

GCE

Applied Science

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

Advanced GCE

Mark Scheme for June 2016

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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/Indicative content	Mark	Guidance
1	a	i	To obtain (important) metals (such as Fe, Co, Ni or Mn) ✓	1	Accept: that is where they are found OWTTE
	a	ii	The content varies ✓	1	
	a	iii	In salt water / sea water / in an oxygen-free environment ✓	1	Accept: similar environment to original conditions / air free Ignore: sealed container
	a	iv	Any two from Date/time of collection/when ✓ Location/where ✓ Mass ✓ Hazard label ✓ Depth of sea at collection point ✓	2	
	a	v	To prevent contamination / remove impurities ✓	1	Ignore: sterilisation
	a	vi	Wear safety glasses ✓ to prevent dust entering the eyes ✓ OR Wear a face mask ✓ to prevent ingestion of solid material ✓ OR Wear gloves ✓ to prevent skin irritation ✓ AVP ✓✓	2	There is a mark for the mention of the correct piece of PPE and one mark for the reason
	a	vii	Some percentages are very small ✓ Use a table/bar chart ✓	2	
	a	viii	Technological – operation of machines at great depths / recovery of nodules, from great depths/to surface ✓ Environmental – destruction of the ecosystem / pollution / disturbance of sediment ✓	2	Accept: at high pressure /specialist machinery Accept: references to plant life

Question		Answer/Indicative content	Mark	Guidance
	b	A peak indicating the A_r of manganese / It will show an ion signal for the presence of manganese ✓	1	
1	c	i <p>[0 marks] Candidate does not include any of the valid steps.</p> <p>[1-2 marks] Candidate includes at least two basic steps and shows some outline understanding of the task.</p> <p>[3-4 marks] Candidate includes at least four valid steps and shows a reasonable level of understanding with some attempt at a logical order of presentation</p> <p>[5-6marks] Candidate includes at least six valid steps and shows a clear and logical understanding of the order of the steps needed.</p>	6	<p><i>Valid steps</i></p> <ul style="list-style-type: none"> • Remove outer zinc case/cardboard lid/cut open • Remove carbon rod (and brass cap) • Remove paste • Add it to water • Stir • Warm (the mixture) • Filter (to remove manganese dioxide) • Wash the material in the filter paper • With distilled water • Remove the manganese dioxide from the filter paper • Dry the manganese dioxide
	c	ii A valid safety requirement and a reason for its use linked to procedure ✓	1	For example: gloves to prevent skin irritation from paste / eye protection to prevent flying fragments/hot liquids /use of fume cupboard protection from fumes
	d	i A material that speeds up a chemical reaction, but is not used up/remains unchanged at the end ✓	1	Accept: A material that reduces the activation energy of a reaction Accept: changes rate
	d	ii $\frac{72.0}{75.0 \times 12}$ ✓ 0.08 ✓	2	Answer without working gains full credit Accept: expression in words Ecf.

Question		Answer/Indicative content	Mark	Guidance
	d iii	Any two from Used less (H ₂ O ₂) solution ✓ Gas escaped during the reaction/slow assembly ✓ Incomplete reaction ✓	2	Ignore: errors in measuring / set up of apparatus
	e i	%/amount of manganese may vary from plant to plant ✓	1	
	e ii	Sketch graph drawn shows Straight line ✓ Through the origin ✓	2	
	e iii	0.10(1) / 0.1008 ✓ % Mn in the ash = 1.2 ✓	2	
	e iv	Initial mass of leaves not taken into account ✓ Calculated % is only % of Mn in ash ✓	2	Accept: comparison of full plant
	f i	Filtration through gravel / settling followed by removal ✓	1	Accept: muslin sheet / large/industrial seive Ignore: filter paper
	f ii	0.30 mg for 1 dm ³ / 1875 cm ³ in 2500 dm ³ ✓ Mass for 2500 dm ³ = 0.75 g ✓	2	Ignore: 1.875 cm ³
		Total	35	

Question			Expected Answers	Marks	Additional Guidance
2	a	i	Isolation / kept away from other areas ✓	1	
	a	ii	Any two from Specific for the insect / non-toxic to other living creatures ✓ Does not affect oranges or growth ✓ Not long lasting / biodegradable / quick acting ✓ Easily applied ✓	2	Ignore: cost Ignore: unqualified availability of product
	b	i	To identify the variable that is responsible ✓	1	Accept: 'the oranges have the citrus greening disease'
	b	ii	reduce deterioration / increase turnover time/ ensure process is as economical as possible ✓	1	
	c	i	20.4 / 20.36 ✓	1	Accept: 20kg
	c	ii	Most efficient packing in a box / efficient packing of a number of boxes together / not too heavy / strong enough to support the oranges ✓	1	
	d		Total juice from the oranges = 984 (g) ✓ Total mass acid in the juice = 14.8 (g) ✓	2	Ecf
	e		Dilution factor $5.4 / 65 \div 12$ ✓ New volume = $1080 / (5.4 \times 200)$ ✓ Volume of water needed = 880 ✓	3	Accept the unrounded answer of 883 (dm ³)

