



Chem!stry

Name: ()

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Identification of Gases

Gas	Observations
Ammonia, NH ₃	Colourless. Pungent. Damp red litmus paper turns blue. White fumes of NH ₄ Cl are observed when a glass rod dipped in concentrated hydrochloric acid is brought near the gas.
Chlorine, Cl ₂	Pale green-yellow. Pungent. Damp blue litmus paper turns red and is then bleached white.
Water vapour, H ₂ O	Colourless. Odourless. Anhydrous copper(II) sulfate paper changes colour from white to blue. Anhydrous cobalt(II) chloride paper changes colour from blue to pink.
Sulphur dioxide, SO ₂	Colourless. Pungent. Acidified potassium manganate(VII) changes colour from purple to colourless.
Carbon dioxide, CO ₂	Colourless. Odourless. White precipitate of CaCO ₃ forms when the gas is bubbled into limewater. Note: Colourless solution of Ca(HCO ₃) ₂ formed if excess CO ₂ is used.
Oxygen, O ₂	Colourless. Odourless. Relights a glowing splint.
Hydrogen, H ₂	Colourless. Odourless. Lighted splint is extinguished with a 'pop' sound.
Hydrogen chloride, HCl	Colourless. Pungent. Damp blue litmus paper turns red. White fumes of NH ₄ Cl are observed when a glass rod dipped in aqueous ammonia is brought near the gas.

Identification of Cations Part #1 – Test-tube Reactions

Cation	Using aqueous sodium hydroxide – NaOH	Using aqueous ammonia – NH ₄ OH
Aluminium cation, Al ³⁺	White precipitate of Al(OH) ₃ – soluble in excess reagent giving a colourless solution.	White precipitate of Al(OH) ₃ – insoluble in excess reagent.
Calcium cation, Ca ²⁺	White precipitate of Ca(OH) ₂ – insoluble in excess reagent.	No observed reaction. No precipitate formed.
Zinc cation, Zn ²⁺	White precipitate of Zn(OH) ₂ – soluble in excess reagent giving a colourless solution.	White precipitate of Zn(OH) ₂ – soluble in excess reagent giving a colourless solution.
Lead(II) cation, Pb ²⁺	White precipitate of Pb(OH) ₂ – soluble in excess reagent giving a colourless solution.	White precipitate of Pb(OH) ₂ – insoluble in excess reagent.
Iron(II) cation, Fe ²⁺	Green precipitate of Fe(OH) ₂ – insoluble in excess reagent. Turns red-brown on standing.	Green precipitate of Fe(OH) ₂ – insoluble in excess reagent. Turns red-brown on standing.
Iron(III) cation, Fe ³⁺	Red-brown precipitate of Fe(OH) ₃ – insoluble in excess reagent.	Red-brown precipitate of Fe(OH) ₃ – insoluble in excess reagent.
Copper(II) cation, Cu ²⁺	Blue precipitate of Cu(OH) ₂ – insoluble in excess reagent.	Blue precipitate of Cu(OH) ₂ – soluble in excess reagent to give a dark blue solution.
Ammonium cation, NH ₄ ⁺	No precipitate – ammonia gas produced on warming (turns damp red litmus paper blue).	Test not applicable.

Identification of Cations Part #2 – Flame Tests

Cation	Observation
Sodium, Na ⁺	Yellow / orange flame colour.
Potassium, K ⁺	Lilac flame colour.
Calcium, Ca ²⁺	Brick red flame colour.
Barium, Ba ²⁺	Apple green flame colour.
Copper(II), Cu ²⁺	Green flame colour.

Identification of Anions

Anion	Observation
Carbonate, CO ₃ ²⁻	Add dilute acid. Effervescence is observed. Carbon dioxide gas is produced (carbon dioxide gas produces a white precipitate of CaCO ₃ when bubbled through limewater).
Chloride, Cl ⁻	Add dilute nitric acid followed by dilute aqueous silver nitrate. A white precipitate of AgCl, which is soluble in aqueous ammonia, but insoluble in dilute nitric acid, confirms chloride ions. Note: Pb(NO ₃) ₂ can be used in place of AgNO ₃ . A white precipitate of PbCl ₂ will be observed.
Iodide, I ⁻	Add dilute nitric acid followed by dilute aqueous silver nitrate. A yellow precipitate of AgI, which is insoluble in aqueous ammonia and insoluble in dilute nitric acid confirms iodide ions. Note: Pb(NO ₃) ₂ can be used in place of AgNO ₃ . A yellow precipitate of PbI ₂ will be observed.
Nitrate, NO ₃ ⁻	Add aqueous sodium hydroxide followed by aluminium foil and warm the mixture. Ammonia gas is produced (turns damp red litmus paper blue). Should exclude NH ₄ ⁺ before testing for NO ₃ ⁻ .
Sulfate, SO ₄ ²⁻	Add dilute nitric acid followed by either dilute aqueous barium chloride or dilute aqueous barium nitrate. A white precipitate of BaSO ₄ indicates the presence of sulfate ions.

Effect of Heat on a Solid

	Observation
Carbonate, CO ₃ ²⁻	Generally decompose on strong heating to produce the metal oxide and carbon dioxide gas. Carbon dioxide gas produces a white precipitate when bubbled through limewater.
Group 1 nitrate, NO ₃ ⁻	Decompose on strong heating to produce the Group 1 metal nitrite (e.g. NaNO ₂) and oxygen gas. Oxygen gas will relight a glowing splint.
Other nitrates, NO ₃ ⁻	Decompose on strong heating to produce metal or metal oxide, oxygen and nitrogen dioxide. Oxygen gas will relight a glowing splint. Nitrogen dioxide gas is reddish-brown in colour.
Ammonium salt, NH ₄ ⁺	Sublime on heating. White solid will be observed on the cooler regions of the test-tube.
Hydrated salt, X·H ₂ O	Produces steam on strong heating. Steam will condense on the cooler regions of the test-tube. Water causes anhydrous cobalt(II) chloride paper to change colour from blue to pink.

Test for Oxidising Agents and Reducing Agents

	Observation
Oxidising agent	Add an aqueous solution of FeSO ₄ . Colour changes from pale green to brown. Add an aqueous solution of KI. Colour changes from colourless to brown – blue / black with starch.
Reducing agent	Add an acidified solution of KMnO ₄ . Colour changes from purple to colourless. Add an acidified solution of K ₂ Cr ₂ O ₇ . Colour changes from orange to green.