

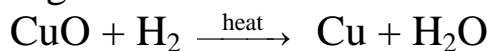
Question Bank

Practical Chemistry

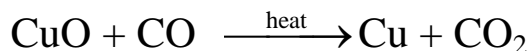
1. Identify the gases from the statements given below :
- (a) A colourless gas which forms an explosive mixture with air and water is the only product of combustion.
 - (b) A colourless gas which rekindles glowing splint but cannot be used for breathing.
 - (c) A colourless gas which burns with a pale blue flame, forming carbon dioxide gas as the only product.
 - (d) A colourless gas having a sharp pungent smell, which gives dense white fumes with HCl.
 - (e) A colourless gas having a choking smell, which causes coughing.
 - (f) An extremely soluble gas in water, which forms dense white fumes with ammonia solution.
 - (g) A colourless gas having a disagreeable smell which it turns lead acetate paper black.
 - (h) A colourless gas which is neither combustible nor does it support combustion. It does not turn lime water milky.
 - (i) A colourless gas which rapidly dissolves in alkaline pyrogallol solution and is a supporter of combustion.
 - (j) A colourless gas which on coming in contact with air, forms a reddish-brown gas.
 - (k) A reddish-brown gas obtained when lead nitrate crystals are strongly heated.
 - (l) A colourless gas which bleaches moist coloured flowers.
 - (m) A coloured gas which bleaches moist coloured flowers.
 - (n) Two gases which react with ammonia to form dense white fumes. [1 mark each]

- Ans.** (a) Hydrogen gas
 (b) Nitrous oxide (N₂O) gas
 (c) Carbon monoxide gas
 (d) Ammonia gas
 (e) Sulphur dioxide gas
 (f) Hydrochloric acid gas
 (g) Hydrogen sulphide gas
 (h) Nitrogen gas
 (i) Oxygen gas
 (j) Nitric oxide (NO) gas
 (k) Nitrogen dioxide gas
 (l) Sulphur dioxide gas
 (m) Chlorine gas
 (n) (i) HCl gas (ii) Chlorine gas.
2. There are three colourless gases A, B and C, which can reduce copper (II) oxide.
- (i) The products of reaction in case of A are copper metal and water. [2]
- (ii) The products of reaction in case of B are copper metal and carbon dioxide. [2]
- (iii) The products of reaction in case of C are copper metal, water and nitrogen. [2]
- Identify A, B and C. Support your answer by relevant chemical equations.

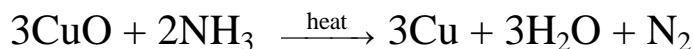
Ans. (i) Gas A is hydrogen.



(ii) Gas B is carbon monoxide.



(iii) Gas C is ammonia.

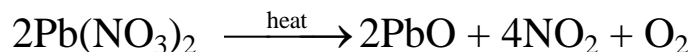


3. Solids A to K are heated strongly, when the following observations are made. Identify each of the solids and write relevant equation in support of your answer.
- (a) A heavy, white crystalline solid decrepitates and forms a residue, which is reddish-brown when hot and yellow when cold. It gives reddish-brown gas along with oxygen.
 - (b) A white solid on heating leaves behind a residue, which is yellow when hot and white when cold. It gives off a gas which turns lime water milky.
 - (c) A light green solid on heating leaves behind a black residue. A colourless gas is evolved, which turns lime water milky.
 - (d) A white crystalline solid melts on heating. It gives off a colourless gas which rekindles a glowing splint. In the flame test, a persistent golden yellow flame is formed.
 - (e) An orange red solid on heating gives off oxygen gas. The residue is reddish-brown when hot and yellow when cold. It fuses in glass and stains it yellow.
 - (f) A red solid on heating gives off a colourless gas, which rekindles a glowing splint. The residue is dark in colour and tiny silvery droplets are seen near the mouth of the test tube.
 - (g) A chocolate-brown solid on heating gives a colourless, odourless gas, which rekindles glowing splint. The residue is reddish-brown when hot and yellow when cold.
 - (h) A white crystalline solid decomposes explosively on heating and leaves behind no residue. One of the gaseous products formed, rekindles a glowing splint.
 - (i) A white crystalline solid on heating decomposes explosively, and leaves behind no residue. An elementary gas is formed as one of the products which is neither combustible nor does it support combustion. It does not turn lime water milky.
 - (j) A white crystalline solid, sublimes on heating to form dense white fumes. The fumes solidify on the cooler parts of the test tube to form a white solid.

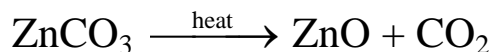
(k) An orange-coloured crystalline solid on heating swells and gives off lot of steam and nitrogen gas. It leaves behind a greenish mass.

[2 each]

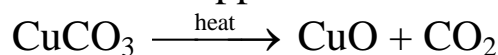
Ans. (a) The solid is lead nitrate.



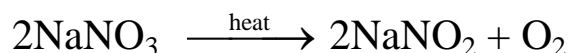
(b) The solid is zinc carbonate.



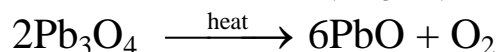
(c) The solid is copper carbonate.



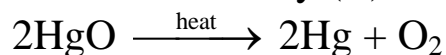
(d) The solid is sodium nitrate.



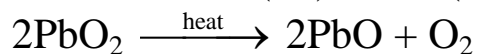
(e) The solid is red lead (Pb_3O_4).



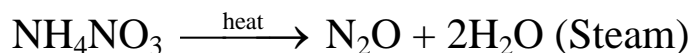
(f) The solid is mercury (II) oxide.



(g) The solid is lead (IV) oxide (PbO_2).



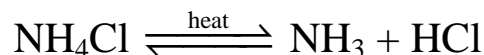
(h) The solid is ammonium nitrate.



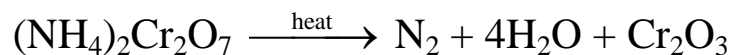
(i) The solid is ammonium nitrite.



(j) The solid is ammonium chloride.



(k) The solid is ammonium dichromate.



