

Unit Test 单元测验

A-Level Chemistry · Unit 27 Group 2

35 marks · 35 minutes

Score 得分:

1 Vocabulary ____ / 10

2 Questions ____ / 25

Total ____ / 35

Part 1 · Vocabulary 词汇 (10 marks). Spelling must be exact in Sections A and C. A、C 部分拼写必须完全正确。

Section A · Chinese to English 中译英

Write the English word.

1. 极化[1]
2. 反应级数[1]
3. 速率常数[1]
4. 共轭酸[1]
5. 半反应方程式[1]
6. 标准电池电势[1]
7. 质谱[1]
8. 分子离子峰[1]

Section B · English to Chinese 英译中

Write the Chinese meaning.

9. solubility product[1]
10. repeat unit[1]

Part 2 · Exam questions 考试题 (25 marks, 3 questions) begins on the next page. Answer in the spaces provided. 第二部分从下页开始。

- 5 Some of the ionic compounds of Group 2 elements undergo thermal decomposition.

Thermal decomposition of solid anhydrous magnesium ethanedioate, MgC_2O_4 , occurs above 650°C . The products are magnesium oxide and a mixture of two different gases, one of which gives a white precipitate with saturated calcium hydroxide solution.

- (a) Complete the equation for the thermal decomposition of MgC_2O_4 .



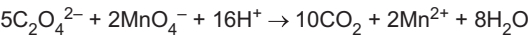
- (b) Suggest which of MgC_2O_4 or CaC_2O_4 undergoes thermal decomposition at a **lower** temperature. Explain your answer.

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.....

..... [2]

- (c) The ethanedioate ion is oxidised by acidified KMnO_4 .



An experiment is performed to find the solubility of MgC_2O_4 in water.

A 40.0 cm^3 sample of saturated aqueous MgC_2O_4 requires 27.05 cm^3 of $0.00200\text{ mol dm}^{-3}$ acidified KMnO_4 to oxidise all the $\text{C}_2\text{O}_4^{2-}$ ions.

Calculate the solubility, in mol dm^{-3} , of MgC_2O_4 in water. Show your working.

solubility = mol dm^{-3} [3]

[Total: 6]

4 Separate samples of 0.01 mol of magnesium nitrate and 0.01 mol of strontium nitrate are heated until completely decomposed to the metal oxide, nitrogen dioxide and oxygen.

- (a) State which of these two Group 2 nitrates requires the **higher** temperature before it begins to decompose. Explain your answer.

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..... [2]

- (b) After decomposition is complete the 0.01 mol sample of magnesium oxide is taken and increasing amounts of water are added to it, with stirring, until no solid remains.

This procedure is repeated with the 0.01 mol sample of strontium oxide.

Identify the sample to which most water must be added to cause all the solid to dissolve. Explain your answer by reference to the solubilities of the products formed when water is added to the oxides. You should refer to relevant energy terms in your answer.

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..... [3]

- (c) The nitrogen dioxide given off by the decomposition of 0.0100 mol of strontium nitrate is dissolved in water. The oxidising agent $\text{H}_2\text{O}_2(\text{aq})$ is then added to give 150.0 cm^3 of a solution in which nitric acid, HNO_3 , is the only nitrogen-containing product.

- (i) Calculate the concentration, in mol dm^{-3} , of HNO_3 in the 150.0 cm^3 of solution.

concentration = mol dm^{-3} [1]

- (ii) The HNO_3 present in 25.0 cm^3 of this solution is neutralised using $0.125\text{ mol dm}^{-3}\text{ NaOH}(\text{aq})$.

Calculate the minimum volume, in cm^3 , of $\text{NaOH}(\text{aq})$ needed. Give your answer to three significant figures.

volume = cm^3 [1]

[Total: 7]

- 2 (a) State and explain the trend observed in the thermal stability of the Group 2 nitrates.

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..... [3]

- (b) (i) Lead(II) nitrate, $\text{Pb}(\text{NO}_3)_2$, decomposes on heating in a similar manner to the Group 2 nitrates.

Write an equation for the decomposition of lead(II) nitrate.

..... [1]

- (ii) Suggest how the ease of decomposition of $\text{Pb}(\text{NO}_3)_2$ would compare to that of $\text{Ba}(\text{NO}_3)_2$. Explain your answer. You may find it useful to refer to the *Data Booklet*.

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..... [1]

- (c) (i) Barium ethanedioate, BaC_2O_4 , decomposes on heating to produce barium oxide and a mixture of two different gases.

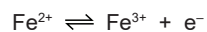
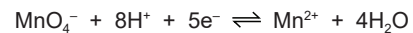
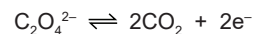
Construct an equation for the decomposition of barium ethanedioate.

..... [1]

- (ii) An impure sample of BaC_2O_4 , of mass 0.500 g, is added to 50.0 cm^3 of $0.0200\text{ mol dm}^{-3}$ acidified MnO_4^- (aq), an excess. A redox reaction takes place and all the BaC_2O_4 reacts.

The resulting solution, containing unreacted acidified MnO_4^- , is titrated with $0.0500\text{ mol dm}^{-3}$ Fe^{2+} (aq).

The end-point is reached when 30.40 cm^3 of $0.0500\text{ mol dm}^{-3}$ Fe^{2+} (aq) has been added.



Calculate the percentage by mass of BaC_2O_4 in the 0.500 g impure sample. Show your working.

[M_r : BaC_2O_4 , 225.3]

percentage by mass of BaC_2O_4 = [4]

- (d) Barium hydroxide, $\text{Ba}(\text{OH})_2$, is completely dissociated in aqueous solution.

Calculate the pH of 0.120 mol dm^{-3} $\text{Ba}(\text{OH})_2$ (aq) at 298 K.

pH = [2]

[Total: 12]

Working space 草稿区 — rough work here is not marked.