

Applied Science

Advanced GCE

Unit **G628**: Sampling, Testing and Processing

Mark Scheme for January 2011

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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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Question			Answer	Mark	Guidance
1	a	i	Any two from: Scientific book/journal ✓ Electronic source/Internet ✓ Ask an expert ✓	2	IGNORE just text book/library ACCEPT books about woad
		ii	So that the results can be compared/to stop other variables from influencing results ✓	1	IGNORE fair test
		iii	Any one from: Indigo/woad stains/damages(fingers/skin) / he may be allergic to the leaves / product ✓ Indigo could be irritant/astringent ✓	1	IGNORE unqualified safety precaution/harmful REJECT references to woad contamination
		iv	Any one from: To use information (in future e.g. for analysis /processing /error identification /comparison /repeats)✓ So the information could be passed to others✓ So method could be modified if necessary ✓	1	
	b	i	To remove impurities/clean ✓	1	ACCEPT remove dirt
		ii	Any four from: How much water to use ✓ How many/mass of leaves to use ✓ Size of shredded leaves ✓ Use of suitable equipment ✓ Temperature of the water ✓ How long to leave it in the water ✓	4	IGNORE methods of shredding IGNORE risk assessments/ wear gloves etc. IGNORE keep temperature constant IGNORE Bunsen burner
		iii	Sieve / colander / muslin ✓	1	REJECT (very) large filter paper/Buchner funnel ACCEPT decant
		iv	Risk assessment ✓	1	ACCEPT PPE if qualified
		v	Add <u>more</u> soda ash ✓	1	IGNORE references to alkalinity/adding alkali

Question			Answer	Mark	Guidance
1	a	vi	Record the modification/amended method ✓	1	
	b	i	<p>[Level 1] Candidate states the apparatus and procedures used at every stage expressed in a clear and logical manner <i>(4 marks)</i></p> <p>[Level 2] Candidate states the apparatus and procedures used in at least two stages, generally expressed in a clear and logical manner <i>(2 – 3 marks)</i></p> <p>[Level 3] Candidate clearly states the apparatus and procedure used for at least one stage <i>(1 mark)</i></p>	4	<p><i>Valid stages may include:</i></p> <ul style="list-style-type: none"> • A method with suitable equipment to aerate the mixture: use of a whisk/method of stirring/pouring from one vessel to another/ bubbling air through the mixture in suitable vessel • Method of filtration using filter paper/funnel • Method of washing the residual solid with correct equipment/water • Appropriate method of drying/oven/incubator/on paper towels/hanging with explanation <p>IGNORE risk assessment</p>
		ii	0.3 ✓	1	
		iii	<p><i>Any two from:</i></p> <p>Climate / light / weather / rainfall ✓</p> <p>Amount of water ✓</p> <p>Type of soil/nutrients ✓</p> <p>Amount of fertiliser used ✓</p> <p>Temperature ✓</p> <p>Growing time / age of plant ✓</p> <p>Plant variety ✓</p>	2	<p>Growing conditions needs qualifying</p> <p>IGNORE location</p>
	c	i	<p><i>Any two from:</i></p> <p>Wash the affected area with (large quantities of) water/eye wash ✓</p> <p>Report it (to others) / fill in the accident book ✓</p> <p>Seek medical advice ✓</p>	2	Wash needs qualifying

Question			Answer	Mark	Guidance
1	c	ii	Any two from: Immersion heater / steam pipes ✓ Mentions the need / a method of monitoring the temperature ✓ Use of thermostat ✓	2	REJECT hot water bath/electronic heater
		iii	So that a constant temperature/50°C was maintained (in the dye bath) ✓	1	
	c	iv	The length of time of immersion/leaving in the air ✓	1	IGNORE amount of fabric
		v	The rinse water was <u>colourless</u> ✓	1	REJECT clear
		vi	Any two from: Fabric was not prepared properly – needs (more) thorough cleaning / degreasing ✓ Fabric has not been in the dye bath long enough – needs more immersion time ✓ Too much fabric used – need to reduce amount of fabric ✓ The vat is too hot / cold – needs maintaining at 50 °C ✓ Dye solution is not concentrated/pure enough – need to increase the concentration ✓ Treated fabric insufficient time to completely oxidise – need to leave longer in air ✓	2	Both identification of problem and solution are required
	d	i	The reaction was (very) exothermic at room temperature / heat generated during the reaction ✓	1	
		ii	(Propanone) is flammable ✓	1	IGNORE toxic/noxious/harmful REJECT references to incorrect substances e.g. propane
		iii	the reaction goes to completion/all precipitate formed ✓	1	IGNORE reference to unqualified precipitation

Question			Answer	Mark	Guidance
1	d	iv	Cost/expense (of starting materials/process) ✓ The reaction is too exothermic and difficult to control ✓ Time consuming process ✓ Increased risks e.g. harmful fumes (due to scaling up) ✓	2	IGNORE availability of chemicals IGNORE superficial references to safety Risks need qualifying
	e	i	Substance not altered for testing ✓ Used as a comparison ✓	2	
		ii	% GBS in untreated plants is 0.25/ mass of GBS in treated plants is 5g ✓ Mass of GBS in untreated plants $\frac{0.25 \times 500}{100} = 1.25$ ✓	2	
			Total	39	

