

INTERNATIONAL A-LEVEL **BIOLOGY (9610)**

BL05

Unit 5 Synoptic paper

Mark scheme

January 2025

Version: 1.0 Final



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 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.

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	A: Light/optical (microscope); B: Transmission electron (microscope); C: Scanning electron (microscope);	3	For B and C : allow 1 mark if electron microscope for both or if names reversed or if B = TEM and C = SEM (allow if reversed) 1 mark for correct initials c.f. 2 marks for the 2 full names

Question	Marking guidance	Mark	Comments
01.2	1. Electrons (in B) have shorter wavelength than light (in A); 2. (Electrons / B) give higher resolution;	2	2. Allow description of higher resolution – can distinguish between 2 objects that are closer together One comparative statement needed for full marks

Question	Marking guidance	Mark	Comments
01.3	1. Thin section cut in B ; 2. Cilia not entirely within the plane of the section;	2	

Question	Marking guidance	Mark	Comments
01.4	1. Drawing large and clear with smooth lines; 2. Correct shape of cell X including cilia; 3. Correct internal details;	3	1. Not sketchy OR broken lines

Question	Marking guidance	Mark	Comments
01.5	2080;;;	3	Allow 2.08×10^3 Allow 1 mark for correct calculation: $\frac{125\,000}{60}$ Allow tolerance of ± 1 mm on measurement of 125 mm Allow 2 marks for 2083.3(333...) or 2083 Allow 2 marks for 2080 but incorrect order of magnitude – eg 208 Allow 2 marks for an answer correctly derived from an incorrect measurement

Question	Marking guidance	Mark	Comments
01.6	1. Cilia are (likely to be) <u>significantly</u> shorter (in smokers); 2. Cilia (are likely to) beat at a <u>significantly</u> lower rate (in mice with smoke); 3. So more difficult to remove mucus (from airways/lungs); 4. So microorganisms remain in / can reach lungs (and cause disease);	4	Allow 1 mark for 1 and 2 if significance not given

Question	Marking guidance	Mark	Comments
02.1	At each temperature: Any two control variables: 1. Lamp at constant distance; 2. Same concentration of CO₂ – eg using NaHCO₃ solution; 3. Ensure temperature remains constant (for a set of readings); Any five further details: 4. Equilibrate plant in apparatus for ≥ 5 minutes; 5. Collect gas for set time (eg 1 to 5 minutes); 6. Use syringe to pull gas bubble onto millimetre scale; 7. Measure length of gas bubble (in millimetres); 8. Convert to mm³ using $\pi r^2 l$; 9. Convert to a rate by dividing by time taken; 10. Repetitions (at least 3 in total) and calculate mean (and SD);	7 max	max. 6 marks if not done at each temperature max. 2 marks for 2 control variables sub-max. 5 marks for 5 further details

Question	Marking guidance	Mark	Comments
02.2	1. Correct orientation + scale + axes labelled including units; 2. + 3. Points plotted correctly for 2 marks;; 4. Line drawn correctly;	4	1. Scale such that plotted data cover > ½ of each axis 2. + 3. 7 points correct for 2 marks, 5 or 6 correct for 1 mark, tolerance ± ½ small square If bar chart allow max 1 for mp2 + 3 4. Smooth curve of best fit or lines ruled point-to-point

Question	Marking guidance	Mark	Comments
02.3	40 (°C) and largest SD;	1	

Question	Marking guidance	Mark	Comments
02.4	1. More repetitions at smaller temperature intervals; 2. (Repetitions) both sides of and near to 35 °C; 3. Test with different plant species; 4. Re-plot graph (including new data) on a larger scale;	3	1. Allow stated intervals – eg every 2 °C 2. Allow in range 20–40 °C Allow alternative method for measuring rate of photosynthesis – eg use of oxygen meter

Question	Marking guidance	Mark	Comments
03.1	Advantage Less time taken for recovery (which would reduce heart rate) OR Heart rate would slow down; Disadvantage Any error in counting is increased when scaling up to beats per minute OR 1 beat error in 10 s is a greater proportional error than 1 beat per minute;	2	Allow example – eg error of 1 in 10s becomes error of 6 beats per minute

Question	Marking guidance	Mark	Comments
03.2	Need to standardise intensity of exercise OR same type of exercise;	1	Allow example – eg rate of running / step-ups as $n \text{ steps s}^{-1}$

Question	Marking guidance	Mark	Comments
03.3	1. Increase sample size; 2. Allow time for recovery to resting heart rate between one round of exercise and the next; 3. A described control variable; 4. Alternative method for recording heart rate – eg finger clip detector and electronic recording;	2 max	1. For example – more students or repetitions with same students 3. For example – age, sex, ethnicity, caffeine, lifestyle

Question	Marking guidance	Mark	Comments
04.1	Two unaffected parents have a child with PKU;	1	Allow 1 and 2 have child 4

Question	Marking guidance	Mark	Comments
04.2	1 = Nn and 2 = Nn;	1	Allow heterozygous for 1 and 2

Question	Marking guidance	Mark	Comments
04.3	1. Parental genotypes Nn and Nn AND Genotypes of gametes N + n and N + n; 2. Offspring genotypes NN and Nn and Nn and nn; 3. Offspring phenotypes <u>Non-PKU</u> and PKU; 4. 0.25;	4	2. Allow offspring genotypes correctly derived from incorrect gametes 3. Allow offspring phenotypes correctly derived from incorrect offspring genotypes but only if non-PKU and PKU present 4. Allow ¼ / 1 in 4 / 1:3 / 25%

