OCR
Oxford Cambridge and RSA

GCE

Applied Science

Unit **G623/01** and **G623/02**: Cells and Molecules

Advanced Subsidiary GCE

Mark Scheme for June 2016

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

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.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

Planning Exercise

An investigation to determine how the concentration of <u>one named</u> cell wall degrading enzyme affects the recovery yield of lycopene, extracted from tomato tissue.

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 identified from: glassware burns biohazard/enzymes electrical e.g.centrifuge waterbath/colorimeter pH buffers solvent Bunsen burner sharps e.g knives/scalpels);	1	Identify hazard /risk/precaution or similar Need minimum of three Evidence of something that is going to make doing the investigation safer – an active document, a working document related to the plan.
B	prediction made;	1	Prediction related to comparison between named enzyme concentration and recovery yield **Ignore** ref to quantity of enzyme **Ignore** ref. to colour/%transmission/absorption unless qualified
C	with justification;	1	Statement relates to changes in enzyme concentration & enzyme collision theory related to yield.
D	description of preliminary work;	1	e.g. temperature /type of enzyme(s) used/ source of enzyme(s)/ pH range/ production of buffer solutions/ pre-treatment times/ source of tissue/ extraction of tissue/ age of tissue/ volume of enzyme solution/ method to measure yield/ research using secondary sources **Ignore** ref to other types of tissue

Marking Point	Marking Criteria	Mark	Additional notes
E	clear and in detail;	1	Clear description of any **preliminary** work /for research evidence of selection with reference to source
F	reason (for doing it) explained;	1	Explanation of why it's necessary for completion of the main investigation
G	clear and in detail;	1	Link to biological explanation. e.g reference to enzyme theory/solubility of lycopene in solvents

Marking Point	Marking Criteria	Mark	Additional notes
H	at least two secondary sources of information identified;	1	**Ignore** reference to 'insert'. Authenticated websites required. Full website address needed. Full description of named text (Title/Author/Publisher) **Allow** one Wikipedia reference.
I	relevance explained;	1	Brief explanation as to how reference(s) helped in the planning for **at least** one source.
J	basic practical skills and accuracy;	1	Simple method/list of instructions. Basic. Is it a feasible approach? use of tomato /enzyme / measurement of yield
K	sound practical skills and accuracy;	1	Could someone follow the instructions unaided? Instructions to include: Range of concentrations (values not needed) Preparation of tomato tissue Incubation of tomato tissue and enzyme Filtration/ removal of residue/ extraction Detail of how yield is to be measured
L	range of appropriate equipment listed;	1	List of names of main items of equipment and materials needed for the investigation. Tomatoes, enzyme, glassware, equipment for measuring yield
M	full range of appropriate equipment listed;	1	Any major item missing do not award Named cellulose digesting enzyme **AND** one of each of: Glassware – number e.g. 5 pipettes Capacity – size e.g. 250cm^3 Volume /mass/concentration
N	appropriate number of measurements stated;	1	Reference to replicates/ use of repeats – at least one set
O	need for range of measurements stated;	1	Statement: e.g. to compare a range of enzyme concentrations to maximise yield. Reference to results of relevant research.

Marking Point	Marking Criteria	Mark	Additional notes
P	appropriate range stated;	1	5 different appropriate concentrations, using one type of cell wall degrading enzyme. **Ignore** reference to drops.
Q	relevant variables are identified (stated);	1	At **least two** from: age of tomato tissue/ variety of tomato/ source of tissue/ type of tissue (pulp, seeds, peel)/ temperature/ mass or volume of substrate/ time of incubation/ stirring or shaking/ pH, volume or type of buffer solution/ type of solvent/ volume of solvent/ method of recovery **Ignore** independent and dependent references
R	how variables to be controlled explained;	1	For at **least two** of the variables mentioned in Q. **A quantitative description** is required
S	one suitable method to display data;	1	One display of results e.g. table, with clear headers & units
T	additional method to display data;	1	Any **different** display relevant to investigation (allow ecf) e.g. graph with axes correct with labels & units
U	simple data handling;	1	Evidence of calculation e.g. mean
V	possible conclusions; (Allow ecf if correctly related back to original prediction)	1	Statements of expectations or observations to confirm or reject prediction made in **B**. 'What would your results need to show to confirm or reject your prediction?' **Accept** an indication of optimum concentration from annotated graph.
W	recognises sources of error;	1	At least two examples: equipment/ materials/ specific human error (max one) Fluctuations in temperature/ resolution of measuring equipment/ Residue left/ state of coagulation/ type/source/ age of tomato/ source of enzyme(s)/ activity of enzyme(s)/ thickness of tomato peel/cell number difference Handling cuvettes/inaccurate reading of measuring equipment

