

Applied Science

Advanced GCE

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

Mark Scheme for January 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
	Correct point
	Incorrect point
	Benefit of the doubt
	No benefit of doubt given
	Error carried forward
	Omission mark
	Ignore
	Reject

Highlighting is also available to highlight any particular points on the script.
Abbreviations, annotations and conventions used in the detailed Mark Scheme.

/	= 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
allow	= answers that can be accepted
()	= words which are not essential to gain credit
<u> </u>	= underlined words must be present in answer to score a mark
ecf	= error carried forward
AW	= alternative wording

Question		Answer	Marks	Guidance
1	(a)	(Weakly) magnetic / odd colour ✓	1	
	(b)	<i>any two from:</i> Falling rocks ✓ Slippery/uneven/sharp surfaces / slipping/falling in / falling on rocks ✓ (Strong) currents ✓ Depth of water ✓ Contamination (of the stream) AVP ✓	2	Not references to weather Ignore drowning Ignore personal safety Ignore wildlife
	(c)	<i>any one from:</i> Contamination / other particles present ✓ Stream 'swollen' / flash flooding / deep water / currents ✓	1	Not everything washed away Not references to wetness of sand
	(d)	<i>any one from:</i> Unaffected by water / oxygen ✓ Already exposed (to air) ✓ Already oxidised ✓	1	Ignore resistance to corrosion
	(e)	<u>36.8%</u>	1	
	(f) (i)	1 20 → 43.8 ± 0.1 30 → 47.3 ± 0.1 ✓ 2 that there is 3.5 / difference between each reading ✓	2	Both answers are needed for the first mark
	(ii)	<i>any one from:</i> Shows any error / anomalous results ✓ Indicates correlation/ relationship / comparison / trends ✓ Can read off 'intermediate' readings ✓	1	Accept description of trend Ignore clear presentation of results

Question		Answer	Marks	Guidance
	(g)	<p>How to obtain / maintain 1000°C/high temperature ✓</p> <p>How to deal with toxic/dangerous/hazard (carbon monoxide and chlorine) gases / no fume cupboard ✓</p>	2	<p>Accept dangerous gases</p> <p>Reject coke is toxic</p> <p>Ignore not having correct equipment / gases hard to control</p> <p>Reject closed system</p>
	(h)	<p>Batch process where a certain amount of substance is made at a time ✓</p> <p>Explanation Reference to cleaning/recharging/emptying/labour / time ✓</p> <p>A comparative statement with reason ✓</p>	3	<p>Accept reference to start stop process</p> <p>Ignore stage by stage process</p> <p>Ignore references to cost</p>

Question		Answer	Marks	Guidance
	(i)	(i) (In general) the % of titanium rises ✓ Correct reference to year of decrease/ non uniformity ✓	2	Ignore reference to data for rise General decrease from 1970-1991 Specific decrease from 1987 - 1991
		(ii) Bar chart / pie chart / table / scattergram ✓	1	
	(j)	(i) Risk assessment /reference to COSHH /hazard warning ✓	1	
		(ii) To ensure solution has uniform concentration / is homogeneous / is consistent throughout ✓	1	Ignore thoroughly mixed Ignore mixture/sample not remaining at bottom of flask Ignore reference to results
		(iii) To obtain maximum absorption / to obtain the most accurate result ✓	1	Ignore reference to valid results Ignore best results unless qualified
		(iv) <i>any three from:</i> Graph should be a straight line/linear ✓ Graph should go through the origin ✓ Absorption proportional to [Ti] ✓ If there is no titanium there is no absorption ✓	3	Accept reference to positive correlation
		(v) Undiluted $13.5 \times 200 = 2700 \text{ (mg dm}^{-3}\text{)}/2.70 \text{ (g dm}^{-3}\text{)} \checkmark$ $\% \text{ Ti} = \frac{2.70 \times 100}{3.0} / \frac{2700 \times 100}{1000 \times 3.00} \checkmark$ 90 ✓	3	Accept alternative method of working Conversion Percentage Answer
	(k)	<i>any two from:</i> Availability of materials ✓ Availability of modern technology/equipment ✓ Type of waste ✓ Amount of waste ✓ (Facilities available for) removal/disposal/storage/use of waste materials /safety ✓ What purity grade of titanium dioxide is required ✓ Amount / yield of titanium dioxide produced ✓	2	Ignore references to time