4. Identify the cations and anions in each case and write relevant equations wherever necessary.
- (a) A white crystalline solid on heating swells and gives off colourless vapours, which condense to form a colourless liquid X. The X turns anhydrous copper sulphate solution blue. The flame test shows the flame as persistent golden yellow. When the solution of solid is treated with HCl, it gives off a colourless gas Y which turns lime water milky. [4]
- (b) A blue solid gives a non-persistent green flame during the flame test. When the solid is heated strongly, it leaves behind a white residue. The residue on treating with few drops of water changes to blue colour. [4]
- (c) A white solid gives a non-persistent brick red flame. On treating with dilute sulphuric acid, it gives off a colourless gas which turns acidified potassium dichromate solution green. [3]
- (d) A white solid gives a non-persistent lilac colour. On treating with dilute sulphuric acid, it gives off a highly offensive smell. The gas turns lead acetate paper black. [3]

Ans. (a) Cation \Rightarrow Sodium (Na^+);

Anion \Rightarrow Carbonate (CO_3^{2-})

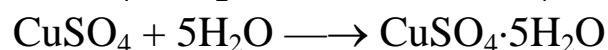
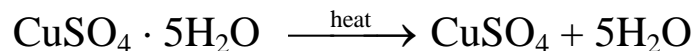
X is water of crystallisation.



Y is carbon dioxide gas.

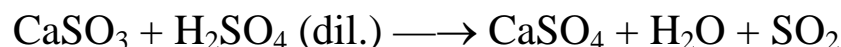
(b) **Cation** \Rightarrow Copper (Cu^{2+});

Anion \Rightarrow Sulphate . (SO_4^{2-}) Salt is $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$.



(c) **Cation** \Rightarrow Calcium (Ca^{2+});

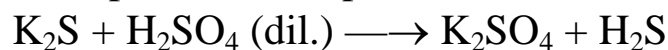
Anion \Rightarrow Sulphite . (SO_3^{2-}) Salt is CaSO_3 .



(d) **Cation** \Rightarrow Potassium (K^+);

Anion \Rightarrow Sulphide (S^{2-})

Salt is potassium sulphide.



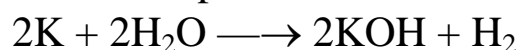
5. Identify the following solids. Write fully balanced chemical equations wherever necessary.

(a) A silvery white solid which floats on the surface of water and reacts violently to give tiny bubbles of a colourless gas. The gas burns in air with a pop sound. The chloride of solid gives a non-persistent lilac colour to non-luminous bunsen flame. [2]

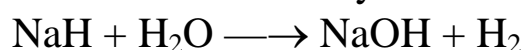
(b) A pale yellow compound gives a persistent golden yellow colour in non-luminous bunsen burner flame. When treated with water, it liberates a colourless gas, which burns with a pop sound. [2]

(c) A white solid on treating with water gives off a colourless gas which has a sharp biting smell and turns red litmus blue. The white solid formed after the reaction is soluble in conc. sodium hydroxide solution. [2]

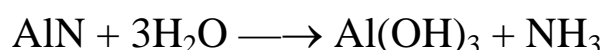
Ans. (a) The solid is potassium metal.



(b) The solid is sodium hydride.



(c) The solid is aluminium nitride.

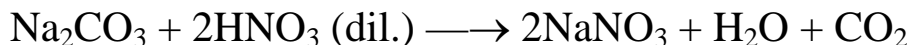


6. A solid **P** is a sodium salt. **P** on strong heating gives off carbon dioxide along with steamy fumes which condense on the cooler parts of the test tube. The residue **Q** left after heating gives off a colourless gas with dilute nitric acid which turns limewater milky. **P** is slightly soluble in water and turns the red litmus paper blue. Identify **P** and **Q** and write the relevant chemical equations. [4]

Ans. P is sodium hydrogen carbonate ($NaHCO_3$)



Q is sodium carbonate.



7. A black solid **A** dissolves in warm and dilute HCl to form greenish-blue solution **B**, but does not give off any gas. The solution **B** on treating with ammonium hydroxide solution forms bluish-white precipitate **C**. The precipitate **C** dissolves in excess of ammonium hydroxide solution to form deep-blue colouration. Identify solid **A** and bluish-white precipitate **C**.

Write equations for :

- (i) Action of dilute HCl on **A**.
- (ii) Action of less amount of ammonium hydroxide on **B**.
- (iii) Action of excess of ammonium hydroxide on **C**.

[5]

Ans. Solid **A** is copper (II) oxide [CuO].

The solution **B** is CuCl₂.

Precipitate **C** is copper (II) hydroxide [Cu (OH)₂].

- (i) $\text{CuO} + 2\text{HCl} (\text{dil.}) \longrightarrow \text{CuCl}_2 + \text{H}_2\text{O}$
- (ii) $\text{CuCl}_2 + 2\text{NH}_4\text{OH} \longrightarrow \text{Cu}(\text{OH})_2 + 2\text{NH}_4\text{Cl}$
- (iii) $\text{Cu}(\text{OH})_2 + 4\text{NH}_4\text{OH} \longrightarrow [\text{Cu}(\text{NH}_3)_4] \cdot (\text{OH})_2 + 4\text{H}_2\text{O}$ Deep-blue colouration

8. (a) A white crystalline sodium salt **P** is mixed with black powder and then heated with conc. sulphuric acid, then a gas **Q** is evolved along with steamy fumes. The gas **Q** is greenish-yellow in colour and turns potassium bromide solution red. The gas **Q** dissolves in water to form light-greenish yellow solution **R**. The solution **R** on exposure to sunlight gives off bubbles of a colourless gas **S**. The solution **T** left after the gas **S** bubbles out, gives curdy white ppt. **U** with silver nitrate solution. The precipitate **U** dissolves in excess of ammonium hydroxide solution. Identify

- (i) Black powder (ii) Solid **P** (iii) Gas **Q** (iv) Solution **R**
- (v) Gas **S** (vi) Solution **T** (vii) White precipitate **U**.

[7]

- (b) Write fully balanced equations for :
- (i) Solid **P**, sodium salt and conc. sulphuric acid.
 - (ii) Gas **Q** and potassium bromide solution.
 - (iii) Solution **R** on exposure to sunlight.
 - (iv) Solution **T** and silver nitrate solution.
 - (v) White ppt. **U** and ammonium hydroxide solution, [5]

Ans. (a) (i) **Black powder** is manganese dioxide.

