | **ACCEPT** ref to receptors on ion channels |
| | | | **6** cell **adhesion** / to hold cells together (in a tissue) **;** | | **ACCEPT** bind to other cells for cell adhesion |
| | | | **7** attach to water molecules (to stabilise membrane / cell) **;** | | |
| | | | **4 max** for description | | |
| | | | **QWC:** | | |
| | | | **three** technical terms used and spelt correctly **;** | | Any **three** from: |
| | | | | **5 max** | receptor, antigen, hormone, <u>cell</u> signal(ling), adhesion, recognition, <u>facilitated</u> diffusion, <u>active</u> transport |
| | | | **Total** | **10** | |

| Question | | | Expected Answers | Mark | Additional Guidance |
|---|---|---|---|---|---|
| 4 | (a) | | timer **OR** scale / ruler **;** | 1 | |
| | | | | | |
| 4 | (b) | | | | ***Mark the first three suggestions*** *irrespective of numbered points*<br>*IGNORE reasons – just mark* ***steps*** *in the process* |
| | | | shoot is healthy **;** | | **ACCEPT** shoot not wilted |
| | | | assemble apparatus / cut shoot**,** under water **;** | | |
| | | | cut last 2-3 cm off cut end / cut at an angle **;** | | **ACCEPT** cut end off shoot |
| | | | check there are no air bubbles in apparatus **;** | | **ACCEPT** make sure cut end of shoot is in contact with water once apparatus assembled |
| | | | apparatus**,** water tight / air tight / has no leaks **;** | | **ACCEPT** screw clip tight<br>**DO NOT ACCEPT** use Vaseline unqualified |
| | | | leaves dry **;** | | |
| | | | | **3 max** | **DO NOT CREDIT** allow time for acclimatisation, equilibration |

| Question | | | Expected Answers | Mark | Additional Guidance |
|---|---|---|---|---|---|
| 4 | (c) | (i) | 25.3 ; | 1 | **IGNORE** any units |
| | | | | | |
| 4 | (c) | (ii) | to make results (more) reliable ; | | **DO NOT ACCEPT** accurate **and** reliable (use of **both** terms) anywhere in the answer |
| | | | to help identify anomalies ; | 2 | Look for idea of spotting the anomaly e.g. spot, notice, recognise, show, detect.<br>**DO NOT CREDIT** prevents / take out / remove / accounts for, anomalies<br>**DO NOT CREDIT** 'ensure there is no anomaly' unless qualified<br>**ACCEPT** outliers for anomalies<br>**ACCEPT** to identify other factors / (uncontrolled) variables that may be having an effect |
| 4 | (c) | (iii) | *in afternoon:*<br>plant dying / less healthy / wilting ;<br>ref to stomatal closure ;<br>more humid / higher water (vapour) potential in air ;<br>less air movement / wind / draughts ; | 2 max | *Mark first response in each numbered section (1-2). If not all sections are used, return to the first section and mark further suggestions*<br>Assume answer is for different conditions in the afternoon<br>**ACCEPT** ORA if stated 'in morning...'<br>**IGNORE** ref to light / dark<br>Look for **comparative** statements – higher, greater etc<br>**DO NOT CREDIT** more **moisture** in air |

| Question | | | Expected Answers | Mark | Additional Guidance |
|---|---|---|---|---|---|
| 4 | (c) | (iv) | (potometer) measures (water) uptake **;** | | |
| | | | not all water (taken up) is lost **;** | | **ACCEPT** ref to figs e.g. 99% water *taken up* is lost<br>**ACCEPT** the assumption that water loss is equal to water uptake is incorrect |
| | | | some water used (in photosynthesis / making cells turgid) **;** | **2 max** | |
| | | | **Total** | **11** | |

| Question | | | Expected Answers | Marks | Additional Guidance |
|---|---|---|---|---|---|
| 5 | (a) | (i) | vein with thinner wall than artery **;** | 1 | **CREDIT:** Correct position of endothelium as indicated by circle or label line<br>Must be clearly **thinner** than shown on artery<br>  <br>**DO NOT CREDIT**:<br>  |

| Question | | | Expected Answers | Mark | Additional Guidance |
|---|---|---|---|---|---|
| 5 | (a) | (ii) | *Arteries have:*<br><br>no valves **;**<br>endothelium / tunica intima, folded / AW **;**<br>more / thicker, muscle / elastic tissue / tunica media **;**<br>more / thicker, collagen / tunica externa **;** | **2 max** | *Assume answer refers to wall of artery.*<br>**IGNORE** any ref to artery wall being thicker, unqualified, as this has already been stated in the question<br>**IGNORE** *reasons for differences*<br>**ACCEPT** ORA if stated - 'vein is…...'<br>Look for **comparative** statements<br>**ACCEPT** tunica adventitia for tunica externa |
| | | | | | |
| 5 | (b) | (i) | contraction of <u>ventricle</u>, wall / muscle **;** | **1** | **ACCEPT** ventricular systole<br>**DO NOT CREDIT** heart muscle unqualified<br>**DO NOT CREDIT** contraction of atria **and** ventricles<br>**DO NOT CREDIT** pump / squeeze / push / beat without ref to contraction |
| | | | | | |

| Marks | | | Expected Answers | Mark | Additional Guidance |
|---|---|---|---|---|---|
| 5 | (b) | (ii) | more, (smaller) vessels / named vessels **;** | | **ACCEPT** *divides* into smaller vessels (implies more of them) |
| | | | (vessels) have larger, total lumen / cross sectional area **;** | | **ACCEPT** larger total surface area |
| | | | reduced resistance to blood flow **;** | | **DO NOT CREDIT** further from the heart |
| | | | arteries, stretch / expand **;** | | |
| | | | loss of, fluid / plasma, from capillaries **;** | **2 max** | **DO NOT CREDIT** loss of, blood / water<br>**DO NOT CREDIT** loss of fluid / plasma, unqualified or from other vessels |
| 5 | (b) | (iii) | | | *Assume 'it' refers to plasma:* |
| | | | plasma / fluid, moves out of**,** capillary / blood **;** | | **DO NOT CREDIT** water / diffuses out<br>**ACCEPT** filters out |
| | | | enters / forms, tissue fluid **;** | | |
| | | | (plasma) proteins, remain in capillary / too large to pass through capillary wall / AW **;** | | |
| | | | (fluid moves) down pressure gradient **;** | | |
| | | | hydrostatic pressure greater than, water potential / Ψ**;** | **3 max** | **DO NOT CREDIT** ref to osmosis |

| Marks | | | Expected Answers | Marks | Additional Guidance |
|---|---|---|---|---|---|
| 5 | (c) | | **X** = carbonic anhydrase **;** | | **ACCEPT** correct phonetic spelling<br>**DO NOT ACCEPT** anahydrase |
| | | | **Y** = carbonic acid / $H_2CO_3$ **;** | | If formula only given, it must be correct. Incorrect formula can be ignored if correct name given. |
| | | | **Z** = hydrogen (ion) / $H^+$ **;** | **3** | **DO NOT CREDIT** H alone |
| | | | **Total** | **12** | |

| Question | | | Expected Answers | Marks | Additional Guidance |
|---|---|---|---|---|---|
| 6 | (a) | (i) | **diaphragm** / **intercostal** muscles**,** contract **:** | | *First two points are marked independently*<br>**DO NOT CREDIT** *internal* intercostal muscles contract |
| | | | **diaphragm** moves down / ribs move upwards and outwards **;** | | **DO NOT CREDIT** diaphragm flattens alone<br>**ACCEPT** movement of diaphragm pushes digestive organs down |
| | | | **volume** of **thorax** increased **;** | | **DO NOT ACCEPT** expands (for increased volume) |
| | | | **pressure** inside thorax falls **;** | | **DO NOT ACCEPT** size for volume<br>**ACCEPT** capacity for volume<br>**ACCEPT** lungs / chest (cavity), for thorax |
| | | | to below atmospheric pressure (so air enters lungs) **;** | | **DO NOT CREDIT** pressure gradient alone - *direction* of gradient must be specified |
| | | | ***2 max*** *for mechanism* | | |
| | | | **QWC:**<br>accept three technical terms used and spelt correctly **;** | **3 max** | accept any **three** from: diaphragm, intercostal, volume, pressure, thorax, thoracic cavity |

