CHEMISTRY ONLINE
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CHEMISTRY

INORGANIC CHEMISTRY

Level & Board	AQA (A-LEVEL)
TOPIC:	GROUP 7 HALOGEN
PAPER TYPE:	SOLUTION - 3
TOTAL QUESTIONS	10
TOTAL MARKS	35

Group 7 the Halogens - 3

1.

(a)

Strontium Chloride ($SrCl_2$):

$SrCl_2$ has strong ionic bonds resulting from the strong electrostatic attraction between strontium and chloride ions in the lattice structure. The presence of these strong ionic bonds contributes to a high melting point. The lattice structure involves many strong bonds that need to be overcome during the melting process.

Iodine Monochloride (ICl):

ICl has dipole-dipole interactions between molecules, which are weaker than the ionic bonds present in $SrCl_2$. The melting point of ICl is expected to be higher than that of bromine (Br_2) due to the polar covalent bonds and dipole-dipole interactions.

Bromine (Br_2):

Bromine (Br_2) has van der Waals forces (dispersion forces) between molecules, which are much weaker than both dipole-dipole interactions in ICl and ionic bonds in $SrCl_2$. Therefore, Br_2 is likely to have the lowest melting point among the three substances.

The revised order of melting points based on the given information $SrCl_2$ >ICl>Br_2.

(6)

(b)

Equation for the Reaction of Chlorine with Cold Water:

$$Cl_2(g)+H_2O(l)\rightleftharpoons HCl(aq)+HClO(aq)$$

Reason for Adding Chlorine to Drinking Water:

Chlorine is added to drinking water as a disinfectant to kill bacteria and neutralize harmful microorganisms present in the water.

Disadvantages of Treating Water with Chlorine:

Disadvantage: Some people may experience eye irritation or find the taste of chlorinated water unpleasant.

(3)

2. A

(1)

3.

(a)

The equation for the reaction between sodium bromide and concentrated sulfuric acid.

Equation for the Reaction:

$2NaBr+2H_2SO_4 \rightarrow Na_2SO_4+Br_2+SO_2+2H_2O$

Explanation:

Bromide ions (Br^-) are larger than chloride ions (Cl^-), and this size difference plays a role in their different reactivity. The larger size of bromide ions makes them more easily oxidized compared to chloride ions. This is because larger ions are more susceptible to losing an electron (undergoing oxidation) compared to smaller ions.

$2Br^- \rightarrow Br_2+2e^-$

(3)

(b)

Formation of Precipitates

Procedure: Add silver nitrate to form precipitates of AgCl and AgBr.

Equations:

$AgNO_3(aq)+NaCl(aq) \rightarrow AgCl(s)+NaNO_3(aq)$

$AgNO_3(aq)+NaBr(aq) \rightarrow AgBr(s)+NaNO_3(aq)$

Selective Dissolving of AgCl

Procedure: Add excess dilute ammonia to the mixture of precipitates. The silver chloride precipitate dissolves.

Equation:

$AgCl(s)+2NH_3(aq) \rightarrow [Ag(NH_3)_2]Cl(aq)+Cl^-(aq)$

Separation and Purification of AgBr

Procedure: Filter off the remaining silver bromide precipitate, wash to remove soluble compounds, and dry to remove water.

(6)

I am Sorry !!!!!

(c)

$Cl_2 + 2HO^- \rightarrow OCl^- + Cl^- + H_2O$

The oxidation state of chlorine in each of the chlorine-containing ions formed

OCl^- is +1 Cl^- is −1

(2)

4. C

(1)

5.

An aldehyde could be tested as:

Test:

Add silver nitrate solution (or an alternative soluble silver salt such as fluoride or sulfate) to the aldehyde.

Observation:

If the aldehyde is pure, a white precipitate is observed.

Example: Consider the aldehyde ethanal (CH_3 CHO).

Procedure:

Take a small amount of ethanal in a test tube.

Add silver nitrate solution to the test tube.

Observation:

If the ethanal is pure, a white precipitate of silver chloride is observed.

(2)

6. A

(1)

7.

(a)

An excess of silver nitrate is added to the solution to ensure that all the halide ions (both chloride and iodide) are removed from the solution. The presence of excess silver nitrate ensures that all halide ions precipitate out of the solution as silver chloride (AgCl) and silver iodide (AgI).

