

Mark Scheme (Results)

June 2010

GCE

GCE Chemistry (6CH08/01)

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Summer 2010

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| Question Number | Acceptable Answers | Reject | Mark |
|-----------------|---|---|------|
| 1 (a) | Compound contains a transition metal (ion) / Compound contains chromate(VI) / CrO_4^{2-} Allow any yellow salt (name or correct formula) Allow 'transition element / metal (present)' Ignore d block Ignore any cation included | Dichromate oxides Cr^{6+} | 1 |

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|-----------------|---------------------------------------|-------------|------|
| 1 (b) | Sodium (ions) present / Na^+ | Na Anion | 1 |

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|-----------------|--|-------------------------------------|------|
| 1 (c) | dichromate(VI) / dichromate / $\text{Cr}_2\text{O}_7^{2-}$ / $2\text{CrO}_4^{2-} + 2\text{H}^+ \rightarrow \text{Cr}_2\text{O}_7^{2-} + \text{H}_2\text{O}$ Ignore references to the other ions present (Na^+ , 2H^+ , SO_4^{2-}) No TE | Cr(VI) Cr^{6+} | 1 |

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|-----------------|---|------------------|------|
| 1 (d) | $\text{Cr}_2\text{O}_7^{2-}$ / dichromate(VI)(allow Cr(VI)) is reduced (by the ethanol) / the ethanol is oxidized (by $\text{Cr}_2\text{O}_7^{2-}$ (allow Cr(VI))) / the ethanol forms ethanal / ethanoic acid (1) Cr^{3+} / chromium(III) / Cr(III) formed (1) Allow fully balanced ionic half-equation (2) No TE | Cr^{6+} | 2 |

| Question Number | Acceptable Answers | Reject | Mark |
|-----------------|---|--|------|
| 1 (e) | Precipitate chromium(III) hydroxide / Cr(OH)_3 / $\text{Cr(OH)}_3(\text{H}_2\text{O})_3$ (1) Solution chromate(III) / tetrahydroxochromate(III) / hexahydroxochromate(III) / Cr(OH)_4^- / Cr(OH)_6^{3-} (1) Allow hydrated forms / CrO_2^- / CrO_3^{3-} Allow chromium hydroxide if Cr^{3+} Allow Cr(OH)_5^{2-} Ignore number of water ligands | Cr_2O_3 Cr^{3+} $\text{Cr}^{3+}(\text{aq})$ | 2 |

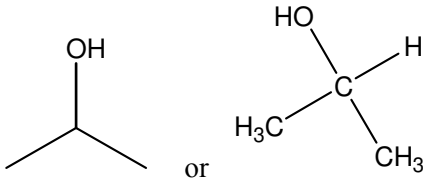
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|-----------------|---|------------------|------|
| 1 (f) | Pale blue ions $\text{Cr}^{2+} / \text{Cr}(\text{H}_2\text{O})_n^{2+}$ chromium(II) / Cr(II) (1) Role of zinc Reducing agent / Reduces / Reduction / providing electrons (1) | Cu^{2+} | 2 |

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|-----------------|---|--------|------|
| 1 (g) | Green ions $\text{Cr}^{3+} / \text{chromium(III)} / \text{Cr(III)}$ (1) Explanation The $\text{Cr}^{2+} / \text{chromium(II)} / \text{Cr(II)}$ (allow 'blue species') is oxidized by (oxygen in) the air (1) Ignore water ligands Allow oxidized by oxygen | | 2 |

| Question Number | Acceptable Answers | Reject | Mark |
|-----------------|--|--|------|
| 2 (a)(i) | OH / hydroxyl group present OR Compound could be an alcohol / OH or a carboxylic acid / COOH | Hydroxide / OH ⁻ alcohol / carboxylic acid alone | 1 |

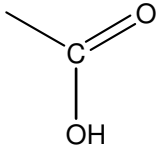
| Question Number | Acceptable Answers | Reject | Mark |
|-----------------|--|-------------------------------|------|
| 2 (a)(ii) | P is (an alcohol) not a carboxylic acid Allow P is an alcohol if in (a)(i) P is described as "an alcohol or a carboxylic acid" Ignore primary and/or secondary | Alcohol without three carbons | 1 |

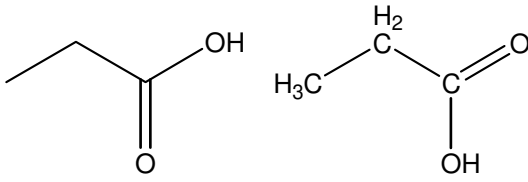
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|-----------------|--|--|------|
| 2 (a)(iii) | P contains the group CH ₃ CH(OH)- / P is a 2-ol Allow P is propan-2-ol / secondary alcohol | P is a methylketone / ethanol / methyl alcohol | 1 |

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|-----------------|--|------------------------|------|
| 2 (a)(iv) | P is propan-2-ol / CH ₃ CH(OH)CH ₃  No TE on earlier incorrect answer | Molecular formula only | 1 |

