OCR
Oxford Cambridge and RSA

GCE

Applied Science

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

Advanced Subsidiary GCE

Mark Scheme for June 2015

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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 compare the growth rate of *Dunaliella salina* with the growth rate of one other named species of microalga, in a range of saline concentrations'.

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	A working document related to the plan. **Three** from: electrical; glassware; biohazard/algae; irritant/allergy ref to salt/minerals used; water/slippery surface
B	prediction made;	1	**Comparison (**of growth rates) wrt to changes in saline concentration between ***Dunaliella salina*** & one different **named** microalga.
C	with justification	1	**Comparative** statement using relevant science related to growth rates of ***Dunaliella*** & **named** microalga & saline concentrations; e.g. correct reference to, osmosis/water potential /photosynthetic activity in high salinity/mucin layer/osmoprotection/ glycerol production as osmotic stabiliser.
D	description of preliminary work;	1	**One** from: range of saline concentrations; choice of method, haemocytometry/colorimetry; choice of filters/use of light sensors; staining techniques to distinguish live/dead cells; pH of incubation medium; temperature/time, of incubation; volume/ concentration/mass/cell number of starter culture;
E	clear and in detail;	1	Clear description of **preliminary** practical work (some detail of method).

Marking Point	Marking Criteria	Mark	Additional notes
F	reason (for doing it) explained;	1	Some explanation of why it's necessary for completion of the whole investigation.
G	clear and in detail;	1	Link to scientific explanation/limitation of equipment.
H	at least two secondary sources of information identified;	1	State at least 2 references in addition to insert. (accept one reference to Wikipedia) Authenticated websites required. Full, URL/ description of named text; **Ignore** reference to teacher
I	relevance explained;	1	Brief explanation as to how at least **one** reference helped in the planning. **Ignore** reference to insert.
J	basic practical skills and accuracy;	1	Simple method/list of instructions. Basic. Is it a feasible approach? Limit to 'J' if just said 'use haemocytometer/colorimeter'.
K	sound practical skills and accuracy;	1	Could someone follow the instructions unaided? Is it repeatable to appropriate degree of accuracy? To include detail/reason of how instrument chosen is used
L	range of appropriate equipment listed;	1	**Four** items of equipment and materials: Glassware/measuring instrument /(micro)algae/salt
M	full range of appropriate equipment listed;	1	Algae: ***Dunaliella salina* +** other **named** microalga AND **Two** from : Glassware: at least 1 'volume' and 1 'number' e.g. 250 cm^3 beaker +6 test tubes. Measuring instrument e.g. + microscope if haemocytometer Salt : Range of saline concentrations /equipment to produce these
N	appropriate number of measurements stated;	1	One repeat. Five different saline concentrations (values not needed)
O	need for range of measurements stated;	1	To identify, difference/change, in growth (rate) in the range of saline concentrations between the two species. e.g. growth rates as counts/turbidity /change in mass, in a range of saline concentrations to see if there is a difference between *Dunaliella* & named microalga.

Marking Point	Marking Criteria	Mark	Additional notes
P	appropriate range stated;	1	5 different **appropriate** saline concentrations (max 6.5 M) **Accept** appropriate % concentration
Q	relevant variables are identified (stated);	1	**Two** variables clearly stated from: age of organism; starter culture concentration; culture media; CO_2 concentration; temperature (of incubation); (incubation) time; surface area (exposed to light); density of initial cells; light intensity; wavelength; nutrient concentration; saline concentration; type of organism; **Ignore** 'amount'.
R	how variables to be controlled explained;	1	For at least 2 of the variables relevant to Q. A **quantitative** description is required where relevant e.g temp/volume/time. **Ignore** equal amounts. **Accept** same batch.
S	one suitable method to display data;	1	One display of results. eg table, with clear headers & units (e.g. cell count /unit volume , concn of salt with units)
T	additional method to display data	1	Any different display e.g. graph with axes correct with labels & units (labelled axes on downloaded must link to method) e.g. % transmission/absorption against conc./ cells per unit volume against conc.
U	simple data handling;	1	Evidence of calculation of mean (increase) / % increase in mass/cell number; / use of graph data i.e. gradients Accept calculations re saline concentration
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 & growth rate from annotated graph.
W	recognises sources of error;	1	At least **two** examples: **human error (max one)** e.g. dilution/counting;

Marking Point	Marking Criteria	Mark	Additional notes
			equipment error magnetic stirrer faulty; 'shredding effect' of stirrer; heat source from light bank; light bank switched off at night; light distribution from source; **materials error** variation of cell number in initial sample; residue in glassware; contamination of algal samples; AVP
X	suggests methods for improving accuracy and /or validity;	1	**One from :** **Accuracy**: relate to '**W**' or use of alternative technique(s). precision of water bath; use of graduated pipettes; increase range of saline concentrations; decrease intervals within concentration range to find optimum growth. **Validity**: state aspect of collected data to be compared with secondary sources/ Alternative measurement of population growth; Ignore 'Coulter counter'
Marks	Maximum for plan = 25	24 + *1 (scientific terminology)*	