Question	Answer	Marks	Guidance
(l)	Sketch shows drawn line lower in the UV-B region and higher in the UV-A region ✓	1	
(m)	A system used with living organism/tissue/skin/(human) body ✓	1	Ignore natural conditions Accept 'real life system'
(n)	<p>Level 0 [0 marks] Candidate does not include sufficient valid points</p> <p>Level 1 (1–2 marks) Candidates demonstrate a basic understanding of a method by giving volunteer guidance</p> <ul style="list-style-type: none"> • indicating a possible test • noting results <p>Level 2 (3–4 marks) Candidates demonstrate some understanding of an appropriate method by giving more detailed instructions with some organisation that includes more detailed volunteer guidance</p> <ul style="list-style-type: none"> • at least two tests on each sample • a method of recording and displaying results <p>Level 3 (5–6 marks) Candidates demonstrate a full understanding of an appropriate method by giving clear, detailed and organised instructions that include detailed guidance to include method of control to be used by the volunteers</p> <ul style="list-style-type: none"> • at least three tests on each sample • a comprehensive table of results 	6	<p>The following are valid points</p> <p>1 Volunteer guidance</p> <ul style="list-style-type: none"> • risk assessment completed • instructions given • full range of samples to be used • are unaware of which sample is which • control used • samples of milk kept at the same temperature • freshness of milk • do not communicate with each other / compare each others results <p>2 Tests are for</p> <ul style="list-style-type: none"> • taste • colour / whiteness/appearance • opacity • smell • texture <p>3 Recording of results</p> <ul style="list-style-type: none"> • basic table /bar chart • use of questionnaire • grading/rating of results
	Total	36	

Question			Answer	Marks	Guidance
2	(a)	(i)	$3.4 \times 10^8 / 3.6 \times 10^8$ ✓	1	
		(ii)	That the oceans are of uniform/the same depth ✓	1	Reject lowest depth
		(iii)	There is a continual cycle of evaporation and condensation ✓ Although evaporation increases the % of salt in the oceans ✓ Condensed water is 'pure' (and will therefore reduce the salt concentration) ✓	3	
	(b)	(i)	Boiling point increases as the pressure increases ✓ This is not a direct/linear relationship / as the pressure falls the boiling point does not become proportionately smaller OTTWE ✓	2	Accept a correct relationship linking boiling point and pressure Reject temperature alone
		(ii)	40 ± 1 ✓	1	
		(iii)	1 Less energy/cost/fuel used in heating the water ✓ 2 Increase costs for manufacture/running reduced pressure equipment ✓ Increase level of risk /hazards of working at reduced pressure ✓ More energy needed in manufacture of equipment ✓	1 1	Ignore references to time More expensive needs qualification More dangerous needs qualifying
	(c)	(i)	To condense water vapour / to change steam into water ✓	1	Ignore condenser Need reference to water vapour or steam

Question		Answer	Marks	Guidance
2	(ii)	<p><i>any two from:</i> The water bath has cooled /heat has been removed/not hot enough ✓ Concentration of the salt water has become more concentrated/changed ✓ The boiling point has increased ✓</p>	2	All of the water evaporated needs qualification
	(iii)	<p><i>any one from:</i> (To prevent cuts by) broken/cracking/flying glass (in case of an implosion)✓ (To prevent scalding from) hot liquid/water ✓</p>	1	Emphasis is on safety
(d)	(i)	<p><i>any four from:</i> Downward pointing arrow on salt water side / pressure is applied to the salt water ✓ This pressure is high enough to overcome the osmotic pressure (which forces molecules of water from the fresh water side to the salt water side) ✓ Arrow pointing from salt water to fresh water labelled water✓ The excess pressure forces water molecules through from the salt water side to the fresh water side ✓ Salt (ions) cannot pass through the membrane✓</p>	4	Accept 'molecules' in place of 'ions'
	(ii)	<u>1.8</u> ✓	1	
(e)	(i)	<p><i>any three from:</i> Position in the river – near or far from the bank ✓ Position in the water – top, middle, bottom ✓ Time of the day/date ✓ Weather ✓</p>	3	Ignore amount taken Accept different areas 1 mark

