INORGANIC CHEMISTRY SEPARATIONS (Paper 2).

Qn. Name the reagent that can be used to distinguish between solutions of the following ions; In each case state what is observed;

1. Br^- and I^-

Reagent: Lead(II) nitrate solution.
observation Br^- – forms a pale yellow precipitate
I^- – Bright yellow precipitate forms

② CO_3^{2-} and HCO_3^-

Reagent: Magnesium (II) sulphate solution.
observation HCO_3^- – No observable change.
CO_3^{2-} – forms a white precipitate

③ $Zn^{2+}_{(aq)}$ and $Al^{3+}_{(aq)}$

Reagent: Ammonia solution
Observation: Zn^{2+} – forms a white precipitate soluble in excess to colourless solution.
Al^{3+} – forms a white precipitate insoluble in excess.

~~OR~~: ~~sodium~~.

④ $Fe^{3+}_{(aq)}$ and $Cr^{3+}_{(aq)}$

Reagent: Sodium hydroxide solution.
observation Fe^{3+} – gives a brown precipitate insoluble in excess
Cr^{3+} gives a green precipitate soluble in excess to form a green solution

⑤ Ba^{2+} and Ca^{2+}.

~~obs~~ Reagent; Potassium chromate VI, solution and ethanoic acid.
Observation: Ba^{2+} – forms a yellow precipitate insoluble in excess ethanoic acid.
Ca^{2+} – forms a yellow (faint) precipitate soluble in excess ethanoic acid.

⑥ NO_2^- and NO_3^-

Reagent: Iron (II) sulphate solution followed by concentrated sulphuric acid

Observation: NO_2^- gives no observable change.

NO_3^- forms a brown ring at the junction where the two layers of the liquids meet.

⑦ Acidified potassium manganate (VII) solution

NO_2^- changes the solution from purple to colourless.

NO_3^- Forms/shows no observable change.

⑧ SO_4^{2-} (aq) and SO_3^{2-} (aq)

Reagent: Acidified barium nitrate solution

observation: SO_4^{2-} (aq) forms a white precipitate insoluble in excess.

SO_3^{2-} (aq) forms a white precipitate soluble in excess with effervescence of a colourless gas (sulphur dioxide)

⑨ Sn^{2+} and Sn^{4+}

Reagent: Mercury (II) chloride solution

Observation: Sn^{2+} - forms a white precipitate

Sn^{4+} No observable change.

⑩ Mg^{2+} and Ba^{2+}

Reagent: Dilute sulphuric acid

Observation: Mg^{2+} - No observable change.

Ba^{2+} - forms a white precipitate.

⑩ Fe^{3+} (aq) and Fe^{2+} (aq).

Reagent; potassium hexacyanoferrate (II);

observation; Fe^{2+} No observable change.

Fe^{3+} Forms a deep blue precipitate.

⑪ NiO and FeO

Reagent: Dilute nitric acid followed by potassium hexacyanoferrate (III) solution

Observation: NiO No observable change.

FeO Dark blue precipitate forms;

(12) Zn^{2+} and Pb^{2+}

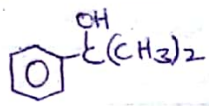
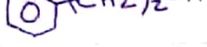
Reagent; potassium Iodide solution

Observation; Zn^{2+} gives a yellow solution

Pb^{2+} gives a yellow precipitate.

ORGANIC CHEMISTRY SEPARATION:

1 Name the (one) reagent that can be used to distinguish between each of the following pairs of compounds and state what would be observed and ~~state~~

①  and 

Reagent: Anhydrous zinc chloride and concentrated hydrochloric acid

Note This distinguishes alcohol class.

Observation 1° alcohols - give no observable change at room Temperature

2° alcohols - give a turbid/cloudy solution with in 5-10 minutes

3° alcohols - give a cloudy solution Immediately

② CH_3CH_2OH and $CH_3CH_2CH_2OH$

Reagent: Iodine solution in presence of sodium hydroxide solution.