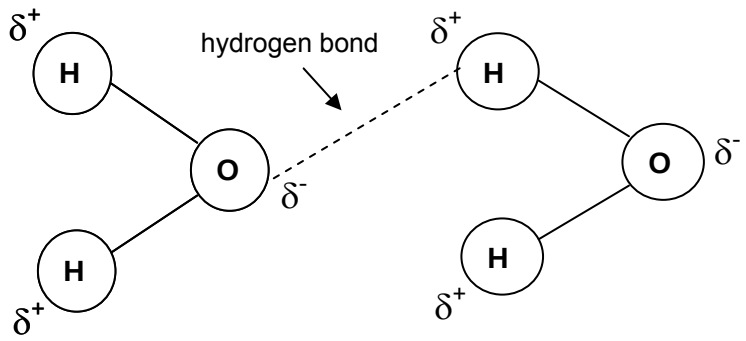
| Question | | | Expected Answers | Marks | Additional Guidance |
|---|---|---|---|---|---|
| 6 | (a) | (ii) | it falls / goes down / AW **;** | 1 | **ACCEPT** decreases in volume / volume gets smaller<br>**DO NOT CREDIT** empties, closes, flattens, deflates, becomes smaller<br>**DO NOT ACCEPT** amount for volume |
| | | | | | |
| 6 | | (iii) | soda lime / sodium hydroxide / potassium hydroxide / calcium hydroxide **;** | 1 | **ACCEPT** correct formulae<br>NaOH / KOH / $Ca(OH)_2$<br>**DO NOT ACCEPT** calcium oxide<br>**ACCEPT** limewater, lime soda |
| | | | | 2 max | |
| 6 | (b) | | to ensure all air breathed comes from chamber<br>**OR**<br>to prevent, escape of air / entry of air**,** through nose **;** | | **ACCEPT** air may be breathed in or out through nose<br>**ACCEPT** ensures breathes through mouth |
| | | | make results <u>invalid</u> **;** | | **DO NOT ACCEPT** ref accuracy, reliability, false results<br>**DO NOT ACCEPT** invalid **and** accuracy / reliability (use of **both** terms) anywhere in the answer |

| Marks | | | Expected Answers | Marks | Additional Guidance |
|---|---|---|---|---|---|
| 6 | (c) | | use (medical grade) oxygen / fresh air **;** | | *Note question relates to measuring **vital capacity*** **ACCEPT** ensure there is enough oxygen / air |
| | | | disinfect mouthpiece **;** | | **ACCEPT** change / wash mouthpiece |
| | | | ref. to health of subject **;** | | e.g. asthmatics |
| | | | ref to correct functioning of equipment **;** | **2 max** | e.g. maintain constant temperature (so that volume of gases is not affected)<br>ensure, valve / hinge, is working<br>level of water correct<br>no leaks / airtight / lips sealed around mouthpiece |
| | | | **Total** | **9** | |

# F212 Molecules, Biodiversity, Food and Health

| Question | | | Expected Answers | Marks | Additional Guidance |
|---|---|---|---|---|---|
| 1 | (a) | | obese ;<br>iron ;<br>haemoglobin ; | 3 | |
| 1 | (b) | | 24.7 ; ; | 2 | If answer incorrect or to the wrong number of dp, then<br>**ALLOW** one mark for working:<br>$69 \div 1.67^2$<br>24.74 = one mark<br>**IGNORE** 25 and look for working mark<br>If units are given, they **must** be $kg\,m^{-2}$ (or $kg/m^2$)<br>Max 1 for incorrect units |
| 1 | (c) | (i) | overweight / borderline overweight ; | 1 | **DO NOT CREDIT** if more than one answer given |
| 1 | (c) | (ii) | **1** very close to border / AW ;<br>**2** graph does not distinguish between male and female ;<br>**3** does not measure actual fat / AW ;<br>**4** has, more / less, muscle / bone (than normal)<br>**OR**<br>(does not take into account) muscle / bone, mass / density / weight ;<br>**5** muscle / bone, heavier / denser, than fat / AW ;<br>**6** pregnant ; | 2 max | **1 DO NOT CREDIT** mistake reading graph<br>**4** Must refer to idea of amount of muscle / bone being different from normal.<br>**DO NOT CREDIT** muscle / bone unqualified<br>**CREDIT** has osteoporosis as ref. to different bone density |

| Question | | | Expected Answers | Marks | Additional Guidance |
|---|---|---|---|---|---|
| 1 | (d) | | **1** coronary heart disease / CHD / atherosclerosis / angina / coronary thrombosis / myocardial infarction / heart attack / cardiac arrest / cardiovascular disease / stroke **;**<br><br>**2** (osteo)arthritis **;**<br>**3** (Type 2) diabetes **;**<br>**4** high blood pressure / hypertension **;**<br>**5** gallstones **;**<br>**6** cancer **;** | **2 max** | **1 DO NOT CREDIT** heart disease alone / arteriosclerosis<br><br>**2 DO NOT CREDIT** rheumatoid arthritis<br>**3 DO NOT CREDIT** Type 1 diabetes<br><br>**6 ACCEPT** any type of cancer |
| | | | **Total** | **10** | |

| Question | | | Expected Answers | Marks | Additional Guidance |
|---|---|---|---|---|---|
| 2 | (a) | | **1** hydrogen bond represented as, horizontal / vertical, dashed line between **O** on one molecule and **H** on the adjacent molecule **;**<br><br>**2** hydrogen / **H**, bond label (on any drawn bond between 2 molecules) **;**<br>**3** (delta positive) $\delta^+$ on **each** drawn **H** **and** (delta negative) (2) $\delta^-$ on **each** drawn **O ;** | **3** |  <br>**1** **DO NOT CREDIT** if >1 H bond is drawn between the same two molecules<br>**3** if both molecules drawn, $\delta^+$ and $\delta^-$ on **all** atoms.<br>**ACCEPT** d (lower case) for $\delta$ |

| Question | | | Expected Answers | Marks | Additional Guidance |
|---|---|---|---|---|---|
| 2 | (b) | | *ice floats* | | |
| | | **P1** | (ice less dense because) molecules spread out **;** | | |
| | | **P2** | molecules form, crystal structure / lattice / AW **;** | | |
| | | **P3** | ice forms insulating layer / clearly described **;** | | **P3** e.g. acts as a barrier to the cold |
| | | **P4** | water (below ice), does not freeze / still liquid / remains water / kept at higher temperature **;** | | |
| | | **S1** | organisms do not freeze **;** | | **S1 DO NOT ACCEPT** die (because 'survival' stated in stem) |
| | | **S2** | animals / organisms, can still, swim / move **;** | | |
| | | **S3** | allows, currents / nutrients, to circulate **;** | | |
| | | | *solubility* | | |
| | | **P5** | ions / named ion, polar / charged **;** | | |
| | | **P6** | ions /named ion, attracted to / bind to / interact with, water; | | |
| | | **S4** | (named) organisms / plants / animals, uptake / AW, minerals / named mineral / nutrients **;** | | **S4 ACCEPT** obtain / enters / goes in / gets |
| | | **S5** | correct use of named, mineral / nutrient, in organism **;** | | **S5** needs to be more specific than 'for growth / metabolism' suitable examples include but are not limited to: nitrates for amino acids / protein / (named) nucleic acid / phosphate for ATP / phospholipids / plasma membrane / magnesium for chlorophyll etc |