Question		Answer	Marks	Guidance
2	(e) (ii)	<i>any one from:</i> To avoid contaminating the sample (by the student) ✓ To prevent danger of toxic/ biological hazards/allergic reaction/disease/contamination (to the student) ✓	1	Dirty needs qualification Accept contaminants
	(iii)	Ensure that the bottles were clean/washed(& dried) /sterilised ✓	1	
	(iv)	<i>any two from:</i> Nature/name of sample ✓ Date / time ✓ Location ✓ Number of sample / collector ✓	2	Ignore quantity
	(v)	UV light does not remain in the water /chlorine remains in water ✓ With UV light pathogens may build up after treatment / chlorine will continue to destroy pathogens ✓	2	
	(vi)	<i>any two from:</i> (UV)frequency / wavelength ✓ Intensity of (UV) radiation ✓ Time duration ✓	2	Ignore reference to temperature /volume of water Accept strength/amount of (UV) light How much (UV) light used 1mark only

Questions			Answer	Marks	Guidance
2	(e)	(vii)	<p>Level 0 [0 marks] Candidate does not include sufficient valid points</p> <p>Level 1 (1–2 marks) Candidates present only an outline plan of the experiment. The text is generally legible but few scientific words are used accurately to ensure a clear meaning. The information covers three to four valid points.</p> <p>Level 2 (3–4 marks) Candidates present a basic plan of the experiment. The text is organised and scientific words are used accurately so that the meaning is clear. The information covers at least five to six valid points to produce a workable experiment.</p> <p>Level 3 (5–7 marks) Candidates present a detailed plan of the experiment. The text is organised, the scientific words are used accurately and the meaning is clear. The information covers at least seven valid points to produce both experimental and processing of results</p>	7	<p>Valid points</p> <ul style="list-style-type: none"> • risk assessment/use of PPE • weigh • evaporating basin /dish • add water sample and reweigh • heat / 'evaporate off' • gentle heating near dryness / mentions problems of 'spitting' • cool • reweigh • heat to constant mass • mass of solid found • details of calculation shown
			Total	37	

Question			Answer	Marks	Guidance
3	(a)	(i)	<i>any one from:</i> Remove diseased leaves / animals / insects ✓ Label (origin/type) ✓	1	
		(ii)	Wash / clean them ✓	1	Ignore wet Ignore dry
		(iii)	Ensure that the machine has a guard / safety cut-off ✓	1	Ignore wearing gloves/goggles
			Do not touch any part of the moving machinery/care not to trap body parts ✓	1	
		(iv)	(Thoroughly) cleaned (to remove traces of the previous sample) ✓	1	Ignore wash/wet/sterilised
		(v)	6.0 / 6 ✓	1	
		(vi)	<i>any two from:</i> The students' fibres were not completely dry ✓ The plant contained material other than leaves ✓ Different plant variety/leaf type used ✓ Age of plant ✓ Different climatic conditions ✓	2	Ignore separating techniques Ignore errors in method or calculation Ignore different sized leaves
(b)	(i)	(vii)	<i>any one from:</i> Fuel/bio-fuel/methane ✓ Alcohol ✓ Fertiliser / compost ✓ Animal feed ✓	1	
		(i)	Which (chemical) bonds / functional groups are present ✓	1	Ignore reference to strength of bond
		(ii)	As a control / so that the results can be compared ✓	1	

Question			Answer	Marks	Guidance
3	(b)	(iii)	<p>any one from:</p> <p>Time in the water</p> <p>Amount or concentration of waterproofing material (used on the rope) ✓</p> <p>Temperature of water ✓</p> <p>Identical / similar rope samples ✓</p>	1	
	(c)	(i)	<p>Correct substitution of numbers into the equation</p> $v = (1 + \frac{2.000}{0.200} \times \sqrt{2 \times 9.8 \times 0.080}) / (1 + 10 \times \sqrt{1.568})$ $/ (1 + 10 \times 1.252) \quad \checkmark$ <p>13.5(2) ✓</p>	1 1	Allow ecf in calculation
		(ii)	<p>Attach a marker pen to the pendulum and attach a white screen behind it for the pen to mark on ✓</p>	1	
		(iii)	<p>Keep v constant and use a smaller value of M/ballistic pendulum ✓</p> <p>AND</p> <p>Reason for referring to equation ✓</p> <p>OR</p> <p>Increase v and keep M/ballistic pendulum constant ✓</p> <p>AND</p> <p>Reason for referring to equation ✓</p>	2	
Total				17	

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