PRACTICAL CHEMISTRY FOR O and A-LEVEL STUDENTS/TEACHERS

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HOW TO TEACH
HOW TO SET
HOW TO MARK
LABORATORY REAGENTS

HOW TO TEACH PRACTICAL CHEMISTRY

- Emphasize the 5 principles in practical work

- Following instructions
- Interpreting the chemistry involved
- Predicting what is going to happen
- Treatment of results
- Applying common sense
- Recording values or observations technically

VOLUMETRIC ANALYSIS

The mole concept

1. *Direct mole concept including the idea of standardization using primary standards*
2. *Dilution and preparation of solutions from stock solutions*
3. *Back titration*
4. *Double indicator titration*
5. *Redox titration*

- Phase equilibrium (As taught in physical chemistry)
- Thermal chemistry(As taught in physical chemistry)
- Colligative properties(As taught in physical chemistry)
- Chemical kinetics(As taught in physical chemistry)

Emphasise the number of decimal places to which values from apparatus should be entered in tables of results.

APPARATUS	NUMBER OF DP
Burette	2dp
Pipette	1dp
Thermometer	1dp
Stop clock/ watch	1dp/2dp
Weighing scale	1dp/2dp

For graph work the following should be brought out clearly.

1. *Title*
2. *Labelled axes*
3. *Scale (mind about consistency and space covered as well as unwanted region)*
4. *Accurate plotting*
5. *Shape (may be straight line or curve of best fit)*
6. *Smoothness(use of a ruler for* straight line or free hand for curves)

INORGANIC QUALITATIVE ANALYSIS

- Emphasise the chemistry of 12 selected cations and 9 selected anions.
- Pointing out the following basic chemistry;

- the role of aqueous sodiumhydroxide in identification of cations
- the role of Aqueous ammonia in identification of cations
- confirmatory tests of cations

- the role of Lead(II)nitrate solution in identification of anions
- the role of silvernitrate solution in identification of anions
- the role of bariumnitrate solution in identification of anions
- confirmatory tests of anions

ORGANIC QUALITATIVE ANALYSIS

Identifying the nature of organic compounds;

Nature of organic compounds include

- Functional group(s) (hydroxyl, carbonyl, phenol or carboxyl)
- Aliphaticity or aromaticity.
- Molecular mass (high or low)
- Class (primary, secondary, tertiary or any other where applicable)
- Saturation or unsaturation (carbon to hydrogen ratio)

1. It's from this that one should derive the required comment on the nature of the organic compound at the end of the analysis.

2. A good observation in qualitative analysis (both number 1 and 2) captures color followed by an appropriate technical term.

COLOURS	TECHNICAL TERMS
Red /pink	Suspension
Orange	Precipitate
Yellow/cream	Filtrate
Green	Residue
Blue	Gas
Indigo	Solid
Violet/Purple	Liquid
Brown	Sublimate
White	Fumes
Colourless	Condensate

selected cations and anions

groupI	groupII	groupIII	groupIV	d-Block	anions
NH_4^+	Mg^{2+}	Al^{3+}	Pb^{2+}	Mn^{2+}	Cl^-
	Ca^{2+}			Fe^{2+}	Br^-
	Ba^{2+}			Fe^{3+}	I^-
				Ni^{2+}	NO_3^-
				Cu^{2+}	CO_3^{2-}
				Zn^{2+}	SO_3^{2-}
					SO_4^{2-}
					CH_3COO^-

