AQA

A-level BIOLOGY (7402/2)

Paper 2

Mark scheme

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 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.

Further copies of this mark scheme are available from aqa.org.uk

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 <u>not</u> 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. Equilibrium reached; 2. Allow for expansion/pressure change in apparatus; 3. Allow respiration rate of seeds to stabilise;	3	1. Accept equilibrate 3. Ignore seeds acclimatise
01.2	1. Optimum temperature/temperature for normal growth of seeds; 2. (Optimum temperature) for enzymes involved in respiration;	2	
01.3	1. Oxygen taken up/used by seeds; 2. CO_2 given out is absorbed by KOH (solution); 3. Volume/pressure (in **B**) decreases;	3	
01.4	0.975/0.98;	2	If incorrect, 0.26 × 6 / or incorrect numbers divided by 1.6 for 1 mark

Question	Marking Guidance	Mark	Comments
02.1	1. Calcium ions diffuse into myofibrils from (sarcoplasmic) reticulum; 2. (Calcium ions) cause movement of tropomyosin (on actin); 3. (This movement causes) exposure of the binding sites on the actin; 4. Myosin heads attach to binding sites on actin; 5. Hydrolysis of ATP (on myosin heads) causes myosin heads to bend; 6. (Bending) pulling actin molecules; 7. Attachment of a new ATP molecule to each myosin head causes myosin heads to detach (from actin sites);	5 max	
02.2	1. Releases relatively small amount of energy / little energy lost as heat; 2. Releases energy instantaneously; 3. Phosphorylates other compounds, making them more reactive; 4. Can be rapidly re-synthesised; 5. Is not lost from/does not leave cells;	2 max	1. Key concept is that little danger of thermal death of cells 2. Key concept is that energy is readily available

Question	Marking Guidance	Mark	Comments
03.1	(Genes/loci) on same chromosome;	1	
03.2	1. GN and gn linked; 2. GgNn individual produces mainly GN and gn gametes; 3. Crossing over produces some/few Gn and gN gametes; 4. So few(er) Ggnn and ggNn individuals;	4	
03.3	(Grey long:grey short:black long:black short) =1:1:1:1	1	
03.4	1. Chi squared test; 2. Categorical data;	2	

Question	Marking Guidance	Mark	Comments
04.1	1. Membrane more permeable to potassium ions and less permeable to sodium ions; 2. Sodium ions actively transported/pumped out and potassium ions in;	2	
04.2	1. (Pressure causes) membrane/lamellae to become deformed/stretched; 2. Sodium ion channels in membrane open and sodium ions move in; 3. Greater pressure more channels open/sodium ions enter;	3	
04.3	1. Threshold has been reached; 2. (Threshold or above) causes maximal response / all or nothing principle;	2	
04.4	1. Less/no saltatory conduction / action potential/impulse unable to 'jump' from node to node; 2. More depolarisation over length/area of membranes;	2	

Question	Marking Guidance	Mark	Comments
05.1	1. (If injected into egg), gene gets into all/most of cells of silkworm; 2. So gets into cells that make silk;	2	
05.2	1. Not all eggs will successfully take up the plasmid; 2. Silkworms that have taken up gene will glow;	2	
05.3	Promoter (region/gene);	1	
05.4	1. So that protein can be harvested; 2. Fibres in other cells might cause harm;	2	

Question	Marking Guidance	Mark	Comments
06.1	0.32;	2	Correct answer = 2 marks Accept 32% for 1 mark max Incorrect answer but identifying 2pq as heterozygous = 1 mark
06.2	1. Mutation produced *KDR minus*/resistance allele; 2. DDT use provides selection pressure; 3. Mosquitoes with *KDR minus* allele more likely (to survive) to reproduce; 4. Leading to increase in *KDR minus* allele in population;	4	
06.3	1. Neurones remain depolarised; 2. So no action potentials / no impulse transmission;	2	
06.4	1. (Mutation) changes shape of sodium ion channel (protein) / of receptor (protein); 2. DDT no longer complementary / no longer able to bind;	2	

Question	Marking Guidance	Mark	Comments
07.1	Hypothalamus;	1	
07.2	1. Water potential of blood will decrease; 2. Water moves from osmoreceptor into blood by osmosis;	2	
07.3	1. Permeability of membrane/cells (to water) is increased; 2. More water absorbed from/leaves distal tubule/collecting duct; 3. Smaller volume of urine; 4. Urine becomes more concentrated;	4	
07.4	115.2/115.3 (cm^3 $minute^{-1}$);	1	
07.5	Any **two** of the following for 1 mark; Muscle/body mass Ethnicity Exercise Kidney disease – do not accept 'health'	1	

Question	Marking Guidance	Mark	Comments
08.1	1. Oxygen produced in light-dependent reaction; 2. The faster (oxygen) is produced, the faster the light-dependent reaction;	2	
08.2	35–36 (µmol O_2 mg^{-1});;	2	Correct difference at 500 µmol photons m^{-2} s^{-1} or incorrect difference but division by 4 shown = 1 mark
08.3	At all light intensities, chloroplasts from mutant plants: 1. Have faster production of ATP and reduced NADP; 2. (So) have faster/more light-independent reaction; 3. (So) produce more sugars that can be used in respiration; 4. (So) have more energy for growth; 5. Have faster/more synthesis of new organic materials;	4 max	Accept converse points if clear answer relates to non-mutant plants

Question	Marking Guidance	Mark	Comments
09.1	1. Methylation prevents transcription of gene; 2. Protein not produced that prevents cell division/ causes cell death/apoptosis; 3. No control of mitosis;	3	
09.2	1. Scatter graph; 2. Fat on *x* axis and death rate on *y* axis; 3. (Because) looking at relationship between two discrete/independent variables;	3	
09.3	1. (Trend) shows positive correlation / shows the more fat in diet, the higher death rate from breast cancer; 2. But number of points off line/anomalies;	2	

Question	Marking Guidance	Mark	Comments
10.1	1. Reduction in ATP production by aerobic respiration; 2. Less force generated because fewer actin and myosin interactions in muscle; 3. Fatigue caused by lactate from anaerobic respiration;	3	
10.2	Couple **A**, 1. Mutation in mitochondrial DNA/DNA of mitochondrion affected; 2. All children got affected mitochondria from mother; 3. (Probably mutation) during formation of mother's ovary/eggs; Couple **B**, 4. Mutation in nuclear gene/DNA in nucleus affected; 5. Parents heterozygous; 6. Expect 1 in 4 homozygous affected;	4 max	
10.3	1. Change to tRNA leads to wrong amino acid being incorporated into protein; 2. Tertiary structure (of protein) changed; 3. Protein required for oxidative phosphorylation/the Krebs cycle, so less/no ATP made;	3	
10.4	1. Mitochondria/aerobic respiration not producing much/any ATP; 2. (With MD) increased use of ATP supplied by increase in anaerobic respiration; 3. More lactate produced and leaves muscle by (facilitated) diffusion;	3	
10.5	1. Enough DNA using PCR; 2. Compare DNA sequence with 'normal' DNA;	2	



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