# Unit Test 单元测验

A-Level Chemistry · Unit 27 Group 2

35 marks · 35 minutes

*Part 1 · Vocabulary answer key. Sections A and C are marked on exact spelling; Section B accepts any listed Chinese form.*

| Question | Answer | Marks |
|---|---|---|
| 1 | polarisation | 1 |
| 2 | order of reaction | 1 |
| 3 | rate constant | 1 |
| 4 | conjugate acid | 1 |
| 5 | half-equation | 1 |
| 6 | standard cell potential | 1 |
| 7 | mass spectrometry | 1 |
| 8 | molecular ion peak | 1 |
| 9 | 溶度积 | 1 |
| 10 | 重复单元 | 1 |





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| 5(a) | $MgC_2O_4 \rightarrow MgO + CO_2 + CO$ [1] |
| 5(b) | magnesium ethanedioate decomposes at lower T because $Mg^{2+}$ has smaller radius than $Ca^{2+}$ [1]<br>so anion is more polarised by $Mg^{2+}$ [1] |
| 5(c) | $(27.05 \div 1000) \times 0.02 = 5.41 \times 10^{-5}$ moles $MnO_4^-$ [1]<br>$5.41 \times 10^{-5} \times 5/2 = 1.3525 \times 10^{-4}$ moles $C_2O_4^{2-}$ [1]<br>0.00338 mol $dm^{-3}$ [1] |



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| 4(a) | strontium nitrate **AND** because of larger cationic radius [1]<br>$NO_3^-$ / nitrate **ion** / anion is less distorted / polarised<br>**OR**<br>N–O or N=O bond less weakened / distorted [1] |
| 4(b) | M1 magnesium oxide requires more water to dissolve **AND** because $Sr(OH)_2$ is more soluble [1]<br>M2 lattice and hydration energies less for $Sr(OH)_2$ [1]<br>M3 lattice energy is dominant factor / change in lattice energy is greater [1] |
| 4(c)(i) | 0.13 [1] |
| 4(c)(ii) | 26.7 $cm^3$ **must be 3SF** [1] |



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| 2(a) | **M1:** increases down the group<br>**M2:** radius / size of cation / $M^{2+}$ increases **OR** charge density of cation / $M^{2+}$ decreases<br>**M3:** less polarisation / less distortion of anion / $NO_3^-$ ion **OR** less weakening of NO bond |
| 2(b)(i) | $Pb(NO_3)_2 \rightarrow PbO + 2NO_2 + ½O_2$ |
| 2(b)(ii) | lead nitrate / $Pb(NO_3)_2$ would decompose more / easier<br>**AND** as $Pb^{2+}$ is smaller / $Pb^{2+}$ has larger charge density (so more polarising) |
| 2(c)(i) | $BaC_2O_4 \rightarrow BaO + CO_2 + CO$ **OR** $BaC_2O_4 \rightarrow BaO + 2CO + ½O_2$ |
| 2(c)(ii) | **M1:** [a] initial moles $MnO_4^- = 0.0200 \times 0.050 = 1.00 \times 10^{-3}$<br>[b] moles $Fe^{2+} = 0.050 \times 0.0304 = 1.52 \times 10^{-3}$<br>**M2:** [a] moles $MnO_4^-$ unreacted $= 1.52 \times 10^{-3} / 5 = 3.04 \times 10^{-4}$<br>[b] moles $MnO_4^-$ reacted $= 1.00 \times 10^{-3} - 3.04 \times 10^{-4} = 6.96 \times 10^{-4}$<br>**M3:** moles $C_2O_4^{2-}$ reacted $= 6.96 \times 10^{-4} \times 5/2 = 1.74 \times 10^{-3}$<br>**M4:** mass of $BaC_2O_4 = 225.3 \times 1.74 \times 10^{-3} = 0.392$ g<br>% Purity of $BaC_2O_4 = 100 \times 0.392/0.50 = 78.4$ |
| 2(d) | **M1:** $[OH^-] = 2 \times 0.12 = 0.24$ (mol $dm^{-3}$)<br>$[H^+] = 1 \times 10^{-14}/0.24 = 4.17 \times 10^{-14}$ / pOH = –log(0.24) **OR** 0.62<br>**M2:** pH = –log$[H^+]$ = 13.4 **OR** pH = 14 – 0.6 = 13.4 |