

**Applied Science**

Advanced Subsidiary GCE

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

**Mark Scheme for June 2013**

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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.

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## Subject-specific Marking Instructions

## Planning Exercise

**An investigation to find the optimum pH for maximum yield of curds produced from cow's milk compared to soya milk.**

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
<b>A</b>	easily recognised safety procedures highlighted; biohazard/enzymes (irritant/allergy)/milk unpasteurised/contamination ; glassware; electrical (water bath/centrifuge); pH buffers (irritant); burns (Bunsen Burner); acids (corrosive)	1	Evidence of something that is going to make doing the investigation safer – an active document, a working document related to the plan. <b>Need minimum of three</b> <b>Reject</b> water bath if linked to burns/spilt on skin <b>Ignore</b> reference to drinking milk
<b>B</b>	prediction made;	1	Prediction related to <b>comparison</b> between <b>pH range &amp; yield from cows milk &amp; soya milk.</b>
<b>C</b>	with justification;	1	Statement related to changes in pH & protein solubility/changes in protein structure & bonding at different pH/ comparison protein or casein content of milk <b>Ignore</b> statements lifted directly from provided insert unless qualified with additional research.
<b>D</b>	description of preliminary work; (ignore if prelim is replicating main investigation).	1	Evidence /outline/intention of preliminary work Must be relevant to task e.g. temperature/type of milk/source of milk/pH range/production of buffer solutions/time to get measureable change /volume of milk/volume of buffer solutions/absence or presence of rennin. <b>Ignore</b> reference to different acids and alkalis
<b>E</b>	clear and in detail;	1	Clear description of practical work

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 biological explanation
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
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. pH reference Use of milk Incubation Measurement of curd related to yield
K	sound practical skills and accuracy;	1	Could someone follow the instructions unaided? Is it repeatable to appropriate degree of accuracy? Instructions Range of pH Cows' milk and soya milk compared Quantities used Control of time Measurement, dry mass/ height
L	range of appropriate equipment listed;	1	List of names of main items of equipment and materials needed for the investigation. Milk required Generic terms: beakers, flasks etc are OK here.
M	full range of appropriate equipment listed;	1	Qualifications noted. Indication of number of each and specific sizes, eg 250 cm <sup>3</sup> beaker, 1dm <sup>3</sup> flask. If any major item missing do not award. Need both cows' and soya of milk Buffer solutions or alternatives to prepare range of differing pH solutions
N	appropriate number of measurements stated;	1	Reference to replicates/ use of repeats – at least 1

Marking Point	Marking Criteria	Mark	Additional notes
O	need for range of measurements stated;	1	pH range needs to cover the information from on insert and be of sufficient precision determine optimum pH for each milk
P	appropriate range stated;	1	Suitable pH range e.g. pH 3-8, 5 different appropriate pH values, using cows' milk and soya milk
Q	relevant variables are identified (stated);	1	At least 2 from: age of milk/type of milk/source of milk/temperature/volume of milk/time of incubation/stirring or shaking/volume of buffer solution/type of buffer solution/time of coagulation/use of rennet/source of rennet/age of rennet/ volume of rennet
R	how variables to be controlled explained;	1	How for at least 2 of the variables relevant to Q. <b>A quantitative description</b> 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 <u>different</u> display e.g. graph. with axes correct with labels & units.
U	simple data handling;	1	Evidence of subtraction, calculation of mean % yield
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?'
W	recognises sources of error;	1	At least two examples: equipment/materials/specific human error (max one) Fluctuations in temperature; state of coagulation; accuracy of measuring equipment; type/source/age of milk/source of rennet/activity of rennet/ milk or curd residue in glassware
X	suggests methods for improving accuracy and or validity;	1	Accuracy: relate to 'W' or use of alternative technique(s). Expand critical range of pH buffer solutions/ alternative method of measuring yield/ alternative equipment to improve precision (burette/ graduated pipette). AND/OR Validity: state aspect of collected data to be compared with secondary sources
<b>Marks</b>	Maximum for plan = 25	24 + 1 ( <i>scientific terminology</i> )	



Question	Answer	Marks	Guidance
(d)	<p><b>Any two from:</b>            Pancreatic duct blocked ✓            No/less pancreatic juice released ✓            Protein/fat/carbohydrate digestion impaired ✓            Digestive enzymes/lipases/proteases/trypsin/amylase, deficiency/not released to gut ✓            Difficulties in absorbing fat/fat soluble vitamins ✓            Liver disease/damage ✓            Glucose intolerance/(CF related) diabetes (mellitus)/insufficient insulin ✓            (Dietary) additives/vitamins supplements needed ✓            Greasy stools ✓</p>	2	<p><b>Accept</b> answers related to lack of digestion and/or lack of absorption</p> <p><b>Ignore</b> references to enzymes not being produced</p> <p><b>Ignore</b> loss of appetite</p>
(e)	<p><b>Any two from:</b>            Whether or not to pursue abortion ✓            (Elective abortion based on a) test which is not 100% accurate ✓            How serious a defect has to be before abortion (might be considered )/human rights of fetus ✓            Religious issues qualified ✓            Whether to inform other family members ✓            Safety of test/side effects/possible harm to foetus/risk of miscarriage ✓</p>	2	
(f)	<p><b>Any one from:</b>            Proteins may occur at surface of /within membranes ✓            Crosses/bridges, the membrane/(phospho)lipid bilayer ✓</p>	1	<p><b>Accept</b> annotated diagram as an alternative to marking points.</p> <p><b>Ignore</b> references to ion channel</p>
	<b>Total</b>	<b>13</b>	