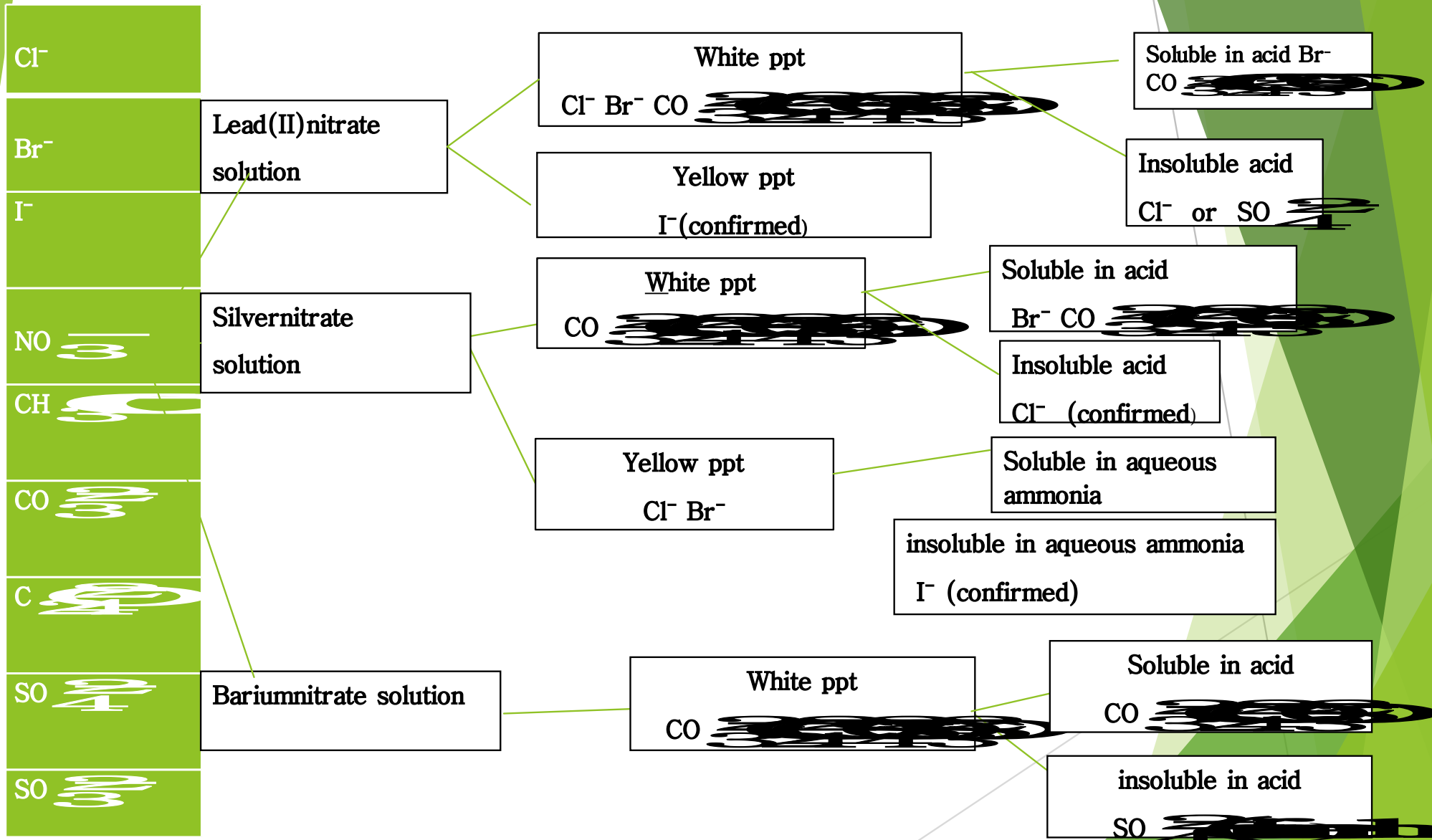
Expected observation	Aqueous ammonia	Aqueous sodiumhydroxide
No observable change	NH	
White ppt insoluble in excess	Ba^{2+} or Mg^{2+}	Ba^{2+} ,Ca^{2+} or Mg^{2+}
White ppt soluble in excess	Zn^{2+}	Al^{3+},Pb^{2+}or Zn^{2+}
White ppt insoluble in excess. it turns brown on standing	Mn^{2+}	Mn^{2+}
Green ppt insoluble in excess		Ni^{2+}
Green ppt soluble in excess forming pale blue solution	Ni^{2+}	
Green ppt insoluble in excess. it turns brown on standing	Fe^{2+}	Fe^{2+}
Brown ppt insoluble in excess	Fe^{3+}	Fe^{3+}
Pale blue ppt soluble in excess forming pale blue solution	Cu^{2+}	

