

Applied Science

Advanced Subsidiary GCE

Unit **G623/02**: Cells and Molecules (Higher Tier)

Mark Scheme for January 2013

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All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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Annotations

Annotation	Meaning
/	alternative and acceptable answers for the same marking point
✓	separates marking points
NOT	answers which are not worthy of credit
REJECT	answers which are not worthy of credit
IGNORE	statements which are irrelevant
ACCEPT	answers that can be accepted
()	words which are not essential to gain credit
<u> </u>	underlined words must be present in order to score a mark
ecf	error carried forward
AW	alternative wording
ora	or reverse argument

Planning Exercise

An investigation to compare the solute potentials of tissues taken from one named drought tolerant and one named drought susceptible cultivar of potato.

Marking of the plan:

- 1 Read the material presented.
- 2 Then award 1 mark if *scientific terminology* has been used appropriately. Record using the letter Y.
- 3 Then re-read, this time point marking up to 24, by placing letters A to X in the margin where you see evidence of the marking criteria.
- 4 The same piece of evidence can be used to award one criterion only.

Marking Point	Marking Criteria	Mark	Additional notes
A	easily recognised safety procedures highlighted ✓ (<i>glassware / AgNO₃ / E.coli OR named microbe/ref to aseptic technique / incubation temp e.g. avoidance of anaerobic strains / safe disposal of microbes / ref to specific chemicals e.g. arsenic / electrical (incubator/ colorimeter)</i>)	1	Evidence of something that is going to make doing the investigation safer – an active document, a working document related to the plan. Minimum of 3.
B	prediction made ✓	1	Prediction related to comparison between <i>filters made with different burnout materials & water quality (e.g. change in microbial counts / turbidity / change in mass of suspended particles / arsenic concs.)</i> Ignore ref to AgNO ₃ conc. Ignore ref to BO material & water cleanliness.
C	with justification ✓	1	Comparative statement related to flow rates &/or pore sizes of filters.
D	description of preliminary work ✓ (Must inform the planning process and be linked to the plan. Accept suitable alternatives to arsenic if qualified e.g. sand & salt.)	1	e.g. mass of clay / mass of burnout material / type of clay / source of burnout material / age of burnout material / kiln temperatures / drying times / soaking times / source of water / aseptic techniques / serial dilutions / effective AgNO ₃ conc.
E	clear and in detail ✓	1	Explain how to do it.
F	reason (for doing it) explained ✓	1	Explain why it is necessary for completion of the whole investigation.
G	clear and in detail ✓	1	Only award if D, E & F already achieved. Scientific knowledge may be included here.
H	at least two secondary sources of information identified ✓	1	State at least 2 references. Ref to Wikipedia is not recommended. Full website address needed. Date of access is recommended. Full description of named text (title / author / publisher required. ISBN recommended) Accept ref to YouTube video.
I	relevance explained ✓	1	Brief explanation as to how references helped in the planning.

Marking Point	Marking Criteria	Mark	Additional notes
J	basic practical skills and accuracy ✓	1	Simple method / list of instructions. Basic. 'Is it a feasible approach?'
K	sound practical skills and accuracy ✓	1	Could someone follow the instructions unaided? Are quantities shown? Is it repeatable to appropriate degree of accuracy? Ignore ref to 'streak plates' to count colonies. Check method works. Limit to 'J' if method of results collection confused.
L	range of appropriate equipment listed ✓	1	List of names of main items of equipment and materials needed for the investigation.
M	full range of appropriate equipment listed ✓ Named BO materials must to be specified. Accept named agar/microbes cultured.	1	Qualifications noted. At least one ref to number of items/ volumetric size. Accept ref to haemocytometer/ colorimeter. Accept ref to gold nanoparticles/ mercuric bromide test to assay arsenic concs. Ignore Coulter Counter.
N	appropriate number of measurements stated ✓	1	Mentions replicates – at least one repeat for each type of burnout material.
O	need for range of measurements stated ✓ Accept statement to 'see if different burnout materials produce a change in bacterial numbers/ arsenic concs'.	1	Statement: need to compare the change in bacterial counts/viable counts/total counts/ turbidity (colorimetry)/ change in mass of suspended particles/ arsenic concs. in water samples using different BO filters.
P	appropriate range stated ✓	1	Types of burnout material used. Minimum of 3 eg rice husks; sawdust; coffee husks.
Q	relevant variables are identified correctly & stated ✓ Independent/dependent/control variables if stated must be identified correctly. Accept incubation times/ source of microbes used for testing/ incubation temp / type of growth media used.	1	At least 2 from: source of water / volume of water / types of BO material / source of BO materials / mass of BO materials / conc. of filtrate used for testing / type of colorimeter filter / source of clay / age of burnout material / mass of clay / degree of milling of burnout material / kiln temp / firing times / drying times / soaking times / thickness of filter
R	how variables to be controlled explained ✓	1	How for at least 2 of the variables relevant to Q. Quantitative values if appropriate or relevant equipment to use stated.
S	one suitable method to display data ✓	1	One display of results e.g. Table. Clear headings & correct units needed.
T	additional method to display data ✓	1	Any <u>different</u> display e.g. graph must be relevant to data collected.
U	simple data handling ✓	1	Mean / use of graph data
V	possible conclusions ✓	1	Statements of expectations or observations to confirm or reject prediction made in B . i.e. filters with small pore sizes = lower microbe counts / slower flow rates / increased transmission / less turbidity (of water)

