OCR
Oxford Cambridge and RSA

GCE

Applied Science

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

Advanced Subsidiary GCE

Mark Scheme for June 2014

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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

Plan an investigation to quantitatively compare the concentration of reducing sugars in one variety of white grape, after the grapes have been exposed to a range of low temperatures.

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; Bunsen burners; glassware; sharps; Benedict's reagent; potassium manganate VII; sulfuric acid; electrical e.g. water bath/colorimeter; allergy e.g latex gloves/ fruit/grapes	1	Evidence of something that is going to make doing the investigation safer – an active document, a working document related to the plan/method. **Need minimum of three** **Ignore** bags/hair. **Ignore** ref to pestle & mortar. **Ignore** if used/referred to Tollen's reagent.
B	prediction made;	1	Prediction related to the comparison of reducing sugar content in one grape variety, and low temperature treatments. **Ignore** reference to temperature values
C	with justification;	1	Comparative statement i.e. ref to lower temp & wine tasting sweeter/less water extracted, higher concentration of sugar in juice Accept use of information from insert
D	description of preliminary work;	1	Evidence /outline/intention of preliminary work Must be relevant to task e.g. range of temperatures; types of reducing sugars present; colorimetry/titration methods; time of incubation; extraction of juice; age/variety/source of grapes; mass of tissue; dilution of grape extract; preparation of standards/standard curve; type of filter. **Ignore** 'to check method if unqualified'

Marking Point	Marking Criteria	Mark	Additional notes
E	clear and in detail;	1	Clear description of preliminary practical work e.g any calculations of glucose concentrations need to be correct
F	reason (for doing it) explained;	1	Explain why it is necessary for completion of the whole investigation. **Ignore** statement ref to more accurate results if compared Benedict's to Clinistix.
G	clear and in detail;	1	Extra information/suitable extension linked to scientific ideas. e.g role of calibration curve
H	at least two secondary sources of information identified;	1	State at least 2 references in addition to Insert. Authenticated websites required. Full website address needed. Full description of named text Must be relevant to the plan/method ignore ref: to Benedict's/Fehlings if not used
I	relevance explained;	1	Brief explanation as to how reference(s) 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;	1	Detailed and ordered instructions to **quantitatively** compare the concentration of reducing sugars in the grape juice Limit to 'J' if used 'Brix' method [for sucrose estimation]'/ if not boiled Benedict's reagent/ if used Benedict's & no colour standards. Accept if Benedict's quantitative reagent used.
L	range of appropriate equipment listed;	1	List of names of main items of equipment and materials needed for the investigation. Limit to'L' if used just Clinistix/Benedicts/red grapes. Do not award if missing grapes/ Benedict's solution if used.
M	full range of appropriate equipment listed;	1	If any major item missing do not award. Qualifications noted. Indication of number **and** specific size of equipment **and** volume/concentration of reagent.

Marking Point	Marking Criteria	Mark	Additional notes
N	appropriate number of measurements stated;	1	5 or more different temperatures **and** repeats.
O	need for range of measurements stated;	1	Qualification of range Justification of temperatures for range chosen Need for a suitable range of colour standards/standard curve to obtain quantitative data.
P	appropriate range stated;	1	Values within range 0 to -15^{o}C
Q	relevant variables are identified (stated);	1	At least 2 from: Age/type/source of grapes; mass of grape tissue; method of juice extraction; temperature of incubation; time of incubation; volume/conc of glucose standards; method of calibration; wavelength of filter; conc of H_2SO_4/ potassium manganateVII;
R	how variables to be controlled explained;	1	How, for at least 2 of the variables relevant to Q. A quantitative description is required if appropriate.
S	one suitable method to display data;	1	One display of results eg table, with clear headers & units
T	additional method to display data;	1	Any <u>different</u> display eg graph with axes correct with labels & units
U	simple data handling;	1	Evidence of mean / use of graph data
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**. ref to absorbance, colour/mass of precipitate & conc. of sugar 'What would your results need to show to confirm or reject your prediction?'
W	recognises sources of error;	1	At least two examples: equipment / materials / specific human error / procedures e.g accuracy of thermometers/fluctuations of water bath temp/precision of temperature treatments/residue in glassware/ age or ripeness or source of grapes/ incomplete extraction of sugars from grape/ discrepancy in colour analysis/contamination risks;

