CHM 122: PRACTICAL CHEMISTRY II

QUALITATIVE ANALYSIS

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- Deals with identification of varoius 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)	Ca^{2+}, Na^{+}, Al^{3+}, Zn^{2+}, Mg^{2+}, NH_4^{+} salts
Blue	Hydrated copper salts, Anhydrous cobalt salts
Green	Fe^{2+} salts, $CuCl_2$ $CuCO_3$
Golden Yellow or Brown	Fe^{3+} salts (Hydrated ferric)
Black	CuS, PbS, MnO_2, 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 whelther they are acidic/basic/neutral
  - Organic acid like RCOOH is insoluble in dilute 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	Inference
Intense colour (golden yellow)	Sodium
Lilacc (purple/pink)	Potassium
Red	Lithium
Black red/ Crimson	Calcium
Light green	Barium
Bluish green	Copper

CHM 122 PRACTICAL CHEMISTRY
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