A-level
BIOLOGY
7402/2

Paper 2

Mark scheme

June 2023

Version: 1.0 Final

236A7402/2/MS

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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Mark scheme instructions to examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information in the 'Comments' column is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right-hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following bullet points is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for the same mark are indicated by the use of **OR**. Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error / contradiction negates each correct response. So, if the number of errors / contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (often prefaced by 'Ignore' in the 'Comments' column of the mark scheme) are not penalised.

3.2 Marking procedure for calculations

Full marks can be given for a correct numerical answer, without any working shown.

However, if the answer is incorrect, mark(s) can usually be gained by correct substitution / working and this is shown in the 'Comments' column or by each stage of a longer calculation.

3.3 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.4 Errors carried forward, consequential marking and arithmetic errors

Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation ECF or consequential in the mark scheme.

An arithmetic error should be penalised for one mark only unless otherwise amplified in the mark scheme. Arithmetic errors may arise from a slip in a calculation or from an incorrect transfer of a numerical value from data given in a question.

3.5 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.6 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.7 Ignore / Insufficient / Do not allow

Ignore or insufficient is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

Do **not** allow means that this is a wrong answer which, even if the correct answer is given, will still mean that the mark is not awarded.

Question	Marking Guidance	Mark	Comments
01.1	1. Draw line/origin on (chromatography) paper (using ruler and pencil); 2. (Use pipette/tubing/dropper to) add chlorophyll/solution to origin/line; 3. Add solvent/**A** below line/origin; 4. Remove/stop (from glassware) before solvent reaches end (of chromatography paper) **OR** Mark (position) where solvent reaches/front;	4 (4 x AO1)	Accept all marks on a labelled diagram. Allow filter paper for chromatography paper. 3. Accept 'so solvent is not above line' for 'solvent below line'. 4. Accept remove/stop (immediately) when solvent reaches end/top. 4. Accept ensure solvent does not reach top/end. 4. Ignore Rf values.

Question	Marking Guidance	Mark	Comments
01.2	For **2 marks** = two pigments have same solubility in (solvent) **A** but different solubility in (solvent) **B** **OR** For **2 marks** = one pigment is soluble in (solvent) **B** but not in (solvent) **A** **OR** For **2 marks** = pigments have different solubilities in the solvents/**A** and **B** **OR** For **2 marks** = one pigment is only soluble in (solvent) **B** **OR** For **2 marks** = one pigment is insoluble (only) in (solvent) **A**;; For **1 mark** = response as for 2 marks but refers to solution rather than solvent;	2 (2 x AO3)	Accept 'dissolves' for solubility. Accept correct reference to 'affinity' for solubility e.g., 'greater affinity' (to solvent) indicates more soluble. Accept correct reference to 'polarity' for solubility' e.g. pigments have different polarities. Accept 'Rf value' for solubility. Ignore 'solvent stronger'.

Question	Marking Guidance	Mark	Comments
02.1	1. No/fewer calcium ions enter synaptic knob **OR** No/less calcium enter synaptic knob via calcium ion channels; 2. No/fewer synaptic vesicles move to/fuse with presynaptic membrane **and** no/less glutamate is released; 3. No/less glutamate diffuses across (synaptic cleft); 4. No/less (glutamate attaches) to receptors on the postsynaptic membrane; 5. No/fewer sodium ions enter (postsynaptic neurone) so no/ fewer impulses (sent to brain);	5 (2 x AO1, 3 x AO2)	Note: If no/fewer/less is correctly included for any mark point allow for all other mark points. A description of synaptic transmission without no/less/fewer gains **four** marks max. 1. Accept Ca^{2+}/Ca^{++} 1. Accept 'presynaptic neurone/knob' for synaptic knob but **not** 'presynaptic membrane' on its own. 2, 3 and 4. Accept acetylcholine or neurotransmitter for glutamate. 5. Accept Na^{+}. 5. Accept 'no transmission' ('of impulses' is in passage) or 'no depolarisation' or 'no action/generator potentials' for fewer impulses, but reject 'messages' and 'signals'. 5. Accept 'threshold (potential) not being reached' for fewer impulses.