Marking Point	Marking Criteria	Mark	Additional notes
X	suggests methods for improving accuracy and or validity;	1	**Accuracy**: relate to '**W**' or use of alternative technique(s). Expand **critical range** of enzyme concentrations/ optimum pre-treatment times /resolution of equipment; AND/OR **Validity**: state aspect of collected data to be compared with secondary sources. Alternative method of measuring yield/ alternative solvent/ use of different varieties/ optimum performance, at pH/ temperature. **Accept** qualified repeats if non in main method.
Marks	Maximum for plan = 25	24 + *1 (scientific terminology)*	

Question			Expected Answers	Marks	Additional Guidance
1	a		**One from:** Diagnose (named) condition/ disease /illness/infection; Assess health of organs/patient/ count of, rbc/ wbc; Screening for, genetic conditions/ cystic fibrosis/ /sickle cell anaemia/ haemophilia;	1	
	b	i	**One from:** Cheap (to purchase); Unaffected by magnetic fields; (Preparation of material/use) is quicker/ simpler/ less complex; Can observe more than 1 cell in field of view/ can use haemocytometer;	1	**IGNORE** reference to EM/ lower magnification/ lower resolution. **IGNORE** reference to view living cells.
	b	ii	**Any three from:** 1. Fixed/ (95%) alcohol added; 2. Stained/named stained, added; 3. Cover slip added; 4. Description of how coverslip added/ attempt to remove air bubbles; 5. Removal of excess stain/ liquid;	3	**ACCEPT:** Giemsa stain/ Wright's stain/ Eosin/ Methylene blue/ any relevant stain for cheek cells.
	c	i	Haemocytometer	1	
		ii	**One from:** Difficulty to distinguish individual cells due to dilution problems/clumping;	1	**IGNORE** ref to difficulty to distinguish live from dead cells **IGNORE** human error
	d		**Two from:** Leukaemia;/ cancer/ named cancer; (Bacterial/viral) infection; Allergy/ immune response disorder; Arthritis; Reaction to drugs/ corticosteroids/ epinephrine;	2	**IGNORE** HIV/sickle cell anaemia/disease
	e	i	The number of times greater an **image** is(than the object)/ OWTTE.	1	**ACCEPT** any description of enlarging image **IGNORE** unqualified reference to zoom.
		ii	Ability to distinguish two separate points (as distinct from each other)/ OWTTE	1	**IGNORE** clear/detail/quality
			Total	**11**	

Question			Expected Answers	Marks	Additional Guidance
2	a	i	Glycosidic;	1	
	a	ii	Benedict's (solution/ reagent);	1	
	a	iii	**Before**: blue/ turquoise; **After**: yellow/ orange/ brown/ red-brown /(brick) red;	2	
	b		**One from:** Reduce running costs/ energy bills; Maximise yields; Increase efficiency/ ensure that starch breakdown occurs in quickest time/ brewing is faster; Prevent premature death of yeast cells; Prevent enzyme denaturing;	1	
	c	i	No, starch/ substrate , left;	1	**IGNORE**: all glycosidic bonds broken/ enzyme reference **IGNORE:** no enzyme-substrate complex formed unless qualified
	c	ii	**Any two from** More, (kinetic) energy/ movement; More, collisions; More, enzyme & substrate complex formed;	2	**IGNORE** reference to particles.
	d		Steeper curve than 24^{o}C; Levels off higher than 24^{o}C;	2	**ACCEPT** redrawn graph, as long as it is clear. **REJECT** a description alone.
	e	i	Automated/ quicker/ large sample numbers can be measured/ rapid repeats/ **reduces** human error;	1	**IGNORE** – No human error/easy to use