(1)

(b)

Moles= Mass / Molar Mass

Given that the mass of silver iodide obtained is 315mg and the molar mass of AgI is 234.8g/mol
So,

Mass in g =315 mg/1000 = 0.315 g

Moles=0.315 g/234.8g/mol

Moles=0.00134mol =1.34×10^{-3} moles

(1)

(c)

Mass of NaI=moles×Molar Mass
Mass of NaI=1.34×10^{-3}mol×149.9g/mol
Mass of NaI =0.201 g

(1)

(d)

Mass of NaCl = 0.600 – 0.201 = 0.399 g

Percentage by mass=(Mass of component/Total mass)×100
Percentage by mass of NaCl=(0.399g / 0.600g)×100
Percentage by mass of NaCl=66.5%

(2)

8. A

(1)

9.

(a)

Dilute nitric acid is added in the test for halide ions with silver nitrate solution to prevent interference from other anions, such as carbonate and hydroxide ions, ensuring a more specific detection of halide ions.

(1)

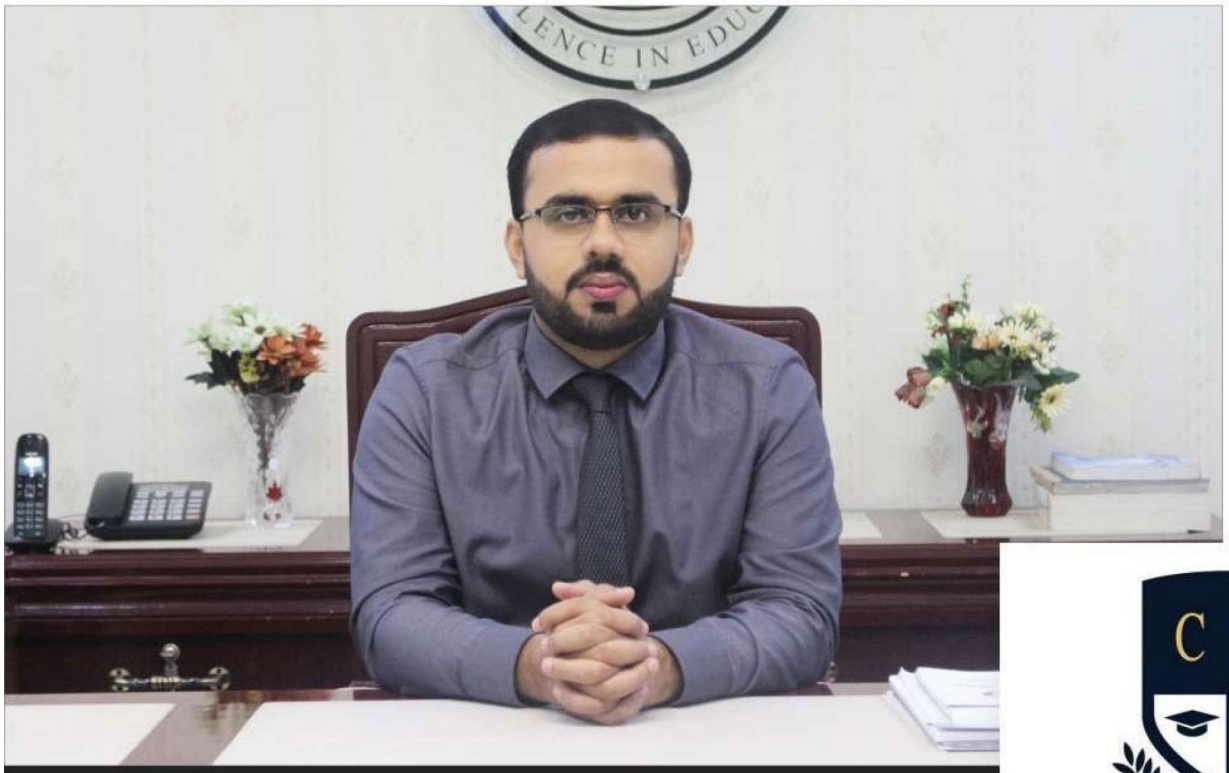
(b)

Adding concentrated ammonia confirms silver bromide if the precipitate partially dissolves in dilute ammonia. Complete solubility in concentrated ammonia is indicative of silver bromide.

(2)

10. C

(1)



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