GCE

Applied Science

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

Advanced Subsidiary GCE

Mark Scheme for June 2015

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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