| | | | | | |
|---|---|---|---|---|---|
| | | | *temperature stability* | | |
| | | **P7** | many / stable, (hydrogen) bonds between molecules **;** | | **P7** Many hydrogen bonds between molecules = 2 marks (gets P7 and H) |
| | | **P8** | at lot of energy to, force apart molecules / break bonds **;** | | **P8** **ACCEPT** heat as alternative to energy |
| | | **P9** | high (specific) heat capacity **;** | | **P9** **DO NOT CREDIT** latent heat capacity |
| | | **S6** | temperature does not change much / small variation in temperature **;** | | **S6** could refer to organisms **or** surrounding water<br>**ACCEPT** stays cool in summer / stays warm in winter<br>**DO NOT CREDIT** constant alone |
| | | **S7** | effect of temperature on **,** enzymes / metabolic rate **;** | | **S7** **ACCEPT** any reference to temperature affecting enzyme activity / metabolic rate |
| | | **S8** | gases remain soluble **;** | | |
| | | **H** | *Award once in any section*<br>hydrogen bonds **;** | **7 max** | **DO NOT CREDIT** if in incorrect context (e.g. they are strong bonds) |
| | | | **QWC** - Award if you see a P mark **and** an S mark within the **same** section **;** | **1** | Look for the **S** mark first, then award QWC if there is a **P** mark **in the same section** in the mark scheme |
| **2** | **(c)** | | hydrolysis / hydrolytic **;**<br>hydrophilic **;** | **2** | **ACCEPT** phonetic spelling throughout<br>**IGNORE** head |
| | | | **Total** | **13** | |

| Question | | | Expected Answers | Marks | Additional Guidance |
|---|---|---|---|---|---|
| 3 | (a) | (i) | X ; | 1 | |
| | | | | | |
| 3 | (a) | (ii) | **1** substrate / PABA, **and**, inhibitor / sulfonamide, similar shape**;**<br>**2** able to, bind / fit into / block, active site **;**<br>**3** (shape) complimentary to active site **;**<br><br>**4** both have, hex / benzene / 6-C, (ring) **;**<br>**5** both have, $NH_2$ / amine **;**<br>**6** correct ref to a difference between sulfonamide and PABA **;** | **3 max** | **1 ACCEPT** similar structure **DO NOT CREDIT** same shape<br>**3 DO NOT CREDIT** refs to PABA and sulfonamide being complementary to each other or to the enzyme (alone)<br>**6** e.g. only sulfonamide contains S<br>sulfonamide has 1 more $NH_2$ group<br>sulfonamide has $SONH_2$ but PABA has $N_2$<br>only PABA has COOH group |
| | | | | | |
| 3 | (b) | (i) | *without inhibitor*<br>**1** more, PABA / substrate, molecules enter active site **;**<br><br>**2** more, enzyme substrate complexes / ESCs, formed **;**<br><br>**3** at low concentration not all active sites occupied /<br>at high concentration all active sites occupied **;**<br><br>**4** achieves / reaches, max (turnover) rate / $V_{max}$ **;**<br><br>**5** (at high substrate concentration) enzyme concentration limiting **;** | **3 max** | **1 ACCEPT** more successful collisions between substrate and active site<br>**3 ACCEPT** active sites filled / no free active sites<br>**DO NOT CREDIT** active sites run out<br>**4 ACCEPT** 'cannot work any quicker'<br>**DO NOT CREDIT** 'optimum rate' or 'rate levels off' |

| Question | | | Expected Answers | Marks | Additional Guidance |
|---|---|---|---|---|---|
| 3 | (b) | (ii) | *with inhibitor*<br>**1** inhibitor / sulfonamide, can, fit / block / bind to / compete for, <u>active site</u> **;**<br>**2** (occupies it) for a short time / temporary / reversibly **;**<br>**3** fewer active sites available (for substrate) / AW **;**<br>**4** (idea of) more substrate reduces chance of inhibitor getting in**;** | **2 max** | **3 ACCEPT** substrate can't access active site<br>**4 ACCEPT** more ESC formed in context of overcoming inhibition / substrate can out-compete inhibitor |
| 3 | (c) | | **1** mutation **;**<br>**2** sulfonamide is <u>selective</u>, agent / pressure **;**<br>**3** resistant survive / non resistant die **;**<br>**4** (resistance) allele / gene / mutation, passed to, offspring / next generation **;**<br>**5** (happens) over many generations **;**<br>**6** AVP **;** | **4 max** | **DO NOT CREDIT** immune for **any** mark point<br>**3 IGNORE** refs to (survivors) breed / reproduce **;**<br>**5 IGNORE** refs to time. Look for generations<br>**6** e.g. mutation is, **random** / spontaneous allele / gene, passed on by, plasmids / horizontal transmission |
| | | | | | |
| 3 | (d) | (i) | <u>bacteria</u>, killed / destroyed / cannot grow / lyse, in presence of antibiotic **;** | **1** | **DO NOT CREDIT** 'antibiotic works better' **or** 'there are no bacteria there' **or** 'bacteria are broken down' |
| | | | | | |
| 3 | (d) | (ii) | streptomycin **;** | **1** | **IGNORE** '4' as it is the number rather than the name |

| Question | | | Expected Answers | Marks | Additional Guidance |
|---|---|---|---|---|---|
| 3 | (d) | (iii) | **1** cheap / AW **;**<br>**2** (test is) quick to carry out / (deals with several antibiotics) at same time / AW **;**<br>**3** (idea of) allowing early treatment of patient **;**<br>**4** (idea of) compares antibiotics under same conditions **;**<br>**5** (correct antibiotic first time) to prevent antibiotic resistance developing **;** | **3 max** | **DO NOT CREDIT** responses which simply refer to selecting the best antibiotic<br><br>**2 DO NOT CREDIT** speed of antibiotic action |
| | | | | | |
| 3 | (e) | | (new) drugs come from (named) organisms **;**<br>biodiversity is reducing **;**<br>habitats / named habitat, destroyed / lost **;**<br>reason for habitat destruction **;** | **2 max** | **ACCEPT** plants / animals / fungi / species / etc.<br><br>**ACCEPT** deforestation / natural environment lost<br>e.g. global warming<br>logging<br>fuel<br>crops<br>construction / industrialisation<br>mining<br>fishing<br>pollution<br>tourism<br>**ACCEPT** any other valid reason that will destroy natural habitats but **not** general statements such as 'human development' or 'business' |
| | | | **Total** | **20** | |

| Question | | | Expected Answers | Marks | Additional Guidance |
|---|---|---|---|---|---|
| 4 | (a) | (i) | L ;<br>M ;<br>J ; | 3 | If 2nd letter given, no mark |
| | | | | | |
| 4 | (a) | (ii) | **1** peptide bond ;<br>**2** between, amine / **J** group (of one amino acid) and carboxyl / **L** group (of another) ;<br>**3** H (from amine group ) combines with OH (from carboxyl group) ;<br>**4** condensation reaction<br>**OR**<br>water, lost / eliminated / produced / created / AW ;<br>**5** covalent ; | 3 max | **CREDIT** answers from clearly drawn diagrams with bonds labelled<br>**1 ACCEPT** peptide link |
| | | | | | |
| 4 | (b) | | **1** some R groups, attract / repel ;<br>**2** disulfide, bridges / bond ;<br>**3** between, cysteine / SH / S (atoms) ;<br>**4** hydrogen / H, bonds ;<br>**5** ionic bonds between, oppositely charged / + and -, R groups ;<br>**6** hydrophilic R groups, on outside of molecule / in contact with water (molecules) ;<br>**7** hydrophobic R groups, on inside of molecule / shielded from water (molecules) ; | 4 max | **4 DO NOT CREDIT** in context of **secondary** structure |

