

Analytical chemistry

• the Physical Properties of an Salt :-

1) Shape ; Powder , Fine crystal , crystal , or sheet

2) color ; colorless , white , yellow etc

3) odor ; ^{→ ده في المعظم} odor less , Pungent odor

4) Solubility ; Soluble or insoluble in water.

!! أي الفرق بين Fine crystal , crystal ؟

crystal ← أي شكل له عرض وارتفاع زي « مكعبات الثلج »

Fine crystal ← أي شكل خشن زي « الملح أو السكر »

!! ال Solubility بنعرفها ازاى ← نجيب المادة ونقط عليها ماء ونري بتدوب ولا لا وغالباً كتبت هذه الخطوة في التجربة التأكيدية.

- ملاحظة لما في فلنب الشف لزق فظ ، الشحنة عليه علشان عليها دارجين
مثلا CO_3^{2-} , HCO_3^- , $\text{S}_2\text{O}_3^{2-}$... وهكذا.

- في التجربة التأكيدية مع carbonate , Bicarbonate يفضل التعامل مع الكواشف الأثنية BaCl_2 , MgSO_4 , HgCl_2 ونتجنب AgNO_3 لانه ذات ملاحظة ضعيفة جداً.

مع carbonate معظم المشاهدات تظهر على البارد

* في التجربة التآليية، هناخذ الملح ونضع عليه ماء وده لازل عشان يتكون معلول لذن في معظم التجارب التآليية يتكون راسب، فلازل اتأكد ان معايا معلول «ملح يذوب في الماء» لو الملح حديش تسخن.

* نخلي بالناتج في 2 Youp معظم الغازات سامت ولذلك هناخذ معايا احتياجهن كما امت في العملي.

Sure solution

- Put a suitable amount of salt in a test tube, Add small amount of water and shake well. If it does not dissolve in cold, heat it.

EXP	carbonate	Bicarbonate
Salt soln + MgSO ₄ or BaCl ₂	Give dense white p.p.t. on cold $\text{Na}_2\text{CO}_3 + \text{MgSO}_4 \rightarrow \text{Na}_2\text{SO}_4 + \text{MgCO}_3\downarrow$ $\text{Na}_2\text{CO}_3 + \text{BaCl}_2 \rightarrow 2\text{NaCl} + \text{BaCO}_3\downarrow$	Give dense white p.p.t after heating $2\text{NaHCO}_3 + \text{MgSO}_4 \rightarrow \text{Na}_2\text{SO}_4 + \text{Mg}(\text{HCO}_3)_2$ $\text{Mg}(\text{HCO}_3)_2 \rightarrow \text{H}_2\text{O} + \text{CO}_2\uparrow + \text{MgCO}_3\downarrow$ $2\text{NaHCO}_3 + \text{BaCl}_2 \rightarrow 2\text{NaCl} + \text{BaCO}_3\downarrow + \text{H}_2\text{O} + \text{CO}_2$
Salt soln + HgCl ₂	Give reddish brown p.p.t. on cold $\text{Na}_2\text{CO}_3 + \text{HgCl}_2 \rightarrow 2\text{NaCl} + \text{HgCO}_3\downarrow$	Give reddish brown p.p.t after heating $2\text{NaHCO}_3 + \text{HgCl}_2 \rightarrow 2\text{NaCl} + \text{Hg}(\text{HCO}_3)_2\downarrow$ $\text{Hg}(\text{HCO}_3)_2 \rightarrow \text{HgCO}_3\downarrow + \text{CO}_2 + \text{H}_2\text{O}$
Salt soln +AgNO ₃	Give dense white p.p.t. on cold $\text{Na}_2\text{CO}_3 + 2\text{AgNO}_3 \rightarrow 2\text{NaNO}_3 + \text{Ag}_2\text{CO}_3\downarrow$	Give dense white p.p.t after heating $\text{NaHCO}_3 + \text{AgNO}_3 \rightarrow \text{NaNO}_3 + \text{AgHCO}_3$ $2\text{AgHCO}_3 \rightarrow \text{H}_2\text{O} + \text{CO}_2\uparrow + \text{Ag}_2\text{CO}_3$

EXP	SULPHIDES
Salt soln + Pb(CH ₃ COO) ₂	Give black p.p.t $\text{Na}_2\text{S} + \text{Pb}(\text{CH}_3\text{COO})_2 \rightarrow 2\text{CH}_3\text{COONa} + \text{PbS}\downarrow$
Salt soln + AgNO ₃	Give black p.p.t $\text{Na}_2\text{S} + 2\text{AgNO}_3 \rightarrow 2\text{NaNO}_3 + \text{Ag}_2\text{S}\downarrow$