Question			Expected Answers	Marks	Additional Guidance
1	a	i	**Beam** = light / photons; **Lenses** = electromagnets/magnetic field / magnets; **State of specimen** = dead; **Surroundings of specimen** = vacuum; **Maximum magnification** = x1000 – x1500;	5	**Ignore** resin/solid. **Accept** any relevant number within range.
	b		**W** = mitochondrion/mitochondria/matrix/crista; **X** = Endoplasmic reticulum/ER;	2	**Ignore** rough/smooth
	c	i	**Description** = more mitochondrial membranes in the liver cell than pancreatic cell; **Explanation** = liver cell, requires **more** ATP / carries out higher rates. of (aerobic) respiration/ Krebs cycle/oxidative phosphorylation (than pancreatic cell).	1 1	Answers must be comparative; accept reverse argument. **Accept** a correct reference to relative differences in ER membrane concentration in the two cells; **Ignore** reference to 'release of energy'
	c	ii	Two from: Larger proportion/ more, of Golgi apparatus present; Higher proportion/ more, of (secretory) vesicles; Higher proportion/ more, of RER.;	2	**Ignore** reference to mitochondria. **Ignore** reference to larger nucleus. **Ignore** reference to less smooth ER
			Total	**11**	

Question			Expected Answers	Marks	Additional Guidance
2	a		Haemocytometer;	1	**Ignore** 'counting chamber'.
	b		12 OR 14;	1	Value dependent on version of rule taught.
	c		Each side (of the triple lined square)= 0.20mm; Volume = 0.2 x 0.2 x 0.1 mm^3 OR Total volume held = 0.1mm^3; Volume = 0.1 ÷25 = 0.004mm^3	2	Volume = 0.2 x 0.2 x 0.1 mm^3 = 2 marks
	d	i	To avoid clumping of cells/ to allow individual cells to be seen / too many cells present in the original sample.	1	**Ignore** easier to count unqualified.
	d	ii	22;	1	**Accept** 21 if comment made to ignore 26 (outlier)
	d	iii	Mean number of cells per mm^3 = 22 x250 or 5500 or 22÷0.004 / Dilution factor = 5500 x1000; 5,500,000;	2	ecf from **dii** Correct answer = 2 marks.
	e		**Advantage** = quicker/automated/ rapid repeats/ large sample numbers can be measured/ reduces human error/ more reliable; **Disadvantage** = cannot distinguish between dead and live cells/ counts inanimate particles (as cells) / 2 or more cells may pass through at once.	1 1	**Ignore** more accurate / no human error **Accept** easier to use **Ignore** reference to cost.
			Total	**10**	

Question			Expected Answers	Marks	Additional Guidance
3	a	i	Glycosidic bond	1	
	a	ii	Benedict's reagent.	1	
	a	iii	**before:** blue/ turquoise; **after:** yellow/green/brick red	2	
	b		-COOH **and** NH_2- on separate molecules	1	
	c		Any **two** from: Hydrogen (bonds); Ionic (bonds); Hydrophobic/hydrophilic interactions (between R groups)	2	**Ignore** covalent
	d		A = **α/alpha** helix; Any **one** from: Hydrogen bonds (formed); (Bonds) between adjacent C=O & N-H groups; Correct ref to spacing between hydrogen bonds.	1 1	
			Total	**9**	

Question			Expected Answers	Marks	Additional Guidance
4	a		Any **one** from: Abnormal, translation/transcription; Less protein produced; Incorrect protein produced;	1	**Accept** reference to incorrect sequence of amino acids.
	b		**Two** from: Personality/behaviour, changes; Anti-social behaviour; Psychiatric disorders/ depression; Dystonia/lack of muscle tone; Dementia/general loss of intellectual abilities/ memory loss/ impaired judgement/ impaired abstract thinking;	2	**Ignore** 'family history' – not a clinical symptom. **Accept** slurred speech/delayed responses/breathing problems Ignore references to jerky movements e.g twitch/shaking
	c	i	DNA	1	
	c	ii	C = cytosine; A = adenine; G = guanine	3	
	c	iii	**Level 0 [0 marks]** Candidate does not include any correct valid points. **Level 1 [1 mark]** Candidate shows a basic understanding of the moral and ethical implications including at least **two valid** points. **Level 2 [2 – 3 marks]** Candidate shows an understanding and discusses some of the moral and ethical implications including **at least three valid** points expressed clearly and logically.	4	Valid points to include Right to pursue family options (have children) if genetic history known; Possibility of error arising from genetic testing; HD is a possible 'life sentence'; Quality of life (of parent &/or child) affected/emotional issues; Whether to pursue selective abortion (e.g.from religious viewpoint); Issues including employment/ insurance/ mortgage facilities; Need for health care; Human rights issues of foetus; Do other family members need/want to know; Do other family members want to be tested;

			Level 3 [**4 marks]** Candidate shows a high level of understanding and gives a full discussion of the moral and ethical implications including at least **five valid** points expressed clearly and logically.		
			Total	**11**	

Question			Expected Answers	Marks	Additional Guidance
5	a		Any **one** from: identical antibodies (produced in large amounts); bind to one specific antigen/molecule; produced from clone of/identical, B cells/ lymphocytes;	1	**Ignore** reference to clone unqualified **Accept** single type of antibody
	b	i	**Two** from: LH combines with mobile (monoclonal) antibodies (containing pink dye); LH antibody complex diffuse/move up the strip; Complex combines with immobilised (monoclonal) antibodies/ both antibodies join; mobile antibodies/mobile antibodies combined LH, can move no further; pink latex particles stay in large window;	2	
	b	ii	Any **one** from: Show viability/activity of antibodies/ confirm that test is working; To prove that, **excess/uncombined**, mobile (monoclonal) antibodies are present; To show that, **excess/uncombined,** mobile (monoclonal) antibodies have moved to the top of the, strip/past, the large window; To confirm that urine has moved all the way up the strip;	1	**Ignore** shows negative result. Accept unused for excess.
			Total	**4**	

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