

A-LEVEL **Biology**

7402/2 - Paper 2

Mark scheme

June 2018

Version/Stage: 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 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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Level of response marking instructions

Level of response mark schemes are broken down into levels, each of which has a descriptor. The descriptor for the level shows the average performance for the level. There are marks in each level.

Before you apply the mark scheme to a student's answer read through the answer and annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

Step 1 Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level. The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer. With practice and familiarity you will find that for better answers you will be able to quickly skip through the lower levels of the mark scheme.

When assigning a level you should look at the overall quality of the answer and not look to pick holes in small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level and then use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 3 with a small amount of level 4 material it would be placed in level 3 but be awarded a mark near the top of the level because of the level 4 content.

Step 2 Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this. The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do not have to cover all of the points mentioned in the Indicative content to reach the highest level of the mark scheme.

An answer which contains nothing of relevance to the question must be awarded no marks.

Question	Marking Guidance	Mark	Comments
01.1	1. (Less/no) ATP;	2	2. Accept NADPH, NADPH + H, NADPH₂ NADPH + H ⁺
	2. (Less/no) reduced NADP;		2. Reject reduced NAD, NADH etc,
01.2	1. (Less/no) carbon dioxide (reacts) with RuBP;	2	
	2. (Less/no) GP;		
		1	Reject: stoma
			Reject stroma of cytoplasm/chlorophyll
01.3	1. Stroma (of/in chloroplast);		Reject stroma of mitochondrion
			Ignore references to Calvin cycle or the light-independent reaction
	1. Rubisco activity increases with temperature	4 max	2. Accept denatures at high temperature (allow
	OR Rubisco optimum temperature is above (rubisco activase);		any temperature above 25 °C)
	2. (Rubisco) activase activity decreases at		
	high temperatures (allow any temperature above 25 °C.)		
	OR		
01.4	(Rubisco) activase optimum (allow in range) 25 to 30 °C.;		4. Accept may not be
	 (Results/graphs suggest) activase cannot/does not affect activity of rubisco; 		species/types of plant Ignore: only one study
	4. (Results are) only for cotton;		
	5. (Results are) for isolated enzymes;		
	6. No stats test;		

Question	Marking Guidance	Mark	Comments
02.1	Box 2. An inversion will result in a change in the number of DNA bases.	1	Reject if more than one box with tick. Ignore crossed-out ticks
02.2	 Increased) methylation (of tumour suppressor genes); Mutation (in tumour suppressor genes); Tumour suppressor genes are not transcribed/expressed OR Amino acid sequence/primary structure altered; (Results in) rapid/uncontrollable cell division; 	3 max	 Accept abnormal methylation or hypermethylation Ignore decreased acetylation of histones Accept mRNA for transcription/transcribed Accept tertiary structure altered Accept different amino acid Ignore reference to protein not being formed Accept cell division cannot be regulated Ignore growth
02.3	 Correct answer of 1.9/1.93 x 10²⁵ = 2 marks;; Incorrect answer but shows 84 = 1 mark OR 28 x 3 = 1 mark OR Incorrect answer but shows 672 divided by 8 = 1 mark; 	2	 Accept 2 x 10²⁵ = 2 marks Ignore any numbers after 1.93

Question	Marking Guidance	Mark	Comments
03.1	1. (So the) oxygen is used/absorbed/respired;	1	
03.2	1. <u>Anaerobic</u> respiration produces carbon dioxide;	2	2. Reference to either volume or pressure required for the mark
	1. Correct answer in range of	2	1. Accept any
	4.9×10^{-4} to 4.91×10^{-4} = 2 marks;;		mathematical
	2. Incorrect answer buts shows division by 24 = 1 mark		representation of this answer
03.3	OR		
	Incorrect answer but shows a number from 1175 to 1178 (ignore position of decimal point, standard form and any numbers that follow) = 1 mark ;		
	OR		
	Incorrect answer but show the number 49 (ignore position of decimal point, standard form and any numbers after 49) = 1 mark ;		
		1	1. Accept reference to exponential (increase)
03.4	Large range/difference/increase in numbers;		 Ignore if the answer only refers to numbers being high
			I. Ignore to 'fit on the scale'
		1	Accept decrease/no oxygen as Figure 4 is not linked to Figure 3.
	1 Decrease/ne diucese/substrate		Accept competition for glucose/oxygen.
03.5	OR		Accept any named sugar
	Increase in ethanol/carbon dioxide/acidity;		Accept decrease in pH
			Accept increase in toxins
			1. Ignore food/nutrients

