AS
Biology
7401/2

PAPER 2

Mark scheme

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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, in which all associates participate, 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' answers. 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 Assessment Writer.

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 that 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 must 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. This will be indicated in the 'Comments' column.

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. Cellulose is made up of β-glucose (monomers) **and** glycogen is made up of α-glucose (monomers); 2. Cellulose molecule has straight chain **and** glycogen is branched; 3. Cellulose molecule has straight chain **and** glycogen is coiled; 4. glycogen has 1,4- and 1,6- glycosidic bonds **and** cellulose has only 1,4- glycosidic bonds;	2 max	Ignore ref. to H bonds / microfibrils
01.2	Any **two** from: 1. Insoluble (in water), so doesn't affect water potential; 2. Branched / coiled / (α-)helix, so makes molecule compact; OR Branched / coiled / (α-)helix so can fit many (molecules) in small area; 3. Polymer of (α-)glucose so provides glucose for respiration; 4. Branched / more ends for fast breakdown / enzyme action; 5. Large (molecule), so can't cross the cell membrane	2 max	Require feature **and** explanation for 1 mark 1. Accept Ψ or WP 1. Accept Insoluble so doesn't affect osmosis 1. Do **not** allow ref to 'doesn't affect water leaving cells' 4. Ignore 'surface area' 4. Accept 'branched so glucose readily released'
01.3	Iodine/potassium iodide;	1	Auto mark
01.4	For correct answer of 40 (µm) award 2 marks;; Evidence of division by 500: award 1 mark	2	Allow tolerance of 0.5mm ie 20±0.5mm
01.5	1. Scanning electron (microscope); 2. 3D (image);	2	Accept SE(M) 2. Ignore any other correct features

Question	Marking guidance	Mark	Comments
02.1	1. (If) too much water the concentration of pigment (in solution) will be lower / solution will appear lighter / more light passes through (than expected); OR (If) too little water the concentration of pigment (in solution) will be greater / solution will appear darker / less light passes through (than expected); 2. So results (from different temperatures) are comparable;	2	1. Ignore reference to too much water so red pigment / solution too weak to measure
02.2	(Take) reading**s** (during the experiment) using a (digital) thermometer / temperature sensor;	1	
02.3	Point-to-point line drawn between co-ordinates (with a ruler); OR Smooth s-shaped line of best fit;	1	Reject any extrapolations below 20 °C or above 80 °C Any line should look smooth (not 'sketchy')
02.4	1. Damage to (cell surface) membrane; 2. (membrane) proteins denature; 3. Increased fluidity / damage to the phospholipid bilayer;	2 max	

Question	Marking guidance	Mark	Comments
03.1	1. Low starch, fewer copies; 2. Ranges overlap almost completely; OR Ranges overlap from 2 – 13 copies; 3. (surprisingly) very few / 2 or 3% have only 2 copies / are diploid; 4. the mode / highest percentage for low starch is 4 copies <u>and</u> for high starch is 6; 5. the range / spread is greater with high starch;	3 max	4. "most people" is not equivalent to mode
03.2	1. More mRNA / more transcription; 2. More translation / enzyme; 3. So reaction faster;	3	The idea of "more" must be stated at least once. 2. Accept 'amylase' for enzyme 3. "More starch digested" is insufficient
03.3	1. Mutation(s) produce extra copies of (*AMY1*) gene; 2. Those with more copies / this adaptation/mutation reproduce / survive better on high starch diet; 3. And pass on multiple copies / this adaptation/mutation (to offspring);	3	3. Ignore ref. to single allele/gene

Question	Marking guidance	Mark	Comments
04.1	6 (g dm^{-3});	1	
04.2	Correct answer of (–)0.14;; 1 mark for correct difference in concentration (5) divided by 35 / (69 – 64) ÷ 35 / 1 ÷ 7	2	Ignore +/- sign Ignore additional d.p. Accept 0.31(4) for 1 mark if female data used
04.3	1. Protein content decreases with age <u>and</u> decreases more in females; 2. Difference (between sexes) only significant at 95 years because SDs do not overlap; OR Differences not significant because 2 x SD would overlap;	2	
04.4	1. Produce known concentrations of <u>protein</u>; 2. Measure absorbance of each concentration OR Measure each concentration with colorimeter; 3. Plot a graph of absorbance on y-axis against concentration (on x-axis) <u>and</u> draw curve; 4. Use absorbance of sample to find protein concentration from curve;	3 max	1. Idea of known concentrations required. Accept % transmission / absorption for absorbance
04.5	(Lower plasma protein concentration suggests) fewer antibodies;	1	Ignore ref. to other proteins. Reject answers which refer to white blood cells as proteins.