- (ii) Solid **P** is sodium chloride.
 - (iii) Gas **Q** is chlorine gas.
 - (iv) Solution **R** is chlorine water.
 - (v) Gas **S** is oxygen.
 - (vi) Solution **T** is hydrochloric acid.
 - (vii) White ppt. **U** is silver chloride.
- (b) (i) $2\text{NaCl} + \text{MnO}_2 + 3\text{H}_2\text{SO}_4 \xrightarrow{\text{heat}} 2\text{NaHSO}_4 + \text{MnSO}_4 + 2\text{H}_2\text{O} + \text{Cl}_2$
- (ii) $2\text{KBr} + \text{Cl}_2 \longrightarrow 2\text{KCl} + \text{Br}_2$
- (iii) $2\text{Cl}_2 + 2\text{H}_2\text{O} \xrightarrow{\text{Sunlight}} 4\text{HCl} + \text{O}_2$
- (iv) $\text{AgNO}_3 + \text{HCl} \longrightarrow \text{AgCl} + \text{HNO}_3$
- (v) $\text{AgCl} + 2\text{NH}_4\text{OH} \longrightarrow [\text{Ag}(\text{NH}_3)_2\text{Cl}] + 2\text{H}_2\text{O}$

9. A white crystalline heavy solid **L**, on strong heating, gives off a reddish-brown gas and leaves behind a solid residue **M** which is reddish-brown when hot and yellow when cold. The solid residue **M** dissolves in conc. **HCl**. On heating, it forms a colourless solution. However, when the solution cools, the white precipitate reappears. The solution of crystalline salt **L** in water is treated with freshly prepared ferrous sulphate solution. To this, reaction mixture is slowly added conc. sulphuric acid, when a brown ring appears.

- (i) Name the reddish-brown gas. [1]
- (ii) Name the solid **L**. [1]
- (iii) Name the white precipitate. [1]
- (iv) Name the residue **M**. [1]
- (v) Give the chemical formula for brown ring. [1]
- (vi) Write fully balanced chemical equations for :

- (a) Action of heat on **L**
 (b) Action of conc. HCl on **M**.
 (c) Why white ppt. appears on cooling. [3]

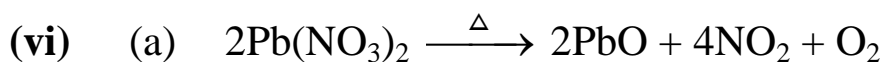
Ans. (i) Reddish-brown gas is nitrogen dioxide (NO₂).

(ii) Solid **L** is **lead nitrate**.

(iii) White precipitate is **lead chloride**.

(iv) Residue **M** is lead **monoxide** (PbO).

(v) The chemical formula for brown ring is
FeSO₄ · NO.



(c) It is because lead chloride is soluble in hot water only.
 Thus, when its solution cools, lead chloride reappears
 as white precipitate.

10. A white crystalline solid **A** on dissolving in water forms a neutral solution. When solid **A** is heated with calcium hydroxide, it gives off colourless gas **B** having a sharp biting smell. The gas fumes very strongly in air and turns red litmus blue. The aqueous solution of **A** on treating with lead acetate solution forms a white precipitate **C**. The precipitate is insoluble in all acids.

(i) Name the cation present in solid **A**. [1]

(ii) Name the anion present in solid **A**. [1]

(iii) Name the solid **A** and write its chemical formula. [1]

(iv) Name the colourless gas **B**. [1]

(v) Write one more chemical test for the identification of gas **B**. [1]

(vi) Name the white precipitate **C**. [1]

(vii) Write fully balanced chemical equations for : [1]

(a) Solid **A** and calcium hydroxide. [1]

(b) Solution of solid **A** and lead acetate solution. [1]

- Ans. (i)** Cation in **A** is ammonium . (NH_4^+)
- (ii)** Anion in **A** is sulphate . (SO_4^{2-})
- (iii)** Solid **A** is ammonium sulphate $[(\text{NH}_4)_2\text{SO}_4]$.
- (iv)** The colourless gas **B** is **ammonia gas**.
- (v)** Bring a rod dipped in HCl sol. near the gas. The dense white fumes of ammonium chloride are formed.
- (vi)** White precipitate **C** is **lead sulphate**.
- (vii)** (a) $(\text{NH}_4)_2\text{SO}_4 + \text{Ca}(\text{OH})_2 \longrightarrow \text{CaSO}_4 + 2\text{NH}_3 + 2\text{H}_2\text{O}$
 (b) $(\text{NH}_4)_2\text{SO}_4 + (\text{CH}_3\text{COO})_2\text{Pb} \longrightarrow \text{PbSO}_4 + 2\text{CH}_3\text{COONH}_4$

11. A yellowish-grey powder of two substances **A** and **B** is heated strongly in a test tube, when the substance **A** melts to form pale yellow liquid. On further heating, the pale yellow liquid darkens and thickens. After some time, the test tube starts glowing with reddish glow, even when the heating is stopped. On cooling, a grey solid **C** is left. The solid **C** on treating with dil. HCl gives off a colourless gas **D** which turns lead acetate solution black. The solution of **C** in HCl on treating with sodium hydroxide solution gives a dirty green precipitate **E**. If the mixture of **A** and **B** is treated with dil. HCl, a colourless, odourless gas **F** is formed. The gas burns with a pop sound on igniting.

- (a)** Name the following :
- (i) Gas **F** (ii) Precipitate **E** (iii) Solution of solid **C** in HCl (iv) Gas **D** (v) Constituents of mixture of **A** and **B**. [5]
- (b)** Write fully balanced chemical equations for the reactions of :
- (i)** **A** and **B** on heating.
(ii) **C** and dil. HCl
(iii) Solution of **C** in HCl and sodium hydroxide.
(iv) Gas **D** and lead acetate solution.
(v) Mixture of **A** and **B** with dil. HCl.
(vi) Name of the residue left after the reaction in (v). [6]

- Ans (a)**
- (i) The gas **F** is **hydrogen**.
 - (ii) Precipitate **E** is **ferrous hydroxide** $[\text{Fe}(\text{OH})_2]$.
 - (iii) Solution of **C** in HCl is **ferrous chloride** $[\text{FeCl}_2]$.
 - (iv) Gas **D** is **hydrogen sulphide**.
 - (v) Constituents of mixture of **A** and **B** are **iron** and **sulphur**.