Marking Point	Marking Criteria	Mark	Additional notes
W	recognises sources of error ✓	1	At least two examples: equipment / materials / specific human error. e.g. Contamination of clay or burnout material prior to firing / drying time variations / errors during firing process / contamination of, sterile/aseptic, conditions / water supply & rainfall
X	suggests methods for improving accuracy and or validity ✓	1	Accuracy: Relate to 'W' or use of alternative technique(s). Ref to precision instruments (graduated pipettes). Ref to improvements in sterile technique. and / or Validity: Expand types of burnout material used / amounts of burnout materials used / alternative method to measure flow rates. Comparison with secondary data.
Marks	Maximum for plan = 25	24 + 1 (<i>scientific terminology</i>)	

Question		Answer	Marks	Guidance
1	(a)	<p>A = mitochondrion ✓ B = nuclear envelope / nuclear membrane / nucleus ✓ C = nucleolus / (hetero)chromatin ✓ D = (cell) wall / middle lamella ✓</p>	4	<p>Accept mitochondria / cristae / matrix Reject nuclear pore Ignore nucleolus (pore)</p>
	(b)	Air (molecules) obstruct, electrons/(electron) beam ✓	1	
	(c)	<p><i>Any one organelle with linked function:</i></p> <p>Rough endoplasmic reticulum / RER ✓ <i>function:</i> protein/polypeptide production/protein synthesis/transport of materials/provides large surface area for chemical reactions ✓</p> <p>Golgi (apparatus/body) ✓ <i>function:</i> glycoprotein/mucin, secretion / packaging of secretory enzymes / transport/storage, of lipids / lysosome/vesicle, formation / secretion / exocytosis / modification of molecules / transports proteins to cell membrane ✓</p> <p>Ribosomes <i>function:</i> (site of) protein synthesis/translation/assembly of peptide/polypeptide chains ✓</p> <p>Smooth endoplasmic reticulum ✓ <i>function:</i> lipid synthesis / lipid transport / steroid synthesis ✓</p> <p>Lysosomes ✓ <i>function:</i> exocytosis / autophagy / autolysis / maintain pH of cytosol / endocytosis etc ✓</p>	2	Award one mark for function if linked correctly to named organelle.

Question	Answer	Marks	Guidance
	Centriole ✓ function: organisation of spindle fibres ✓		
(d)	<p>Advantage</p> <p><i>Any one from:</i> Whole cells can be viewed / provides larger field of view ✓ Living material can be observed ✓ Sectioning does not require specialist equipment / ultra microtome ✓ Staining is simple/short process/requires less expertise ✓ Preparation of material is less likely to, produce artefacts/distort the, image/material ✓ Cheap to, purchase/operate, / readily available ✓ Many can be operated in a single space / relatively small / can be used in the field ✓</p> <p>Disadvantage</p> <p><i>Any one from:</i> Lower magnification / less detailed images ✓ Lower resolution / images not as sharp ✓</p>	2	<p>Ignore ref to 'quick' / 'simple to use' unless qualified.</p> <p>Accept ref to 'organelles can not be seen'.</p>
	Total	9	