Question	Marking Guidance	Mark	Comments
02.2	1. Rapidly/quickly/directly reaches spinal cord; 2. Is broken down by enzymes **OR** Is broken down by acid **OR** Is too large to be absorbed;	2 (2 x AO2)	1. Accept 'synapses' for spinal cord. 1. Accept spinal cord and brain but reject brain on its own. 2. Accept denatured by acid. 2. Accept 'not affected by acid/enzymes' 2. Reject broken down by named enzymes which are not proteases. 2. Ignore location of enzymes. 2. Accept description for 'absorption' e.g. 'cross the ileum'.

Question	Marking Guidance	Mark	Comments
02.3	Correct answer of 5/4.7(232) x 10^{-5} = **2 marks**;; Answer of 5 or 47(232) with incorrect order of magnitude = **1 mark** **OR** Answer of 2/1.9(68) x 10^{-6} (i.e., not multiplied by 24) = **1 mark** **OR** Answer of 6/5.8/5.76 x 10^{-7} (i.e., not multiplied by 82) = **1 mark** **OR** Answer of 2/1.6/1.57(44) x 10^{-5} (i.e., not multiplied by 3) = **1 mark** **OR** Answer of 6/5.9/5.904 x 10^{-6} (i.e., not multiplied by 8) = **1 mark**;	2 (2 x AO2)	Accept any equivalent numerical representation of the correct answer. Ignore numbers after 4.7 and 47.

Question	Marking Guidance	Mark	Comments
02.4	1. (Sensation of) pain is subjective **OR** Pain sensitivity/threshold/tolerance varies; 2. To ensure that differences (in pain detection) were (statistically) significant **OR** For (valid) comparison;	2 (2 x AO3)	1. Accept 'could exaggerate pain'. 2. Accept 'not due to chance' for significant. 2. Do not credit 'to determine if results are significant.'

Question	Marking Guidance	Mark	Comments
03.1	Correct answer of 12 = **2 marks** **OR** Correct answer of 11.95 = **2 marks**;; Incorrect answer but shows 1195 (ignoring orders of magnitude) = **1 mark** **OR** Incorrect answer but shows 1.05 (Tg) or 13 (Tg) = **1 mark**;	2 (2 x AO2)	Accept any numerical representation of the correct answer for **two** marks. Do not allow 1.05 or 13 to the incorrect order of magnitude e.g. x 10^{1}.

Question	Marking Guidance	Mark	Comments
03.2	1. No significant difference (in production between untreated and treated) with **no** water shortage **OR** No significant difference (in production) between **R** and **S**; 2. Significantly greater/different (production in treated than untreated) with water shortage **OR** Significantly greater/different (production) in **Q** than **P**; 3. Significant decrease/difference (in production) of treated with water shortage **OR** Significant increase/difference (in production) of treated with **no** water shortage **OR** Significantly greater/different (production) in **S** than **Q**; 4. Overlap in SDs indicate no significant difference **OR** No overlap in SDs indicate a significant difference; 5. Only one (mycorrhizae) species studied; 6. Only shows (results for) tomato(es); 7. Large sample size increases validity/reliability; 8. (Investigation) done in sterile soil; 9. (Investigation) done in green/glasshouse **OR** Not done in field;	5 max (5 x AO3)	**Max 3 marks from points 5 to 9** 1, 2, 3 and 4. Accept descriptions of production e.g., more tomatoes and descriptions of treated and untreated seedlings / plants / seeds e.g., with / without mycorrhizae / *Glomus* / fungus. 1, 2, 3 and 4. Reject 'results are significant' or 'results are not significant' **once,** but **only** where there is no indication that these results are 'different', 'greater', 'reduced' etc. 1, 2, 3 and 4. Accept 'not due to chance' for significant and converse for not significant. 4. Accept '(error) bars' for SDs. 5. Accept 'only *Glomus* studied'. 6. Accept only shows 'one crop' or one 'species or type of plant'. 9. Do not credit idea of variation between green/glasshouses.