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) BUT needs clarification alternative measurement of reducing sugar conc.; increase range of low temp treatments linked to plan; decrease intervals within existing temp range; **Ignore** ref to digital thermometer unless qualified with a precision/accuracy comment. AND / OR Validity: state aspect of collected data to be compared with secondary sources. comparison with secondary source comparison with other groups in class
Marks	Maximum for plan = 25	24 + *1 (scientific terminology)*	

Question			Expected Answers	Marks	Additional Guidance
1	a	i	One from: greater/higher magnification/ x250000 (on screen); greater resolution/ (0.2 – 0.5 nm);	1	**IGNORE:** value if greater given **IGNORE**: high **ACCEPT:** clearer/ more detailed/ reference to any named correct cellular organelle.
	b		One from: use (beam) of electrons / light rays used in LM; electromagnets/ magnetic field (focus electron beam)/ glass lenses in LM; image (usually) in black and white/ coloured image in LM; heavy metals/ named heavy metal (used as stains)/ coloured dyes in LM; image viewed on a screen/ image viewed through eyepiece in LM;	1	**ACCEPT:** references to real/virtual images
	c		(vacuum minimises) electron scattering/ electron deflection/ air <u>molecules</u>/dust/microbes, obstruct electron beam;	1	**IGNORE:** air particles
	d		A = Golgi (apparatus/ body) **Function:** glycoprotein production/ modification of proteins; packaging of secretory enzymes; transport / storage of lipids; lysosome/vesicle formation; secretion/ exocytosis; B = Nucleus; **Function:** transcription/ organisation of DNA into genes /controls cell division;	1 1 1 1	**ACCEPT:** reference to packaging antibodies **ACCEPT:** manufacture of ribosomes **ACCEPT:** codes for proteins **IGNORE**: contains genes/ DNA/ chromosomes, without qualification.

Question			Expected Answers	Marks	Additional Guidance
	e		One from: cheap (to purchase); unaffected by magnetic fields; preparation of material is quick/ simple/ requires less complex staining; (use of light microscope) requires less training/ easier to operate; can observe more than 1 cell in field of view; can observe living cells;	1	**ACCEPT**: can use haemocytometer with LM to count cells. **IGNORE:** there is no need for training [to use light microscope] **ACCEPT**: EM more prone to image distortion.
	f		Any three from: fixed using alcohol; stained [using Pap stain/ haematoxylin (for nucleus)/ OG/EA for cytoplasm]; cover slip added, with description of how coverslip added/ attempt to remove air bubbles; removal of excess stain/ reference to stain irrigation technique;	3	**ACCEPT:** reference to any relevant stain for cheek cells / methylene blue. **ACCEPT:** reference to dye/colour
	g	**i**	(cervical) cancer(cells)/ dysplastic/ abnormal/ CIN 3;	1	
	g	**ii**	Any two from large nuclei**;** irregular-shaped/abnormal-shaped nucleus; nucleus wrinkled/ indented/with protrusions; nucleus darker/hyperchromatic/prominent nucleoli;	2	**IGNORE:** reference to cells
			Total	**14**	