<table>
<tr><th colspan="3">Question</th><th>Expected Answers</th><th>Marks</th><th>Additional Guidance</th></tr>
<tr><td>4</td><td>(c)</td><td>(i)</td><td>
<table>
<tr><th></th><th>glycogen</th><th>collagen</th><th></th></tr>
<tr><td>1</td><td>carbohydrate / polysaccharide</td><td>protein / polypeptide</td><td>;</td></tr>
<tr><td>2</td><td>(alpha) glucose (units)</td><td>amino acid (units)</td><td>;</td></tr>
<tr><td>3</td><td>identical units</td><td>different amino acid units</td><td>;</td></tr>
<tr><td>4</td><td>glycosidic, bonds / links</td><td>peptide, bonds / links</td><td>;</td></tr>
<tr><td>5</td><td>branched</td><td>unbranched / linear</td><td>;</td></tr>
<tr><td>6</td><td>non-helical</td><td>helical</td><td>;</td></tr>
<tr><td>7</td><td>one chain (per molecule)</td><td>three chains (per molecule)</td><td>;</td></tr>
<tr><td>8</td><td>no cross links</td><td>cross links (between chains)</td><td>;</td></tr>
<tr><td>9</td><td>contains C H O</td><td>contains C H O N</td><td>;</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
</table>
</td><td>3 max</td><td>AWARD 1 mark per correct row<br>Comparative statements must be made in a row<br><br>2 DO NOT CREDIT beta<br><br>5 ALLOW straight<br><br>7 DO NOT CREDIT strands<br><br>9 IGNORE S (for collagen)</td></tr>
<tr><td>4</td><td>(c)</td><td>(ii)</td><td>(high tensile) strength / strong ;<br>does not stretch / is not elastic ;<br>insoluble ;<br>flexible ;</td><td>2 max</td><td>Mark the 1st answer on each numbered line<br>IGNORE fibrous / tough</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>15</td><td></td></tr>
</table>

| Question | | | Expected Answers | Marks | Additional Guidance |
|---|---|---|---|---|---|
| 5 | (a) | (i) | (diagram shows that some) individuals have more than one risk factor ; | 1 | **DO NOT CREDIT** CHD is multifactorial |
| | | | | | |
| 5 | (a) | (ii) | **1** high, saturated / animal, fat diet ;<br>**2** high salt intake ;<br>**3** (diet) low in (named) antioxidants / vitamin A / vitamin C / vitamin E ;<br>**4** obesity ;<br>**5** genetic / heredity / inherited / ethnicity / race ;<br>**6** gender / sex ;<br>**7** excess alcohol consumption ;<br>**8** (increasing) age ;<br>**9** diabetes ;<br>**10** stress ; | 2 max | Mark the 1st answer on each numbered line.<br>**1 ACCEPT** absence of polyunsaturated fats<br>**7** must indicate, excess / high levels |

<table>
<tr><th colspan="3">Question</th><th>Expected Answers</th><th>Marks</th><th>Additional Guidance</th></tr>
<tr><td>5</td><td>(a)</td><td>(iii)</td><td>
<table>
<tr><th>effect</th><th>nicotine</th><th>carbon monoxide</th></tr>
<tr><td>increases heart rate</td><td>✓</td><td></td></tr>
<tr><td>constricts arterioles</td><td>✓</td><td></td></tr>
<tr><td>damages the lining of arteries</td><td></td><td>✓</td></tr>
<tr><td>reduces the ability of haemoglobin to carry oxygen</td><td></td><td>✓</td></tr>
<tr><td>makes platelets sticky</td><td>✓</td><td></td></tr>
</table>
;<br>;<br>;<br>;<br>;
</td><td>4</td><td>DO NOT CREDIT hybrid ticks<br>IGNORE crosses in the ‘blank’ boxes</td></tr>
</table>

| Question | | | Expected Answers | Marks | Additional Guidance |
|---|---|---|---|---|---|
| 5 | (b) | | **1** damage to endothelium **;**<br>**2** LDLs contain, saturated fat / cholesterol **;**<br>**3** LDLs collect at site of damage **;**<br>**4** fatty substances / cholesterol / LDLs, deposited, in artery wall / under endothelium **;** | **2 max** | **2 DO NOT CREDIT** moves / transports<br>**CREDIT** LDLs are protein **and** saturated fat / cholesterol<br>**3** must be stated<br>**4 ACCEPT** fats / lipids<br>**ACCEPT** under lining of artery wall<br>**DO NOT CREDIT** veins / vessels / capillaries |
| | | | | | |
| 5 | (c) | | **1** increases size / AW, of lumen **;**<br>**2** increases / eases / decreases resistance to, blood flow **;**<br>**3** (therefore) more, $O_2$ / glucose **;**<br>**4** for aerobic respiration **;**<br>**5** in, heart muscle / cardiac muscle / myocardium **;**<br>**6** more $CO_2$ removed **;** | **4 max** | **1 ACCEPT** reduces blockage in lumen<br>**2 ACCEPT** 'more blood' / 'blood flows more freely' / 'blood flows as normal' / 'quicker blood flow'<br>**3** needs idea of more oxygen (than before operation)<br>**CREDIT** idea of preventing oxygen starvation<br>'more oxygenated blood' gets mark points 2 and 3 |
| | | | **Total** | **13** | |

| Question | | | Expected Answers | Marks | Additional Guidance |
|---|---|---|---|---|---|
| 6 | (a) | (i) | deoxyribose (sugar) ;<br>phosphate (group) ;<br><br>(nitrogenous / purine or pyrimidine) base /<br>one correctly named base ; | 3 | **DO NOT CREDIT** dioxyribose<br>**DO NOT CREDIT** phosphate head or phosphate backbone<br><br>**DO NOT CREDIT** letter instead of named base<br>**DO NOT CREDIT** uracil<br>**DO NOT CREDIT** incorrect spelling of thymine with 'a' |
| | | | | | |
| 6 | (a) | (ii) | has ribose ;<br>uracil / U, instead of, thymine / T ;<br>single stranded ;<br>3 forms / AW ; | 2 max | assume answer refers to RNA unless otherwise stated<br><br>**DO NOT CREDIT** incorrect spelling of thymine with 'a' |

| Question | | | | Expected Answers | Marks | Additional Guidance |
|---|---|---|---|---|---|---|
| 6 | (b) | | 1 | untwist / unwind ; | | 1 **DO NOT CREDIT** unravel |
| | | S | 2 | unzip / described ; | | 2 **DO NOT CREDIT** strands separating without qualification |
| | | S | 3 | H bond breaks ; | | |
| | | | 4 | both strands act as template ; | | |
| | | N | 5 | (aligning of) free (DNA) nucleotides ; | | 5 **DO NOT CREDIT** bases |
| | | N | 6 | complementary, base / nucleotide, pairing ; | | 6 & 7 Do not consider for **QWC** if mark awarded in the context of breaking apart or DNA structure only, rather than forming new double helix |
| | | N | 7 | C to G **and** T to A / purine to pyrimidine ; | | |
| | | R | 8 | hydrogen bonds reform ; | | |
| | | R | 9 | sugar-phosphate back bone forms ; | | |
| | | R | 10 | (using) covalent / phosphodiester, bond ; | | |
| | | | 11 | semi-conservative replication ; | | |
| | | | 12 | DNA polymerase ; | | 12 **CREDIT** at any stage in the process |
| | | | 13 | AVP ; | | 13 e.g. ligase / helicase / gyrase used in correct context<br>C – G 3 H bonds / T – A 2 H bonds<br>activation of free nucleotides (with 2 phosphates)<br>synthesis in the 5’ to 3’ direction<br>Okazaki fragments on lagging strand |
| | | | | | 6 max | |
| | | | | **QWC** - correct sequence –<br>1 **S** mark, then 1 **N** mark, then 1 **R** mark ; | 1 | It should be clear that candidate realises that the sequence is S, then N then R – even if not written in that order<br>**DO NOT CREDIT** if any ref to transcription / translation |

| Question | | | Expected Answers | Marks | Additional Guidance |
|---|---|---|---|---|---|
| 6 | (c) | (i) | polypeptide / protein / primary structure / a sequence of amino acids **;** | 1 | **DO NOT CREDIT** 'codes for an amino acid'<br>**IGNORE** enzyme / named protein |
| | | | | | |
| 6 | (c) | (ii) | different, sequence of amino acids / primary structure / AW **;**<br>different protein / protein folds up differently / different tertiary structure **;**<br>(product) no longer functions / different function **;** | 2 max | **DO NOT CREDIT** 'product' or incorrect biochemical (e.g. carbohydrate)<br>**ACCEPT** suitable example, e.g. active site of enzyme no longer complimentary to substrate |
| | | | **Total** | **15** | |

