OCR
RECOGNISING ACHIEVEMENT

GCE

Applied Science

Advanced Subsidiary GCE

Unit **G623:** Cells and Molecules

Mark Scheme for January 2012

Oxford Cambridge and RSA Examinations

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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.

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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 that are irrelevant
ACCEPT	answers that can be accepted
( )	words that are not essential to gain credit
_	underlined words must be present in order to score a mark
ecf	error carried forward
AW	alternative wording
ora	or reverse argument

Planning Exercise

Investigation to determine the effect of temperature on the leakage of betalains as an indicator of nitrate ion loss from beetroot cells.

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 ✓	1	Evidence of something that is going to make doing the investigation safer – an active document, a working document related to the plan. Reject anything 'over the top' At least 3 **different** hazards & risks Check that hazards/risks are the correct way round eg water baths (electric) / sharps (knives) / glassware (cuts) / allergies
B	prediction made ✓	1	Prediction related to task: linked to pigment & nitrate loss Ignore references to 'phospholipid bilayer melting'. [shorter chain lengths + increase in saturation leads to increases in fluidity]
C	with justification ✓	1	Use evidence: correct science linked to cell membrane structure & diffusion.
D	description of preliminary work ✓	1	At least one from: type of tissue variety ✓ age of tissue ✓ source of tissue ✓ temperature range ✓ surface area of tissue ✓ incubation time ✓ method of data collection ✓ type of colorimeter filter ✓
E	clear and in detail ✓	1	Explain how to do it.
F	reason (for doing it) explained ✓	1	Explain why it's necessary for completion of the whole investigation.
G	clear and in detail ✓	1	Extra information/suitable extension. Some scientific knowledge expected.

Main investigation starts here.

Marking Point	Marking Criteria	Mark	Additional notes
H	at least two secondary sources of information identified ✓	1	State at least 2 references [credible sources: ignore Wikipedia unless reference is justified]. Full website address needed. Full description of named text (Title, Author, Publisher.)
I	relevance explained ✓	1	Brief explanation as to how references helped in the planning.
J	basic practical skills and accuracy ✓	1	Simple method / list of instructions. Basic. 'Is it a feasible approach?'
K	sound practical skills and accuracy✓ (may also look for evidence of 'P' here) Ensure that modifications from preliminary work are linked to 'K'.	1	Could someone follow the instructions unaided? Are quantities shown? Is it repeatable to appropriate degree of accuracy? Do not award 'K' if no explanation given to 'quenching' if used in method.
L	range of appropriate equipment listed ✓	1	List of names of main items of equipment and materials needed for the investigation. Generic terms: beakers, flasks etc are OK here.
M	full range of appropriate equipment listed ✓ Number or sizes of <u>at least</u> 3 items to provide a <u>workable</u> method.	1	Qualifications noted. Indication of number of each, specific sizes, eg 250 cm^3 beaker, 1dm^3 flask. If any **major item** is missing do not award.
N	appropriate number of measurements stated ✓	1	Mentions replicates / repeats [minimum of 2]
O	need for range of measurements stated ✓	1	Statement: reason for range chosen. ['to show a change in leakage over a range of temperatures' /AW]
P	appropriate range stated ✓	1	5 temperature values to provide a sensible range
Q	relevant variables are identified (stated)✓ controlled variables	1	At least 2 from: type of beetroot variety ✓ age of tissue ✓ source of tissue ✓ surface area of tissue ✓ temperature range ✓ incubation time ✓ % absorbance or % transmission ✓ Accept independent/dependent/controlled variables in list

