A' Level Chemistry

Year 1

Unit 7: Group II & Group VII

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

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

Use the 3 Wave Process when completing these revision packs.

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.

Do not write outside the box

0 8 This question is about ion testing.

0 8 . 1 Describe how a student could distinguish between aqueous solutions of potassium nitrate, KNO_3, and potassium sulfate, K_2SO_4, using **one** simple test-tube reaction.

[3 marks]

Reagent ____________________

Observation with $KNO_3(aq)$ ____________________

____

Observation with $K_2SO_4(aq)$ ____________________

____

0 8 . 2 Describe how a student could distinguish between aqueous solutions of magnesium chloride, $MgCl_2$, and aluminium chloride, $AlCl_3$, using **one** simple test-tube reaction.

[3 marks]

Reagent ____________________

Observation with $MgCl_2(aq)$ ____________________

____

Observation with $AlCl_3(aq)$ ____________________

____

6

Question	Answers	Mark	Additional Comments/Guidance
08.1	$BaCl_2$ / $Ba(OH)_2$ / $Ba(NO_3)_2$ / BaX_2 or names	1	Ignore acidification but CE = 0/3 if H_2SO_4 If reagent incorrect or blank then CE =0/3 If Ba^{2+} or wrong formula, lose M1 and mark on
	colourless solution / no (visible) change (nvc) / no ppt / no (visible) reaction	1	Ignore nothing happens and no observation
	white precipitate / white solid	1	
08.2	NaOH / sodium hydroxide / other Group 1 hydroxides	1	If reagent incorrect or blank then CE =0/3 If reagent incomplete, lose M1 and mark on
	<u>white</u> precipitate / <u>white</u> solid	1	
	(white) ppt which dissolves in <u>excess</u> (NaOH)	1	If reagent is excess NaOH, allow colourless solution for M3
	<u>Alternative Method</u> Name or formula of Group 1 carbonate	1	
	<u>white</u> precipitate / <u>white</u> solid	1	
	(white) precipitate <u>and</u> effervescence	1	
Total		**6**	

Do not write outside the box

0 4 This question is about s-block metals.

0 4 . 1 Give the full electron configuration for the calcium ion, Ca^{2+}

[1 mark]

0 4 . 2 Explain why the second ionisation energy of calcium is lower than the second ionisation energy of potassium.

[2 marks]

0 4 . 3 Identify the s-block metal that has the highest first ionisation energy.

[1 mark]

0 4 . 4 Give the formula of the hydroxide of the element in Group 2, from Mg to Ba, that is least soluble in water.

[1 mark]

Question 4 continues on the next page

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0 4 . 5 A student added 6 cm^3 of 0.25 mol dm^{-3} barium chloride solution to 8 cm^3 of 0.15 mol dm^{-3} sodium sulfate solution.
The student filtered off the precipitate and collected the filtrate.

Give an ionic equation for the formation of the precipitate.
Show by calculation which reagent is in excess.
Calculate the total volume of the other reagent which should be used by the student so that the filtrate contains only one solute.

[3 marks]

Ionic equation ________________________________

Reagent in excess ________________________________

Total volume of other reagent ________________________________

03.4	Reactant(s) adsorbed onto the (platinum surface) / (platinum) provides a surface / active sites Reaction (on the surface) or bond breaking(weakening) / bond making occurs (on the surface) Desorption (of the product) or wtte		1 1 1
03.5	(Oxidation state changes from) -3 to +2 OR (+) 5		1
03.6	$2NH_3 + 2O_2 \rightarrow N_2O + 3H_2O$	Allow multiples Ignore state symbols	1

Total			11

Question	Answers	Additional Comments/Guidance	Mark
04.1	$1s^2 2s^2 2p^6 3s^2 3p^6 (4s^0)$		1
04.2	M1 In $Ca^{(+)}$ (outer) electron(s) is further from nucleus Or $Ca^{(+)}$ loses electron from a higher (energy) orbital Or $Ca^{(+)}$ loses electron from a 4(s) orbital or 4th energy level or 4th energy shell and $K^{(+)}$ loses electron from a 3(p) orbital or 3rd energy level or 3rd energy shell M2 More shielding (in Ca^+)	Must be comparative Allow converse arguments	1 1
04.3	Be /Beryllium		1
04.4	$Mg(OH)_2$		1
04.5	$Ba^{2+} + SO_4^{2-} \rightarrow BaSO_4$ n $BaCl_2$ (6/1000 x 0.25) = 1.5×10^{-3} and n Na_2SO_4 = (8/1000 x 0.15) = 1.2×10^{-3} and $BaCl_2$ /barium chloride in excess 10 cm^3 (of 0.15 mol dm^{-3} sodium sulfate)	Ignore state symbols Working required or 3×10^{-4} of $BaCl_2$ or 0.01dm^3	1 1 1

Do not write outside the box

0 5 This question is about some Group 7 compounds.