| Question | | | Expected Answers | Marks | Additional Guidance |
|---|---|---|---|---|---|
| 7 | (a) | | *habitat*<br>**1** the place where, an organism / organisms / a population / a community, lives **;** **1 max**<br><br>*biodiversity*<br>**2** variety of life / the range of living organisms found / AW **;**<br><br>**3** variety / range, of, habitats / ecosystems **;**<br>**4** number of different species **;**<br>**5** variety / genetic diversity, within species **;** **2 max** | **3 max** | **1 ACCEPT** animal or plant<br>**ACCEPT** location / environment / area<br>**DO NOT CREDIT** ecosystem<br><br>***max 2** for biodiversity*<br>**2 DO NOT CREDIT** ref to variation<br>**ACCEPT** species richness / species diversity<br><br>**4** must have ref to number / how many / etc. |
| | | | | | |
| 7 | (b) | | not random / should have been random **;**<br>unrepresentative / skewed / biased, results **;**<br>creates an over-estimate of diversity **;**<br>may miss some (dominant) species / does not cover full range of species **;** | **2 max** | **DO NOT CREDIT** ref to 'fair test' unless qualified<br><br>'misleading' is not quite good enough<br><br>**CREDIT** plant / animal instead of species |
| | | | | | |
| 7 | (c) | (i) | remove units from the body of the table **and** put units in column heading / AW **;** | **1** | **ALLOW** 'measurement' or 'type of measurement' instead of 'unit'<br>**DO NOT CREDIT** 'units are not necessary in table' |

| Question | | | Expected Answers | Marks | Additional Guidance |
|---|---|---|---|---|---|
| 7 | (c) | (ii) | bell shaped **;**<br><br>peak / highest point, for ling between peaks for bracken and cotton grass (on horizontal axis) **;**<br>peak / highest point, for ling lower than both bracken and cotton grass (on vertical axis) **;** | **3** | • must start at 0% cover and after 0m and finish at 0% cover and before 100m<br>• line must cross the line for bracken<br>• allow sharp angle for peak of bell |
| 7 | (c) | (iii) | **1** absent at bottom of slope / present at top of slope **;**<br><br>**2** amount of bracken / percentage cover, increases with increasing distance **;**<br>**3** comparative figs. with units **;** | **2 max** | **1 DO NOT CREDIT** that bracken is present at top if answer also implies that some bracken is present at the bottom<br>**ALLOW** 'before 40 - 50m' as AW for 'bottom'<br>**ALLOW** 'after 40 - 50m' as AW for 'top'<br>**ALLOW** 'start' instead of 'bottom' and 'finish' or 'end' or 'higher up' instead of 'top'<br>Needs to be stated – cannot be implied from mp 2<br><br>**3** two percentages at two stated distances (must be from table) e.g. 0% at 0m and 74% at 100m<br>**or** percentage difference between two stated distances<br>**ALLOW** 'percentage cover' instead of % for units<br>**DO NOT CREDIT** 0% at the bottom and 74% at the top (as no distance has been quoted) |

| Question | | | Expected Answers | Marks | Additional Guidance |
|---|---|---|---|---|---|
| 7 | (d) | (i) | record / identify / list / AW, all species / (all) other plants **;**<br><br>(count / estimate) numbers of individuals within each species / AW **;** | **2 max** | **IGNORE** observe<br>**IGNORE** animals *for this habitat*<br>**IGNORE** 'species richness' and any other calculation<br>**ACCEPT** the number of plants / species<br><br>If the formula is given, only credit this mark if 'n' is explained in terms of the number of individuals within the species |
| 7 | (d) | (ii) | not stable / at risk / low ability to withstand change / AW **;**<br>more likely to lose species **;** | **1 max** | **IGNORE** 'biodiversity is low' as this is given in the question<br>**IGNORE** 'only a few species' or 'dominated by a few species' as these are descriptions of low biodiversity |
| | | | **Total** | **14** | |

# F214 Communication, Homeostasis & Energy

| Question | | | Expected Answers | | | | | Marks | Additional Guidance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | (a) | | | | *excretion* | *secretion* | | | **One mark per row.**<br><br>**CREDIT** converse statements on either side or unmatched statements for each<br><br>**IGNORE** name or type of product without qualification<br><br>**DO NOT CREDIT** any ref to egestion in 'excretion' |
| | | | 1 | *one difference* | (metabolic) waste ***or*** toxin / harmful ***or*** substance is to be removed from body ***or*** does not use vesicles | useful product ***or*** used in cell communication (e.g. to target tissues) ***or*** released from glands (ducts or ductless) ***or*** uses vesicles ***or*** remain in body | ; | | 1 |
| | | | 2 | *one example of a product* | urea / carbon dioxide / water / bile *pigment* / named example | hormone / enzyme / antibodies / mucus / bile *salts* / neurotransmitter / named example | ; | | 2 **IGNORE** sweat / urine / bile / saliva / salt / (named) digestive juice |

| Question | Expected Answers | | | Marks | Additional Guidance |
|---|---|---|---|---|---|
| | 3 | *one similarity* | requires ATP<br>***or***<br>(involved in) homeostasis<br>***or***<br>(compounds)<br>produced by cell(s) /<br>produced by metabolism /<br>need to cross membrane /<br>need to move through membrane /<br>need to leave cell /<br>(may be) transported in blood ; | 3 | **3**<br>**CREDIT** method of leaving cell e.g. exocytosis<br>**IGNORE** going into cells (as some excretory products do) |

| Question | | | Expected Answers | | Marks | Additional Guidance |
|---|---|---|---|---|---|---|
| 1 | (b) | | | | S & C | **Mark the first answer.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks**<br>**CREDIT one statement and a suitable explanation related to that (first) given statement** (e.g. S3 + E3 but not S4 + E1)<br>**DO NOT AWARD 2 marks for 2 statements or 2 explanations** |
| | | | **S1** | glucose is not the only substrate / there are other substrates **;** | | **1** 'fats can (also) be respired' = E1<br>'fats can be respired as well as glucose' = S1 + E1 |
| | | | **E1** | named alternative substrate **;** | | |
| | | | | ***or*** | | |
| | | | **S2** | ATP is produced / energy is released **;** | | **S2** **DO NOT CREDIT energy** produced / made / created |
| | | | **E2** | (by) substrate level / oxidative, phosphorylation **;** | | |
| | | | | **or** | | |
| | | | **S3** | ATP / energy, required **;** | | |
| | | | **E3** | (for) phosphorylation / glycolysis **;** | | |
| | | | | ***or*** | | |
| | | | **S4** | is not a single step reaction / other steps involved / other products / other intermediates **;** | | **4** Krebs cycle / ETC **,** happens = E4<br>'other stages such as link reaction are involved' = S4 + |
| | | | **E4** | named stage(s) / named intermediate compound(s) **;** | | **E4** E4 e.g. pyruvate / acetyl CoA / acetate<br>**IGNORE** NAD(H) / FAD(H) / ATP |
| | | | | **or** | | |
| | | | **S5** | enzymes are involved **;** | | |
| | | | **E5** | dehydrogenation / decarboxylation / oxidative phosphorylation / named (respiratory) enzyme **;** | | |
| | | | | ***or*** | | |
| | | | **S6** | coenzymes / NAD, involved **;** | | **S6** **DO NOT CREDIT** NADP |
| | | | **E6** | oxidative phosphorylation / link reaction / Krebs cycle / glycolysis **;** | | |
| | | | | ***or*** | | |
| | | | **S7** | glucose does not, combine / react **,** (directly) with oxygen **;** | | |
| | | | **E7** | (oxygen) used in oxidative phosphorylation / is final electron acceptor / is final hydrogen acceptor **;** | **2** | |

