

# CHM 122: PRACTICAL CHEMISTRY II

## QUALITATIVE ANALYSIS

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- Deals with identification of various species (cations, anions and functional groups etc) present in a mixture of species without bothering on the quantity
- Answers question what is present?
- It entails the following:
  - a. Preliminary test
  - b. Cation test & its confirmatory test (metal ions)
  - c. Anion test & its confirmatory test (acid radicals or anions)
  - d. Functional group test
  - e. Test for starch, proteins, fats and oils

# PRELIMINARY TEST

- This gives an insight to what the unknown substance could likely be
- Major preliminary tests are summarized below:
  - a. Observation of the physical properties  
(Physical Appearance)
  - b. Solubility test
  - c. Action of heat
  - d. Flame test

# PHYSICAL APPEARANCE

- Investigate if the solid is crystalline or amorphous (powdery)
- Investigate if the solid has a characteristic colour or smell

COLOUR	LIKELY COMPOUNDS
White (Colourless)	$\text{Ca}^{2+}$ , $\text{Na}^+$ , $\text{Al}^{3+}$ , $\text{Zn}^{2+}$ , $\text{Mg}^{2+}$ , $\text{NH}_4^+$ salts
Blue	Hydrated copper salts, Anhydrous cobalt salts
Green	$\text{Fe}^{2+}$ salts, $\text{CuCl}_2$ , $\text{CuCO}_3$
Golden Yellow or Brown	$\text{Fe}^{3+}$ salts (Hydrated ferric)
Black	$\text{CuS}$ , $\text{PbS}$ , $\text{MnO}_2$ , $\text{FeS}$
Very Pink (Not Visible in Solution)	Hydrated manganese salt

# SOLUBILITY TEST

- Dissolve
  - Water (aqueous)
  - Organic solvent(s) (polar or non-polar solvent)
  - Dilute acids
  - Dilute base/alkaline
- Observe the colour of the solution when dissolved in any of above
- Action of litmus paper to test if it is acidic, basic or neutral
- Check the back of the reaction vessel to know if it is exothermic or endothermic
- Is any gas given off in the course of dissolving the substance and identify the gas evolved by observing the colour, odour, response to moist litmus paper etc

# NOTES ON SOLUBILITY TEST

- Carbon compound small molecule (low molecular mass) with single polar bond due to attachment with electronegative element is bound to be polar hence it dissolves in water
- Carbon compounds with higher molecules (higher homologues) the properties of the hydrocarbon part of the molecule dominate and hence they are insoluble in water but soluble in organic solvents (non-polar)
- Organic compounds can also dissolve in dilute mineral acids or alkaline depending on whether they are acidic/basic/neutral
  - Organic acid like  $\text{RCOOH}$  is insoluble in dilute  $\text{HCl}$  but soluble in alkaline solution due to chemical reaction
  - Organic base (amines) dissolves in acidic solvents/solution

# ACTION OF HEAT

- Check for evolution of gas(es)
- Is residue present or not after heating
- Observe the colour of the residue when hot and cold
  - If substances sublime and no residue is left----- No heavy metal present
  - If residue left is ----- Heavy metal present
    - Reddish brown when hot and yellow when cold-----Lead salt
    - Yellow when hot and white when cold----- Zinc salt
    - Almost black when hot and vest red when cold-----Iron salt

# FLAME TEST

- Certain metallic compounds are volatilized in a non luminous Bunsen flame and give characteristics colour to the flame.
  - Flame colour
    - Intense colour (golden yellow)
    - Lilacc (purple/pink)
    - Red
    - Black red/ Crimson
    - Light green
    - Bluish green
- | Inference |
|-----------|
| Sodium    |
| Potassium |
| Lithium   |
| Calcium   |
| Barium    |
| Copper    |



Date: -----

Title: Solubility test

Aim: -----

Apparatuses/ materials: -----

	TEST	OBSERVATION	INFERENCE
A	Sample A NaCl		
1	Small portion of sample A + distilled water + vigorous shaking		Polar compound Sodium salt
2	Dip red litmus paper into solution of sample A		
3	Dip blue litmus paper into solution of sample A		
B	Sample B Benzoic acid		
4	Small portion of Sample		Acidic compound