Question	Marking Guidance	Mark	Comments
03.3	1. Kill/remove/no (other) mycorrhizae/fungi; 2. Kill/remove/no nitrogen-fixing /nitrifying/denitrifying/saprobiotic bacteria; 3. Kill/remove/no pathogens; 4. Kill/remove/no pests; 5. Kill/remove/no competitors; 6. Kill/remove/no seeds/spores; 7. Is a (controlled) variable;	2 max (2 x AO2)	1 to 6. Accept in context of organisms being present if soil not sterilised. 2. Accept saprophytes and saprobionts. 3. Accept removes disease-causing bacteria/viruses /microorganisms. 3. Removes 'harmful bacteria' is not enough. 4. Accept named pests. 6. Accept weeds or (other) plants.

Question	Marking Guidance	Mark	Comments
03.4	1. So mycorrhizae/water is the only variable **OR** (So fertiliser) is **not** a variable **OR** So fertiliser is a controlled variable; 2. Affects (crop) production/growth/mass; 3. (Concentration of fertiliser) would affect water potential of soil; 4. Does not affect pH (of soil); 5. To provide (usual) soil/farming conditions;	2 max (2 x AO2)	Ignore leaching and eutrophication. 1. 'For comparison' on its own is not enough. 1. Accept same amount of fertiliser. 2. Accept benefits or limiting factor of named nutrient/ion.

Question	Marking Guidance	Mark	Comments
04.1	Epistasis **OR** Epistatic;	1 (AO2)	Ignore any words before or after epistasis e.g. dominant'. Accept phonetic spellings.

Question	Marking Guidance	Mark	Comments
04.2	Tortoiseshell female;	1 (AO2)	Accept 'female tortoiseshell'. Accept 'ginger & black female'.

Question	Marking Guidance	Mark	Comments
04.3	1. (Gametes) X^GF, X^Gf, X^Bf **and** Yf; 2. X^GX^BFf, X^GX^Bff, X^GYFf **and** X^GYff; 3. White female, Tortoiseshell female, White male, Ginger male, **and** ratio 1 : 1 : 1 : 1;	3 (3 x AO2)	Allow **one mark** for correct dihybrid genotypes of offspring from incorrect parental gametes. 1 and 2. Accept if g and b are used throughout for G and B. 2. Accept the alleles within a genotype in any order. 1 and 2. Accept in Punnet square. 2 and 3. Accept any order of genotypes and phenotypes and accept if on incorrect answer lines. 3. Accept sequence of phenotypes does not need to mirror genotypes but must be correct. 3. Accept equivalent ratios e.g. 4:4:4:4. 3. Accept 'Ginger and

			black' for tortoiseshell and accept 'no pigment' for white.

Question	Marking Guidance	Mark	Comments
04.4	Correct answer of 0.8 = **2 marks**;; Incorrect answer but shows ff/q^2 = 0.64 = **1 mark** **OR** Incorrect answer but shows ff/q^2 = 64% = **1 mark;**	2 (2 x AO2)	Accept answer of 80% for **2 marks.**