| Question | | | Expected Answers | | Marks | Additional Guidance |
|---|---|---|---|---|---|---|
| 1 | (c) | (i) | | | | **Max 1 if referring to insulin receptors** |
| | | | **1** | unable to produce (enough) insulin / do not secrete insulin / produces ineffective insulin **;** | | **1** **DO NOT CREDIT** 'excrete' as incorrect |
| | | | **2** | insulin-producing cells / beta cells / islets of Langerhans, not functioning (correctly) / damaged / destroyed / attacked **;** | | **2** **ALLOW** lack of beta cells / ref to b cells<br>**DO NOT CREDIT** alpha cells / B cells (if lymphocytes implied) |
| | | | **3** | by (body's own) immune system / by (body's own) antibodies / auto-immune disease **;** | | **3** **CREDIT** description |
| | | | **4** | (idea of) family history / genetic / hereditary **;** | | |
| | | | **5** | (condition can be) triggered by **,** virus / environmental factor **;** | | **5** e.g. • shock<br>• drugs side effect<br>• (pancreatic) cancer<br>• infection / disease |
| | | | | | **2 max** | |
| 1 | (c) | (ii) | | | | **Mark the first 3 responses only** |
| | | | **1** | increasing age / older / ageing / more prevalent over 40 **;** | | **1** **DO NOT CREDIT** age without 'older' implication |
| | | | **2** | (idea of) family history / genetic / hereditary **;** | | |
| | | | **3** | (more common in) males **;** | | |
| | | | **4** | (more common in) some ethnic groups / African / Afro-Caribbean / Asian / Hispanic / Oceanic **;** | | |
| | | | **5** | obese / overweight / fat around abdomen **;** | | **5** **CREDIT** 'apple shaped' |
| | | | **6** | high / frequent, intake of **,** sugar / highly processed food / high GI food **;** | | **6** **IGNORE** **'**poor diet' / 'bad diet' / 'unhealthy diet'<br>**IGNORE** fat / carbohydrate **,** in diet |
| | | | **7** | lack of physical activity / sedentary lifestyle **;** | | |
| | | | **8** | high blood pressure **;** | | **8** **CREDIT** history of **,** heart attack / stroke |
| | | | **9** | excessive alcohol intake **;** | | **9** idea of *too much* is needed |
| | | | | | **3 max** | |
| | | | | **Total** | **10** | |

| Question | | | Expected Answers | Marks | Additional Guidance |
|---|---|---|---|---|---|
| 2 | (a) | (i) | glycolysis / glycolytic pathway ; | 1 | **Mark the first answer.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks**<br><br>**CREDIT** phonetic spelling but must have 'glycol...' |
| 2 | (a) | (ii) | cytoplasm ; | 1 | **Mark the first answer.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks**<br><br>**CREDIT** cytosol<br>**DO NOT CREDIT** cytoplasm, in / of, mitochondrion |
| 2 | (a) | (iii) | **D** ATP ;<br>**E** NAD ;<br><br>**F** pyruvate ; | 3 | **Mark the first answer for each letter.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 mark**<br><br>**E** **ALLOW** oxidised NAD<br>**DO NOT CREDIT** NADP / reduced NAD<br>**F** **ACCEPT** pyruvic acid |

| Question | | | Expected Answers | | Marks | Additional Guidance |
|---|---|---|---|---|---|---|
| 2 | (b) | | | | | **Award marks from labelled / annotated diagrams – but ensure that mp 2 only awarded if H clearly shown to be accepted by pyruvate** |
| | | | **1** | (pyruvate / **F**) converted to lactate **;** | | **1** **ACCEPT** lactic acid<br>**DO NOT CREDIT** if pyruvate → ethanol in the animal is indicated/implied<br>**DO NOT CREDIT** wrong reaction type (e.g. oxidation) |
| | | | **2** | **F** / pyruvate **,** accepts hydrogen (atoms) **;** | | **2** **ACCEPT** pyruvic acid<br>**DO NOT CREDIT** hydrogen **ions** (unless also $e^-$) / molecules |
| | | | **3** | hydrogen from **, reduced** NAD / **reduced E ;** | | **3** **ACCEPT** NADH / $NADH_2$ / NADH + $H^+$ |
| | | | **4** | (catalysed by) <u>lactate</u> dehydrogenase **;** | | **4** for pyruvate → lactate **ACCEPT** LDH |
| | | | **5** | no, oxygen / $O_2$ **,** to act as (final), hydrogen / electron, acceptor **;** | | |
| | | | **6** | (so) link reaction / Krebs cycle / ETC, cannot take place **;** | | **6** Needs a clear statement of **not** taking place<br>**CREDIT** no , electron transport chain / electron carrier chain / chemiosmosis / oxidative phosphorylation |
| | | | **7** | NAD / **E**, regenerated / recycled / able to be re-used **;** | | **7** **IGNORE** reduced NAD **,** oxidised / reoxidised (as this does not give the idea of reusing it) |
| | | | **8** | allows glycolysis to continue / pyruvate continues to be made **;** | | **8** Needs a clear statement |
| | | | **9** | limited / small amount of / some, ATP can be produced **;** | | **9** **CREDIT** 1 ATP (per pyruvate) / 2 ATP (rather than 28-38 per glucose) / only substrate level phosphorylation<br>**IGNORE** 'enough ATP for ...' |
| | | | | | **5 max** | |

| Question | | | Expected Answers | | Marks | Additional Guidance |
|---|---|---|---|---|---|---|
| 2 | (c) | | | *physical (probably from diagrams)* | S & C | |
| | | | 1 | large nostrils (open) to take in air ; | | 1 **ACCEPT** oxygen |
| | | | 2 | (when submerged) nostrils close / nose closes , to , keep air in / stop air from escaping ; | | 2 **ACCEPT** oxygen<br>**IGNORE** ref to keeping water out |
| | | | 3 | lungs / airways , have high (vital) capacity ; | | 3 **ACCEPT** deep / barrel / large , chest **IGNORE** big lungs<br>**CREDIT** large lung volume /<br>takes in large volume of oxygen /<br>larger numbers of alveoli /<br>larger (exchange) surface area /<br>increased number of capillaries |
| | | | | *links to respiration* | | |
| | | | 4 | *idea that* seal , has low(er) metabolic rate / has low(er) respiratory rate / has low(er) energy requirements / uses (relatively) little ATP ; | | 4 e.g. • (streamlined, less resistance so) uses less energy<br>• (insulated so retain heat so) uses less energy<br>• (buoyant so) less energy required<br>• (small flippers so less surface area of extremity so loses less heat so) uses less energy |
| | | | 5 | able to respire anaerobically for a long time / more glycolysis ; | | 5 'anaerobic' needs time ref |
| | | | 6 | large supplies of NAD (to accept H) ; | | |
| | | | 7 | (this) prevents , build-up of lactate / lowering of pH ; | | 7 **ACCEPT** lactic acid |
| | | | 8 | *idea that* (seal) tolerates lactate / removes lactate quickly ; | | 8 **ACCEPT** lactic acid |
| | | | 9 | *idea that* (seal) tolerates high $CO_2$ concentration ; | | |
| | | | 10 | *idea that* (seal) tolerates low pH / has **more** pH buffers ; | | |
| | | | | *synoptic / inference* | | |
| | | | 11 | *idea that* blood diverted from certain regions / certain regions have reduced metabolic activity ; | | 11 **DO NOT CREDIT** zero respiration rate |
| | | | 12 | *idea that* has plenty of , haemoglobin / red blood cells / myoglobin (as oxygen source) ; | | |
| | | | 13 | *idea that* haemoglobin has a higher affinity for oxygen / dissociates less readily / dissociation curve shifted to **left** ; | 3 max | |
| | | | | **Total** | 13 | |

| Question | | | Expected Answers | | Marks | Additional Guidance |
|---|---|---|---|---|---|---|
| 3 | (a) | | 1<br>2<br>3 | myelin / myelinated / lipid / fatty (sheath) ;<br>(Schwann) cell, wrapped around / surrounds / AW, axon ;<br>except at nodes of Ranvier / (sheath) not continuous / presence of gaps (in the sheath) ; | 2 max | 1 **DO NOT CREDIT** fatty acids<br>3 must be in the context of structure rather than function (as many refer to it in context of saltatory conduction) |
| 3 | (b) | (i) | 1<br>2<br>3 | (myelination produces) greater speeds ;<br>unmyelinated needs larger diameter to produce same speed ;<br>comparative figs, **all** with units, to support either the general trend or the exception to the trend with the mollusc ; | 2 max | 1 **IGNORE** ref to axon diameter for this mp<br>3 1 speed for myelinated (25 / 30 / 35 **, m s$^{-1}$** ) **and** 1 speed for unmyelinated (3 / 30 **, m s$^{-1}$**) (allow m/s) **or** calculated difference in speed between myelinated and unmyelinated (**with units unless** a multiple e.g. approx. x12) |
| 3 | (b) | (ii) | 1<br>2 | larger axon diameter produces greater speeds ; **ora**<br>comparative figs, **all** with units, to support ; | 2 max | 1 needs to be a general statement<br>2 2 diameters & speeds (**both with units**) for ***myelinated*** **or** calculated difference in diameter for 2 stated speeds (**both with units unless** diameter is a multiple e.g. around x 1.4 / around 140%) |

| type of neurone | diameter (μm) | speed (m s$^{-1}$) | animal taxon |
|---|---|---|---|
| myelinated | 4 | 25 | mammal |
| myelinated | 10 | 30 | amphibian |
| myelinated | 14 | 35 | amphibian |