Question		Expected Answers	Marks	Additional Guidance
	f i	Place lead shot into the test tube ✓ Place water in the measuring cylinder ✓ Add the test tube to the water so that it just floats in the water ✓ Make a mark on the label where the surface of the water just reaches ✓ Repeat the exercise using the sugar solution ✓ Mark intermediate marks on the label for readings between 1.00 and 1.20 ✓	6	
	f ii	Any one from Washed/cleaned ✓ Measure the temperature ✓	1	Ignore: dried only
	g	% of sugar is proportional to RI ✓	1	Accept: linear relationship

Question		Expected Answers	Marks	Additional Guidance	
2	h	Covalent bonds ✓	1		
	i	Steam distillation: steam is lead into the mixture / distillate mix of oil and water ✓ Simple distillation: the mixture is heated externally /distillate gives purer product ✓	2	Accept: steam heats mixture (internally)	
	j	Oil is less dense than aqueous layer /liquids have different densities ✓ Two liquids are immiscible / do not mix ✓	2		
	k	i	35% ✓	1	
	k	ii	(Run the GLC of myrcene and) find its retention time/RT / add myrcene to the sample, run another chromatogram and compare ✓	1	
	k	iii	Use a different, column/stationary phase / run the experiment at a different temperature ✓	1	Accept: reference to different carrier gas /pressure change Ignore: reference to solvent
	l	Home prepared / biodegradable / non-toxic /easy to make/limonene readily available ✓	1	Ignore: effectiveness / Accept: not harmful qualified / environmentally friendly	
Total			29		

Question			Expected Answers	Marks	Additional Guidance
3	a	i	Wash with a suitable named solvent ✓	1	Ignore: abrasives Accept: soap/detergent/alkaline, solutions
	a	ii	Weigh to constant mass ✓	1	
	b	i	8.4 / 8.38 ✓	1	
	b	ii	Graph not necessarily a straight line / could be curve / Insufficient values ✓	1	
	c	i	Between 3 and 5 ✓	1	Ignore: names of materials
	c	ii	See if brass will scratch a piece of fluorite ✓	1	
	d	i	Diameter of circle = 2.4 cm / 24 mm ✓ Actual diameter of the indentation = $24/300 = 0.08$ mm ✓	2	ecf
	d	ii	(Increase) force ✓ (Increase) length of time ✓	2	Accept: use softer material (instead of brass) Ignore: references to pressure
	e	i	Mass of brass used ✓ Volume of acid used ✓	2	Ignore: concentration of acid / solution Accept: amount /how much of acid
	e	ii 1	The apparent percentage of copper would be lower than actually present ✓	1	
	e	ii 2	Use an acid that will not dissolve the copper ✓	1	Accept dilute the acid
	f	i	(Initially high then) falls and steadies out ✓	1	Accept: trends decrease, increase, decrease OWTTE

Question			Expected Answers	Marks	Additional Guidance
3	f	ii	(Sep to Nov) Biomass growth decreases corrosion rate decreases ✓ (Nov to June) Biomass growth increases inhibiting corrosion rate ✓	2	It is not expected that candidates will give a detailed answer and examiners should look for the ideas outlined in the expected answers.
	f	iii	Increased water movement / turbulence. ✓	1	Accept: more rain/flooding Ignore: weather conditions
	f	iv	pH / temperature / oxygen levels / flow rate ✓	1	Accept: acidity/alkalinity Ignore: references wildlife
	f	v	[0 marks] Candidate does not include any of the valid steps. [1-2 marks] Candidate includes at least two valid points and shows an outline understanding of the task. [3-4 marks] Candidate includes at least four valid points and shows a reasonable level of understanding with some effect at a logical order of presentation. [5-6 marks] Candidate includes at least six valid points and shows a clear understanding of the order of steps needed. [7 marks] Candidate includes at least 7 required steps, which includes the need for all brass pieces to be of equal area . Answers are set out in a clear and logical order.	7	Valid points Factors that you would constant <ul style="list-style-type: none"> • Equal area of brass • Time in salt water • Immersed/placed in salt water • Temperature Factors that you would vary <ul style="list-style-type: none"> • Varying concentrations of salt solutions Measurements that you would take <ul style="list-style-type: none"> • Weigh each piece • Reweigh (after drying) • Record mass change Method <ul style="list-style-type: none"> • Risk assessment • Wash brass with distilled water • Dry brass
Total				26	

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