Marking Point	Marking Criteria	Mark	Additional notes
R	how variables to be controlled explained ✓	1	Explanation for at least 2 of the variables. [Quantitative data needed]
S	one suitable method to display data✓	1	One display of results eg table with appropriate column headings with units. rows/columns drawn.
T	additional method to display data ✓	1	Any <u>different</u> display eg graph. Ignore graph lines; reject if no title/no axes labelled/ no units/ inappropriate scales
U	simple data handling ✓	1	Mean / use of graph data. Accept display of error bars.
V	possible conclusions ✓ Must link temperature & betalain loss to loss of nitrate ions.	1	Statements of expectations or observations to confirm or reject prediction made in **B**. <u>Do not</u> penalise twice for lack of reference to nitrate ion loss in B
W	recognises sources of error✓	1	At least two examples: equipment / materials / specific human error.
X	suggests methods for improving accuracy and or validity✓	1	**Accuracy:** relate to '**W**' or use of alternative technique(s) precision of water bath ✓ use of standard curve if none used in J/K AND / OR **Validity:** state aspect of collected data to be compared with secondary sources comparison with secondary source ✓ alternative data collection to colorimetry ✓ use of narrower range of temps around optimum ✓ accept repeats if none used in J/K
Marks	Maximum for plan = 25	24 + *1 (scientific terminology)*	

Question			Answer	Marks	Guidance
1	(a)	(i)	Carbon, hydrogen and oxygen ✓	1	All 3 components needed for the mark Accept symbols / C, H, O
	(b)	(i)	Glycerol ✓	1	
		(ii)	Covalent (bond) / ester ✓	1	Reject hydrogen bond
		(iii)	Water ✓	1	Accept H_2O
		(iv)	Addition of lipid to ethanol + water/lipid emulsion ✓	1	Ethanol and water needed
	(c)	(i)	R = lipid bilayer / fatty acid chains / hydrophobic tails (of phospholipid / hydrocarbon chains ✓	1	Ignore phospholipid bilayer
		(ii)	*any **one** from*: Water is the main solvent in cells/protoplasm/cytoplasm ✓ (Most) biological molecules are soluble in water, (which is polar) ✓ Hydrocarbon tails (in lipid bilayer) are 'non polar' / hydrophobic/immiscible in water ✓	1	Accept any reference to size of molecules or charge of ions Ignore references to 'hydrophilic heads are polarised & tails repel' & 'lipids are polarised'
		(iii)	(Phospho)lipid molecules can diffuse/move (sideways/freely/within own monolayer) ✓ (Globular/intrinsic/extrinsic), proteins scattered throughout the lipid bilayer ✓	2	
			Total	**9**	

Question			Answer	Marks	Guidance
2	(a)		Structure: Protein/globular/active site ✓ Function: Catalyst/speeds up chemical reactions/lowers activation energy ✓	2	Accept reference to 'tertiary structure/ α – helix/ ß- pleated sheet
	(b)	(i)	*any **one** from*: 40°C is optimum temperature (for reaction) / good rate of reaction ✓ Close to human body temperature ✓ To control temperature variable ✓ Ref. to not denaturing enzyme ✓	1	Alternative: Accept 'to liquefy fats/AW' Ignore reference 'to kill enzyme'
	(b)	(ii)	*any **three** from*: Rate of reaction increases as fat concentration increases / positive correlation ✓ From 0 – 0.7% ✓ Rate of reaction slows from 0.6% / at high fat concentrations ✓ Data quote from graph between 0 – 0.7% ✓	3	Emphasis is on description NOT explanation Award: 1 mark = any correlation statement ✓ 1 mark = any relevant data quote ✓ 1 mark = rate slows from 0.6% /high concentrations ✓ Reject reference to change beyond 0.7%
	(c)		Both lines start at 0°C ✓ At 20°C, curve drawn below given line ✓ At higher enzyme concentration, curve rises higher than given line ✓	3	Ignore 'hairy lines'
	(d)		Curve shows <u>a peak</u> at pH 8 ✓ Curve shows <u>symmetry</u> around optimum pH ✓	2	Line must show a peak at pH 8 Reject if extrapolation beyond grid lines Symmetry linked to 'narrow range around optimum pH'
			Total	**11**	