Question	Marking Guidance	Mark	Comments
05.1	1. (Colour vision involves) <u>cones</u>; 2. (Each type of) photoreceptor has a different pigment **OR** (Each type of) photoreceptor absorbs particular/different (range of) wavelength(s) **OR** (Each type of) photoreceptor stimulated by particular/different (range of) wavelength(s); 3. Greater absorption by 'red sensitive' than 'green sensitive' (cells/photoreceptors/cones) **OR** Provides percentage values which indicate difference in light absorption (at 600nm) **OR** More impulses to brain from 'red sensitive' than 'green sensitive' (photoreceptors/cones) **OR** More impulses along optic nerve from 'red sensitive' than 'green sensitive' (photoreceptors/cones);	3 (3 x AO2)	1, 2 and 3. Reject 'red cones/photoreceptors' and 'green cones/photoreceptors' only **once**. 1 and 2. Each cone has a different pigment or absorbs particular wavelengths = **two** marks. 1 and 3. Greater absorption by 'red sensitive' than 'green sensitive' <u>cones</u> = **two** marks. 3. Allow approximately correct percentage values. 3. Accept suitable alternatives for 'sensitive' e.g. detecting/absorbing. 3. Accept action potentials for impulses.

			3. Do **not** credit 'signals', 'messages' for third or fourth options for mark point 3.

Question	Marking Guidance	Mark	Comments
05.2	Box 3 correct - Several photoreceptors connecting to one neurone and spatial summation	1 (AO1)	

Question	Marking Guidance	Mark	Comments
05.3	1. Geographical isolation/separation due to elevation/altitude; 2. Allopatric speciation due to isolation/separation; 3. Different selection pressures **OR** Different environment(s); 4. (However) some overlap in distribution **OR** (Both) plants found in same area/habitat/altitude; 5. So (possibly) sympatric speciation; 6. (Variation due to) mutation(s); 7. Reproductive isolation/separation due to different pollinators/distributions/altitudes **OR** Separate gene pools due to different pollinators/distributions/altitudes; 8. Change in allele frequency (in each population) **OR** Different allele frequency (in each population); 9. Different species) can no longer (interbreed to) produce fertile offspring;	5 max (5 x AO3)	3. Accept selection (due to) flower colour. 3. Accept different 'abiotic conditions/factors' for 'different environment(s)' or different named factor e.g. temperature, humidity but 'different altitudes' on its own is not enough. 5. Only awarded if mark point 4 is credited. 6. Reject mutation(s) if context incorrect e.g. 'mutate to adapt'. 7. Accept 'no gene flow' for separate gene pools. 8. Accept 'increase' or 'decrease' for 'change'.

Question	Marking Guidance	Mark	Comments
06.1	1. Microvilli provide a large surface area **OR** Folded (cell-surface) membrane provides a large surface area; 2. Many channel/carrier proteins for facilitated diffusion; 3. Many <u>carrier</u> proteins for active transport; 4. Many channel/carrier proteins for co-transport; 5. Many mitochondria produce ATP **OR** Many mitochondria for active transport; 6. Many ribosomes to produce carrier/channel proteins;	3 max (3 x AO1)	**Max 2 from mark points 2, 3 and 4.** For 2, 3, 4, 5 and 6 penalise omission of 'many' only once. 1. Ignore 'brush border'. 3 and 4. Accept sodium-potassium pumps as an alternative to carrier proteins. 4. Accept 'co-transport protein' or 'symport' for type of transport protein. 5. Accept co-transport for active transport. 6. Accept abundant rough endoplasmic reticulum for many ribosomes, but abbreviation is not enough.

Question	Marking Guidance	Mark	Comments
06.2	Collecting duct **and** distal (convoluted) tubule;	1 (AO1)	Do not accept DCT for distal convoluted tubule.

Question	Marking Guidance	Mark	Comments
06.3	1. Has a (specific) <u>tertiary</u> structure/shape; 2. (Structures are) <u>complementary</u>;	2 (2 x AO2)	1. Accept in context of ADH or receptor. 1. Ignore 3D. 1. Reject reference to Antigen or antibody. 1 and 2. Reject reference to active site, enzyme, substrate or induced fit only once.

Question	Marking Guidance	Mark	Comments
06.4	1. Aorta **OR** Carotid artery/sinus; 2. (ADH) increases (re)absorption of water; 3. Increases volume of (blood) **and** pressure increases **OR** Increases volume of (blood) **and** pressure returns to normal;	3 (1 x AO1, 2 x AO2)	1. Ignore arteries but reject named incorrect artery. 2. Reject if other substances are also absorbed e.g. glucose, ions.