Question			Expected Answers	Marks	Additional Guidance
	e	ii	**Level 0 [0 marks].** Candidate includes fewer than two correct valid points. **Level 1 [1 mark]** Candidate uses basic ideas to simply explain how a Coulter counter may be used, including at least two valid points. **Level 2 [2 marks]** Candidate shows an understanding and partially explains how a Coulter counter may be used including **at least three valid** points expressed clearly and logically. **Level 3 [3-4 marks]** Candidate shows a high level of understanding and gives a full explanation of how a Coulter counter may be used, including at least **four valid** points expressed clearly and logically	4	Valid points to include: 1. Calibration 2. Placed in culture/sample 3. Cell count obtained 4. (Probe with) two electrodes 5. One electrode enclosed in glass tube 6. Small hole/ narrow entrance in glass tube 7. Electrical current flows/passes between electrodes 8. Cells/cell pass through hole/gap/entrance 9. Alters conductivity/ current, inside probe 10. Number/ size of the cell influences current/deviation/ AW 11. Deviation recorded/displayed (digitally)
			Total	**15**	

Question			Expected Answers	Marks	Additional Guidance
3	a	i	Structure A: Nuclear envelope/ nuclear membrane; Structure B: Mitochondrion/Mitochondria;	2	**IGNORE** nucleus **REJECT** nuclear wall
		ii	**Adaptation**: Large/larger nucleus/ large amount of chromatin/ euchromatin; **Explanation:** transcription/formation of mRNA; manufacture of ribosomes; **OR** **Adaptation**: Many ribosomes/ rough ER **Explanation:** Translation (of mRNA) OR peptide/polypeptide, synthesis; **OR** **Adaptation:** Golgi apparatus (present); **Explanation**: Modification/ packaging, of proteins/antibodies; Lysosome/vesicle formation; Secretion/ exocytosis;	2	Adaptation & explanation required for 2 marks. **ACCEPT** DNA codes for proteins **ACCEPT** **Adaption:** more mitochondria **Explanation**: ATP chemical energy for, transcription/ translation/modification/packaging (of proteins)
	b	i	Amino acid 1 = methionine Amino acid 2 = valine;	2	
	b	ii	Second codon = GUU Third codon = UAU	2	
	b	iii	Chemical bond = peptide/ covalent; Type of reaction = condensation;	2	
			Total	**10**	

Question			Expected Answers	Marks	Additional Guidance
4	a	i	**Any three from** Human rights of the unborn/ fetus; Risk of miscarriage (with CVS/ amniocentesis); Having test against religious belief; Decisions based on tests which could give false positives /not 100% accurate; Whether to pursue selective abortion with reason; Right to pursue family options if genetic history known; Access to information with family members; AVP;	3	
	a	ii	**Any three from:** Blocked airways / bronchi / bronchioles (by mucus); Coughing; Ventilation physically difficult / wheezing / harder to breathe/ heavy breathing/ breathlessness; Obtain less oxygen/ lack of oxygen (in blood) / gas exchange impaired / AW; Less energy/ respiration impaired; Need for regular physiotherapy / chest patting / drug treatment; Increased risk, of infection/pneumonia; Difficult to participate in (some) sports / AW;	3	**ACCEPT** reduced, peak flow/vital capacity
	b	i	**Any two from:** Personality changes/anti-social behaviour; Psychiatric disorders/depression/mood changes; Dystonia/lack of muscle tone/owtte; Dementia/general loss of intellectual abilities/memory loss/impaired judgement/impaired abstract thinking/owtte;	2	**ACCEPT** slurred speech/difficulties in swallowing/unsteady **IGNORE**‘ ref to ‘family history’ as not a clinical symptom. **IGNORE** ref to ‘more than 36 CAG repeats’ as not a clinical symptom
			Total	**9**	

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