

GCE

Applied Science

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

Advanced GCE

Mark Scheme for June 2017

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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.

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These are the annotations, (including abbreviations), including those used in scoris, which are used when marking

| Annotation | Meaning |
|---------------------|--|
| DO NOT ALLOW | 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 |
| — | Underlined words must be present in answer to score a mark |
| ECF | Error carried forward |
| AW | Alternative wording |
| ORA | Or reverse argument |

| Question | | | Gd | Answer/Indicative content | Mark | Additional Guidance |
|----------|-----|--------------------|---|---|--|--|
| 1 | a | i | E/EU | A stone/pit surrounded by soft fleshy material ✓ | 1 | Accept A fruit with a (large) stone Accept nut / seed in place of stone /pit |
| | | ii | E/EU | eg Date, cherry, walnut, nectarine, avocado ✓ | 1 | Accept pistachio Do not accept grape |
| | b | i | E/EU | Eliminates dangers of falling from trees / more efficient / (some) trees are tall and the monkeys are (better) climbers ✓ | 1 | Accept Easy, efficient, quick (needs qualifying), effective, safer, cost effective. 'Safe' needs qualifying, |
| | | ii | E/EU | To obtain a representative sample / a variety of samples / comparison (needs qualifying) ✓ | 1 | Accept Amount of coir |
| | b | iii | C/D | By a large difference in size / colour / weight ✓ | 1 | |
| | c | | E/EU | 625mg / 0.625g ✓ | 1 | The correct unit must be given |
| | d | i | A/B | A pH of 5.5 is still acid, solutions with a pH of less than 7 are acidic ✓ | 1 | Allow reverse answer – alkaline solutions have a pH greater than 7. |
| | | ii | C/D | Adding an acid / named acid ✓ | 1 | |
| | e | i | C/D | 1.010(4) / 1.0 / 1.01 / ✓ | 1 | Do not accept 1 Ignore any fourth decimal place |
| | | ii | A/B | Plot a graph of density (y axis) against percentage of sugar ✓ | 1 | The answer must be detailed, not just 'plot a graph' |
| f | i | E/EU | So that it can be repeated / share the result with others / compared / valid (needs qualification) ✓ | 1 | | |
| | ii | C/D | (Washed and) dried ✓ | 1 | Do not accept sterilised by itself | |
| f | iii | E/EU C/D A/B | Mass of water = 23.2819g ✓ and Mass of coconut water = 23.4682g ✓ (Relative) density = 1.0080 (g cm ⁻³) ✓ | 3 | | |
| g | i | E/EU C/D | Mass of water = Mass of white flesh before drying – Mass of white flesh after drying ✓ 86.(3)g ✓ | 2 | Accept 93.25 (g) for one mark | |
| | ii | C/D A/B | Incomplete drying ✓ Unripe / overripe coconut ✓ | 2 | Accept coconuts are from different trees / coconuts are different types Do not accept coconuts are from different areas | |
| h | | C/D C/D | 29.7 x 100 / 33.5 (= 88.656) ✓ 88.7 ✓ | 2 | ecf | |
| | i | E/EU C/D | 6.68kg copra every year ✓ Volume of coconut oil / year = 2.75 (dm ³) | 2 | ecf Accept 2.7 (dm ³) | |

| | | | | | |
|---|---|-----|---|---|---|
| 1 | j | i | <p>E/EU E/EU C/D C/D A/B A/B</p> <p>[0 marks] Candidate has not provided a description or a diagram that would be suitable for distillation.</p> <p>[1-2 marks] Candidate includes a basic account and / or a drawing of the process but has not ensured that the apparatus is closed at the distillation end / or has drawn a completely closed system.</p> <p>[3-4 marks] Candidate includes a basic account and a drawing of the process but has omitted the correct position of the thermometer and / or has not considered how to reduce the risks of a fire.</p> <p>[5 marks] Candidate provides a detailed description of the process and a drawing that shows the assembly of the apparatus required for simple distillation but omits the correct position of the thermometer but has considered some steps to ensure a low risk of fire.</p> <p>[6 marks] Candidate provides a complete description of the process and a drawing that shows the correct position of the thermometer and has taken most steps to reduce the chance of a fire.</p> | 6 | <p><i>Valid steps</i></p> <ul style="list-style-type: none"> • Closed system at distillation end • Suitable method of heating – hot water bath / electrical heating • Use of anti-bumping granules • Use of a condenser • Condenser has water input at the bottom and output at the top • Open system at collection end • Suitable vessel for receiver (not a beaker) • Use of cotton wool to prevent escape of flammable fumes • Appropriate labelling • Correct position of thermometer |
| | j | ii | <p>C/D A/B</p> <p>No more drops of hexane distil over / stops bubbling / stops boiling ✓ The reading on the thermometer changes ✓</p> | 2 | |
| | j | iii | <p>A/B</p> <p>The distillation flask could have two necks, with a separating funnel in one of the necks containing more liquid to be distilled ✓</p> | 1 | |
| | j | iv | <p>C/D</p> <p>70.3(%) ✓</p> | 1 | Answer without working gains full credit |
| | j | v | <p>A/B A/B</p> <p>$100 = (\text{density} - 0.660/0.239) \times 100$ ✓ $0.899 \text{ (g cm}^{-3}\text{)} \checkmark$</p> | 2 | |

