

Applied Science

Advanced GCE

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

Mark Scheme for June 2012

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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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Annotations

Annotation	Meaning
	Tick
	Cross
	Benefit of doubt
	Error carried forward
	Example/Reference
	Ignore
	Not answered question
	Benefit of doubt not given
	Large dot (Key point attempted)
	Reject
	Contradiction
	Error in no. of significant figures
	Unclear
	Omission mark

Abbreviations, annotations and conventions used in the detailed Mark Scheme (to include abbreviations and subject-specific conventions).

Annotation	Meaning
/	alternative and acceptable answers for the same marking point
✓	separates marking points
Not	answers which are not worthy of credit
Reject	answers which are not worthy of credit
Ignore	statements which are irrelevant
Accept	answers that can be accepted
()	words which are not essential to gain credit
—	underlined words must be present in answer to score a mark
ecf	error carried forward
AW	alternative wording
ora	or reverse argument

Question		Answer	Marks	Guidance
1	(a)	It occurs in, bands/layers ✓	1	Ignore contains fossils/nodules
	(b)	(i) Location / reference to position / where sample found ✓	1	Ignore reference to identification Ignore mass
		(ii) Science /geology, books/journals / asking an expert / in a, museum/library ✓	1	Note subject specific book/journal needed Ignore text book unqualified
		(iii) <i>Any two from:</i> Size / mass / volume ✓ Details of the other side / labelled parts ✓ Colour ✓ Name / type of fossil / what it is ✓ Location / depth / type of rock found in ✓	2	Ignore age
	(c)	(i) Lump / chunk / piece / block / small amount (rounded rock) ✓	1	Ignore deposits / cluster / segment
		(ii) <i>Any two from:</i> Suitable, PPE/shoes/clothing/ hard hat/goggles/mask ✓ Uneven / falling rocks ✓ Slipping / falling down / access to pit ✓ Ensure contact / not working alone ✓ Care taken when using sharp, tools / rocks/inclusions ✓	2	Ignore escape route
		(iii) <i>Any one from:</i> Cleaned / washed ✓ Remove contamination / impurities ✓ Photograph ✓	1	Ignore weighing Reject risk assessment
		(iv) 1 All correct plots ✓	1	Ignore any plotting of B
		2 Suitable line of best fit ✓	1	Reject any line of best fit which may include B Ignore extrapolations Reject graphs drawn through origin allow unit mark only

Question		Answer	Marks	Guidance
		3 Suitable lines drawn on graph ✓ Gradient / density calculated (2.6 -2.8)✓ Correct unit given (g/cm ³ / gcm ⁻³) ✓	3	Ignore size of triangle drawn Reject density with incorrect sig figs
		4 From the graph reading = (47.5 - 49.5) ✓ Measuring cylinder reading = (197.5-199.5) ✓	2	Accept wherever written Ecf graph value +150.0cm ³
	(d)	(i) <i>Any three from:</i> Ease of use / level of, expertise/training required ✓ Quick in operation / time / efficient ✓ Availability of apparatus / chemicals ✓ Health and safety / toxicity / environmental concerns ✓ Sample size ✓ Temperature used ✓ Accuracy ✓ Effective /successful /reliable ✓	3	Ignore cost Ignore scale of equipment/correct equipment Ignore risk assessment Reject references to by-products Ignore feasible / achievable
		(ii) % of silica = 99.01005 ✓ Correct answer given to four significant figures 99.01 ✓	2	Accept answer wherever written
	(e)	(i) Flints placed in a bag / basket / container ✓ Bag attached to a rope / suitable method of raising / use of pulley system ✓ Link to technology of time ✓	3	Accept suitable diagram Ignore references to post Neolithic technology eg metal
		(ii) Fuel / wood /hat/grasses/ animal fat / (bees) wax / tar ✓ Wick / method of ignition ✓	2	Ignore references to candle
		(iii) Use of, wooden stakes/pillars/poles ✓	1	Accept suitable diagram showing support of ceiling Ignore prop Ignore references to metals
	(f)	(Hot) liquid / molten (rock) ✓	1	Accept reference to mantle instead of rock Ignore lava if unqualified