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|-----------------|--|---|------|
| 2 (a)(v) | Peak is caused by (CH ₃ CHOH) ⁺ / C ₂ H ₅ O ⁺ / CH ₂ CH ₂ OH ⁺ (1) stand alone (molecular ion (of propan-2-ol) will fragment by) loss of one CH ₃ group / CH ₃ [•] / CH ₃ radical (1) Second mark can be awarded only if ion has relative mass of 45 Allow the molecule fragments (instead of molecular ion) Allow equations with charge not balanced | Formula without positive charge Breaking C-C bond on its own CH ₃ ⁺ | 2 |

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|-----------------|--|---------------------------|------|
| 2 (b)(i) | Hydrogen chloride / HCl Allow hydrochloric acid / HCl(aq) | HCl and POCl ₃ | 1 |

| Question Number | Acceptable Answers | Reject | Mark |
|-----------------|---|-------------|------|
| 2 (b)(ii) | Q is a carboxylic acid / COOH /  Allow CO ₂ H / propanoic acid / carboxylic alone | Carboxylate | 1 |

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|-----------------|--|--------|------|
| 2 (b)(iii) | Q is propanoic acid / CH ₃ CH ₂ COOH / CH ₃ CH ₂ CO ₂ H / C ₂ H ₅ COOH  | | 1 |

| Question Number | Acceptable Answers | Reject | Mark |
|-----------------|--|--------------------|------|
| 3 (a) | $\text{Fe} + 2\text{H}^+ \rightarrow \text{Fe}^{2+} + \text{H}_2$ $\text{Fe} + 2\text{H}_3\text{O}^+ \rightarrow \text{Fe}^{2+} + \text{H}_2 + \text{H}_2\text{O}$ Ignore state symbols and correct sulfate formulae | Non ionic equation | 1 |

| Question Number | Acceptable Answers | Reject | Mark |
|-----------------|--|--|------|
| 3 (b) | Effervescence / fizzing stopped/no more bubbles of gas given off Allow no more gas given off | All iron dissolved Steamy fumes (for gas) | 1 |

| Question Number | Acceptable Answers | Mark | | | | | | | | | | | | | | |
|-------------------------|---|-------------------------|-------|-------|-------|-------|-------|-----|----------------------|---|---|---|---|---|-----|---|
| 3 (c)(i) | <table border="1"> <tbody> <tr> <td>Titre / cm³</td> <td>23.35</td> <td>23.05</td> <td>22.70</td> <td>23.00</td> <td>22.95</td> <td>(1)</td> </tr> <tr> <td>Titres used (✓ or ✗)</td> <td>✗</td> <td>✓</td> <td>✗</td> <td>✓</td> <td>✓</td> <td>(1)</td> </tr> </tbody> </table> Ignore omission of trailing zeros | Titre / cm ³ | 23.35 | 23.05 | 22.70 | 23.00 | 22.95 | (1) | Titres used (✓ or ✗) | ✗ | ✓ | ✗ | ✓ | ✓ | (1) | 2 |
| Titre / cm ³ | 23.35 | 23.05 | 22.70 | 23.00 | 22.95 | (1) | | | | | | | | | | |
| Titres used (✓ or ✗) | ✗ | ✓ | ✗ | ✓ | ✓ | (1) | | | | | | | | | | |

| Question Number | Acceptable Answers | Reject | Mark |
|-----------------|---|--------|------|
| 3 (c)(ii) | $((23.05 + 23.00 + 22.95) \div 3) = 23.00 \text{ (cm}^3\text{)}$ Allow 23 / 23.0 TE from (c)(i) | | 1 |

| Question Number | Acceptable Answers | Reject | Mark |
|-----------------|--|-----------|------|
| 3 (c)(iii) | <p>(A) Moles MnO_4^- (in titre) = $23.00 \times 10^{-3} \times .022$ = 5.06×10^{-4} (1)</p> <p>(B) Moles Fe^{2+} in 250 cm^3 = $10 \times 5 \times$ Answer in (A) (= 0.0253) (1)</p> <p>(C) Mass of Fe = Answer in B $\times 55.8$ (= $0.0253 \times 55.8 = 1.41$ (g)) (1)</p> <p>(D) % iron = $100 \times$ answer in C $\div 1.48$ (= 95.4 %) (1)</p> <p>Ignore SF except 1 SF Ignore correct intermediate rounding of calculated values Allow 56 for A_r of iron (95.7 %) Allow TE from (c)(i) and (ii) Correct answers with no working score full marks</p> | % > 100 % | 4 |

| Question Number | Acceptable Answers | Reject | Mark |
|-----------------|---|--|------|
| 3 (d) | <p>Iron(II) ions: Pipette and sulfuric acid: measuring cylinder (1) both needed for the mark</p> <p>An exact volume of iron(II) ion solution is needed but only an approximate volume of /excess sulfuric acid (1) The second mark may be awarded if a burette and measuring cylinder are given</p> <p>Allow any recognisable spelling of pipette, eg pipet</p> | Just pipette more accurate than measuring cylinder | 2 |

| Question Number | Acceptable Answers | Reject | Mark |
|-----------------|---|-----------------------------|------|
| 3 (e) | To ensure that the manganate(VII) ions were fully reduced (to manganese(II)) Or To ensure MnO ₂ is not precipitated Allow Large number of H ⁺ ions required in (titration) equation 8 moles H ⁺ ions required (per mol Fe ²⁺ in titration) To prevent oxidation of Fe ²⁺ by (oxygen in) air or by water To prevent hydrolysis | To ensure complete reaction | 1 |

| Question Number | Acceptable Answers | Reject | Mark |
|-----------------|---|--------------------------------|------|
| 3 (f) | First permanent pink colour Allow (colourless) solution turns pink | Purple to pink Turns purple | 1 |