0 5 . 1 Solid sodium chloride reacts with concentrated sulfuric acid.

Give an equation for this reaction.
State the role of the sulfuric acid in this reaction.

[2 marks]

Equation

____

Role ____

0 5 . 2 Fumes of sulfur dioxide are formed when sodium bromide reacts with concentrated sulfuric acid.

For **this** reaction

- give an equation
- give **one** other observation
- state the role of the sulfuric acid.

[3 marks]

Equation

____

Observation ____

____

Role ____

0 5 . 3 Chlorine reacts with hot aqueous sodium hydroxide as shown in the equation.

$$3Cl_2 + 6NaOH \rightarrow NaClO_3 + 5NaCl + 3H_2O$$

Give the oxidation state of chlorine in $NaClO_3$ and in NaCl

[1 mark]

$NaClO_3$ ____________________

NaCl ____________________

Do not write outside the box

0 5 . 4 State, in terms of redox, what happens to chlorine in the reaction in Question **05.3**.
[1 mark]

____

____

0 5 . 5 Solution **Y** contains **two** different negative ions.

To a sample of solution **Y** in a test tube a student adds
- silver nitrate solution
- then an excess of dilute nitric acid
- finally an excess of concentrated ammonia solution.

The observations after each addition are recorded in **Table 3**.

Table 3

Reagent added to solution Y	**Observation**
silver nitrate solution	cream precipitate containing compound **D** and compound **E**
excess dilute nitric acid	cream precipitate **D** and bubbles of gas **F**
excess concentrated ammonia solution	colourless solution containing complex ion **G**

Give the formulas of **D, E** and **F**.
Give an **ionic** equation to show the formation of **E**.
Give an equation to show the conversion of **D** into **G**.
[6 marks]

Formula of **D** ______________________

Formula of **E** ______________________

Formula of **F** ______________________

Ionic equation to form **E**

____

Equation to show the conversion of **D** into **G**

____

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Turn over ►

Question	Answers	Additional Comments/Guidelines	Mark
05.1	$NaCl + H_2SO_4 \rightarrow NaHSO_4 + HCl$ Proton donor	Allow $2NaCl + H_2SO_4 \rightarrow Na_2SO_4 + 2HCl$ Allow (Bronsted-Lowry) acid	1 1
05.2	$2NaBr + 2H_2SO_4 \rightarrow Na_2SO_4 + SO_2 + Br_2 + 2H_2O$ Or $2NaBr + 3H_2SO_4 \rightarrow 2NaHSO_4 + SO_2 + Br_2 + 2H_2O$ Or $2H^+ + 2Br^- + H_2SO_4 \rightarrow SO_2 + Br_2 + 2H_2O$ Or $4H^+ + 2Br^- + SO_4^{2-} \rightarrow SO_2 + Br_2 + 2H_2O$ brown gas or brown fumes or orange gas or orange fumes Oxidising agent	Ignore $2NaBr + H_2SO_4 \rightarrow Na_2SO_4 + 2HBr$ Ignore $NaBr + H_2SO_4 \rightarrow NaHSO_4 + HBr$ Do not accept yellow solid Ignore fizzing and misty fumes Allow electron acceptor Ignore acid / proton donor	1 1 1
05.3	(+)5 and -1		1
05.4	Is oxidised <u>and</u> reduced	Allow undergoes disproportionation Allows gains <u>and</u> loses electrons	1
05.5	D AgBr E Ag_2CO_3 F CO_2 $2Ag^+ + CO_3^{2-} \rightarrow Ag_2CO_3$ $AgBr + 2NH_3 \rightarrow Ag(NH_3)_2^+ + Br^-$	Ignore state symbols Or $\rightarrow Ag(NH_3)_2Br$ One mark for $Ag(NH_3)_2^+$ and 1 mark for equation If D = AgCl, then allow 2 marks for $AgCl + 2NH_3 \rightarrow Ag(NH_3)_2^+ + Cl^-$	1 1 1 1 2

Do not write outside the box

0 9 This question is about sodium halides.

0 9 . 1 State what is observed when silver nitrate solution is added to sodium fluoride solution.

[1 mark]

____

0 9 . 2 State **one** observation when solid sodium chloride reacts with concentrated sulfuric acid.

Give an equation for the reaction.

State the role of the chloride ions in the reaction.

[3 marks]

Observation ____

Equation

____

Role ____

0 9 . 3 Give an equation for the redox reaction between solid sodium bromide and concentrated sulfuric acid.