| | | | | | |
|--|----------|--|--------------|--|--|
| | | | | | |
| | k | | E/EU | HPLC / high performance liquid chromatography / high pressure liquid chromatography / column chromatography or paper chromatography or TLC and a locating agent ✓ | 1 Accept gas chromatography / gas-liquid chromatography / GC / GLC Do not accept just 'chromatography' |
| | | | Total | 36 | |

| Question | | | Gd | Answer /indicative content | Marks | Additional Guidance |
|----------|---|-----|-----------------------------|---|-------|--|
| 2 | a | i | C/D | $\text{H}_3\text{C} - \text{CH} = \text{CH}_2$ | 1 | The answer must be unambiguous and must show the double bond between the two carbon atoms. |
| | a | ii | C/D C/D | Advantage - use lower pressures / it is a gas phase method (and therefore easier for the separation of products) ✓ Disadvantage – it needs hydrogen as an additional reactant ✓ | 2 | |
| | a | iii | E/EU | The process needs high pressures ✓ | 1 | Ignore references to temperature |
| | b | i | A/B | The higher the stretching rate, the smaller the maximum extension of the polythene strip (until breakage occurs) / ORA ✓ | 1 | |
| | c | | E/EU | Urea-formaldehyde is a thermosetting plastic (and cannot be resoftened once it has hardened / set) ✓ | 1 | |
| | d | i | E/EU | Risk assessment ✓ | 1 | Do not accept only PPE |
| | d | ii | C/D A/B | Any TWO from Better stirring / slower addition / hotter water / leave to stand for longer / add more borax ✓ ✓ | 2 | |
| | d | iii | E/EU E/EU E/EU C/D | Basic idea of a force being used to separate the two pieces of wood ✓ Clamp the top piece of wood in a stand ✓ Method of changing the force applied ✓ The one that needs the most weight to separate the wood pieces is the strongest glue ✓ | 4 | |
| | e | i | C/D | To ensure proper mixing / remove trapped air / to make it homogeneous ✓ | 1 | One from list. |
| | e | ii | E/EU | A process of linking the chains together (crosswise) / Chemical connection made between polymer chains ✓ | 1 | The use of the term 'molecule' needs to be qualified |
| | e | iii | A/B | Add an alkali / named alkali / correct formula of alkali / neutralise the acid | 1 | Accept adding more borax Ignore add more PVA glue |

| Question | | | Gd | Answer /indicative content | Marks | Additional Guidance |
|----------|---|-----|------------|--|-----------|---|
| 2 | f | i | E/EU | Ensure that it clean / not cracked / apparatus connected properly / firmly clamped ✓ | 1 | |
| 2 | f | ii | E/EU | To prevent fires ✓ | 1 | Accept to allow (some) gas to escape / to prevent pressure build up |
| 2 | f | iii | C/D | Not heated strongly enough – stronger heating needed ✓ | 1 | Accept by-products form for one mark |
| | | | A/B | Loss of monomer by evaporation – longer distillation tube / collect in ice water ✓ | 1 | |
| | f | iv | E/EU | It gives the (relative) molecular mass of the compound / monomer / the (relative) molecular mass is 100 ✓ | 1 | |
| | g | i | E/EU | Down the (fume cupboard) sink ✓ | 1 | |
| | g | ii | E/EU | Infrared absorption spectroscopy ✓ | 1 | Accept infrared spectrometry / IR |
| | g | iii | E/EU | Use a sieve / fine mesh / muslin gauze ✓ | 1 | |
| | h | i | C/D | 0.50 is equivalent to 0.35 mg dm ⁻³ , this represents 5%✓ | 1 | Allow inclusive answers 0.30 to 0.40 mg dm ⁻³ Accept 0.35 on answer line for one mark |
| | | | A/B | Originally 20 x 0.35 = 7.00 mg dm ⁻³ ✓ | 1 | |
| | h | ii | C/D A/B | Concentration = 0.65 mg dm ⁻³ ✓ The graph is no longer a straight line / linear / curve (so that emission divided by concentration is not constant / emission not proportional to concentration) ✓ | 1 1 | Allow inclusive readings 0.65 to 0.70 mg dm ⁻³ |
| | | | | Total | 28 | |

