

Group 7, the halogens

11 questions · 40 marks

Answer all questions. The marks available are shown against each part. Every question is taken unaltered from a past paper; the source is noted beneath it. In Section A, choose the best answer and write its letter in the box.

Section A · Multiple choice

8 questions · 8 marks

1. Which species is the strongest reducing agent? [1 mark] 1 mark

A F_2 ☐

B I_2 ☐

C F^- ☐

D I^- ☐

Answer

AQA 7405/3 Chemistry · June 2023 · Paper 3, Question 22

2. Which statement correctly describes a trend down Group 7 from Cl to I? 1 mark

X represents Cl, Br or I

[1 mark]

A The boiling point of HX increases. ☐

B The bond dissociation energy of H-X increases. ☐

C The standard electrode potential value for $X_2(aq) + 2e^- \rightarrow 2X^-(aq)$ becomes more positive. ☐

D The solubility of AgX in ammonia increases. ☐

Answer

AQA 7405/3 Chemistry · June 2024 · Paper 3, Question 20

3. Which statement is **not** correct about the trends in properties of the hydrogen halides from HCl to HI ? 1 mark

[1 mark]

- A The boiling points decrease.
- B The bond dissociation energy of H–X decreases.
- C The polarity of the H–X bond decreases.
- D They are more easily oxidised in aqueous solutions.

☐☐☐☐

Answer

— AQA 7405/3 Chemistry · June 2019 · Paper 3, Question 17

4. Which statement about chloride ions is correct? 1 mark

[1 mark]

- A They are oxidised by concentrated sulfuric acid.
- B They form a cream precipitate with silver nitrate solution.
- C They form a cobalt(II) complex with a tetrahedral shape.
- D They have the electron configuration $1s^2 2s^2 2p^6 3s^2 3p^4$

☐☐☐☐

Answer

— AQA 7405/3 Chemistry · June 2024 · Paper 3, Question 21

5. In the test for a halide ion in aqueous solution, dilute nitric acid is added before the addition of silver nitrate solution. 1 mark

Why is nitric acid added?

[1 mark]

- A It increases the concentration of nitrate ions.
- B It prevents the precipitation of silver compounds other than halides.
- C It prevents the silver nitrate being precipitated.
- D It provides the acidic solution required for precipitation.

☐☐☐☐

Answer

— AQA 7405/3 Chemistry · June 2020 · Paper 3, Question 15

6. Which shows the major product(s) formed when chlorine reacts with cold, dilute, aqueous sodium hydroxide? 1 mark

[1 mark]

- A NaCl only
B NaClO only
C NaCl and NaClO
D NaCl and NaClO₃

☐☐☐☐

Answer

— AQA 7405/3 Chemistry · June 2020 · Paper 3, Question 16

7. Which statement about chloride ions is **not** correct? 1 mark

[1 mark]

- A They form a white precipitate with silver nitrate solution that is soluble in dilute aqueous ammonia.
B They form an octahedral cobalt(II) complex when aqueous cobalt(II) ions are reacted with an excess of chloride ions.
C They form when chlorine reacts with potassium bromide solution.
D They have the electron configuration $1s^2 2s^2 2p^6 3s^2 3p^6$

☐☐☐☐

Answer

— AQA 7405/3 Chemistry · 2021 · Paper 3, Question 8

8. An aqueous solution of a salt gives a white precipitate when mixed with aqueous silver nitrate and when mixed with dilute sulfuric acid. 1 mark

Which could be the formula of the salt?

[1 mark]

- A BaCl₂
B (NH₄)₂SO₄
C KCl
D Sr(NO₃)₂

☐☐☐☐

Answer

— AQA 7405/3 Chemistry · June 2019 · Paper 3, Question 16

Section B · Structured questions

3 questions · 32 marks

9. This question is about Group 7 chemistry.

7 marks

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

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]

10. This question is about chlorine. 10 marks

1

Give an equation to show how chlorine forms an acidic solution in water.

[1 mark]

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2

Give an equation for the reaction between chlorine and cold, dilute aqueous sodium hydroxide.

[1 mark]

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3

In acidic conditions, ClO_3^- ions oxidise Cl^- ions to form Cl_2

Deduce a half-equation for the oxidation of Cl^- to Cl_2

Deduce a half-equation for the reduction of ClO_3^- to Cl_2

Deduce the overall equation for this reaction.

[3 marks]

Half-equation for the oxidation of Cl^- to Cl_2

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Half-equation for the reduction of ClO_3^- to Cl_2

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Overall equation

4

Give the equation for the reaction of solid sodium chloride with concentrated sulfuric acid.

State the role of the chloride ions in this reaction.

[2 marks]

Equation

Role

5

Draw the shape of the Cl_3^- ion.
Include any lone pairs of electrons that influence the shape.

[1 mark]

6

Chlorine forms an ion with the Group 3 element thallium (Tl).

State and explain the bond angle in TlCl_2^+

[2 marks]

Bond angle

Explanation

— AQA 7405/1 Chemistry · June 2024 · Paper 1, Question 5

11.

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

15 marks

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]

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

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

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

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

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

7

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

Give an equation for this reaction.

[1 mark]

— AQA 7405/1 Chemistry · 2022 · Paper 1, Question 6