Question		Answer	Mark	Guidance	
2	a	The coprolite occurs in bands/rock does not have the same appearance/colour throughout ✓	1		
	b	To obtain representative/range of samples ✓	1		
	c	<i>Any two from:</i> Protective clothing / helmet / goggles / suitable shoes – danger of sharp rocks / falling rocks /falling✓ Waterproof clothing – wet weather ✓ To work with colleague – in case of accidents ✓ Inform others of destination/return time - in case of accidents ✓	2	Both identification of precaution and reason are required REJECT masks REJECT not alone	
	d	The figures are (relatively) small (larger % errors in weighing)/lowest mass ✓	1		
	e	i	All plots correct (+/- one division) ✓	1	
		ii	D ✓ Erroneous/incorrect weighing/measuring of the volume / this coprolite was of a different composition to the others ✓	2	ACCEPT 32.5g /13.0cm ³
		iii	Suitable straight line, must go through the origin ✓	1	REJECT hairy lines IGNORE extrapolations
		iv	Suitable lines drawn on graph ✓ Graph read correctly ✓ Density within range 3.0 – 3.3 g cm ⁻³ ✓	3	REJECT 3 g cm ⁻³
	f	To ensure that the samples are not contaminated/no impurities ✓	1		

Question		Answer	Mark	Guidance
2	g	<p>[Level 1] Candidate gives a full description of a workable experiment in a logical sequence. For 8 marks candidates should include at least seven valid points across three sections. For 7 marks candidates should include at least six valid points across three sections. A form of writing that is appropriate to purpose has been used. <i>(7 – 8 marks)</i></p> <p>[Level 2] Candidate gives a description of a workable experiment in a logical sequence. For 6 marks candidates should include at least five valid points across three sections For 5 marks candidates should include at least five valid points across two sections. For 4 marks candidates should include at least four valid points across two sections. A form of writing with some structure. <i>(4 – 6 marks)</i></p> <p>[Level 3] Candidate shows some knowledge of experimental technique but not necessarily in a logical order. For 1 mark candidates should include at least two valid points. For 2 marks candidates should include at least two valid points across two sections. For 3 marks candidates should include at least three valid points across at least two sections. A form of writing with limited structure. <i>(1 – 3 marks)</i></p>	8	<p><i>valid points for experimental procedure include:</i></p> <p>Section 1 Detail</p> <ul style="list-style-type: none"> • Perform a risk assessment • Division of field/pot into two parts • Add powdered coprolite to one half/pot • Seed (each half) with turnip seeds • Water evenly <p>Section 2 Reason</p> <ul style="list-style-type: none"> • So there is as a control • So that each receives the same amount of water <p>Section 3 Evaluation</p> <ul style="list-style-type: none"> • Measure the height of the plants at intervals / measure the mass of the turnips produced • Compare the height / mass of the turnips in the treated and untreated areas <p>IGNORE growth/big</p>
	h	i	1	
		If the price of 'phosphate rock' rises / outweighs the cost of 'poor' extraction from the shale ✓		

Question			Answer	Mark	Guidance
2	h	ii	Find another method that gives a higher separation (of 'nodules' from the shale) ✓	1	IGNORE cheaper
	i	i	80 (million tonnes) ✓	1	
		ii	54.4 (million tonnes) ✓ ecf from (i)	1	
	j		Environmental consideration – how the hydrogen fluoride is contained/controlled ✓ Economic consideration – a market for the hydrogen fluoride/cost of removal ✓	2	
	k		<i>Any six from:</i> Prepare a series of suitable solutions ✓ Solutions are of known concentration/dilution ✓ Pour solution into cuvette ✓ Use a suitable filter ✓ Set instrument to zero ✓ Measure the absorption of each solution ✓ A calibration graph is drawn of absorption against concentration/% ✓ Measure the absorption of the unknown solution ✓ Find the concentration using the calibration graph ✓	6	ACCEPT transmission measurements
Total				33	

Question			Answer	Mark	Guidance												
3	a	i	Volume – allow 100 – 250 cm ³ inclusive ✓ Reason – flasks cannot be safely heated if almost full (or largely empty) ✓	2													
		ii	The temperature is (more easily) controlled/monitored/maintained constant ✓	1													
		iii	A process of heating where the solvent evaporates and is condensed (by the cold water jacket), returning to the flask ✓	1													
		iv	Mass of fat = 8.14 g ✓ % of fat = $\frac{8.14 \times 100}{24.30} = 33.5$ ✓ ecf from mass of fat	2	ACCEPT 33.49 and 34 REJECT 33												
	b	i	Investigate the safety of ultraviolet radiation/put on eye protection ✓	1	ACCEPT risk assessment IGNORE glasses												
		ii	$R_f \text{ value} = \frac{\text{distance moved by spot B}}{\text{distance moved by solvent front}} = \frac{3.2}{4.0}$ ✓ 0.8(0) ✓ ecf from measurements	2	REJECT subtraction												
		iii	Use a different (eluting) solvent ✓	1													
	c	i	<table border="1" style="margin-left: auto; margin-right: auto;"> <tbody> <tr> <td>~</td> <td>~</td> <td>~</td> <td>~</td> </tr> <tr> <td>~</td> <td>~</td> <td>~</td> <td>~</td> </tr> <tr> <td></td> <td>3.04</td> <td>3.18</td> <td>2.89</td> </tr> </tbody> </table>	~	~	~	~	~	~	~	~		3.04	3.18	2.89	2	
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	3.04	3.18	2.89														
	3 correct 2 marks ✓✓ 2 correct 1 mark ✓																

Question			Answer	Mark	Guidance
3	c	ii	Because the maximum value is $3.00 + 0.15 = 3.15$ ✓ The value for C is greater than this ✓ ecf on ratios	2	
3	c	iii	It should be repeated (from the same bag) ✓	1	
	d		<i>Any three from:</i> Powder the crisps ✓ Heat the water ✓ Leave/stir mixture longer ✓ Wash the filter paper/contents with water ✓	3	IGNORE add more water
Total				18	

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