Question	Marking Guidance	Mark	Comments
07.1	(1) carrying (2) niche (3) abiotic (4) community;;	2 (2 x AO1)	All 4 correct = **two** marks. 2 or 3 correct = **one** mark. 1 correct = **zero**. (3) Accept physical, chemical, physicochemical or non-living.

Question	Marking Guidance	Mark	Comments
07.2	1. Conserve/protect species/plants/animals/organisms **OR** For (bio)diversity; 2. Conserve/protect habitats/niches **OR** Provides/many habitats/niches; 3. Reduces climate change; 4. Source of medicines/drugs/wood; 5. Reduces erosion/eutrophication; 6. (For) tourism;	2 max (2 x AO2)	2. Accept conserving land (and ways of life) for indigenous communities. 3. Accept 'reduces global warming', 'reduces greenhouse effect', 'removes/takes up carbon dioxide' or 'produces/provides oxygen'.

Question	Marking Guidance	Mark	Comments
07.3	1. Heat (loss) from respiration; 2. (Food) not digested **OR** Not all eaten; 3. Excretion;	3 (3 x AO1)	2. Accept faeces for not digested. 3. Accept urine/urea for excretion.

Question	Marking Guidance	Mark	Comments
08.1	1. Mutation (in *KRAS* gene) **OR** Change in <u>base</u> sequence (of *KRAS* gene); 2. Change in (signalling) protein **OR** More (signalling) protein/K-Ras produced; 3. (Results in) rapid/uncontrollable cell division;	3 (3 x AO2)	1. Accept named mutation e.g. substitution. 1. Accept mutation in promoter gene. 1. Ignore epigenetic modifications. 2. Accept change in amino acid sequence (of protein). 2. Reject 'no protein produced' or suggests a non-functional protein is produced. 3. Accept cell division cannot be regulated. 3. Ignore growth. 3. Reject meiosis for cell division, but accept mitosis.

Question	Marking Guidance	Mark	Comments
08.2	1. **A**/untreated (type II diabetes) lowest survival (time) **OR** **A**/untreated (type II diabetes) lowers/reduces survival (time compared with control group); 2. **B**/metformin increases survival (time) the most **OR** **B**/metformin has the highest survival (time); 3. **C**/combined drugs increases survival (time); 4. Groups **A and B** have a significant difference (in survival time compared with control); 5. Group **C** has no significant difference (in survival time compared with control); 6. (In group **C**) other drugs have reduced effect of metformin **OR** **B**/metformin is more effective (treatment/drug) than **C**/combined drugs;	5 max (5 x AO3)	1 to 6. Accept descriptions of each group e.g. **A** = no drugs, **B** = metformin, **C** = combined drugs. 4 and 5. Reject 'results are significant' or 'results are not significant' **once,** but **only** where there is no indication that these results are 'different', 'greater', 'reduced' etc. 4 and 5. Accept 'not due to chance' for 'significant' and converse for 'not significant'. Ignore reference to sample size, repeats or a single study.

Question	Marking Guidance	Mark	Comments
09.1	1. Restriction endonucleases/enzymes; 2. (Cut DNA) at specific <u>base</u> sequences/pairs **OR** (Cut DNA) at recognition/restriction sites;	2 (2 x AO2)	2. Accept 'at palindromic sequences'

Question	Marking Guidance	Mark	Comments
09.2	1. (For) primers; 2. (To produce) a complementary base sequence **OR** (Primers provide starting sequence) for DNA/taq polymerase **OR** (Primers) stop (original) DNA strands re-joining;	2 (2 x AO2)	

Question	Marking Guidance	Mark	Comments
09.3	Correct answer of 1.35×10^{16} = **2 marks** **OR** Correct answer of 1.36×10^{16} (due to rounding at an earlier stage of the calculation) = **2 marks** **OR** Correct answer of 1.4×10^{16} = **2 marks**;; Incorrect answer but shows 2^{50} = **1 mark**;	2 (2 x AO2)	Ignore any numbers after 1.35.