Explain, using oxidation states, why this is a redox reaction.

[3 marks]

Equation

____

Explanation ____

____

____

____

0 9 . 4 State what is observed when aqueous chlorine is added to sodium bromide solution.

Give an ionic equation for the reaction.

[2 marks]

Observation ____

Ionic equation

____

9

Question	Answers	Additional comments/Guidelines	Mark
09.1	Colourless (solution)	Allow no (visible) change, no reaction or no ppt (formed) Ignore none or nothing	1
09.2	M1 Misty or steamy or white fumes/gas M2 $NaCl + H_2SO_4 \rightarrow NaHSO_4 + HCl$ OR $2NaCl + H_2SO_4 \rightarrow Na_2SO_4 + 2HCl$ M3 Base OR proton acceptor	 Accept multiples	1 1 1
09.3	M1 $2NaBr + 2H_2SO_4 \rightarrow Na_2SO_4 + Br_2 + SO_2 + 2H_2O$ OR $2Br^- + 2H^+ + H_2SO_4 \rightarrow SO_2 + Br_2 + 2H_2O$ Br changes oxidation state from -1 to 0 and is oxidised S changes oxidation state from +6 to +4 and is reduced	M1 Allow ionic equations $2Br^- + 2H_2SO_4 \rightarrow Br_2 + SO_4^{2-} + SO_2 + 2H_2O$ OR $2Br^- + 4H^+ + SO_4^{2-} \rightarrow Br_2 + SO_2 + 2H_2O$	1 1 1
09.4	M1 Yellow or orange solution M2 $Cl_2 + 2Br^- \rightarrow 2Cl^- + Br_2$	M1 Do not accept brown solution M2 Accept multiples	1 1

Do not write outside the box

0 6 This question is about some elements in Group 7 and their compounds.

0 6 . 1 Chlorine is added to some drinking water supplies to decrease the risk of people suffering from diseases such as cholera.

State why the amount of chlorine added must be controlled.

[1 mark]

0 6 . 2 Give an equation for the reaction of chlorine with water to form a solution containing **two** acids.

Explain, with reference to electrons, why this is a redox reaction.

[2 marks]

Equation

Explanation

0 6 . 3 A student bubbles chlorine gas through a solution of sodium iodide.

State the observation the student would make.

Give an ionic equation for the reaction.

[2 marks]

Observation

Ionic equation

0 6 . 4 The student adds a few drops of concentrated sulfuric acid to a small amount of solid sodium iodide.

Two gaseous sulfur-containing products are formed.

Give an equation for the formation of each of these sulfur-containing products.

State the role of sulfuric acid in the formation of these products.

[3 marks]

Equation 1

____

Equation 2

____

Role ____

0 6 . 5 The student adds a few drops of acidified silver nitrate solution to a solution of an unknown **impure** sodium halide.
The student observes bubbles of gas and a colourless solution.
The student bubbles the gas through calcium hydroxide solution and a white precipitate forms.

Deduce the identity of the sodium halide.

Suggest the identity of the gas.

Give an ionic equation for the formation of this gas from the impurity.

[3 marks]

Identity of sodium halide ____

Identity of gas ____

Ionic equation

____

Question 6 continues on the next page

Do not write outside the box

0 6 . 6 The ClF_2^+ ion contains two different Group 7 elements.

Use your understanding of the electron pair repulsion theory to draw the shape of this ion.

Include any lone pairs of electrons that influence the shape.

Explain why the ion has the shape you have drawn.

Suggest a value for the bond angle in the ion.

[3 marks]

Shape

Explanation ____________________

____

____

Bond angle ____________________

0 6 . 7 Magnesium is used in the extraction of titanium from titanium(IV) chloride.

Give an equation for this reaction.

[1 mark]

____

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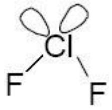
Question	Answers	Additional Comments/Guidelines	Mark
06.1	toxic/poisonous/too much chlorine causes death		1 AO1

Question	Answers	Additional Comments/Guidelines	Mark
06.2	$Cl_2 + H_2O \rightarrow HCl + HClO$ chlorine/Cl/Cl_2 gains electron(s) (to form Cl^-) **and** loses electron(s) (to form ClO^-)	allow $Cl_2 + H_2O \rightarrow 2H^+ + Cl^- + ClO^-$ ignore chlorine is oxidised and reduced ignore disproportionation ignore oxidation numbers unless incorrect	1 1 AO1

Question	Answers	Additional Comments/Guidelines	Mark
06.3	brown solution **or** black solid (forms) $Cl_2 + 2I^- \rightarrow 2Cl^- + I_2$	do **not** accept purple allow multiples ignore state symbols	1 1 AO1 AO2