Question			Answer	Marks	Guidance
3	(a)		P = **rough** endoplasmic reticulum/RER Function: protein/polypeptide production/protein synthesis/transport of proteins/provides large surface area for chemical reactions ✓ Q = Golgi (apparatus/body) ✓ *any **one** from*: Function: glycoprotein production/modification of proteins✓ Packaging of secretory enzymes ✓ Transport/storage of lipids ✓ Lysosome/vesicle formation ✓ Secretion/exocytosis ✓	2 2	Do not award if <u>not stated</u> type of ER Reject 'smooth ER' Accept 'processes materials ready for export'
	(b)		Maximum length of mitochondrion = 39mm / 3.9 cm ✓ Correct conversion to µm = 39 000µm ✓ Actual maximum length = 39 000÷ 5 000 = 7.8µm ✓	3	Accept tolerance +/- 1mm If 38mm, then actual length = 7.6 µm If 40 mm, then actual length = 8.0 µm Award 3 marks for correct answer
	(c)		*any **one** from*: To produce proteins ✓ Transcription ✓	1	Accept haemoglobin production Ignore reference to production of red blood cells
	(d)	(i)	(6.4 – 5.0) ÷ 5.0 x 100 ✓ 28% ✓	2	Award 2 marks for correct answer, no workings Award 1 mark for difference between cell counts at high altitude & sea level [if incorrect answer]
			Total	**10**	

Question			Answer	Marks	Guidance
3	(d)	(ii)	To see if performance improves/changes (with an increase in red blood cells/oxygen carrying capacity) ✓	1	Reason must be linked to performance & sports scientist Ignore references to blood doping/ increased performance at high altitude
		(iii)	Athlete 2 may be suffering from anaemia/iron deficiency ✓	1	Reject reference to fitness levels/ unqualified disease
	(e)	(i)	**Level 3 [4 marks]** Candidate shows a high level of understanding and gives a full description of how a Coulter counter can be used to measure red blood cell counts, including **four valid** points expressed clearly and logically. **Level 2 [2 – 3 marks]** Candidate shows an understanding and describes how a Coulter counter can be used to measure red blood cell counts, including **at least three valid** points expressed clearly and logically. **Level 1 [1 mark]** Candidate shows a basic understanding of how a Coulter counter can be used to measure red blood cell counts, including **at least two valid** points.	4	Valid points to include: Probes are placed into sample ✓ Probes consist of two electrodes ✓ One electrode enclosed in glass tube ✓ Electrical current flows/passes between electrodes ✓ Small hole/narrow entrance in glass tube ✓ Cells/cell pass through small hole/gap ✓ Alters current/conductivity inside probe ✓ Number/ size of cell influences deviation/current/ AW ✓ Deviation recorded ✓
		(ii)	*any **one** from*: Probe can't distinguish between dead and live cells ✓ Probe registers air bubbles/dust particles (as well as cells)✓	1	Reject 'not 100% accurate' Accept: there may be dead cells / clumping of cells (due to dilution errors) / may count wbc as well
			Total	**17**	

Question			Answer	Marks	Guidance
4	(a)		*any **two** from*: Personality changes / anti-social behaviour ✓ Psychiatric disorders / depression ✓ Progressive chorea* / AW / shaking ✓ Dystonia / lack of muscle tone / AW ✓ Dementia / general loss of intellectual abilities / memory loss / impaired judgement / impaired abstract thinking / AW✓ AVP eg more than 36 CAG repeats ✓	2	Reject 'family history' – not a clinical symptom. *chorea involves motor co-ordination disorder eg minor involuntary movement such as non-repetitive, non-periodic jerking
	(b)	(i)	*any **two** from*: Possibility of error arising from testing ✓ Decision making process may be based on incorrect results ✓ Whether to pursue selective abortion ✓ Human rights issues (later in life) ✓ AVP ✓	2	Accept as AVP's: Religious issues, if qualified / reference to quality of life issues, if qualified / risk of potential harm to foetus if test carried out.
	(c)	(i)	Monoclonal antibody – hCG complex diffuse / move up the strip ✓ (Mobile antibodies / mobile antibodies + hCG complex) combine with immobilised antibodies / both type of antibodies join ✓ Mobile antibodies / mobile antibodies combined with hCG can move no further (so blue marker particles stay in large window) ✓	3	

Question			Answer	Marks	Guidance
4	(c)	(ii)	*any **one** from*: Show viability/activity of antibodies ✓ To prove that **excess** mobile monoclonal antibodies /monoclonal antibodies not combined to hCG, have moved to the top of the strip/past the large window / confirms that urine has moved all the way up the strip ✓	1	Reject ref to the 'diffusion process is complete'
			Total	**8**	

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