- (b)**
- (i) $\text{Fe} + \text{S} \xrightarrow{\Delta} \text{FeS}$
 - (ii) $\text{FeS} + 2\text{HCl} \longrightarrow \text{FeCl}_2 + \text{H}_2\text{S}$
 - (iii) $\text{FeCl}_2 + 2\text{NaOH} \longrightarrow \text{Fe}(\text{OH})_2 + 2\text{NaCl}$
 - (iv) $(\text{CH}_3\text{COO})_2\text{Pb} + \text{H}_2\text{S} \longrightarrow \text{PbS} + 2\text{CH}_3\text{COOH}$
 - (v) $\text{Fe} + 2\text{HCl} (\text{dil.}) \longrightarrow \text{FeCl}_2 + \text{H}_2$
 - (vi) Sulphur is the residue left.

- 12.** When a light green crystalline solid **P**, is heated strongly in a hard glass test tube, tiny droplets of water collect on the cooler parts of the test tube. Furthermore, two colourless gases **R** and **Q** are given out, such that, they fume strongly in air. One of the gases amongst **R** and **Q** turns acidified potassium dichromate solution green. The residue **T** left behind is brown in colour. It dissolves in HCl to form a reddish-brown solution **S**. The solution **S** on treating with sodium hydroxide solution forms a reddish-brown precipitate **U**. The aqueous solution of **P** on treating with sodium carbonate solution forms a greenish precipitate **V**. On filtering out precipitate **V**, a colourless solution **W** is obtained. The colourless solution **W**, on treating with barium chloride solution forms white precipitate **X** which is insoluble in all acids.

(a) Identify :

- (i) Light green solid **P**.
- (ii) Which of the gases **Q** and **R**, turns acidified potassium dichromate solution green?
- (iii) Which of the gases **Q** and **R** fumes strongly in air?
- (iv) Name the residue **T**.
- (v) Name the solution **S**?
- (vi) Name the precipitate **U**.
- (vii) Name the precipitate **V**.
- (viii) Name the solution **W**.
- (ix) Name the white precipitate **X**.

(b) Write fully balanced equations for :

- (i) Action of heat on solid **P**.
- (ii) Action of HCl on residue **T**.
- (iii) Action of sodium carbonate solution on solution of **P**.
- (iv) Action of colourless solution **W** with barium chloride solution.
- (v) Action of sodium hydroxide solution on solution **S**. [5]

Ans. (a) (i) Light green solid is **hydrated ferrous sulphate**.

(ii) **Sulphur dioxide gas** turns acidified potassium dichromate solution green.

(iii) Sulphur trioxide gas fumes strongly in air.

(iv) The residue **T** is **ferric oxide** [Fe₂O₃].

(v) The solution **S** is **ferric chloride** [FeCl₃].

(vi) **U** is **ferric hydroxide** [Fe(OH)₃].

(vii) Precipitate **V** is **ferrous carbonate** [FeCO₃].

(viii) The solution **W** is **sodium sulphate** [Na₂SO₄].

(ix) The white precipitate **X** is **barium sulphate** [BaSO₄].

(b) (i) $2\text{FeSO}_4 \cdot 7\text{H}_2\text{O} \xrightarrow{\text{heat}} \text{Fe}_2\text{O}_3 + \text{SO}_2 + \text{SO}_3 + 7\text{H}_2\text{O}$ (steam)

(ii) $\text{Fe}_2\text{O}_3 + 6\text{HCl}$ (dil.) $\longrightarrow 2\text{FeCl}_3 + 3\text{H}_2\text{O}$

(iii) $\text{Na}_2\text{CO}_3 + \text{FeSO}_4 \longrightarrow \text{Na}_2\text{SO}_4 + \text{FeCO}_3$

(iv) $\text{Na}_2\text{SO}_4 + \text{BaCl}_2 \longrightarrow \text{BaSO}_4 + 2\text{NaCl}$

(v) $\text{FeCl}_3 + 3\text{NaOH} \longrightarrow \text{Fe(OH)}_3 + 3\text{NaCl}$

13. A sample salt **X** has a cation and anion from the following list:

Anions : CO₃²⁻; SO₃²⁻; S²⁻; NO₃⁻; Cl⁻; SO₄²⁻.

Cations : K⁺; Na⁺; NH₄⁺; Ca²⁺; Zn²⁺; Fe²⁺; Pb²⁺; Cu²⁺ .

Following tests are conducted on a small amount of sample **X**. State the presence or absence of ions on the basis of observations made in each test :

- (i) When salt **X** is strongly heated, it slightly sublimes. Which cation may be present?

- (ii) A thick paste of **X** in HCl does not impart any colour to non-luminous bunsen flame. Which cations are absent?
- (iii) On treating solution of **X** with sodium hydroxide solution (a) no precipitate is formed (b) a sharp-smelling colourless gas is evolved, which gives dense white fumes with HCl. Which cations are absent? Which cation is certainly present?
- (iv) There is no visible reaction between **X** and dil. HCl. Which anions are absent?
- (v) There is no visible reaction between conc. HCl and **X**. Which anions are absent?
- (vi) The aqueous solution of **X** forms white precipitate with lead acetate solution. The precipitate is insoluble in all acids. Which anion is certainly present?
- (vii) Name the salt **X**. [7]

Ans. (i) Ammonium (NH_4^+) ion may be present.

- (ii) **Potassium** (K^+); **sodium** (Na^+); **calcium** (Ca^{2+}) and **copper** (Cu^{2+}) ions may be absent.
- (iii) **Calcium** (Ca^{2+}); **zinc** (Zn^{2+}); **ferrous** (Fe^{2+}); **ferric** (Fe^{3+}); **lead** (Pb^{2+}) and **copper** (Cu^{2+}) ions are absent.

Ammonium (NH_4^+) ion is certainly present.