| Question | Gd | Expected Answers | Marks | Additional Guidance |
|----------|---------|--|-------|---|
| 3 | a i | E/EU Ease of accessibility / health and safety considerations ✓ | 1 | Easier needs qualifying |
| | a ii | E/EU Safety glasses – to prevent debris entering the eyes ✓ Gloves – The material may be toxic / to prevent material entering the skin/ hand ✓ | 1 | Both responses needed for the mark |
| | a lii | A/B They have been exposed to the weather for a long time (and relatively short term storage will not alter them) ✓ | 1 | |
| | a iv | C/D Enough to carry out repeat tests / difficult to extract enough copper from small samples ✓ | 1 | |
| | a v | E/EU Any TWO from Date or time / Name of collector / Identity of the sample / Mass / Storage instructions / Sample number / Location / Hazard label ✓✓ | 2 | |
| | a vi | E/EU To ensure that they were clean (and dry) for their next use ✓ | 1 | Ignore references to sterilise Accept references to (cross)contamination |
| | a vii | C/D To remove dust and dirt / impurities that were not part of the sample ✓ | 1 | |
| | a vii i | E/EU E/EU C/D Any THREE from Ease of the method Availability of equipment / instruments Accuracy of the method Safety of the method How much material was needed Cost of materials if qualified Cost of the method Time taken Familiarisation with the method Energy considerations ✓✓✓ | 3 | Ignore references to environmental considerations |

| Question | | | Gd | Expected Answers | Marks | Additional Guidance | |
|----------|---|----|--|--|---|--|-----------------------------|
| 3 | a | ix | E/EU E/EU C/D C/D A/B A/B | <p>[0 marks] Candidate has not described a suitable experiment.</p> <p>[1-2 marks] Candidate describes a basic account of the experiment but has not used a suitable container / crucible.</p> <p>[3-4 marks] Candidate describes a workable experiment with appropriate heating. The use of a fume cupboard has not been mentioned.</p> <p>[5 marks] Candidate describes a sound workable experiment carried out in a fume cupboard but has not allowed the sample to cool or described the use of tongs to handle hot samples.</p> <p>[6 marks] Candidate describes a sound experiment with all the necessary details included.</p> | 6 | <p><i>Valid steps</i></p> <ul style="list-style-type: none"> • Crushes sample • Uses heat proof mat • Uses tripod and pipe clay triangle • Use of a Bunsen burner / suitable electric heater • Use of a crucible • Heats gently and then more strongly • Heats for the appropriate amount of time • Use of a fume cupboard • Use of tongs • Allows to cool | |
| | | b | i | E/EU E/EU A/B | <p>Experiment 5 has not been carried out correctly ✓</p> <p>The product is the wrong colour / green-grey (rather than black) ✓</p> <p>The mass of the product is too high, (it should only just be above experiment 3 and less than experiment 2) ✓</p> | 1 1 1 | A comparison is needed here |
| | | b | ii | A/B | The sample has not been heated strongly enough / to a high enough temperature ✓ | 1 | |

| | | | | | | |
|--|----------|------------|--------------------------|---|-----------|--|
| | b | iii | C/D A/B | Mass lost is 2.98g and the percentage mass lost is 27.2 / mass remaining is 7.97 g and the percentage remaining is 72.8 ✓ This is close to the value for pure malachite (and therefore the sample is almost pure malachite) ✓ | 2 | Allow ECF |
| | b | iv | A/B | If there is / are no copper (ions) present then the solution will not be blue and no absorption will occur ✓ | 1 | |
| | b | v | C/D C/D | 0.48 is equivalent to 2.60g of copper (in 100 cm ³ of solution). % Copper in malachite sample = $2.60 \times 100 / 4.35 = 59.8$ ✓ | 1 1 | Allow an inclusive range from 2.55-2.60 Allow ecf |
| | | | | Total | 26 | |

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