

Acids, Alkalis and Titrations

Mark Scheme 1

| | |
|-------------------|-------------------------------|
| Level | IGCSE(9-1) |
| Subject | Chemistry |
| Exam Board | Edexcel IGCSE |
| Module | Double Award (Paper 1C) |
| Topic | Inorganic Chemistry |
| Sub-Topic | Acids, Alkalis and Titrations |
| Booklet | Mark Scheme 1 |

Time Allowed: 59 minutes

Score: /49

Percentage: /100

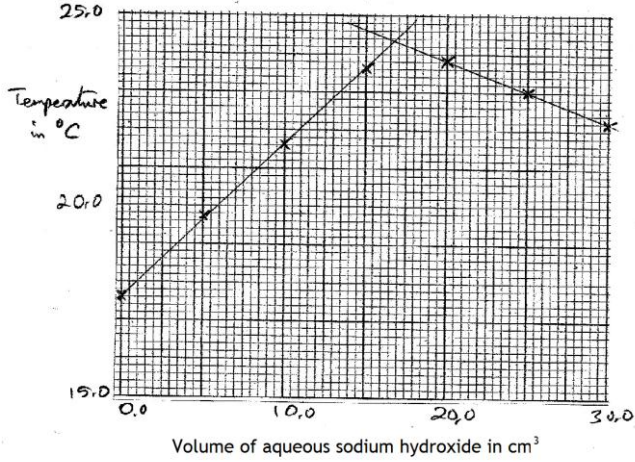
Grade Boundaries:

| | | | | | | | | |
|------|-----|-----|-----|-----|-----|-----|-----|-----|
| 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| >90% | 80% | 70% | 60% | 50% | 40% | 30% | 20% | 10% |

| Question number | Answer | Notes | Marks |
|-----------------|--|---|-------|
| 1 (a) | <p>M1 & M2 all points plotted correctly, to the nearest gridline</p> <p>M3 best fit straight line through first 3 points drawn with the aid of a ruler</p> <p>M4 best fit straight line through last 6 points drawn with the aid of a ruler</p> | <p>deduct one mark for each incorrectly plotted point</p> <p>ALLOW M3 and M4 even if lines do not intersect</p> | 4 |
| (b) (i) | value correctly read ($\pm 0.25 \text{ cm}^3$) to nearest gridline from candidate's graph (12.5 cm^3 if correctly drawn) | Do not award these marks if lines do not cross | 1 |
| (ii) | value correctly read ($\pm 0.1^\circ\text{C}$) to nearest gridline from candidate's graph (10 $^\circ\text{C}$ if correctly drawn) | | 1 |

| Question number | Answer | Notes | Marks |
|-----------------|---|---|-------|
| 1 (c) | <p>M1 (water) – to remove/flush out solution (X)</p> <p>M2 (solution Y) – to remove the water / avoid diluting solution Y</p> | <p>ACCEPT so that the only liquid in the burette is solution Y</p> <p>IGNORE to remove impurities for both M1 and M2</p> | 2 |
| (d) | <p>solution Y is less concentrated (than solution X)</p> <p>OR</p> <p>solution (in Experiment 2) is less concentrated</p> | <p>IGNORE references to reactivity</p> <p>ALLOW weaker / less strong instead of less concentrated</p> <p>IGNORE refs to more/less acidic</p> <p>ACCEPT reverse argument</p> | 1 |

| Question number | Answer | Notes | Marks |
|-----------------|--|--|-------|
| 2 a | (polystyrene is an) insulator / prevents/reduces heat loss | Accept is a poor conductor (of heat) Accept keeps heat in Accept doesn't conduct (heat) as well (as glass) Ignore does not heat up Ignore references to accuracy/safety/breakages Reject to keep the temperature constant | 1 |
| b | M1 (after) 19.4(0) M2 (before) 15.9(0) M3 3.5(0) | If readings are correct but in the wrong order, award 1 mark for M1 and M2 M3 CQ on (M1 – M2) | 3 |
| | | | |

| | | | |
|-----|---|--|---|
| c i |  | <p>M1+M2 all seven points plotted to nearest gridline Deduct 1 mark for each error</p> <p>M3 best fit straight line through first 4 points drawn with aid of a ruler</p> <p>M4 best fit straight line through last 3 points drawn with aid of a ruler</p> <p>No penalty if lines do not cross or if the two straight lines are joined by a curve</p> | 4 |
| ii | <p>M1 (temperature)</p> <p>M2 (volume)</p> | <p>values correctly read from candidate's graph Do not award these marks if lines do not cross or if curve drawn</p> <p>temperature to ± 0.1 °C</p> <p>volume to ± 0.25 cm³ If values correct but in wrong places allow 1/2</p> | 2 |

| Question number | Answer | Notes | Marks |
|-----------------|--|---|-------|
| 2 d | M1 mass = 47.7 (g) M2 temperature change = 5.8 (°C) M3 (47.7 × 4.2 × 5.8 =) 1200 (J) | Accept 1160, 1162, 1161.97, 1161.972 Reject 1161.9 M3 CQ on M1 and M2 answer correct to two or more sig fig Correct final answer with or without working scores 3 marks Accept answer in kJ if unit included Ignore sign | 3 |