Question		Answer	Marks	Guidance
2	(a)	<ul style="list-style-type: none"> <li>• NH<sub>2</sub> ✓</li> <li>• COOH ✓</li> </ul>	2	Bonding if drawn MUST be correct. Reject NH <sup>2</sup>
	(b)	Condensation (reaction) ✓ Peptide/covalent (bond) ✓	2	
	(c)	ELISA/immunoassay/use of monoclonal antibodies ✓	1	<b>Ignore</b> amniocentesis
	(d)	1 = t-RNA/amino acid ✓ 2 = amino acid/t-RNA ✓ 3 = DNA ✓ 4 = transcription ✓ 5 = mRNA ✓ 6 = translation ✓	6	Accept reverse for 1 and 2.
		<b>Total</b>	<b>11</b>	



Question		Answer	Marks	Guidance
3	(a)	Starch ✓ Sodium hydroxide (solution) <b>and</b> copper sulphate (solution)/biuret (A and B) ✓ Ethanol <b>and</b> water ✓ (dilute) hydrochloric acid <b>and</b> ,sodium hydroxide/hydrogen carbonate (solution), <b>and</b> Benedict's reagent ✓	4	<b>Ignore</b> references to heat  <b>Accept</b> alcohol
	(b)	(i)	speed up, rate/ reaction/chemical change ✓	1 <b>Ignore</b> changes ✓ <b>Reject</b> reference to slows down <b>Ignore</b> reference to 'without taking part in chemical reactions'
		(ii)	Protein ✓ Lock and Key/induced fit ✓ Reduces/lower/smaller ✓ <b>Any three from:</b> pH ✓ temperature ✓ concentration of enzyme; ✓ concentration of substrate ✓ presence of inhibitors ✓ presence of cofactors/prosthetic groups ✓	6  <b>Accept</b> very small <b>ignore</b> small  <b>Ignore</b> concentration unless qualified
<b>Total</b>			<b>11</b>	

Question		Answer	Marks	Guidance
4	(a)	<p><b>Any one from:</b>            To check if normal in, number/appearance ✓            (To assist diagnosis of) leukaemia/named disease/ infection/inflammation/ carcinoma/lymphoma/melanoma/surgery/burns/HIV/AIDS ✓</p>	1	Ignore reference to red blood cells/anaemia
	(b)	<p><b>Any one from:</b>  <b>Large nucleus</b> ✓  <b>Explanation:</b> site of m-RNA synthesis/transcription of DNA/triplet code ✓  <b>OR</b>  <b>Large numbers of rough endoplasmic reticulum/RER</b> ✓  <b>Explanation:</b> transport of protein/translation on ribosomes /formation of, peptides/polypeptides, on ribosomes ✓  <b>OR</b>  <b>Increased levels of Golgi apparatus/body</b>  <b>Explanation:</b>            Packaging of, proteins/antibodies,/modification of proteins /vesicle formation /secretion /exocytosis ✓  <b>OR</b>  <b>Large numbers of ribosomes</b>  <b>Explanation:</b>            Site of protein synthesis/translation/assembly of peptide/polypeptide chains ✓</p>	2	Allow 1 mark for correct explanation linked to correct organelle but unqualified
	(c)	<p>Magnified scale length = 42 (+/-1)(mm)/ conversion to 42000(μm) ✓             (x)4200 ✓</p>	2	<p>Accept values from 41000 to 43000μm</p> <p>If units of magnification are included maximum of 1 mark</p>

Question	Answer	Marks	Guidance
(d)	<p><b>Any one from:</b>            (Haemocytometer) counts dead cells (as well as live ones) ✓            Dilution problems ✓            Cells clumping together ✓</p>	1	Ignore reference to artefacts/dust /human error/faulty equipment
(e)	<p><b>Level 0 (0 marks)</b>            Candidate includes fewer than <b>three</b> correct valid points</p> <p><b>Level 1 (1 mark)</b>            Candidate uses basic ideas to simply explain <b>how and/or why</b> a Coulter counter may be used, including <b>three</b> valid points.</p> <p><b>Level 2 (2 marks)</b>            Candidate shows an understanding and partially explains <b>how and/or why</b> a Coulter counter may be used, including <b>at least four valid</b> points expressed clearly and logically.</p> <p><b>Level 3 (3-4 marks)</b>            Candidate shows a high level of understanding and gives a full explanation of how and why a Coulter counter may be used, including at least <b>six valid</b> points expressed clearly and logically.</p>	4	<p>Valid points to include:</p> <p><b>How:</b></p> <ol style="list-style-type: none"> <li>1. Calibration</li> <li>2. Placed in culture/sample ✓</li> <li>3. (Use of) probe with two electrodes/two probes ✓</li> <li>4. One electrode enclosed in glass tube;</li> <li>5. Small hole/entrance in glass tube; ✓</li> <li>6. Electrical current flows/passes( between electrodes) ✓</li> <li>7. cells/cell passing through hole/gap/entrance alters</li> <li>8. cells/cell alters conductivity/current, inside probe ✓</li> <li>9. Number /size of the cell influences current/deviation ✓</li> <li>10. Results /deviation/number recorded, digitally/on computer/onscreen</li> </ol> <p><b>Why:</b></p> <ol style="list-style-type: none"> <li>11. Quicker;</li> <li>12. Can be automated/easier to use/can be set up and left ✓</li> <li>13. Reduces chance of <b>human</b> error/more reliable ✓</li> <li>14. Multiple samples can be counted/many repeats ✓</li> </ol> <p>Ignore reference to 'more accurate' (depends on expertise of technician).</p>
	<b>Total</b>	<b>10</b>	

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