Question		Answer	Marks	Guidance
2	(a)	A = glycolipid ✓ B = protein ✓ C = phospholipid ✓ D = cholesterol ✓	4	
	(b) (i)	<u>Boil/heat</u> , with Benedict's, reagent/solution ✓ Green/yellow/orange/red, precipitate/colour ✓	2	
	(ii)	Fructose ✓	1	
	(iii)	Glucose ✓	1	
	(iv)	<p>[Level 0] Candidate includes fewer than two valid points. (0 marks)</p> <p>[Level 1] Candidate uses basic ideas to simply explain how the cell volume may change, including at least two valid points. (1 mark)</p> <p>[Level 2] Candidate shows an understanding and partially explains how the cell volume may change, including at least three valid points expressed clearly and logically. (2–3 marks)</p> <p>[Level 3] Candidate shows a high level of understanding and gives a full explanation of how the cell volume may change, including at least five valid points expressed clearly and logically. (4 marks)</p>	4	<p>Valid points to include:</p> <ul style="list-style-type: none"> • Ref to water movement • By osmosis • Across a selectively permeable membrane • Water moves out of the cell/ volume decreases • Surrounding solution has a higher concentration (of sugars/ solutes) than cell contents • Cell has a higher water potential • (water moves) down an water potential gradient/ from high Ψ to low Ψ <p>Ignore reference to movement of sugars/solute potential</p>
	(v)	Any one from: Phospholipid molecules cannot diffuse/move sideways freely (within own monolayer)/ not joined together ✓ (Globular/intrinsic/extrinsic), proteins are not scattered throughout the lipid bilayer ✓	1	
Total			13	

Question		Answer	Marks	Guidance
3	(a)	Carbon, hydrogen, oxygen, nitrogen ✓	1	All four elements needed. Accept symbols - C, H, O, N
	(b)	C ₁ – O – C ₄ bond / glycosidic link / oxygen bridge shown correctly and glycosidic bond indicated correctly ✓ Condensation / water molecule eliminated ✓	2	Accept 'covalent' bond'
	(c)	<i>Any one from:</i> Unsaturated lipids: one or more, double/triple bonds, between C atoms / bends in H-C chains ✓ Saturated lipids: single C – C bonds only / no, double/triple, C-C bonds / straight H-C chains / solid at room temp ✓	1	Accept 'they have double bonds'. Assume 'it' refers to unsaturated lipids.
	(d) (i)	Increase the pH above 7 / to provide alkaline environment / to provide optimum pH (for enzyme, lipase) ✓	1	
	(ii)	To, control/maintain/keep, constant temperature ✓	1	Ignore ref to body temperature / ref to optimum temperature Ignore ref to change in rate
	(iii)	Greeny-blue/blue ✓	1	
	(iv)	<i>Colour:</i> yellow/orange ✓ <i>Explanation:</i> Lipase digested lipids (in milk) ✓ to fatty acids (and glycerol) / which lower pH ✓	3	Allow green-yellow Ignore ref to rust/red-brown/brown Award: 1 mark for colour change 1 mark for idea of enzyme digestion 1 mark for fatty acids lowering/decreasing pH value.
	(v)	<i>Colour:</i> greeny/blue ✓ <i>Explanation:</i> Lipase denatured (following heat treatment) / little/no, digestion of lipids (in milk) ✓	2	

Question		Answer	Marks	Guidance
	(vi)	Any two from: (At high temperature) active site changes shape ✓ Substrate no longer fits active site / enzyme substrate complex reduced ✓ Due to changes in (named) bonding (in tertiary structure)✓	2	
		Total	14	

Question		Answer	Marks	Guidance
4	(a)	<p><i>Any one from:</i></p> <p>To, count numbers/check appearance, of (red/white) blood, cells/platelets ✓</p> <p>To assist diagnosis of, disease/anaemia/cancer/parasites ✓</p>	1	Accept owtte
	(b)	<p>Correct measurements, A = 10 mm & B = 30/29 mm ✓</p> <p>Link to 7.2 μm ✓</p> <p>Calculation of max dimension 21.6/22.0 μm ✓</p> <p>Award 3 marks if correct answer but no clear working.</p>	3	<p>e.g. 10 mm = 7.2 μm ✓</p> <p>Accept B = 29 mm/2.9 cm</p> <p>B = 0.72 x 30 or 7.2 x 3 (or similar if 29 mm used) ✓</p> <p>If B = 29 mm, accept 20.88/ 20.8/ 20.9/ 21.0 μm ✓</p> <p>Limit to 2 marks to allow ecf for measurement i.e. if B = 28mm. accept 20.16/ 20.2</p> <p>If B = 31mm accept 22.32/ 22.3.</p>
	(c)	Bacterial infection / inflammation / carcinoma / lymphoma / melanoma / burns / leukaemia / gout/ diabetes / HIV (infection) / ketoacidosis ✓	1	Accept surgery
	(d)	<p>G before E ✓</p> <p>H before D ✓</p> <p>D before F ✓</p> <p>F directly before B ✓</p>	4	Mark 'F' first
Total			9	

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