Question		Answer	Marks	Guidance	
	(g)	(i)	Maximum length on the diagram (14 -16) mm ✓ ECF Actual length 0.028 – 0.032 ✓	2	
		(ii)	Processing of answer / $(4 \times 10^{-3} / 1.20 \times 10^{-5}) /$ ✓ 333 ✓	2	
	(h)	(i)	<u>Bonds</u> ✓	1	
		(ii)	Increase ✓	1	Accept decrease in transmittance Accept increase in absorption Reject increase in transmittance
			Total	34	

Question			Answer	Marks	Guidance
2	(a)	(i)	35 (g kg ⁻¹) ✓	1	
		(ii)	Decrease / become less ✓ E nearest source of the river/ water fresh/not saline/ 0.2 g kg ⁻¹ water or less ✓	2	Ignore further inland with no qualification
		(iii)	<i>Any one from:</i> For, reference/research / details can be used by others ✓ For comparison / back up ✓ In case of loss of label / jar ✓	1	
		(iv)	Salt concentration increase as water evaporates ✓	1	
		(v)	Ignore / treat as, anomalous / outlier ✓	1	Ignore unreliable Ignore repeat
		(vi)	Sea water getting in / tidal activity ✓ Period of high rainfall ✓	2	Ignore currents Ignore unqualified reference to weather / weather change Ignore reference to evaporation
		(vii)	<i>Any two from:</i> Gloves ✓ Mask/eye protection ✓ Biological isolation cabinet ✓ Fume cupboard ✓ Safe disposal ✓	2	Ignore laboratory coat Ignore risk assessment
		(viii)	Total mass = 141.11g ✓ Mass of solid residue = 4.11 g ✓ Mass of water = 137.00 g ✓ Salinity = $\frac{4.11 \times 1000}{137.00} = 30$ ✓	4	Accept $\frac{4.11 \times 1000}{141.11} = 29$ for 1 mark (max 3 marks)
		(ix)	Avoid contamination / ensure no material is left ✓	1	
		(x)	1.020 -1.025 g cm ⁻³ ✓	1	

Question		Answer	Marks	Guidance
	(xi)	Ratio salt to water / concentration/percentage , of salt is the same ✓	1	Ignore references to amount of salt and salt content
	(xii)	Measure density of seawater/use of, hydrometer/titration ✓ Plot graph of salinity against density (data from 2a) ✓ Use graph to find salinity of seawater ✓	3	
	(b)	<i>Any two from:</i> Fig. 2a shows the salt at different depths / uneven distribution ✓ The thickness of the salt layer varies ✓ To obtain, representative/range of , samples ✓	2	Ignore amounts
	(c)	Salt is water soluble ✓	1	
	(d)	<p>[Level 0] Candidate has included fewer than three valid steps <i>(0 marks)</i></p> <p>[Level 1] Candidate has shown some knowledge of experimental technique but not necessarily in a logical order. To include at least three valid steps. <i>(1 – 2 marks)</i></p> <p>[Level 2] Candidate gives a description of a workable experiment in a logical order. To include at least five valid steps including apparatus. <i>(3 – 4 marks)</i></p> <p>[Level 3] Candidate gives a full description of a workable experiment in a logical sequence. To include at least seven valid steps. For six marks include apparatus, filter hot, add washings to the filtrate. <i>(5 – 6 marks)</i></p> <p><i>N.B. The number of ticks on the script will not always directly equate with the numbers of marks given.</i></p>	6	<p>Valid steps:</p> <ul style="list-style-type: none"> • carry out risk assessment/PPE • crush/grind material • use of a pestle and mortar • add to (cold) water • use of a beaker / flask before or after filtration • warm / heat • stir • filter hot • use of a filter paper and funnel • wash residue (with distilled water) • add washings to filtrate

