A' Level Chemistry
Year 1

Unit 7: Group II

Summer Examination Revision Pack

The questions in this pack should be attempted **AFTER** completing all other revision.

Grade Accelerator
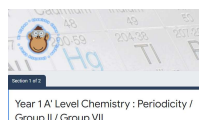*Recall Definitions*
Drawing Diagrams
Using Equations
Drawing Graphs

Quizlet Classes
Flashcard Based
Games
Tests & Quizzes
Keyword Spell Checker

Condensed Notes
Keywords & Definitions
Key Concepts
Application
Key Skills

Online Forms
Take Time to Answer
Use Paper & Calculator
Work It Out
Review Missed Marks

Year 1 A' Level Chemistry : Periodicity / Group II / Group VII

Use the 3 Wave Process when completing these revision packs.

333
- *Take the Test*
- *Use Your Notes*
- *Use the Mark Scheme*

1. Complete the questions without assistance
(Can't answer a question? Leave it and move on)
2. Use your notes to fill any gaps after step 1
3. Use the mark scheme to fill in any remaining gaps.

1. Having gaps after step 1 is normal, that's why we are doing revision!
2. If your notes don't help during step 2, they are not good enough!
(Change your note taking method and try to understand the problem)
3. If you don't understand why the mark scheme answer is correct, **see Andy.**

STOP If you struggle with the questions in the pack, **STOP!** and complete some more revision.

STOP If you come to a complete dead-end, **STOP!** and speak to **Andy** asap.

9

0 9 . 1 A student was given a powder made from a mixture of anhydrous barium chloride and anhydrous magnesium chloride. The student dissolved 1.056 g of the powder in water in a conical flask and added an excess of sulfuric acid. A white precipitate formed and was filtered off, washed and dried. The mass of this solid was 0.764 g.

Identify the white precipitate and calculate the percentage, by mass, of magnesium chloride in the powder.

[4 marks]

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Turn over for the next question

Question	Marking Guidance	Mark	Comments
09.1	Identifies precipitate as being $BaSO_4$ Moles of Barium sulfate = mass/Mr (= 0.764 / 233.4)	1	
	= 0.003273 moles	1	Allow conseq if Mr $BaSO_4$ or $BaCl_2$ incorrect
	Mass of Barium chloride = 208.3 x 0.003273 = 0.6818 g	1	
	Percentage of Magnesium chloride $= \dfrac{1.056 - 0.6818}{1.056} \times 100$ = 35.4 %	1	Do NOT penalise incorrect precision here Allow range 33.7-35.5% (rounding errors penalised elsewhere in paper)

| **0** | **7** | | An aqueous solution **Y** is known to contain one type of group 2 metal ion and one type of negative ion. |

Aqueous solutions of sulfuric acid and magnesium nitrate are added to separate samples of solution **Y**. The observations are shown in **Table 5.**

Table 5

Solution added	Observation with solution Y
Sulfuric acid	A white precipitate forms
Magnesium nitrate	A white precipitate forms

| **0** | **7** | **.** | **1** | Suggest the identity of the group 2 metal ion present in solution **Y**. |

Write an ionic equation, including state symbols, for the reaction that takes place when sulfuric acid is added to solution **Y**.

[2 marks]

Group 2 metal ion _____

Ionic equation _____

| **0** | **7** | **.** | **2** | Suggest the identity of the negative ion present in solution **Y**. |

Write an ionic equation, including state symbols, for the reaction that takes place when magnesium nitrate is added to solution **Y**.

[2 marks]

Negative ion _____

Ionic equation _____

Question	Marking Guidance	Mark	Additional Comments/Guidance
07.1	Ba^{2+} OR Sr^{2+}	1	Award M1 if barium named in M1 then used Ba^{2+} in the equation
	SO_4^{2-} (aq) + Ba^{2+} (aq) $\rightarrow$ $BaSO_4$ (s)	1	
07.2	OH^-	1	Award M1 if hydroxide named in M1 then used OH^- in the equation
	Mg^{2+} (aq) + $2OH^-$ (aq) $\rightarrow$ $Mg(OH)_2$ (s)	1	

0 7 This question is about the reactions of magnesium and its compounds.

0 7 . 1 Magnesium is used in one of the stages in the extraction of titanium.

Give an equation for the reaction between titanium(IV) chloride and magnesium.
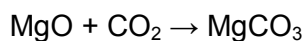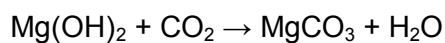State the role of magnesium in this reaction.

[2 marks]

Equation

_____

Role of magnesium _____

0 7 . 2 A mixture of magnesium oxide and magnesium hydroxide has a mass of 3200 mg

This mixture is reacted with carbon dioxide to form magnesium carbonate and water.
The mass of water produced is 210 mg

$$Mg(OH)_2 + CO_2 \rightarrow MgCO_3 + H_2O$$

$$MgO + CO_2 \rightarrow MgCO_3$$

Calculate the percentage by mass of magnesium oxide in this mixture.