03.6	 Correct answer of 298000 or 297766 or 297765.59 or 296826 = 2 marks;; Incorrect answer but working shows 2000 × 2.72 = 1 mark; OR Incorrect answer but working shows 2.72^{0.5 x10} / 2.72⁵ / e^{0.5 x10} / = 1 mark 	2	1. Accept: any equivalent answer with appropriate rounding e.g. 2.98×10^5 , 29.78×10^4 etc.
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Question	Marking Guidance	Mark	Comments
04.1	 Method of randomly determining position (of quadrats) e.g. random numbers table/generator; Large number/sample of quadrats; Divide total percentage by number of quadrats/samples/readings; 	3	 Ignore line/belt transect Accept many/multiple Ignore point quadrat If a specified number is given, it must be 20 or more
04.2	 Beach grass is the pioneer (species); Pioneers/named species change the (abiotic) environment/habitat/conditions/factors; (So) less <u>hostile</u> for named species OR (So) more <u>suitable</u> for named species; Conifer/hardwood trees represent climax community; 	4	2. Must convey idea of change being caused by a species2. Accept example of change e.g. more humus
04.3	1. Trees block/reduce (sun)light;	1	Reject 'blocks' all of the light
04.4	 1.(NPP) remains constant; 2. GPP/photosynthesis and respiration constant; OR 3. (NPP) low/decreases; 4. Less light so less photosynthesis/GPP; 	2	Mark in paired statements 1 and 2 or 3 and 4 2. Accept GPP/photosynthesis equals respiration 4. Reject no photosynthesis

Question	Marking Guidance	Mark	Comments
05.1	1. Affects water potential (of blood/body);	2	1. Accept Ψ for water potential
	2. Affects <u>volume</u> of unite (produced/femoved),		
	 Furosemide and CVT more effective than placebo/control/C OR 	2	1. Accept both (drugs)/A and B more effective than placebo/control/C
05.2	Furosemide more effective (than CVT);		
	2. Correct reference to a significant increase/difference as SD's do not overlap;		
05.3	1. Lower <u>volume</u> of blood;	1	
		3	1. Accept correct reference to water potential gradient
			1. Accept maintains low water potential.
	1.Water potential of filtrate/tubule decreased;		1 and 2. Accept nephron for filtrate/tubule.
05.4	2. Less water (reabsorbed) by <u>osmosis (</u> from filtrate/tubule);		2. Accept no water (reabsorbed) for 'less'
	3. Collecting duct (is where osmosis occurs);		2. Accept (more) water (absorbed) by <u>osmosis</u> (into filtrate/tubule)
			3. Accept proximal convoluted tubule or distal convoluted tubule or (descending) loop of Henle
			3.Ignore PCT, DCT.
05.5	1. Accept answers in the range 33840 to 34680;	1	

Question	Marking Guidance			Mark	Comments
	1. Small sample size;			2 max	2. Ignore breeding is random
	2. Fusion/fertilisation of ga	ametes is random;			3. Accept crossing over / sex linkage
06.1	3. Linked Genes;				
	4. Epistasis;				
	5. Lethal genotypes;				
06.2	1. ttmm;			1	Accept mmtt or any order of these alleles e.g. mtmt, tmtm etc
	1 Genes are linked:			3	1 Accept 'Alleles are
06.3	 Genes are linked; Produces few(er) tall, mottled and dwarf, normal offspring; Crossing over (has occurred); 		3	 Accept Alleles are linked' but reject if context suggests alleles of the 'same gene' Accept produces few Tm and tM gametes Accept 'fewer recombinants' 	
	One mark for each correct column;;			2	Note: Accept correct phenotypes in any order for one mark and correct ratio in
	Phenotype of	Ratio of			any order e.g. 3:9:3:1 for one mark
	Tall (plant and) normal	9			However, phenotypes
06.4	Tall (plant and) mottled (leaves)	3		Accept alterna wording e.g. s	for two marks
	Dwarf (plant and) normal (leaves)	3			wording e.g. short for
	Dwarf (plant and) mottled (leaves)	1			2. Accept
					⁹ / ₁₆ ³ / ₁₆ ³ / ₁₆ ¹ / ₁₆

Question	Marking Guidance	Mark	Comments
	1. (Dopamine) <u>diffuses</u> across (synapse);	3	2.Ignore name/nature of receptor e.g. cholinergic
07.1	2. Attaches to <u>receptors</u> on <u>postsynaptic</u> <u>membrane</u> ;		3. Accept Na⁺ for sodium ions
	3. Stimulates entry of sodium <u>ions</u> and depolarisation/action potential;		3. Accept generator potential for action potential
07.2	1. Morphine attaches to <u>opioid</u> receptors;	2	1. Reject reference to active site
	 (More) dopamine released (to provide pain relief); 		2. Reject receptors release dopamine
		3	1. Ignore K ⁺
	 (Inside of postsynaptic) neurone becomes more negative/hyperpolarisation/inhibitory postsynaptic potential; 		1. Accept -75mV or any value below this as equivalent to more negative
07.3	 More sodium ions required (to reach threshold) OR 		1. Accept 'decrease in charge'
	Not enough sodium ions enter (to reach threshold);		2. Accept Na ⁺ for sodium ions
	3. For depolarisation/action potential;		3. Context must covey idea that depolarisation / action potential is less likely