Question			Expected Answers	Marks	Additional Guidance
2	a		**[0 marks]** Candidate includes fewer than two correct valid points in the response. **[1 mark]** Candidate gives a correct description of the red blood cell and/or shows a basic understanding of osmosis including at least **two valid** points. **[2 marks]** Candidate gives a correct description of the red blood cell. They show an understanding and discuss some of the processes of osmosis including **at least three valid** points expressed clearly and logically. **[3-4 marks]** Candidate gives a correct description of the red blood cell. They show a high level of understanding and give a full discussion of the processes of osmosis including at least **four valid** points expressed clearly and logically	4	Valid points: [4 marks requires full scientific detail]. **Description:** cells crenated/ changed in shape/ change in size/shrivelled; **IGNORE:** flaccid cells **Explanation:** saline solution has a lower water potential (than red blood cytoplasm); RBC plasmalemma/ cell (surface) membrane is selectively/partially permeable/ OWTTE; RBC have lost water; **more** water moves out of RBC (than enters);= 2 marking points by osmosis; down a concentration gradient/ from high water potential to lower water potential; (consequently) solute potential decreases/ becomes more negative/ concentration of solute increases (in RBC); enzyme controlled reactions/ metabolism disrupted/ transport of oxygen disrupted;
	b		Haemocytometer; **Advantage: one from** equipment inexpensive; technician can distinguish between cells and inanimate particles/ dust; **OR** Coulter counter; **Advantage: one from** automated/does not need trained operator; quicker/ large sample numbers can be measured/ rapid repeats;	1 1	

Question			Expected Answers	Marks	Additional Guidance
2	c	i	150 – 80 = 70; (70 ÷ 150) x100 = 46.66/ 46.7/ 47%	2	
	c	ii	Patient 3: **Reason:** higher/ uncontrolled growth/ uncontrolled cell division of wbc / more wbc, as a symptom of leukaemia;	1 1	**IGNORE:** wbc unqualified
	d		The width each division on the graticule represents changes with magnification. √ The stage micrometer is placed in the eyepiece of the microscope. ☐ The stage micrometer can be used to measure cell dimensions directly. ☐ The graticule and stage micrometer scales are superimposed for each objective lens of the microscope. √ Once calibrated, the scale on the graticule can be used to measure cell dimensions. √	2	All three correct statements = 2 marks. Two correct statements only/ two or three correct statements plus 1 incorrect = 1 mark. Fewer than 2 correct ticks/ 2 incorrect ticks = 0 marks.
			Total	**12**	

Question			Expected Answers	Marks	Additional Guidance
3	a		Two from: rate (of enzyme activity) increases from 15^{o}C to 30^{o}C; rate (of enzyme activity) decreases from 30^{o}C (to 60^{o}C); rate increases faster between 20^{o}C – 30^{o}C than between 15^{o}C & 20^{o}C. effect qualified using relevant numerical rate data quote;	2 1	**IGNORE:** 'At 30^{o}C,enzymes denatured & drop in enzyme activity' **ACCEPT** any correct reference to rate increase between 15-30^{o}C Limit to 1 mark if 'rate increases to optimum and then slows'.
	b		Any three from: at high temperatures enzyme is denatured; change in shape of active site/ active site specificity reduced; enzyme/substrate complex cannot form; increased KE/more vibration of/in molecules; bonds break (within enzyme molecule) / tertiary structure changed; ref to breakage of named bond types within tertiary structure e.g. ionic/ hydrogen/ disulfide/ hydrophobic interactions between R groups.	3	**IGNORE**: enzyme killed **IGNORE:** molecule changing shape
			Total	**6**	

<table>
<tr><th colspan="3">Question</th><th>Expected Answers</th><th>Marks</th><th>Additional Guidance</th></tr>
<tr><td>4</td><td>a</td><td></td><td>1 = bilayer;
2 = hydrophobic;
3 = ester;
4 = condensation;

5 = fluid mosaic
6 = Benedict’s
7 = glycosidic;
8 = enzyme</td><td>8</td><td></td></tr>
<tr><td></td><td>b</td><td></td><td>
<table>
<tr><th>Name of food molecule</th><th>Reagent(s) used</th><th>Observation if test is positive</th></tr>
<tr><td></td><td></td><td>(blue) black</td></tr>
<tr><td>Lipids/fats</td><td>Ethanol and water</td><td></td></tr>
<tr><td>Protein/peptides/ polypeptides</td><td></td><td>Lilac/purple</td></tr>
</table>
</td><td>5</td><td></td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>13</td><td></td></tr>
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