Note: This reaction occurs only for secondary alcohols and; ethanol is the only primary alcohol that gives a positive result. $CH_3-\underset{OH}{CH}-R$

Observation: CH_3CH_2OH - gives a yellow precipitate

$CH_3CH_2CH_2OH$ - shows no observable change.

③ $CH_3CH_2C\equiv CH$ and $CH_3C\equiv CCH_3$

Reagent: Ammoniacal silver nitrate solution

Note: This can be used to distinguish; terminal and internal alkynes; carbonyl compounds (aldehydes and ketones).

Observations $CH_3CH_2C\equiv CH$ - forms a white precipitate

$CH_3C\equiv CCH_3$ - gives no observable change.

CH_3CH_2CHO and $CH_3\overset{O}{\overset{\|}{C}}CH_3$

Observations — Aldehyde - Form a silver mirror on the walls of the test tube.

- Ketone — No observable change.

Note:

This can also be used to distinguish Methanoic acid ($HCOOH$) from the rest of carboxylic acids eg CH_3CH_2COOH

Observation $HCOOH$ - forms a silver mirror on the test tube walls.

CH_3CH_2COOH - No observable change.

(others)

Note Ammoniacal copper (I) chloride can be used where the positive result forms a red precipitate.

(4) $CH_3\overset{O}{\overset{\|}{C}}CH_2CH_2CH_3$ and $CH_3CH_2\overset{O}{\overset{\|}{C}}CH_2CH_3$.

Reagent. Iodine solution in presence of sodium hydroxide solution

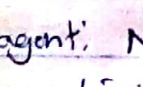
Note This reaction can be used to distinguish aldehydes and ketones that contain $CH_3\overset{O}{\overset{\|}{C}}-$ (ie CH_3CHO and methyl ketones)

Observation $CH_3\overset{O}{\overset{\|}{C}}CH_2CH_2CH_3$ – gives a yellow precipitate.

$CH_3CH_2\overset{O}{\overset{\|}{C}}CH_2CH_3$ – No observable change.

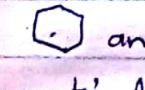
(5)  and

Reagent: Neutral iron III chloride solution.

Observation:  – forms a violet/purple colouration

 – No observable change.

Note This reaction distinguishes phenols (enol group $>C=\overset{OH}{C}-$) from other alcohols

(6)  and

Reagent: Acidified potassium Manganate (VII) solution

Note This reaction is used to detect presence of a double bond.

Observations – gives no observable change.

 – The solution turns from purple to colourless;

OR: We use; Bromine water to detect a double bond;

The positive result turns the Bromine water from brown to colourless.

(7)  and $CH_3CH_2CH_2Cl$

Reagent: Hot sodium hydroxide solution followed by acidified silver nitrate solution.

Note This reaction is used to distinguish between an aromatic halide () and aliphatic halides ($R-CH_2\overset{X}{Cl}$)

Observation; – shows no observable change

$CH_3CH_2CH_2Cl$ – gives a white precipitate.

Note; $-Br$ – gives a pale yellow precipitate.

$-Cl$ – gives a white precipitate.

^-I – gives a yellow precipitate.

(8)  and $CH_3(CH_2)_3NH_2$

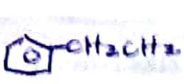
Reagent: Sodium nitrite and concentrated hydrochloric acid.

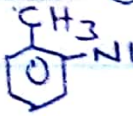
Note This reagent can be used to distinguish between amines, (1°2°3°)

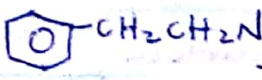
For
1° amine form a colourless solution, with evolution of a colourless gas
1° aromatic amine, form a colourless solution with no evolution of a colourless gas; from 0-5 °C, or below 10 °C
At above 10 °C, a colourless liquid forms, and effervescence of a colorless gas
2° amine, form a yellow oily liquid
3° amine form a colourless solution with no gas evolved.

Observation  forms a colourless solution with no evolution of a colourless gas at 0-5 °C

$CH_3(CH_2)_3NH_2$ forms a colourless solution and a colourless gas is evolved.

Q. Distinguish between;  and 

 – shows no observable change.

 – forms a colourless solution with the evolution of a colourless gas.

Note Taking for Annihilation Group.