Question	Marking Guidance	Mark	Comments
08.1	1. (All) the DNA in a cell/organism;	1	Accept '(all) the 'genes'/alleles' 'genetic material/code' in a cell/organism/ person' 'the total number of DNA bases in a cell/organism' Reject all the DNA/ genes within a <u>species</u>
08.2	 (Transcriptional factor/antibody) has a specific/tertiary structure/shape; <u>Complementary</u> (shape/structure); 	2	 Accept (antibody) has a specific variable region Accept (transcription factor/antibody) has a specific binding site and 2. Reject active site but only once.
08.3	1. DNA, transcription factor and antibody;	1	Accept Nucleotides for DNA Ignore 'reference to chemicals'
08.4	1. Binds to P34 gene/DNA/mRNA OR Binds to transcription factor gene/DNA OR Binds to promoter;	1	Reject binds to transcription factor
08.5	 Restriction (endonuclease/enzyme) to cut plasmid/vector; Ligase joins gene/DNA to plasmid/vector; 	2	

	1. Mass/number of amino acids/polypeptides;	2 max	1. Accept weight for mass
08.6	2. Charge; 3. R groups (differ);		 Ignore density/size Accept length of polypeptide/amino acid chain Accept primary structure /sequence of amino acids. Accept tertiary structure

Question	Marking Guidance	Mark	Comments
	1. LP due to mutation OR	4 max	1. Reject mutation caused by drinking milk.
	Allele due to mutation; 2. Milk provides named nutrient;		2. Accept any correct named nutrient e.g. glucose, galactose, protein
	3. Individuals with LP more likely to survive and reproduce		2. Ignore 'sugar' 'lactose' as named nutrient
00.1	OR Individuals with advantageous <u>allele</u> more likely		1. and 3. Reject (LP) gene
09.1	4. Directional selection:		3. Accept 'individuals who produce lactase' for 'LP individuals'
	5. Frequency of <u>allele</u> increases (in the		3. Accept 'pass on allele/LP/characteristic' for reproduce.
	offspring/next generation);		5. Accept description of increasing frequency of allele e.g. 'higher proportion', 'more common' but ignore increase in number of allele
	1.Dominant <u>allele;</u>	2	
09.2	 2. (Always) expressed/shown (when present in phenotype/offspring) OR Expressed when only one (dominant allele) present; 		
	1. Mutation in promoter (DNA/gene) for transcription factor	2	1. Accept mutation in an epistatic gene
09.3	Mutation in promoter (region/DNA) for the gene OR Mutation in gene for transcription factor;		
	2. Lactase gene continues to be transcribed/active;		

Question	Marking Guidance	Mark	Comments
	1. No (functional) cones OR	3	2. Accept correct reference to retinal convergence
10.1	Only rods;		2. Accept 'bipolar/nerve cell' for
	2. Cones are connected to a single neurone OR		2. Accept 'many' 2 or more for 'several'
	Several rods connected to a single neurone;		3. Accept 'optic nerve' for brain
	3. (Cones) Separate (sets of) impulses to brain OR		 Reject 'signals', 'messages' for 'impulses'
	(Rods) Single (set of) impulse/s to brain;		3. Accept 'action potential'
	1. Correct answer in range 42 – 44% = 2 marks;;	2	2. Accept $1 - (p^2 + q^2)$
10.2	 Incorrect answer but shows that understanding that 2pq = heterozygous/carriers = 1 mark; 		2. Accept understanding of 2pq by using calculation involving 2 × two different numbers
	1. (Gene/allele) is on the <u>X chromosome;</u>	2	2. Reference to allele is essential but only required once
10.3	 Females require two alleles/females can be heterozygous/carriers and males require one 		2. Reference to females and males required
	allele;		2. Reject dominant allele
	1. Green sensitive pigment/cones non-functional	3	1, 2 and 3. Reject reference to 'green
	OR		cones'/ 'blue cones / 'red cones' but once only
10.4	Cones that detect green light non-functional;		1 2 and 3 Reject
	2. Three different types of pigment/cone;		reference to 'green pigment'/ 'blue pigment/ 'red pigment'

	3. Other/different colours ('seen') due to stimulation of more than one cone/pigment;		but once only and only if 'green cones' etc, (see above) has not been rejected.
10.5	 (iPS cells) divide; (iPS cells) develop/differentiate into (green sensitive) cones; 	2	 2. Accept 'produce'/'specialise' 'turn in to' / 'genes switched on' / 'turned on' for 'develop' but ignore 'grow' 2. Reject develop into 'green cones'/blue' cones'/'red cones' Ignore develop/differentiate into (blue/red sensitive) cones; Reject reference to develop in to 'green pigment'/ 'blue

Question	Marking Guidance	Mark	Comments
10.6	 (Use of iPS cells) long-term; (Use of iPS cells) less chance of rejection/immune response; (Use of iPS cells) single treatment; Harm/side effects from using viruses (in gene therapy); 	3 max	 Accept 'gene therapy short-term' or 'only two years' Accept 'permanent' Accept 'gene therapy 'regular/frequent treatment"