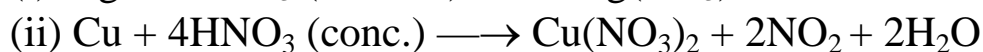
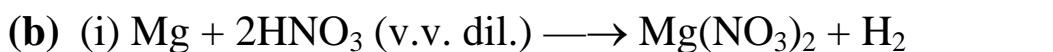
- (iv) **Carbonate** ; (CO_3^{2-}) **sulphite** (SO_3^{2-}) ; **sulphide** (S^{2-}) ions are absent.
- (v) **Nitrate** (NO_3^-) and **chloride** (Cl^-) ions are absent.
- (vii) **Sulphate** (SO_4^{2-}) ion is certainly present.
- (viii) Salt **X** is **ammonium sulphate**.

14. Following tests are performed with a colourless liquid **P**.
- When a very very dilute solution of liquid **P** is treated with magnesium ribbon, a colourless, odourless gas is evolved which burns with a pop sound.
 - When liquid **P** is treated with copper turnings, a brown gas is evolved. The reaction mixture is greenish-blue in colour.
 - When freshly prepared ferrous sulphate solution is added to **P**, followed by conc. sulphuric acid, a brown ring is formed.

Answer the following questions :

- Identify cations and anions present in **P** and hence name the substance. [2]
- Write fully balanced equations for the reaction of **P** with :
(i) magnesium (ii) copper turnings. [2]
- Name the compound and state its formula which forms the brown ring. [1]

Ans. (a) The **cation** present in **P** is **hydrogen** H^+ . The **anion** present in **P** is **nitrate** (NO_3^-). The liquid **P** is **nitric acid**.



(c) The compound is nitroso-ferrous sulphate $[FeSO_4 \cdot NO]$.

15. A heavy grey solid **P** which marks the paper black has the melting point between 300 °C to 350°C. It does not react readily with hot water and dilute HCl. However, it dissolves rapidly in conc. nitric acid. It also dissolves in sodium hydroxide solution, with the liberation of a colourless gas which burns with a pop sound. Its oxide is yellow when cold and reddish brown when hot.

(i) Identify **P**. [1]

(ii) Why does **P** not react readily with dilute HCl? [2]

(iii) Describe the reaction of **P** with conc. HNO_3 and support your answer with a chemical equation. [2]

(iv) Write the chemical equation for the reaction of **P** with sodium hydroxide solution. [2]

- Ans.**
- (i) The solid **P** is **lead metal**.
 - (ii) It is because its position in metal activity series is just above hydrogen, Thus, it cannot displace hydrogen easily from acid.
 - (iii) The solid **P** rapidly dissolves in nitric acid. The reaction mixture starts boiling and gives off a large volume of nitrogen dioxide which is reddish-brown in colour.

$$\text{Pb} + 4\text{HNO}_3 (\text{conc.}) \longrightarrow \text{Pb}(\text{NO}_3)_2 + 2\text{NO}_2 + 2\text{H}_2\text{O}$$
 - (iv)
$$\text{Pb} + 2\text{NaOH} + \text{H}_2\text{O} \xrightarrow{\text{heat}} \text{Na}_2\text{PbO}_2 + 2\text{H}_2\text{O}$$

16. Three sodium salts **A**, **B** and **C** are subjected to the following tests :

(a) To each of the dry salts is added a few ml of conc. H_2SO_4 and gently warmed. In case of **A**, a colourless gas is formed which fumes strongly in moist air.

In case of **B**, steamy vapours are given off which are slightly yellowish-red in colour.

In case of **C**, no visible reaction takes place.

(b) To the aqueous solution of each of the above salts is added silver nitrate solution and then excess of ammonium hydroxide solution.

In case of **A**, a curdy white ppt. is formed which is soluble in excess of ammonium hydroxide.

In case of **B**, no visible reaction takes place.

In case of **C**, a white ppt. is formed which is insoluble in ammonium hydroxide.

(c) To the aqueous solution of **A**, **B** and **C** is added barium chloride solution.

In case of **A** and **B**, there is no visible reaction.

In case of **C**, a white ppt. is formed, which is insoluble in HCl .

(1) Identify **A**, **B** and **C**. [3]

(2) Write equations for the chemical reactions taking place in (a), (b) and (c). If no visible reaction takes place, write no reaction. [9]

Ans. (1) A is sodium chloride.

B is sodium nitrate.

C is sodium sulphate.

(2) Reactions in case of (a) :

With A : $2\text{NaCl} + \text{H}_2\text{SO}_4 (\text{conc.}) \longrightarrow \text{Na}_2\text{SO}_4 + 2\text{HCl}$

With B : $2\text{NaNO}_3 + \text{H}_2\text{SO}_4 (\text{conc.}) \longrightarrow \text{Na}_2\text{SO}_4 + 2\text{HNO}_3$

With C : $\text{Na}_2\text{SO}_4 + \text{H}_2\text{SO}_4 (\text{conc.}) \longrightarrow \text{No reaction.}$

Reactions in case of (b) :

With A : $\text{NaCl} + \text{AgNO}_3 \longrightarrow \text{AgCl} + \text{NaNO}_3$

With B : $\text{NaNO}_3 + \text{AgNO}_3 \longrightarrow \text{No reaction.}$

With C : $\text{Na}_2\text{SO}_4 + 2\text{AgNO}_3 \longrightarrow \text{Ag}_2\text{SO}_4 + 2\text{NaNO}_3$

Reactions in case of (c) :

With A : $\text{NaCl} + \text{BaCl}_2 \longrightarrow \text{No reaction.}$

With B : $\text{NaNO}_3 + \text{BaCl}_2 \longrightarrow \text{No reaction.}$

With C : $\text{Na}_2\text{SO}_4 + \text{BaCl}_2 \longrightarrow \text{BaSO}_4 + 2\text{NaCl}$

17. Answer the following questions :

- (i) State the colour of precipitate and its chemical formula when aqueous solution of sodium hydroxide is mixed with iron (III) chloride solution. [2]
- (ii) Name two elements whose hydroxides are soluble in water. [2]
- (iii) Name one non-metallic hydroxide. [1]
- (iv) Name two metals which form more than one type of cations. Name the cations. [1]
- (v) Name the ion which is responsible for the blue colour of copper sulphate. [1]
- (vi) Why does dilute sulphuric acid not react easily with slaked lime? [2]

Ans. (i) The precipitate is **Iron (III) hydroxide** which is reddish-brown in colour. Its formula is **Fe(OH)₃**.