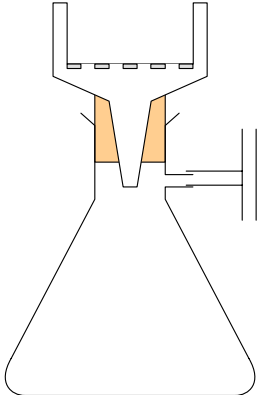
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|-----------------|---|---|------|
| 3 (g) | HCl / Cl ⁻ will be oxidized (to chlorine) by the manganate(VII) OR HCl / Cl ⁻ will react with manganate(VII) to form chlorine (1) So the reaction of the iron(II) ions with manganate(VII) will not be quantitative/titre will be too high (1) Allow permanganate / manganate (for manganate(VII)) Ignore references to toxicity of chlorine | HCl / Cl ⁻ strong reducing agent / oxidised by Fe ²⁺ Just chlorine formed Titration values inaccurate | 2 |

| Question Number | Acceptable Answers | Reject | Mark |
|-----------------|---|--------|------|
| 4 (a) | <p>Amount of phenylamine = $9/93 / 0.0968$ (mol) (1) = amount of ethanoic anhydride</p> <p>Mass ethanoic anhydride = $102 \times 9/93 = 9.87$ (g) (1)</p> <p>Ignore SF except 1 SF Correct answer with no working scores full marks Mr values reversed scores max 1 only if a mole calculation is clearly shown</p> | | 2 |

| Question Number | Acceptable Answers | Reject | Mark |
|-----------------|---|--|------|
| 4 (b)(i) | To ensure that all the phenylamine reacts | <p>So ethanoic anhydride is in excess</p> <p>To ensure complete reaction</p> | 1 |

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|-----------------|--|--------|------|
| 4 (b)(ii) | <p>Reaction is exothermic / produces heat</p> <p>Allow reaction is vigorous so that the temperature does not increase (too much) Ignore references to the reaction being violent, dangerous, explosive etc</p> | | 1 |

| Question Number | Acceptable Answers | Reject | Mark |
|-----------------|--|--------|------|
| 4 (b)(iii) | <p>Mistake: The condenser water flow is wrong way round so air may be trapped/jacket will not be full of water (1) Allow cooling not so effective / flammable liquid might escape Correction Reverse the flow of water (1)</p> <p>Mistake: Flammable liquids are being heated with a Bunsen/naked flame (1) Correction so the Bunsen burner should be replaced by a hot plate (allow water bath) (1) OR Mistake: Heating with a Bunsen too strong (so glass may crack) (1) Correction Use micro-burner/gauze (1)</p> | | 4 |

| Question Number | Acceptable Answers | Reject | Mark |
|-----------------|---|--------|------|
| 4 (b)(iv) |  <p>Funnel (conical allowed) with grid / line / horizontal filter paper (1) Side-arm conical flask (with valve or connection to a pump) (1)</p> <p>Reduced pressure achieved by: Flow of water through the pump/valve/can be shown in diagram (reduces pressure in the flask) (1)</p> <p>Allow using a (vacuum / suction) pump connected to side-arm (connection may be shown in diagram)(1)</p> | | 3 |

| Question Number | Acceptable Answers | Reject | Mark |
|-----------------|---|--|------|
| 4 (c) | <p>Mass of N-phenylethanamide if 100% yield = $135 \times 9/93$ (1) = 13.06 g</p> <p>Yield = $100 \times 7.49/13.06$ = 57.3 % (1)</p> <p>Alternatively Moles phenylamine = $9/93$ = 0.0968 Moles N-phenylethanamide = $7.49/135$ = 0.0555 (1) Yield = $100 \times .0555/.0968$ = 57.3 % (1)</p> <p>Correct answer with no working scores (2)</p> <p>Ignore sf except 1 sf Yields greater than 100 % score zero</p> | <p>$100 \times 7.49/9$ = 83.2 % (0)</p> | 2 |

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|-----------------|--|--------|------|
| 4 (d) | Some of the <i>N</i> -phenylethanamide will remain on the filter paper/will be deposited on the sides of the glassware/in solution (and will not be recovered by filtration) | | 1 |

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|-----------------|--|--------|------|
| 4 (e) | The product was not dry / was damp / water (still) present Ignore reference to impurities present | | 1 |

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