Question		Answer	Marks	Guidance
	(e)	Varying amounts of, impurities/salt ✓ Samples were from different areas ✓	2	Accept no homogenous
	(f) (i)	Decomposition/breaking up of a chemical substance by passing electricity through it ✓	1	
	(ii)	<i>Advantage</i> – gives high(er) purity / produces 50% concentration ✓ <i>Disadvantage</i> – expensive / toxic ✓	2	Reject 50% purity
	(iii)	Any two from: Purer product / purity similar to mercury cell ✓ Higher concentration ✓ Less frequent replacement ✓	2	Ignore less expensive
	(g) (i)	$\frac{0.13 \times 2000}{50} = 5.2$ (g) ✓	1	
	(ii)	5.2 (g) ✓	1	
	(iii)	$\frac{5.2 \times 100}{20} = 26$ (%) ✓	1	Note answer from (iii) is ecf from (ii)
Total			39	

Question			Answer	Marks	Guidance
3	(a)	(i)	Its (relative) molecular mass ✓	1	Reject relative atomic mass
		(ii)	To compare (the spectrum to a reference) ✓	1	
		(iii)	0.45 - 0.48 ✓	1	Ignore significant figures / any units
	(b)	(i)	<p>[Level 0] Candidate has included fewer than two valid steps. (0 marks)</p> <p>[Level 1] Candidate gives an outline description of the experiment with a number of details missing. At least two valid steps have been given. (1 – 2 marks)</p> <p>[Level 2] Candidate gives a description of the experiment including the apparatus used but has omitted the sizes. The writing shows a logical sequence. At least four valid steps have been given. (3 – 4 marks)</p> <p>[Level 3] Candidate gives a full description of the experiment including the apparatus used and its size. The writing shows a logical sequence. At least six valid steps have been given, which must include</p> <ul style="list-style-type: none"> • suitable size of flask 250 / 500 cm³ • method of filtration stated with apparatus described • the solution is heated using a water bath / an electrical hot plate. <p><i>Answer to be bullet pointed for 6 marks.</i> (5 – 6 marks)</p> <p><i>N.B. The number of ticks on the script will not always directly equate with the numbers of marks given.</i></p>	6	<p>Valid steps:</p> <ul style="list-style-type: none"> • use a measuring cylinder to measure 150 cm³ of hexane • (add to red pulp) in suitable size of flask 250 / 500 cm³ • stir the mixture • until no further colour change occurs • filter using filter, paper/funnel, / Buchner funnel • collect filtrate in flask of size 250 / 500 cm³ or large evaporating basin • use a fume cupboard • heat solution, using a water bath / an electrical hot plate • solid (orange) annatto remains <p>Reference to washing with liquids other than hexane - max 5 marks.</p>

Question		Answer	Marks	Guidance
	(ii)	<p><u>20 x 5 x 75</u> ✓ 100 x 100</p> <p>0.75 (g) ✓</p>	2	
	(iii)	<p>Any two from:</p> <p>(Gently) warm / heat / increase temperature ✓</p> <p>Stir for longer / at a faster rate ✓</p> <p>Wash the residue in the filter paper (with more hexane) ✓</p> <p>More effective crushing of seed pods ✓</p>	2	<p>Reject use more hexane</p> <p>Ignored fully stirred</p>
	(iv)	<p>1 Mixture could be stirred – (mechanical) paddle / electric stirrer / industrial/commercial, stirrer/mixer / rods ✓</p> <p>2 Mixture could then be filtered – filter ‘beds’ / mesh / fine sieve/ centrifuge/ sheet of muslin ✓</p> <p>3 The apparatus could be modified so that hexane was recovered – heat in an ‘enclosed’ system or collect gas ✓ So that hexane vapour could be condensed ✓</p>	4	<p>Ignore large filter funnel</p>
Total			17	

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