(ii) **Hydroxides of sodium and a potassium** are very soluble in water.

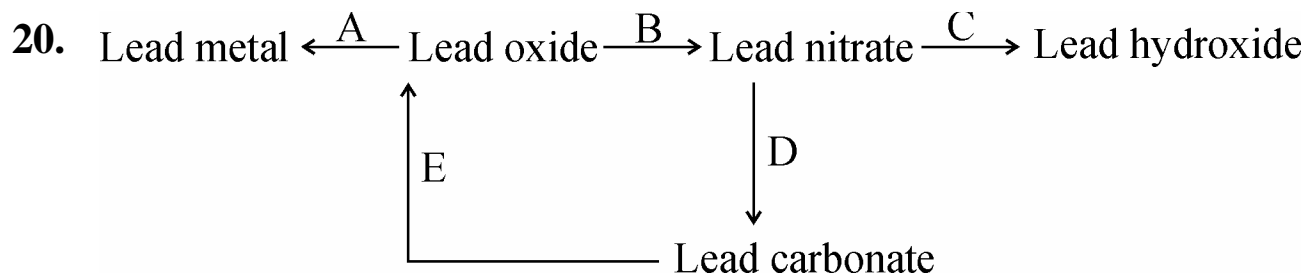
(iii) **Ammonium hydroxide** is a non-metallic hydroxide.

- (c) **Nitrogen dioxide, sulphur dioxide and carbon dioxide** dissolve in water to produce acidic solutions.
- (d) **Calcium hydroxide, sodium hydroxide and ammonia** on dissolving in water form alkaline solutions.
- (e) **Chlorine, bleaching powder and nitrogen dioxide** are oxidising agents.
- (f) **Carbon, ammonia and carbon monoxide** are reducing agents.
- (g) **Chlorine, nitrogen dioxide and copper carbonate** are coloured.

19. Give the chemical formula and one large-scale use of the following :

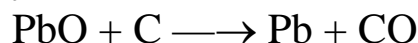
- (a) Cryolite (b) Quicklime (c) Oil of vitriol (d) Aqua fortis (e) Haematite; (f) Sal ammoniac (g) Galena. [1 mark each]

- Ans.**
- (a) Cryolite is **Na_3AlF_6** . It is used as an electrolyte in the manufacture of aluminium from alumina.
 - (b) Quicklime is **CaO** . It is used in the manufacture of cement.
 - (c) Oil of vitriol is **conc. H_2SO_4** . It is used in the manufacture of dyes, drugs and explosives.
 - (d) Aqua fortis is **conc. HNO_3** . It is used in the manufacture of explosives.
 - (e) Haematite is **Fe_2O_3** . It is the ore of iron from which iron metal is extracted.
 - (f) Sal-ammoniac is **NH_4Cl** . It is used as an electrolyte in dry cells.
 - (g) Galena is **PbS** . It is ore of lead from which lead metal is extracted.

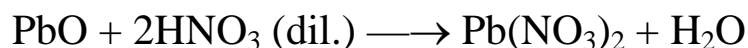


State briefly, how you can carry out conversions from A to E. Write fully balanced equations, in support of your answer. [5 × 2]

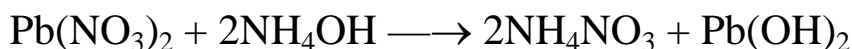
Ans. Conversion A : Mix lead oxide with powdered coke and heat strongly. The lead oxide is reduced to lead metal.



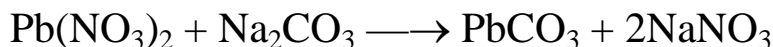
Conversion B : Dissolve lead oxide in warm and dilute nitric acid.



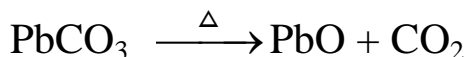
Conversion C : To the lead nitrate solution, add excess of ammonium hydroxide solution. Lead hydroxide appears as white ppt.



Conversion D : To the lead nitrate solution, add excess of sodium carbonate solution. Lead carbonate will appear as white ppt.



Conversion E : Filter the ppt. of lead carbonate and heat it strongly. The lead carbonate decomposes to form lead oxide.



21. Give one test to distinguish between :

- (a) Washing soda and baking soda.
- (b) Copper oxide and manganese dioxide.
- (c) Potassium chloride and sodium chloride.
- (d) Zinc carbonate and lead carbonate.
- (e) Powdered coke and manganese dioxide.
- (f) Ammonium chloride and ammonium nitrate.

- (g) A solution containing ferrous ions from a solution containing ferric ions.
- (h) A solution of HCl in toluene to a solution of HCl in water.
- (i) Potassium nitrate and potassium nitrite.
- (j) Mercuric oxide and red lead.
- (k) Ferrous sulphate and copper carbonate. [2 marks each]

Ans. (a) Heat each of the salts strongly in a hard glass test tube and pass the gas evolved through lime-water.

- (i) In case of washing soda, lime-water does not turn milky.
- (ii) In case of baking soda, lime-water turns milky.
- (b)** Warm each of the oxides with dilute hydrochloric acid.
 - (i) In case of copper oxide, a greenish-blue solution of copper chloride is formed.
 - (ii) In case of manganese dioxide, no reaction takes place.
- (c)** Make a thick paste of each salt in HCl. Take a small amount of the paste on clean platinum wire and introduce it in non-luminous bunsen flame.
 - (i) In case of potassium chloride, a non-persistent lilac flame is formed.
 - (ii) In case of sodium chloride, a persistent golden yellow flame is formed.
- (d)** Heat each of the carbonates strongly in a hard glass test tube.
 - (i) In case of zinc carbonate, residue is yellow when hot and white when cold.
 - (ii) In case of lead carbonate, residue is reddish-brown when hot and yellow when cold.
- (e)** Heat each of the substances with conc. hydrochloric acid.
 - (i) In case of coke, no visible reaction takes place.
 - (ii) In case of manganese dioxide, greenish-yellow gas chlorine is evolved.