Question	Marking guidance	Mark	Comments
05.1	1. First oxygen binds (to Hb) causing change in shape; 2. (Shape change of Hb) allows more O_2 to bind (easily) / greater saturation with O_2 OR Cooperative binding;	2	
05.2	1. (HbA has) lower affinity for O_2 at low partial pressures; OR (HbA has) lower affinity for oxygen at pp found in tissues; 2. Easier unloading of O_2 for (aerobic) respiration;	2	
05.3	1. A large/significant increase in HbF; 2. (HbF has) higher affinity for O_2 (than faulty HbA); 3. Higher proportion of HbF in blood so more oxygen carried; OR More oxygen carried after treatment;	3	

Question	Marking guidance	Mark	Comments
06.1	1. Measure (each stoma) using eyepiece graticule; 2. Calibrate eyepiece graticule against stage micrometer / ruler / graph paper; 3. Take a number of measurements (to calculate a mean);	3	2. Accept micrometer slide 3. Idea of enough readings for a reliable mean (min. 5)
06.2	1.48;;	2	Accept 1.5 and 1.479 1 mark for PS3 = 7.1 (µm) and ABA = 4.8 (µm)
06.3	1. (Causes less stomatal opening so) less transpiration; OR Less evaporation; OR Less water lost by diffusion; 2. (So more) water available for photosynthesis / metabolism / support; OR (So) less water needed from the (dry) soil;	2	2. Water conserved / retained is insufficient 2. Ignore respiration
06.4	(Closes the stomata so) fewer/no <u>spores</u> enter leaf;	1	

Question	Marking guidance	Mark	Comments
07.1	1. (Anti-AQP4) antibody has a (specific) tertiary structure; 2. Has binding site / variable region that only binds to / complementary to one antigen; 3. Antigen to this antibody (only) found on these nerve cells; 4. So, antibody (only) binds to / forms antigen-antibody complex with these nerve cells (causing damage);	4	Reject "active site" (only penalise once if it occurs throughout) 3. / 4. Accept 'receptor' for antigen
07.2	1. Only 20 in the study; OR Only one study; 2. For some concentrations of antibody there is a range in the number of vertebrae surrounding damaged nerve cells; 3. No statistical test used; 4. Correlation is weak;	3 max	1. Accept small sample 2. Accept suitable use of data 2. Accept converse
07.3	1. The monoclonal antibody binds to nerve cell antigen so less / no anti-AQP4 can bind; OR The monoclonal antibody forms antigen-antibody complex with nerve cell antigen so less / no anti-AQP4 can bind; 2. When monoclonal antibody binds it doesn't cause damage to nerve cell;	2 max	It = monoclonal antibody 1. Reject "active site" Ignore "competitive inhibitor" Accept receptor for antigen Do not credit responses in the context of enzymes

Question	Marking guidance	Mark	Comments
08.1	Three of chromosome 13 / an extra chromosome 13;	1	Accept trisomy 13 Accept circle around three chromosomes or any other correct indication on Figure 8 Do not allow references to any other chromosomes. Do not accept chromatids for chromosomes.
08.2	1. In meiosis; 2. Homologous chromosomes / sister chromatids do not separate;	2 max	2. Accept non-disjunction
08.3	1. Mutation / extra chromosome in gamete/egg/sperm (that formed zygote); 2. All cells derived (from a single cell/zygote) by mitosis; OR 3. All cells derived from a single cell/zygote by mitosis; 4. Mitosis produces genetically identical cells / a clone;	2	Mark points 1 and 2 OR 3 and 4 4. Accept: have same DNA / same alleles
08.4	1. (Some) oxygenated blood (from the aorta) flows into pulmonary artery; OR Less oxygenated blood flows out through aorta; OR Lower blood pressure in aorta; 2. Less oxygen delivered to cells / tissues / organs / named organ / via named blood vessel; 3. So less/not enough oxygen for <u>aerobic</u> respiration (in cell/ tissue/organ); 4. Tissue/organ doesn't grow/develop properly (causing death); OR Tissue dies/organ stops working (causing death);	3 max	1. Accept mixing of deoxygenated with oxygenated blood in pulmonary artery 2. Do not accept "no oxygen" 3. Do not accept "produce energy"

Question	Marking guidance	Mark	Comments
09.1	1. Water lost from leaf because of transpiration / evaporation of water (molecules) / diffusion from mesophyll / leaf cells; OR Transpiration / evaporation / diffusion of water (molecules) through stomata / from leaves; 2. Lowers water potential of mesophyll / leaf cells; 3. Water pulled up xylem (creating tension); 4. Water molecules cohere / 'stick' together by hydrogen bonds; 5. (forming continuous) water column; 6. Adhesion of water (molecules) to walls of xylem;	5 max	2. Accept Ψ or WP
09.2	1. The DNA strands separate by breaking the H bonds; OR H bonds broken between (complementary) (DNA) bases; 2. (Only) one of the strands/template strand is used (to make mRNA/is transcribed); 3. (Complementary) base pairing so A→U, T→A, C→G, G→C; 4. (RNA) <u>nucleotides</u> joined by RNA polymerase; 5. pre-mRNA formed; 6. Splicing / introns removed to form mRNA;	5 max	1. Ignore 'hydrolysis' of bonds 1. Accept DNA "unzips" by breaking the H bonds 6. Accept 'non-coding' sections for introns