**or**
2 diameters & speeds (**both with units**) for ***unmyelinated***
**or**
calculated difference in diameter for 2 stated speeds (**both with units unless** diameter is a multiple e.g. about x10)

| type of neurone | diameter (μm) | speed (m s$^{-1}$) | animal taxon |
|---|---|---|---|
| unmyelinated | 15 | 3 | mammal |
| unmyelinated | 1 000 | 30 | mollusc |

| Question | | | Expected Answers | | Marks | Additional Guidance |
|---|---|---|---|---|---|---|
| 3 | (c) | (i) | 1 | increased <u>kinetic energy</u> / <u>KE</u> so,<br>• ions <u>diffuse</u>, across (axon) membrane / into neurone / into cell / between nodes / along neurone**,** more quickly<br>***or***<br>• faster movement of (neurotransmitter) vesicles / exocytosis (of neurotransmitter)<br>***or***<br>• neurotransmitter diffuses more quickly across, synapse / synaptic cleft<br>***or***<br>• neurotransmitter (ACh) broken down by enzyme (acetylcholinesterase) more quickly **;** | **S & C**<br><br>**1 max** | description of ion movement must be correct (e.g. $Na^+$ in for depolarisation / $Ca^{2+}$ into presynaptic knob) |
| | | | 2 | faster <u>diffusion</u> of ions leads to,<br>• faster depolarisation<br>***or***<br>• shorter duration of action potential<br>***or***<br>• shorter refractory period<br>***or***<br>• faster repolarisation **;** | | |
| 3 | (c) | (ii) | 1<br>2<br>3 | ion, channels / pumps, disrupted / denatured / no longer function **;**<br>fluidity of, membrane / phospholipid / bilayer, disrupted **;**<br>(named) synaptic enzymes denatured **;** | **1 max** | **DO NOT CREDIT** general denaturation of proteins / enzymes<br><br>**2** **IGNORE** leaky membrane unless qualified |

| Question | | | Expected Answers | | Marks | Additional Guidance |
|---|---|---|---|---|---|---|
| 3 | (d) | | | | | **IGNORE** ref to influx of $Na^+$ and events when action potential arrives at the synaptic knob – start when the $Ca^{2+}$ channels open |
| | | | **1** | calcium **channel**s open **;** | | |
| | | | **2** | $Ca^{2+}$ / $Ca^{++}$ / calcium ions **,** enter / diffuse into, | | **2** **DO NOT CREDIT** 'calcium' alone<br>**DO NOT CREDIT** $Ca^+$<br>**DO NOT CREDIT** **'**enter membrane' – must cross it |
| | | | **3** | acetylcholine / ACh / **neurotransmitter**, in **vesicle**(s) **;** | | |
| | | | **4** | (synaptic) vesicles move towards **presynaptic** membrane **;** | | **4** **CREDIT** **pre-synaptic** |
| | | | **5** | vesicles fuse with membrane **;** | | **5** **DO NOT CREDIT** attach / bind / join |
| | | | **6** | release acetylcholine, by **exocytosis ,** into synaptic **cleft ;** | | 'vesicles move and fuse with presynaptic membrane' = mps 4 & 5 |
| | | | | | **3 max** | 'vesicles move and fuse with membrane' = mp 5 only |
| | | | **QWC** – technical terms used appropriately and spelt correctly **;** | | **1** | Use of **three** terms from:<br>**channel**(s), **vesicle**(s),<br>**neurotransmitter**, **presynaptic / pre-synaptic**,<br>**exocytosis**, **cleft**, |
| | | | | **Total** | **12** | |

| Question | | | Expected Answers | Marks | Additional Guidance |
|---|---|---|---|---|---|
| 4 | (a) | (i) | ultrafiltration ; | 1 | **Mark the first answer.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks**<br><br>This term required but **ACCEPT** phonetic spelling |
| | | | | | |
| 4 | (a) | (ii) | 17.9 ; ; | 2 | **Correct answer = 2 marks**<br>If answer incorrect, not rounded or incorrectly rounded then allow 1 mark for working<br>125 ÷ 700<br>**or**<br>an unrounded answer e.g. 17.857412 |
| | | | | | |
| 4 | (b) | (i) | (cuboidal) epithelium / epithelial ; | 1 | **Mark the first answer.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks**<br><br>**DO NOT CREDIT** 'epithelium **cells'** / 'ciliated epithelium' / 'squamous epithelium' / endothelium<br>**ALLOW** columnar epithelium |
| 4 | (b) | (ii) | microvilli / microvillus ; | 1 | **Mark the first answer.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks**<br><br>**ACCEPT** 'brush border'<br>**DO NOT CREDIT** cilia |

| Question | | | Expected Answers | | Marks | Additional Guidance |
|---|---|---|---|---|---|---|
| 4 | (b) | (iii) | ***This is a QWC question*** | | | |
| | | | **1** | selective **<u>re</u>absorption ;** | **S & C** | |
| | | | **2** | of glucose <u>and</u> amino acids **;** | | **2** **DO NOT CREDIT** if glucose & amino acids **& proteins** |
| | | | **3** | **co-transport** / ***facilitated*** **diffusion** / uptake described **;** | | **3** **ACCEPT** direct uptake , of glucose / amino acids, by active transport |
| | | | **4** | water follows by **osmosis** so concentration of, ions / nitrogenous waste / urea / remaining substances **,** increases **;** | | |
| | | | **5** | AVP **;** | | **5** e.g. • microvilli provide large surface area for uptake<br>• many mitochondria provide energy for uptake<br>• many brush border enzymes (ATPase) for active uptake<br>• active secretion of nitrogenous waste into lumen |
| | | | | | **3 max** | |
| | | | **QWC** - technical terms used appropriately and spelt correctly **;** | | **1** | Use of **three** terms from:<br>**reabsorption** (or derived term),<br>**co-transport** (or derived term),<br>**facilitated diffusion**, **osmosis** |

| Question | | | Expected Answers | Marks | Additional Guidance |
|---|---|---|---|---|---|
| 4 | (c) | (i) | **L** artery / shunt / vein (at arterial end of shunt)<br>**AND**<br>**M** vein **;** | 1 | **IGNORE** names of artery / vein (e.g. renal)<br>**DO NOT CREDIT** aorta and vena cava |
| | | | | | |
| 4 | (c) | (ii) | so that clots don't form,<br>while in the (dialysis) machine / during dialysis **;** | 1 | **ALLOW** congeal instead of clot<br>**IGNORE** prevents clotting in the body<br>**IGNORE** clumping |
| | | | | | |
| 4 | (c) | (iii) | *idea of* allowing blood to clot normally after treatment **;** | 1 | **CREDIT** preventing low blood pressure (as low viscosity) |
| | | | | | |
| 4 | (c) | (iv) | (simple) <u>diffusion</u> **;** | 1 | **Mark the first answer.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then **= 0 marks**<br>**IGNORE** dialysis<br>**DO NOT CREDIT** facilitated diffusion |
| 4 | (c) | (v) | *idea that* it, maintains diffusion gradient /<br>maintains concentration gradient /<br>maximises diffusion gradient /<br>maximises concentration gradient /<br>allows maximum removal of waste /<br>allows maximum rate of diffusion / AW **;** | 1 | **IGNORE** unqualified ref to countercurrent<br>e.g. • solutions in contact over greater distance<br>• provides maximum contact for exchange<br>• allows exchange over longer distance<br>**IGNORE** ref to surface area |
| | | | **Total** | 14 | |