- (f)** Heat each of salts strongly in a hard glass test tube.
 - (i) In case of ammonium chloride, sublimation takes place and white powdery deposit settles near the mouth of test tube.
 - (ii) In case of ammonium nitrate, an explosion takes place and nitrous oxide and steam are given off. No residue is left in the test tube.
- (g)** Treat the solution of each ion with sodium hydroxide solution.
 - (i) In case of ferrous ions, a dirty green ppt. of ferrous hydroxide is formed.
 - (ii) In case of ferric ions, a reddish-brown ppt. of ferric hydroxide is formed.
- (h)** Test each of the solutions with magnesium ribbon.
 - (i) In case of solution of HCl in toluene, no visible reaction takes place.
 - (ii) In case of solution of HCl in water, magnesium rapidly dissolves with the liberation of hydrogen gas.
- (i)** Treat each of the salts with dilute sulphuric acid and gently warm.
 - (i) In case of potassium nitrate, no visible reaction takes place.
 - (ii) In case of potassium nitrite, reddish-brown gas, nitrogen dioxide is given off.
- (j)** Heat each of the oxides strongly in a hard glass test tube.
 - (i) In case of mercuric oxide, tiny droplets of mercury are seen near the mouth of the test tube and residue is black.
 - (ii) In case of red lead, no tiny droplets are seen. The residue is reddish-brown when hot and yellow when cold.

- (k) Treat each of the salts with dilute sulphuric acid and gently warm.
- (i) In case of ferrous sulphate, the crystals dissolve to form light green solution, but no visible chemical reaction takes place.
 - (ii) In case of copper carbonate a lot of effervescence takes place with the liberation of carbon dioxide gas which turns limewater milky.

22. How will you separate the following gases?

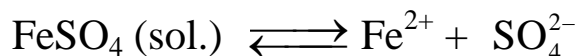
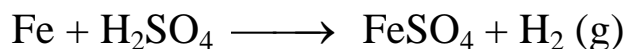
- (i) Chlorine gas from HCl gas.
- (ii) Nitric oxide gas from nitrogen dioxide gas.
- (iii) Ammonia gas from a mixture of nitrogen and hydrogen.
- (iv) Sulphur dioxide from sulphur trioxide
- (v) Oxygen from a mixture of ammonia and oxygen.
- (vi) Nitrogen dioxide from nitric oxide. [2 marks each]

- Ans.**
- (i) Pass the mixture of gases through warm water. HCl will dissolve but chlorine gas bubbles out.
 - (ii) Pass the mixture of gases through potassium hydroxide solution. The nitrogen dioxide gas reacts with potassium hydroxide solution but not with nitric oxide gas. Thus, nitric oxide gas bubbles out.
 - (iii) Pass the mixture through water. Ammonia gas dissolves in water but not in nitrogen and hydrogen. On warming the solution, ammonia gas is released.
 - (iv) Pass the mixture of gases slowly into a flask, placed in freezing mixture. Sulphur trioxide solidifies, leaving sulphur dioxide gas.
 - (v) Pass the mixture through water. Ammonia gas dissolves in water but oxygen bubbles out.
 - (vi) Pass the mixture through freshly prepared ferrous sulphate solution. Nitric oxide reacts with ferrous sulphate to form $\text{FeSO}_4 \cdot \text{NO}$. Nitrogen dioxide bubbles out.

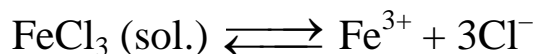
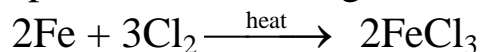
23. Briefly explain how you can obtain the following ions in aqueous solution, starting from elements. Support your answer by relevant equations.

- (a) Iron (II) ions from iron.
- (b) Iron (III) ions from iron.
- (c) Sulphate ions from sulphur.
- (d) Zinc ions from zinc.
- (e) Sulphide ions from sulphur.
- (f) Chloride ions from chlorine. [2 each]

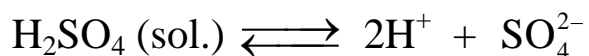
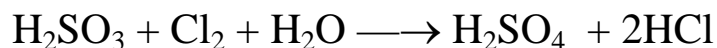
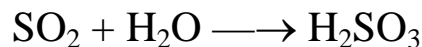
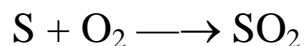
Ans. (a) Treat iron filings with dilute sulphuric acid. Iron dissolves to form ferrous sulphate which furnishes Fe^{2+} ions.



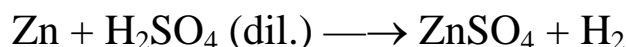
(b) Strongly heat iron filings and pass chlorine gas over them. Volatile vapours of iron (III) chloride are formed. These vapours on dissolving in water, furnish Fe^{3+} ions.

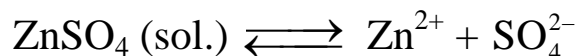


(c) Burn sulphur in air to obtain sulphur dioxide gas. Dissolve sulphur dioxide gas in water to obtain sulphurous acid. When sulphurous acid is treated with chlorine water, sulphuric acid is formed. Sulphuric acid furnishes SO_4^{2-} ions.

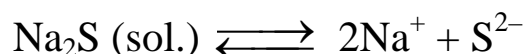
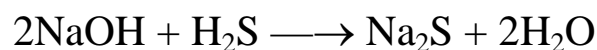
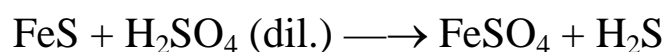
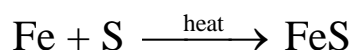


(d) On dissolving a few pieces of zinc in dilute sulphuric acid, zinc sulphate and hydrogen gas are formed. Zinc sulphate in solution furnishes Zn^{2+} ions.

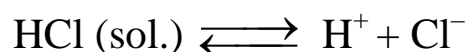
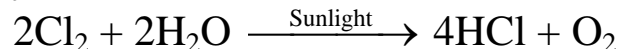




- (e) Mix iron filings with sulphur and heat strongly so as to obtain iron sulphide. Treat iron sulphide with dilute sulphuric acid to obtain hydrogen sulphide gas. When hydrogen sulphide gas is passed through dil. sodium hydroxide solution, sodium sulphide solution is formed. This solution furnishes sulphide ions.