[4 marks]

% of magnesium oxide _____

6

Question	Marking guidance	Additional Comments/Guidelines	Mark
07.1	Equation: $2Mg + TiCl_4 \rightarrow Ti + 2MgCl_2$	Allow multiples / ignore ss	1
	Role: Reducing agent	Allow electron donor (not electron pair donor)	1
07.2	M1 moles of water in 210 mg $\quad$ = mass / mr = 0.210 / 18 $\quad\quad\quad\quad\quad\quad\quad\quad\quad$ = <u>0.0117</u> mol ONLY Equal to moles of magnesium hydroxide produced in stage one M2: mass of $Mg(OH)_2$ = 0.0117 x 58.3 = 0.680 g M3: mass of MgO $\quad$ = $\quad$ 3.2 – 0.68 $\quad\quad\quad\quad\quad\quad\quad\quad\quad$ = 2.52 g M4: % of MgO = 2.52/3.2 x 100 = 78.7%	M1 = moles of water M2 = mass of $Mg(OH)_2$ = M1 x 58.3 M3 = subtraction = 3.2 – M2 M4 = answer to M3 x 100/3.2 Alternative correct alternative methods such as M1 = moles of water M2 = mass of $Mg(OH)_2$ = M1 x 58.3 M3 = M2 x 100/3.2 M4 = 100 – M3 M4: Allow 78.7 – 78.8 or 79 %	4

| 0 | 5 | | This question is about Group 2 elements and their compounds.

| 0 | 5 | . | 1 | Explain why the melting point of magnesium is higher than the melting point of sodium.

[2 marks]

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| 0 | 5 | . | 2 | Give an equation to show how magnesium is used as the reducing agent in the extraction of titanium.

Explain, in terms of oxidation states, why magnesium is the reducing agent.

[2 marks]

Equation

_____

Explanation _____

_____

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_____

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Question 5 continues on the next page

Turn over ▶

0 5 . 3 State what is observed when dilute aqueous sodium hydroxide is added to separate solutions of magnesium chloride and barium chloride.

[2 marks]

Observation with magnesium chloride _____

Observation with barium chloride _____

6

Question	Marking guidance	Additional Comments/Guidelines	Mark
05.1	Mg^{2+} has a higher charge than Na^+ / Mg^{2+} ions are smaller / Mg^{2+} has a greater charge density / Mg atoms smaller than Na atoms / Mg has more delocalised electrons than Na	Allow Mg has a higher nuclear charge	1
	Stronger attraction to delocalised sea of electrons / stronger metallic bonding	Not attraction for outer electrons	1
05.2	$2Mg + TiCl_4 \rightarrow 2MgCl_2 + Ti$	Allow multiples	1
	Mg changes oxidation state from 0 to +2 so electrons are lost / Ti changes oxidation state from +4 to 0 , so gains electrons	Allow Oxidation state of Mg increases so it is a reducing agent	1
05.3	Observation with $MgCl_2$: (slight) white ppt	Do not allow nothing / no observation	1
	Observation with $BaCl_2$: no (visible) change / colourless solution / no reaction		1

| **0** | **2** | | This question is about magnesium and its compounds. |

| **0** | **2** | . | **1** | State **one** observation when magnesium reacts with steam.

Give an equation, including state symbols, for this reaction.

[2 marks]

Observation _____

_____

Equation

| **0** | **2** | . | **2** | Describe the bonding in magnesium.

[2 marks]

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| **0** | **2** | . | **3** | Explain, in terms of structure and bonding, why magnesium chloride has a high melting point.

[3 marks]

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| **0** | **2** | . | **4** | Give **one** medical use for magnesium hydroxide.

[1 mark]

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Question	Marking guidance	Additional Comments/Guidelines	Mark
02.1	Bright light / white light / white powder/ash/solid		1
	$Mg(s) + H_2O(g) \rightarrow MgO(s) + H_2(g)$	State symbols essential	1

Question	Marking guidance	Additional Comments/Guidelines	Mark
02.2	M1: Attraction between (lattice of) Mg^{2+} ions M2: And <u>delocalised</u> electrons	M1 attraction between nucleus and delocalised electrons or between + ions and delocalised electrons M2 outer shell electrons delocalised	1 1

Question	Marking guidance	Additional Comments/Guidelines	Mark
02.3	(Giant) ionic lattice / lots of Mg^{2+} and Cl^- ions		1
	Strong (electrostatic) forces of attraction		1
	Between Mg^{2+} and Cl^- ions	Allow oppositely charged ions	1

Question	Marking guidance	Additional Comments/Guidelines	Mark
02.4	Indigestion relief / laxative / neutralise (excess stomach) acid	Allow milk of magnesia	1