Question	Marking Guidance	Mark	Comments
09.4	1. Number of nucleotides/repeats/bases **OR** Length/mass; 2. (Negative) charge;	2 (2 x AO2)	1. Accept weight for mass. 1. Ignore 'short' on its own. 1. Accept number of base pairs. 1. Ignore density/size. 2. Accept 'polarity'. 2. Reject positive (charge).

Question	Marking Guidance	Mark	Comments
10.1	1. To break actinomyosin (bridges); 2. To move/bend the myosin head/arm; 3. (So) actin (filaments) are moved (inwards); 4. For active transport of calcium ions (into the sarcoplasmic/endoplasmic reticulum);	2 max (2 x AO1)	1. Accept 'to form actinomyosin'. 1. Accept 'to detach or attach myosin and actin'. 1. Reject reference to 'active site'. 2. Accept 'to change shape of myosin head/arm'. 2. Accept ADP/Pi moves (myosin) head/arm. 2. Accept powerstroke/pivot /recocks etc. for movement. 3. Ignore 'sliding'.

Question	Marking Guidance	Mark	Comments
10.2	1.35 **OR** 1.4;	1 (AO2)	Accept numbers after 1.35.

Question	Marking Guidance	Mark	Comments
10.3	1. Fast (skeletal muscle) fibres used during short-term/intense exercise; 2. Slow (skeletal muscle) fibres used during long(er)-term exercise; 3. Creatine used to form phosphocreatine; 4. (Phosphocreatine) combines with ADP to form ATP; 5. (Carbohydrate/glucose) stored as glycogen **OR** Glycogenesis; 6. Glycogen hydrolysed to glucose **OR** Glycogenolysis; 7. Glucose for respiration;	5 max (5 x AO2)	**Max 3 marks from mark points 3, 4, 5, 6 and 7.** 1 and 2. Accept examples of short-term/intensity exercise e.g. sprint and longer-term/endurance exercise, e.g. marathon or low(er) intensity exercise. 1. Accept fast twitch fibres for fast (skeletal muscle) fibres 2. Accept slow twitch fibres for slow (skeletal muscle) fibres. 7. Accept glycolysis for respiration.

Question	Marking Guidance	Mark	Comments
10.4	1. (More) glucose enters (muscle) cells; 2. (Glucose/fatty acids enter by) facilitated diffusion; 3. Fatty acids used in Krebs cycle; 4. Respiration provides (more) ATP;	3 max (3 x AO2)	**Max 2 marks if only in context of glucose or only in context of fatty acids**. 1. Ignore more glucose leaves (liver) cells. 1. Reject glucose enters mitochondria. 2. Accept active transport or cotransport. 3. Ignore gluconeogenesis. 4. Accept in context of glucose or fatty acids. 4. Accept for fatty acids 'Krebs cycle produces ATP'.

Question	Marking Guidance	Mark	Comments
10.5	1. Increase in CO_2 detected by chemoreceptors; 2. Send (more) impulses to cardiac centre **OR** Send (more) impulses to the medulla; 3. More impulses (from centre/medulla) along sympathetic pathway/neurones/nerves **OR** Fewer impulses (from centre/medulla) along parasympathetic/vagus pathway/neurones /nerves; 4. (To) SAN;	4 (1 x AO1, 3 x AO2)	1. Accept increase in acidity/H^+ or decrease in pH for increase in CO_2. 1. Ignore location of chemoreceptors. 2 and 3. Reject reference to 'an/one impulse' once only. 2 and 3. Reject 'signals', 'messages' for 'impulses' once only. 2 and 3. Accept 'action potentials' for impulses.