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BL02

Unit 2 Biological Systems and Disease

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 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 <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	Any **two** from DNA/chromosome replication Replication/production of organelles Cell growth Protein synthesis;;	2	Allow respiration/ATP production Allow named organelle

Question	Marking guidance	Mark	Comments
01.2	A (Sister) Chromatid and B Centromere;	1	

Question	Marking guidance	Mark	Comments
01.3	Chromosomes attach to the spindle fibres (by the centromeres) **OR** Chromosomes are on the equator (of the cell);	1	

Question	Marking guidance	Mark	Comments
01.4	1. Anaphase; 2. Chromatids have been separated;	2	 2. Ignore unevenly

Question	Marking guidance	Mark	Comments
01.5	1. (In nondisjunction) one cell does not have a copy of the RB1/tumour suppressor gene; 2. (Retinoblastoma/cancer is) uncontrolled cell division;	2	Allow mitosis

Question	Marking guidance	Mark	Comments
01.6	1. (Same number as starting point) so can compare; 2. (Large) enough (number) to make eye swell (within time) **OR** (Large) enough (number) to make big enough tumour (within time) **OR** (Large) enough (number) so sufficient cells take up (functioning) RB1 gene (to reduce size of tumour within time);	2	

Question	Marking guidance	Mark	Comments
01.7	**Allow for 3 marks** 27.5 mm^3;;; **Allow for 2 marks** Correct answer not to 3sf;; Using diameter instead of radius, answer to 3sf;; Incorrect radius used at 4 weeks, answer to 3sf;;	3	

	Allow for 1 mark Incorrect radius used at 4 weeks, answer not to 3sf;		

Question	Marking guidance	Mark	Comments
01.8	For 1. (Idea of) gene therapy stops eyes increasing in size/diameter/volume as much (as without gene therapy); 2. Increase in diameter (of treated eye) is significantly less at 3 weeks and 4 weeks/after 3 weeks (than not treated eye); Against 3. Sight not tested (so don't know if gene therapy prevents sight loss); 4. Tumour cells all come from same/only 1 patient; 5. (Idea that) gene therapy (in eye) could be difficult/painful/time-consuming/could have side effects; 6. (Only 4 weeks so) do not know long term effect **OR** Treatment might need to be repeated **OR** Treatment might not cure (retinoblastoma); 7. Only 10 mice/small sample size **so** not representative **OR** On mice **so** do not know effect on humans;	4	Must have at least 1 mark for, to gain full marks

Question	Marking guidance	Mark	Comments
02.1	1. Less (oxygen for aerobic) respiration **OR** More anaerobic respiration; 2. Less ATP/energy for muscle contraction; 3. More/faster build-up of lactic acid (so less muscle contraction);	2 max	

Question	Marking guidance	Mark	Comments
02.2	1. Thrombus/blood clot blocks artery; 2. Less/no oxygen/glucose reaches tissue/cells/muscle; 3. Less/no respiration so tissues/cells/muscle die;	3	3. Allow for tissue/cells/muscle dies: in heart causes heart attack/CHD in brain causes stroke/description

Question	Marking guidance	Mark	Comments
02.3	To show it is the (chemicals in the) TC/EC/smoking/vaping that cause the changes (in blood pressure/heart rate) **OR** To show that it is not the action of smoking that causes the changes (in blood pressure and heart rate);	1	

Question	Marking guidance	Mark	Comments
02.4	(Not ethical to ask non-smokers to smoke) because known to be harmful to health; **OR** Method of smoking likely to be the same – eg depth of inhalation;	1	

Question	Marking guidance	Mark	Comments
02.5	1. TC **and** EC increase blood pressure **and** heart rate (from rest/control); 2. EC causes more increase in blood pressure than TC; 3. Increase in heart rate caused by TC and EC very similar **OR** Increase in heart rate caused by TC (slightly) more than increase caused by EC; 4. Cannot tell if any differences are significant since no SD/SE/statistical test;	3 max	

Question	Marking guidance	Mark	Comments
03.1	1. Set bubble at start/known value **OR** record starting point; 2. Leave for set time and record how far bubble has moved **OR** time how long it takes for bubble to reach set distance; 3. Divide distance (mm) by time (s or min);	3	Ignore references to setting up the equipment/shoot 3. Allow volume instead of distance

Question	Marking guidance	Mark	Comments
03.2	Problem: 1. Water will evaporate from soil surface (decreasing mass more than the decrease due to transpiration only); How to correct the problem: 2. Cover soil surface **OR** Measure evaporation rate for pot of soil with no plant and take this value from pot of soil with plant;	2	

Question	Marking guidance	Mark	Comments
03.3	Mass will decrease (as water evaporates from leaves);	1	Allow any quoted value of less than 257.0

Question	Marking guidance	Mark	Comments
03.4	**Mark in pairs** 1 and 2 **OR** 3 and 4 **OR** 5 and 6 **OR** 7 and 8 1. Light intensity higher; 2. causes more stomata to open; **OR** 3. Temperature higher; 4. causes faster evaporation; **OR** 5. humidity lower; 6. increases water potential gradient; **OR** 7. more wind/air movement; 8. increases water potential gradient;	2 max	

Question	Marking guidance	Mark	Comments
04.1	1. HIV has RNA but adenovirus has DNA; 2. HIV has a lipid envelope, but adenovirus does not;	2	