| Question | | | Expected Answers | Marks | Additional Guidance |
|---|---|---|---|---|---|
| 5 | (a) | (i) | control ; | 1 | **CREDIT** a description<br>e.g. • comparison<br>• to compare results with<br>• to show that (wavelengths of) light is producing the effect<br>• to show the result produced without light<br>• create baseline<br>• create set point<br>• validity<br><br>**IGNORE** 'fair test'<br>**DO NOT CREDIT** 'control variable' / 'controlled variable' |

| Question | | | Expected Answers | | Marks | Additional Guidance |
|---|---|---|---|---|---|---|
| 5 | (a) | (ii) | | | | **Read as paragraph. Mark the first 2 responses only.**<br>**DO NOT CREDIT** ref to **time** / same **number** of leaf discs / **same plant** (as these given in the question)<br>**IGNORE** 'fair test' without further explanation |
| | | | **1** | discs, the same size / cut with same cutter, ***so*** same surface area **;** | | **1** **ALLOW** for same amount of pigment / chloroplast |
| | | | **2** | discs taken from same part of the leaf / leaves used from the same part of the plant ***so*** same amount of **,** pigment / chloroplast **;** | | |
| | | | **3** | tubes same distance from light source ***so*** light intensity is the same **;** | | |
| | | | **4** | light bulb the same (wattage) each time ***so*** light intensity is the same **;** | | |
| | | | **5** | same thickness of filter ***so*** light intensity is the same **;** | | |
| | | | **6** | carry out in darkened room / only 1 light source in room / completely cover tube with filter, ***so*** only light of desired wavelength enters **;** | | |
| | | | **7** | $CO_2$ in excess / AW, ***so*** $CO_2$ not limiting / enough $CO_2$ for photosynthesis / enough $CO_2$ for Calvin cycle / enough $CO_2$ for light independent stage **;** | | |
| | | | **8** | same **,** <u>volume</u> / <u>concentration</u> / batch, of indicator ***so*** that colour changes are comparable **;** | | |
| | | | **9** | heat, sink / shield, between light source and tube ***to*** reduce temperature changes **;** | | |
| | | | **10** | carry out at, same / constant, temperature ***as*** temperature affects enzyme, activity / structure **;** | | **10** Enzyme ref must be qualified |
| | | | **11** | carry out **,** repeats / replicates, ***to***, calculate <u>mean</u> / identify anomalies **;** | | **11** **IGNORE** ref to improving reliability<br>**IGNORE** how anomalies dealt with<br>**DO NOT CREDIT** preventing anomalies |
| | | | **12** | AVP (to include precaution and explanation) **; ;** | **2 max** | **12** **CREDIT** any reasonable precaution with a suitable explanation (even if explanation already given)<br>e.g. • rinse test tubes with distilled water ***so*** starting pH is the same |

| Question | | | Expected Answers | | Marks | Additional Guidance |
|---|---|---|---|---|---|---|
| 5 | (a) | (iii) | chlorophyll a **;** | | 1 | **Mark the first answer.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks**<br>**ALLOW** chlorophyll A / chlorophyll $\alpha$<br>**IGNORE** p680 / p700 / PSI / PSII<br>**DO NOT CREDIT** chlorophyll a and b<br>**DO NOT CREDIT** chlorophyll alone |
| 5 | (a) | (iv) | **1** | chlorophyll / pigments / leaf,<br>reflect /<br>does not absorb /<br>absorbs little,<br>green light / light of this wavelength **;** | 3 max | **1** Needs to refer to green rather than other colours |
| | | | **2** | (green light) cannot be used in photosynthesis /<br>no photosynthesis /<br>little photosynthesis /<br>no light dependent reaction (or described) /<br>little light dependent reaction (or described)<br>correct ref to action spectrum in green region **;** | | **2** Needs to refer to green rather than other colours |
| | | | **3** | little / no, photolysis / splitting of water **;** | | **3** **CREDIT** (some) photolysis with accessory pigments |
| | | | **4** | little / no, $CO_2$ **,** taken up / fixed (in light independent reaction) **;** | | |
| | | | **5** | some $CO_2$ produced during respiration **;** | | |
| | | | **6** | (slight) increase in $CO_2$, increases acidity / decreases pH **;** | | **6** **CREDIT** increase in $H^+$ decreasing pH for accessory pigments |
| | | | **7** | AVP **;** | | **7** e.g. • accessory pigments absorb (some) green light |

| Question | | | Expected Answers | | Marks | Additional Guidance | |
|---|---|---|---|---|---|---|---|
| 5 | (b) | | | | S & C | | **Question is asking for an <u>increased</u> rate of photosynthesis and maximum production**<br>**IGNORE LIGHT** |
| | | | **1** | photosynthesis / named stage,<br>is controlled by / needs / involves / uses **,**<br>(named photosynthetic) enzymes **;** | | **1** | Needs to be a clear generalised statement – cannot be implied from a description of the effects<br>**IGNORE** 'enzymes are affected by temperature' |
| | | | **2** | temperature can be,<br>increased by heater /<br>reduced by ventilation (or fan)<br>maintained by air conditioning (or other method) **;** | | **2** | Needs to indicate ***how*** factor is controlled |
| | | | **3** | increase $CO_2$ concentration (in environment) by burning,<br>fuel / gas / paraffin **;** | | **3** | Needs to indicate ***how*** factor is controlled<br>**CREDIT** increase in $CO_2$ by other reasonable methods |
| | | | **4** | *idea that* increased / more / high<u>er</u>, $CO_2$ (conc),<br>so $CO_2$ no longer a limiting factor /<br>increases $CO_2$ fixation / (or described)<br>increases Calvin cycle (or described) **;** | | **4** | **ALLOW** ref to maximum rate for increase in rate |
| | | | **5** | *idea that* easier to control,<br>water supply / irrigation (to prevent wilting) / humidity / minerals / fertiliser **;** | | **5** | Look for the idea that factors can be more easily regulated in the greenhouse rather than outside<br>**CREDIT** use of hydroponics |
| | | | **6** | *idea that* easier to control use of,<br>pesticides / pest control / biological control **;** | | **6** | Look for the idea that factors can be more easily regulated in the greenhouse rather than outside |
| | | | **7** | AVP **;** | | **7** | e.g. • gas / paraffin , heater supplies heat **and** $CO_2$<br>• prevents described damage of plants by, wind chill / frost / wind / hail / etc<br>• description / effect, of photorespiration |
| | | | | | **4 max** | | |
| | | | | **Total** | **11** | | |

# Grade Thresholds

**Advanced GCE (Biology) (H021 H421)**
**January 2010 Examination Series**

**Unit Threshold Marks**

| Unit | | Maximum Mark | A | B | C | D | E | U |
|---|---|---|---|---|---|---|---|---|
| **F211** | Raw | 60 | 40 | 35 | 31 | 27 | 23 | 0 |
| | UMS | 90 | 72 | 63 | 54 | 45 | 36 | 0 |
| **F212** | Raw | 100 | 69 | 62 | 56 | 50 | 44 | 0 |
| | UMS | 150 | 120 | 105 | 90 | 75 | 60 | 0 |
| **F214** | Raw | 60 | 40 | 36 | 32 | 28 | 25 | 0 |
| | UMS | 90 | 72 | 63 | 54 | 45 | 36 | 0 |

**Specification Aggregation Results**

Overall threshold marks in UMS (ie after conversion of raw marks to uniform marks)

| | Maximum Mark | A | B | C | D | E | U |
|---|---|---|---|---|---|---|---|
| **H021** | 300 | 240 | 210 | 180 | 150 | 120 | 0 |

The cumulative percentage of candidates awarded each grade was as follows:

| | A | B | C | D | E | U | Total Number of Candidates |
|---|---|---|---|---|---|---|---|
| **H021** | 8.8 | 28.6 | 54.1 | 78.4 | 95.1 | 100.0 | 1505 |

**1505 candidates aggregated this series**

For a description of how UMS marks are calculated see:

http://www.ocr.org.uk/learners/ums/index.html

Statistics are correct at the time of publication.

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