Confirmatory tests of the selected cations

Cation	Confirmatory tests	Expected observations
NH_4^+	Aqueous sodiumhydroxide is added and the mixture wamed	A colourless gas with chocking smell turn moist blue litmus paper red and dense white fumes with HCl
Mg^{2+}	Solid ammoniumchloride is added followed by excess aqueous ammonia	No observable change
Ca^{2+}	Ammoniumoxalate solution is added followed by ethanoic acid	White ppt soluble in the acid
Ba^{2+}	Potassiumchromate solution is added followed by excess aqueous sodiumhydroxide	yellow ppt insoluble in excess aqueous sodiumhydroxide
Al^{3+}	aqueous ammonia is added followed by litmus solution	Blue lake solution

Pb^{2+}	Potassiumchromate solution is added followed by aqueous sodiumhydroxide	yellow ppt soluble in excess aqueous sodiumhydroxide
Mn^{2+}	Conc. Nitric acid is added followed by sodiumbismuthate solid	Purple solution
Fe^{2+}	Potassiumhexacyanoferrate(III) solution is added	Dark blue ppt
Fe^{3+}	Potassiumthiocyanate solution is added	Blood-red solution
Ni^{2+}	aqueous ammonia is added followed by dimethyglyoxime solution	Red ppt
Cu^{2+}	Potassiumhexcyanoferrate(II) solution is added	Dark brown ppt

Basic chemistry of anions


Cl⁻
Br⁻
I⁻
NO
CH
CO
C
SO
SO
Lead(II)nitrate solution
Silvernitrate solution
Bariumnitrate solution
White ppt
Cl⁻ Br⁻ CO
Yellow ppt
I⁻(confirmed)
White ppt
CO
Yellow ppt
Cl⁻ Br⁻
White ppt
CO
Soluble in acid Br⁻
CO
Insoluble acid
Cl⁻ or SO
Soluble in acid
Br⁻ CO
Insoluble acid
Cl⁻ (confirmed)
Soluble in aqueous ammonia
insoluble in aqueous ammonia
I⁻ (confirmed)
Soluble in acid
CO
insoluble in acid
SO

ORGANIC QUALITATIVE ANALYSIS

	TEST	OBSERVATION	DEDUCTION
a	Burn	It burns with Yellow sooty flame	Aromatic cpd/unsaturated aliphatic cpd/ Saturated aliphatic cpd of high molecular mass
		It burns with Yellow nonsooty flame	Saturated aliphatic cpd of low molecular mass
b	Add NaOH	Solid dissolves in NaOH	Acidic cpd (carboxylic acid or phenol)
		Solid is insoluble NaOH	basic cpd (amine)
c	Add water	It is miscible/soluble in cold water	polar cpd of low molecular mass
		It is sparingly miscible/soluble in cold water	polar cpd of high molecular mass
d	Test the solution with litmus or universal indicator	Solution turn blue litmus to red (pink solution PH=4)	Acidic cpd (carboxylic acid or phenol)
		Solution has no effect on litmus (green solution PH=7)	Neutral cpd (alcohol or carbonyl cpd)

e	Add Na	Effervescence occurs No Effervescence	Carboxylic acid confirmed present Carboxylic acid absent
f	Add neutral $FeCl_3$	Violet/purple solution is formed Violet/purple solution is not formed	phenol confirmed present phenol absent
g	Add tollens reagent and warm	Silver mirror is formed No Silver mirror	aldehyde confirmed present aldehyde absent
h	Add Fehling's reagent and heat	Red ppt is formed No Red ppt	aldehyde confirmed present aldehyde absent

i	Add Brady's reagent	Yellow ppt is formed No Yellow ppt	Carbonyl cpd present Carbonyl cpd absent
j	Add K  H^+ and heat	Orange solution turns to green No observable change	Reducing agent present Reducing agent present
k	Add excess I  NaOH	Yellow ppt is formed No Yellow ppt	CH  CH  CH  CH 
l	Add lucus reagent	Cloudy solution is formed in 5minutes Cloudy solution is formed in 8minutes No observable change	Tertiary alcohol present Secondary alcohol present Primary alcohol present

THANK YOU FOR YOUR ATTENTION