Question	Marking guidance	Mark	Comments
04.2	5 7;	1	

Question	Marking guidance	Mark	Comments
04.3	1. Reverse transcriptase and (HIV needs it) to produce (c)DNA from RNA; 2. (Reverse transcriptase and adenovirus does not need) as its genetic material is DNA; 3. Integrase and (HIV needs it) to integrate viral (c)DNA into host cell DNA; 4. (Integrase and adenovirus) does not integrate its DNA into host cell DNA;	4	Needs to identify reverse transcriptase once for both mp1 and mp2 Needs to identify integrase once for both mp3 and mp4 Allow **one mark** for stating reverse transcriptase and integrase if no other marks awarded

Question	Marking guidance	Mark	Comments
04.4	Structure of capsid **OR** Attachment proteins;	1	

Question	Marking guidance	Mark	Comments
05.1	Any **one** from: • Remove/kill snails • Kill swimming stage • Better sanitation **or** prevent faeces entering water • Don't go swimming/stand in contaminated water • Drain contaminated water;	1	

Question	Marking guidance	Mark	Comments
05.2	**3 marks for** 1.697×10^6 **OR** 1.7×10^6;;; **2 marks for** 1 696 801 (not standard form) **OR** 3.61×10^6 (not 47%) **OR** 3.77×10^5 (not × 4.5 years);; **1 mark for** 3610215 **OR** 377067;	3	2 marks if number of days in year incorrect but process of sum correct and in standard form (1 mark if not in standard form) Allow **three marks** for 1.698×10^6 or 1.699×10^6 (including 1 or 2 leap years)

Question	Marking guidance	Mark	Comments
05.3	1. Low pressure in veins, **so** less likely to be washed away (than high pressure/turbulent flow in arteries); 2. Veins have larger lumen than arteries **so** able to fit (both male and female worm);	2	1. Allow slower blood flow for low pressure Allow **one mark** for veins have low pressure and wider lumen. Allow worms need to live in low oxygen environment

Question	Marking guidance	Mark	Comments
05.4	1. (Protein has specific shape so) antibodies would be complementary/only bind to this protein; 2. On surface **so** accessible to antibodies;	2	

Question	Marking guidance	Mark	Comments
05.5	1. So people know what to expect/so people are not surprised/worried; 2. (Too many) minor side effects might discourage people from using the vaccine; 3. In case the minor side effects (could) develop into more serious ones (later);	1	

Question	Marking guidance	Mark	Comments
05.6	More appropriate units 1. g dm^{-3} **OR** mg cm^{-3} **OR** mg mm^{-3} **OR** µg mm^{-3} **OR** Add $x10^3$, $\times 10^4$ or $\times 10^5$ to legend (so values on y-axis are 100s, 10s or 1s); Reason 2. (because fewer zeros mean) less likely to make mistake when reading off values/doing calculations;	2	

Question	Marking guidance	Mark	Comments
05.7	Pros 1. Antibody concentration increases (with vaccine); 2. No serious/only mild side effects (so safe to use); 3. Women do not have schistosomiasis/not in country where it is found so antibodies are not result of natural infection; Cons 4. Don't know if vaccine prevents schistosomiasis (as women weren't exposed to it); 5. Not tested in men/children **so** may not be representative **OR** Small sample/only 10 women **so** not representative; 6. Antibody production only measured over 120 days **so** may not be long term; 7. Only over 120 days **so** side effects may occur later/don't know long term effects; 8. Might be cheaper/quicker to kill snails/improve sanitation; 9. Three doses not practical;	3 max	Must have both Pros and Cons for full marks

Question	Marking guidance	Mark	Comments
06.1	Circle round 9th base (as A replaced by G);	1	Allow any shape

Question	Marking guidance	Mark	Comments
06.2	Substitution;	1	

Question	Marking guidance	Mark	Comments
06.3	1. (DNA base sequence changes but) triplet still codes for same amino acid; 2. (because) DNA code is degenerate/degenerative;	2	

Question	Marking guidance	Mark	Comments
06.4	Addition of 2 extra bases/TC (after 8th base);	1	Allow addition of CT (after 7th base) Ignore frameshift

Question	Marking guidance	Mark	Comments
06.5	1. All amino acids/primary structure after mutation changed; 2. (Channel) protein will have different tertiary structure **OR** (Channel) protein will have different shape; 3. So ions no longer fit through **OR** So movement of ions reduced;	3	2. Do not allow reference to active site

Question	Marking guidance	Mark	Comments
07.1	At least **1 mark** from each section for full marks **Digestion** 1. Salivary gland releases (saliva containing) enzymes/amylase to start digestion of starch; 2. Stomach for (description of) physical digestion **OR** Stomach for mixing of food with enzymes/acid **OR** Stomach releases protease enzymes to digest proteins; 3. Pancreas releases enzymes into duodenum; 4. Duodenum for enzyme/chemical digestion of starch/fats/proteins; 5. Ileum for membrane-bound enzymes (to complete digestion); **Absorption** 6. Ileum has microvilli/villi to increase surface area for absorption; 7. Ileum absorbs small/soluble molecules by diffusion/active transport/co-transport;	5	Allow 1 mark in the digestion section for role of liver eg produces bile to emulsify lipids/neutralise stomach acid/ create optimum pH for enzymes (in duodenum) 3, 4, 5, 6 Allow small intestine Allow 1 mark in the absorption section for role of liver eg bile (salts) in forming micelles 7. Allow named examples eg glucose, monosaccharides, amino acids, monoglycerides, fatty acids

Question	Marking guidance	Mark	Comments
07.2	1. Active transport/co-transport of sucrose into phloem by companion cells/at source; 2. Lowers water potential (in phloem); 3. Water enters from xylem by diffusion/osmosis; 4. Increases volume/pressure/creates pressure gradient (in phloem); 5. Aphids insert stylet into phloem; 6. Sap enters aphid (gut) from high to low pressure/down pressure gradient/passively;	5 max	