| Question number | Answer | Notes | Marks |
|-----------------|--|--|-------|
| 3 a | pipette | | 1 |
| b | B (pink to colourless) | | 1 |
| c | <p>correct reference to one of these:</p> <ul style="list-style-type: none"> number of colours end point/colour change (accept neutral point) | <p>Examples: phenolphthalein has <u>only</u> two colours / only one colour change / negative statement eg does not have a range of colours / UI has several colours/more than one colour change</p> <p>sharp / definite / sudden / quick / not gradual / needs only one drop / converse for UI</p> | 1 |
| d | <p>M1 (after) 24.15 (only this answer)</p> <p>M2 (before) 2.30 (only this answer)</p> <p>M3 (added) 21.85</p> | <p>Award 1 mark for both burette readings correct but in wrong order</p> <p>CQ on after and before readings</p> <p>In M3, penalise answer not to 2 dp unless penalty already applied in M2</p> | 3 |

| Question number | Answer | Notes | Marks |
|-----------------|--|--|-------|
| 3 e i | ticks in columns 2 and 4 | | 1 |
| ii | M1 $\frac{26.30 + 26.40}{2}$ M2 26.35 | CQ on ticked results If no results ticked, award M1 only if columns 2 and 4 averaged If only one result ticked, no marks can be awarded in (e) CQ on results averaged Answer must be to 2 dp M2 subsumes M1 | 2 |

| | | | |
|---|---|--|-----------------------|
| f | | <p>In part (f):</p> <ul style="list-style-type: none"> • accept values in standard form, eg 4.5×10^{-3} • do not accept unevaluated fractions, eg $0.0045 \div 3$ in (ii) • do not penalise too many sig figs • correct answer without working scores 2 marks in (i) and (iii) • penalise missing use of 1000 in (i) and (iii) once only | |
| | <p>i M1 $\frac{0.18(0) \times 25(.0)}{1000}$</p> <p>M2 0.0045(0)</p> | <p>Award 1 mark for 4.5</p> | 2 |
| | ii (0.0045 \div 3 =) 0.0015(0) | CQ on answer to (i) | 1 |
| | iii M1 $\frac{0.0015 \times 1000}{28.3(0)}$ | CQ on answer to (ii) | 2 |
| | M2 0.053(0) | <p>Award 1 mark out of 2 for 0.000053</p> <p>Award 1 mark out of 2 for 0.05</p> | |
| | | <p>If correct final answer obtained by omission of 1000 in both (i) and (iii), award marks of 1,1, 2</p> | |
| | | | Total 14 marks |

| Question number | Answer | Notes | Marks | | | | | | | | | | | | | | | |
|--|--|---|--------|-------|---|---|--|-------|-------|-------|-------|----------------------------------|--|---|--|---|--|---|
| 4 (a) | <table border="1"> <tr> <td>Titration number</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> </tr> <tr> <td>Volume of KMnO_4 solution added / cm^3</td> <td>22.80</td> <td>22.10</td> <td>22.50</td> <td>22.20</td> </tr> <tr> <td>Concordant titration results (✓)</td> <td></td> <td>✓</td> <td></td> <td>✓</td> </tr> </table> | Titration number | 1 | 2 | 3 | 4 | Volume of KMnO_4 solution added / cm^3 | 22.80 | 22.10 | 22.50 | 22.20 | Concordant titration results (✓) | | ✓ | | ✓ | | 1 |
| Titration number | 1 | 2 | 3 | 4 | | | | | | | | | | | | | | |
| Volume of KMnO_4 solution added / cm^3 | 22.80 | 22.10 | 22.50 | 22.20 | | | | | | | | | | | | | | |
| Concordant titration results (✓) | | ✓ | | ✓ | | | | | | | | | | | | | | |
| (b) | <p>M1 $\frac{22.1(0) + 22.2(0)}{2}$</p> <p>M2 – 22.15 (cm^3)</p> | <p>CSQ on boxes ticked in (a)</p> <p>If no results ticked, award M1 only if columns 2 and 4 averaged</p> <p>If only one result ticked, no marks can be awarded in (b)</p> <p>CSQ on results averaged, but the results must be taken from the table</p> <p>Answer must be to 2dp</p> <p>correct answer with no working scores 2</p> | 1 1 | | | | | | | | | | | | | | | |
| (c) | D (pipette) | | 1 | | | | | | | | | | | | | | | |

| Question number | Answer | Notes | Marks |
|-----------------|---|---------------------------------|-------|
| 4 (d) (i) | <p>M1 $\frac{20(.00) \times 0.02(00)}{1000}$</p> <p>-</p> <p>M2 - $4(.00) \times 10^{-4}$ (mol)</p> | | 1 |
| (ii) | 5 x M2 from (i) / $4(.00) \times 10^{-4} \times 5 / 2(.00) \times 10^{-3}$ | 0.4(00) scores 1 | 1 |
| (iii) | 10 x answer to (ii) / $2(.00) \times 10^{-2}$ | | 1 |
| (iv) | answer to (iii) x 152 / $(2(.00) \times 10^{-2} \times 152) = 3.04$ (g) | | 1 |
| (e) (i) | $m(\text{H}_2\text{O}) = (24.2 - 15.2) = 9(.0)$ (g) | | 1 |
| (ii) | answer to (i) $\div 18$ / $n(\text{H}_2\text{O}) = (9.00 \div 18) = 0.5(0)$ (mol) | | 1 |
| (iii) | $n(\text{FeSO}_4) = (15.2 \div 152) = 0.1(00)$ (mol) | | 1 |
| (iv) | x = answer to (ii) \div answer to (iii) / 5 | must be given as a whole number | 1 |