Question	Answers	Additional Comments/Guidelines	Mark
06.4	$H_2SO_4 + 2H^+ + 2I^- \rightarrow SO_2 + 2H_2O + I_2$ $H_2SO_4 + 8H^+ + 8I^- \rightarrow H_2S + 4H_2O + 4I_2$ oxidising agent	equations can be in either order allow $SO_4^{2-} + 4H^+ + 2I^- \rightarrow SO_2 + 2H_2O + I_2$ allow $SO_4^{2-} + 10H^+ + 8I^- \rightarrow H_2S + 4H_2O + 4I_2$ allow alternative correct balanced equations starting from NaI to form SO_2 and H_2S eg $2H_2SO_4 + 2NaI \rightarrow Na_2SO_4 + SO_2 + 2H_2O + I_2$ $3H_2SO_4 + 2NaI \rightarrow 2NaHSO_4 + SO_2 + 2H_2O + I_2$ $5H_2SO_4 + 8NaI \rightarrow 4Na_2SO_4 + H_2S + 4H_2O + 4I_2$ $9H_2SO_4 + 8NaI \rightarrow 8NaHSO_4 + H_2S + 4H_2O + 4I_2$	1 1 1 AO1

Question	Answers	Additional Comments/Guidelines	Mark
06.5	NaF **or** sodium fluoride CO_2 **or** carbon dioxide $CO_3^{2-} + 2H^+ \rightarrow CO_2 + H_2O$	 allow multiples	1 1 1 AO1 AO3

Question	Answers	Additional Comments/Guidelines	Mark
06.6	 lone pair–lone pair repulsion > bond pair–bond pair repulsion **or** lone pair repel to be as far apart as possible 104 to 106(°)	allow shape with 2 lp and 2 bp ignore absence of charge allow lp–lp repulsion > bp–bp repulsion allow 95 to 106(°)	1 1 1 AO1 AO2 AO3

Question	Answers	Additional Comments/Guidelines	Mark
06.7	$TiCl_4 + 2\,Mg \rightarrow 2\,MgCl_2 + Ti$	allow multiples ignore state symbols	1 AO2

0 4 This question is about Group 7 chemistry.

0 4 . 1 Give an equation for the reaction of solid sodium bromide with concentrated sulfuric acid to form bromine.

State **one** observation made during this reaction.

[2 marks]

Equation

Observation

0 4 . 2 A solution that is thought to contain chloride ions and iodide ions is tested.

1. Dilute nitric acid is added to the solution.
2. Aqueous silver nitrate is added to the solution.
3. A pale yellow precipitate forms.
4. Excess dilute aqueous ammonia is added to the mixture.
5. Some of the precipitate dissolves and a darker yellow precipitate remains.

Give a reason for the use of each reagent.

Explain the observations.

Give ionic equations for any reactions.

[5 marks]

Do not write outside the box

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Turn over for the next question

Question	Answers	Additional comments/Guidelines	Mark
4.1	**M1** $2H_2SO_4 + 2NaBr \rightarrow Na_2SO_4 + SO_2 + Br_2 + 2H_2O$	**allow** ionic and equation forming $NaHSO_4$ $3H_2SO_4 + 2NaBr \rightarrow 2NaHSO_4 + SO_2 + Br_2 + 2H_2O$ $2H^+ + 2Br^- + H_2SO_4 \rightarrow SO_2 + Br_2 + 2H_2O$ **not** equation from HBr unless formation of HBr shown in separate equation	1
	M2 orange/brown fumes/solution	**not** liquid / yellow solid / bad eggs smell / white ppt **ignore** choking gas/fumes / steamy/white fumes	1

Question	Answers	Additional comments/Guidelines	Mark
4.2	HNO_3 removes (hydroxide/carbonate) ions that may give other ppts with $AgNO_3$		1
	$AgNO_3$ produces ppts with chloride/iodide/halide	**not** chlorine/iodine/halogen	1
	$Ag^+(aq) + Cl^-(aq) \rightarrow AgCl(s)$ **OR** $Ag^+(aq) + I^-(aq) \rightarrow AgI(s)$	**allow** $Ag^+(aq) + X^-(aq) \rightarrow AgX(s)$ state symbols not required but **not** if wrong	1
	NH_3 dissolves AgCl (leaving yellow AgI)	**allow** chloride/iodide salt/ppt	1
	$AgCl(s) + 2NH_3(aq) \rightarrow Ag(NH_3)_2^+(aq) + Cl^-(aq)$	**allow** with $Ag^+(aq)$	1