Question	Marking guidance	Mark	Comments
04.4	1. $q^2 = 1/2600 = 0.0003846$, so $q = \sqrt{0.0003846} = 0.0196$; 2. $p = 1 - q = 1 - 0.0196 = 0.9804$ OR $p^2 = 0.9612$; 3. Number = $0.9612 \times 86\,171\,873 = 82\,828\,404$;	3	If no other marks awarded, allow 1 mark for use of: people with PKU = q^2 and use of $p + q = 1$ and answer = p^2 3. Allow answer in range 82 724 998 to 82 828 404

Question	Marking guidance	Mark	Comments
04.5	1. Selection against having PKU / against nn OR some (with PKU) do not survive; 2. Non-random mating; 3. Population not isolated / immigration / emigration; 4. Mutation could occur;	3	

Question	Marking guidance	Mark	Comments
05.1	1. Liver; 2. A muscle;	2	2. Allow a named muscle – eg Biceps

Question	Marking guidance	Mark	Comments
05.2	Glucagon release would increase blood glucose concentration (which is already increased after a meal);	1	Allow glucagon causes glycogen to produce glucose

Question	Marking guidance	Mark	Comments
05.3	Large number Reduces effect of anomalies/outliers OR can calculate a valid OR reliable OR more representative OR accurate <u>mean</u>; Double-blind Overcome bias / expectation of doctors OR patients OR prevent doctors treating patients differently;	2	Allow gives a more representative sample Allow overcome psychological effects

Question	Marking guidance	Mark	Comments
05.4	>99.99 % probability that <u>difference</u> (from placebo) is not due to chance OR <0.01% probability that <u>difference</u> (from placebo) is due to chance OR significant <u>difference</u> (between effect of Tirzepatide and placebo);	1	Allow reference to >95% / >0.95 Allow reference to <5% / <0.05 Allow difference not (just) due to chance

Question	Marking guidance	Mark	Comments
06.1	1. Structural proteins – in tendons (inelastic, fibrous) and ligaments (elastic fibres) in cell membranes (cell surface + membrane-bound organelles) in ribosomes; 2. Movement – myosin and actin in muscle + in cyclosis within cells spindle fibres (microtubules) in mitosis OR meiosis; 3. Enzymes – specific catalysts for all metabolic reactions; 4. Transport across membranes – protein channels – aquaporins + ion channels (eg Na⁺ & K⁺ in neurones) + co- transport / facilitated diffusion (eg Na⁺ & glucose) + active transport (eg Na⁺ activated ATPase); 5. Electron/proton transport in mitochondria via cytochromes OR ATP synthesis via ATP synthase in mitochondrial membrane; 6. Receptors – for hormones (eg insulin/glucagon) for neurotransmitters (eg acetylcholine); 7. Defence – antibodies against antigens/pathogens; 8. Mass transport – haemoglobin + oxygen; 9. Gene expression – repressors, histones, RNA polymerase; 10. Maintenance of Ψ_s of blood plasma by serum albumins and globulins; 11. Hormones – eg insulin;	6	Allow any correct examples, throughout If just different examples of importance but no explanations – max. 2 marks for 2 examples 12. Allow storage - eg iron by ferritin;

Question	Marking guidance	Mark	Comments
06.2	1. Put tubes of egg white in set volume of buffer solutions at different pH values 2. put set volume of pepsin solution in buffer in a separate tube at each pH value; 3. Suitable range of pH values (at least 5) with different buffers; 4. All at same constant temperature in a water bath; 5. After equilibration, add pepsin solution to egg white tubes; 6. Measure length of egg white at a set time OR measure time taken for standard decrease in length of egg white OR measure length of egg white at several time intervals; 7. Repetitions and calculation of mean (for each pH); 8. Plot a line graph of (mean) rate / time taken vs. pH; 9. Optimum pH = pH giving maximum rate (/minimum for time taken) on graph OR repeat with intermediate pH values around the peak value;	6	1. Allow idea of egg white + pepsin + buffer 2. Allow set volume/concentration of pepsin/buffer 1. and 2. Allow 1 mark if not in separate tubes 3. eg pH 1–7 4. Allow a temperature in the range 20–37 °C 7. At least 2 more repetitions 8. Accept a sketch graph

Question	Marking guidance	Mark	Comments
06.3	Role of the gene: 1. Amino acid sequence / primary structure determined by a gene; 2. 3 bases code for one amino acid OR sequence of triplets codes for amino acid sequence; (=mp1 + mp2) Transcription: 3. Transcription → mRNA via complementary binding of nucleotides (nucleoside triphosphates) or base pairing; 4. Role of enzyme(s) – eg RNA-polymerase; Translation: 5. mRNA binds to ribosome; 6. Role of amino-acyl-tRNAs – via anticodon-codon complementary H-bonding; 7. Peptide bond formation; 8. Role of start/stop codons; 9. Folding of polypeptide chain – via H-bonds / ionic bonds / hydrophobic interactions / disulfide bonds;	6 max	For full marks, must include all 3 sections: Role of the gene + Transcription + Translation Max 5 marks if feature(s) of eukaryotic cells mentioned 8. Allow reference to AUG (start) OR UAA/UAG (stop)

Question	Marking guidance	Mark	Comments
06	<u>Quality of written communication</u> These are awarded for correct use of scientific terms and the ability to present a clear, logical account. They are not awarded for spelling, punctuation and grammar. <u>2 marks</u> for an answer in which technical terms are used correctly throughout and the accounts are presented clearly and logically. <u>1 mark</u> for an answer in which most technical terms are used correctly and most of the accounts are presented clearly and logically. <u>0 marks</u> for an answer in which few technical terms are used correctly or the accounts are seldom presented clearly and logically.	2	Award mark for overall performance in 06.1, 06.2 and 06.3