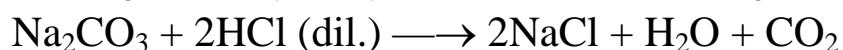
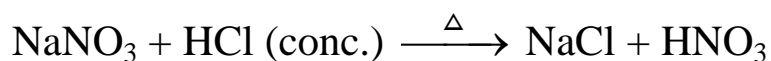


- (f) Pass chlorine gas through water to obtain chlorine water. When chlorine water is exposed to sunlight, it forms hydrochloric acid and oxygen. The aqueous solution of hydrochloric acid furnishes chloride ions.

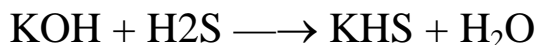
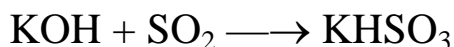
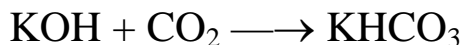


24. (a) By writing chemical equations, name two salts of different acids which react with hydrochloric acid. [2]
- (b) By writing chemical equations, name three gases which react with potassium hydroxide solution. [3]
- (c) By writing chemical equations, name four metals in powdered form which dissolve in caustic potash solution. [4]
- (d) An acid in dilute form reacts with metals to liberate hydrogen. However the same acid in concentrated form liberates sulphur dioxide gas when heated with metals. Name the acid and support your answer by two fully balanced equations. [2]

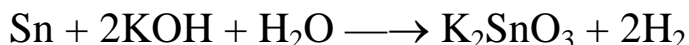
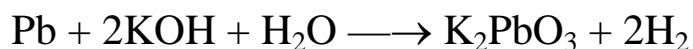
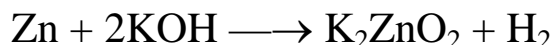
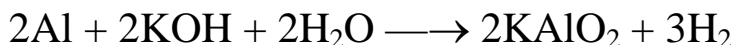
Ans. (a) The salts are **sodium nitrate** and **sodium carbonate**.



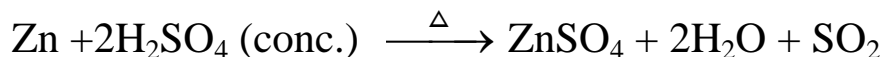
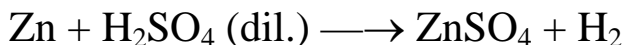
- (b) The gases are (i) **Carbon dioxide** (ii) **Sulphur dioxide** (iii) **Hydrogen sulphide.**



- (c) The metals are (i) **Aluminium** (ii) **Zinc** (iii) **Lead** (iv) **Tin.**



- (d) The acid is **sulphuric acid.**



25. Some of the properties of six pure substances, represented by **P**, **Q**, **R**, **S**, **T** and **W** are given below.

P is heated with conc. sulphuric acid. It gives off a choking gas which dissolves in water, giving an acid.

Q is a greenish-yellow gas which dissolves in water and when its aqueous solution is exposed to sunlight, a colourless gas is evolved. The gas rekindles glowing splint.

R is a metal. On treating with conc. nitric acid, it gives off brown fumes and greenish-blue solution.

S is a white solid. It gives sweet-smelling neutral gas which rekindles a brightly glowing splint.

T is a heavy oily liquid which chars sugar to porous mass.

W is a gas which turns moist red litmus blue. When the gas is passed over heated copper (II) oxide, another inactive gas is formed.

- (a) Identify **P**, **Q**, **R**, **S**, **T** and **W**.

- (b) Write equations for the following reactions, using substances named above.

(i) **P** is heated with conc. sulphuric acid.

(ii) An aqueous solution of **Q** is exposed to sunlight.

- (iii) **R** and conc. nitric acid.
 (iv) Action of heat on **S**.
 (v) Action of **T** on sugar.
 (vi) Action of **W** on heated copper (II) oxide. [1 mark each]

Ans. (a) **P** is sodium chloride.

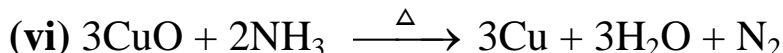
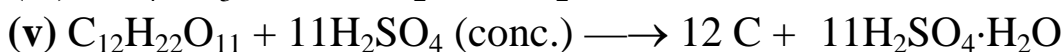
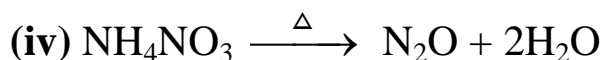
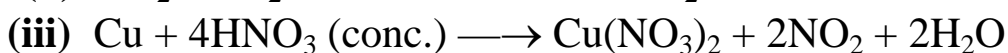
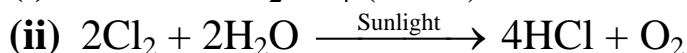
Q is chlorine gas.

R is copper metal.

S is ammonium nitrate.

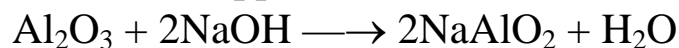
T is conc. sulphuric acid.

W is ammonia gas.



26. How would you obtain pure copper oxide from a homogeneous mixture of copper oxide and aluminium oxide? [2]

Ans. Dissolve the mixture in a hot and concentrated sodium hydroxide solution. The aluminium oxide dissolves to form sodium meta-aluminate, but copper oxide has no reaction. On filtering, the reaction mixture, copper oxide is left on the filter paper.



27. From the list of substances, choose one substance in each case which matches the description (a) to (f) given below. Only write exact names and not the formulae from list.

Copper carbonate, calcium hydrogen carbonate, sodium carbonate, sodium hydrogen carbonate, lead nitrate, ammonium nitrate, zinc carbonate, potassium nitrate.

(a) A hydrogen carbonate which exists in the solid state.

(b) A green coloured carbonate which on heating turns black.

(c) A nitrate which on heating gives off only oxygen gas.

- (d) A nitrate which on heating gives off nitrous oxide (dil. nitrogen oxide) and steam.
- (e) A carbonate which does not decompose on heating.
- (f) A nitrate which gives off nitrogen dioxide and oxygen on heating. [1 mark each]

- Ans.** (a) Sodium hydrogen carbonate
(d) Ammonium nitrate
(b) Copper carbonate
(e) Sodium carbonate
(c) Potassium nitrate
(f) Lead nitrate.