Salt soln + $\text{Na}_2\text{Fe}(\text{CN})_5\text{NO}$	Give violet color $\text{Na}_2\text{S} + \text{Na}_2\text{Fe}(\text{CN})_5\text{NO} \rightarrow \text{Na}_4\text{Fe}(\text{CN})_5\text{NOS} \downarrow$
EXP	SULPHITES
Salt soln + $\text{Pb}(\text{CH}_3\text{COO})_2$	Give white p.p.t $\text{Na}_2\text{SO}_3 + \text{Pb}(\text{CH}_3\text{COO})_2 \rightarrow 2\text{CH}_3\text{COONa} + \text{PbSO}_3 \downarrow$
Salt soln + AgNO_3	Give white p.p.t change to black $\text{Na}_2\text{SO}_3 + 2\text{AgNO}_3 \rightarrow 2\text{NaNO}_3 + \text{Ag}_2\text{SO}_3 \downarrow$
Salt soln + iodine solution	Color of iodine disappears as iodine is reduced to iodine ion $\text{Na}_2\text{SO}_3 + \text{I}_2 + \text{H}_2\text{O} \rightarrow \text{Na}_2\text{SO}_4 + 2\text{HI}$
Salt soln + acidified $\text{K}_2\text{Cr}_2\text{O}_7$	Give green color owing to the formation of chromic sulphate $\text{K}_2\text{Cr}_2\text{O}_7 + 3\text{K}_2\text{SO}_3 + \text{H}_2\text{SO}_4 \rightarrow \text{K}_2\text{SO}_4 + \text{Cr}_2(\text{SO}_4)_3 + \text{H}_2\text{O}$
EXP	THIOSULPHATE
Salt soln + $\text{Pb}(\text{CH}_3\text{COO})_2$	Give white p.p.t change into black by boiling $\text{Na}_2\text{S}_2\text{O}_3 + \text{Pb}(\text{CH}_3\text{COO})_2 \rightarrow 2\text{CH}_3\text{COONa} + \text{PbS}_2\text{O}_3$ $2\text{PbS}_2\text{O}_3 \rightarrow 2\text{SO}_2 + 2\text{PbS} \downarrow$
Salt soln + AgNO_3	Give white p.p.t the color changes through yellow and brown to black $\text{Na}_2\text{S}_2\text{O}_3 + 2\text{AgNO}_3 \rightarrow 2\text{NaNO}_3 + \text{Ag}_2\text{S}_2\text{O}_3$ $\text{Ag}_2\text{S}_2\text{O}_3 + \text{H}_2\text{O} \rightarrow \text{Ag}_2\text{S} \downarrow + \text{H}_2\text{SO}_4$
Salt soln + iodine solution	Color of iodine disappears as iodine is reduced to iodine ion $2\text{Na}_2\text{SO}_3 + \text{I}_2 \rightarrow \text{Na}_2\text{S}_4\text{O}_6 + 2\text{NaI}$
Salt soln + FeCl_3	Give violet color disappear by increase FeCl_3 $2\text{Na}_2\text{S}_2\text{O}_3 + 2\text{FeCl}_3 \rightarrow 4\text{NaCl} + 2\text{Fe}(\text{S}_2\text{O}_3)\text{Cl}$
EXP	NITRITE
Salt soln + $\text{KI} + \text{dil H}_2\text{SO}_4$	Give brown color of iodine as oxidation which give blue color of starch $2\text{KNO}_2 + 2\text{KI} + 2\text{H}_2\text{SO}_4 \rightarrow 2\text{K}_2\text{SO}_4 + 2\text{NO} + \text{I}_2 + 2\text{H}_2\text{O}$

Salt soln + KMnO_4 + dil H_2SO_4	<p>Give purple color of permanganate disappear</p> $5\text{KNO}_2 + 2\text{KMnO}_4 + 3\text{H}_2\text{SO}_4 \rightarrow 5\text{KNO}_3 + \text{K}_2\text{SO}_4 + 2\text{MnSO}_4 + 3\text{H}_2\text{O}$
Salt soln + FeSO_4 + conc H_2SO_4	<p>Give black ring which disappear by shaking or heating tube</p> $2\text{KNO}_2 + 6\text{FeSO}_4 + 4\text{H}_2\text{SO}_4 \rightarrow \text{K}_2\text{SO}_4 + 3\text{Fe}_2(\text{SO}_4)_3 + 4\text{H}_2\text{O} + 2\text{NO}$ $\text{FeSO}_4 + \text{NO} \rightarrow \text{FeSO}_4.\text{NO}$
Salt soln + AgNO_3	<p>Give white p.p.t</p> $\text{NaNO}_3 + \text{AgNO}_3 \rightarrow \text{NaNO}_3 + \text{AgNO}_2\downarrow$
Salt soln + Zn dust + NaOH	<p>Evolution of ammonia gas</p> $\text{NaNO}_2 + \text{Zn} + 2\text{NaOH} \rightarrow \text{Na}_2\text{ZnO}_2 + \text{NH}_3\uparrow$

EXP	OBS	RES
Solid salt + conc H ₂ SO ₄	Efference and evolution of colorless gas (HCl) which forms white clouds when exposed to a glass rod moistened with ammonia (NH ₃) OR ammonium hydroxide (NH ₄ OH) $2\text{NaCl} + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + 2\text{HCl}\uparrow$ $\text{HCl} + \text{NH}_3 \rightarrow \text{NH}_4\text{Cl}\downarrow$	A.R may be chloride
Solid salt + conc H ₂ SO ₄	Efference and evolution of reddish orange fume evolved, and solution turns to orange due to separation of bromine $2\text{NaBr} + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + 2\text{HBr}\uparrow$ $2\text{HBr} + \text{H}_2\text{SO}_4 \rightarrow 2\text{H}_2\text{O} + \text{SO}_2 + \text{Br}_2$	A.R may be bromide
Solid salt + conc H ₂ SO ₄	Violet fumes evolved and brown p.p.t or black p.p.t $2\text{KI} + \text{H}_2\text{SO}_4 \rightarrow \text{K}_2\text{SO}_4 + 2\text{HI}\uparrow$ $2\text{HI} + \text{H}_2\text{SO}_4 \rightarrow 2\text{H}_2\text{O} + \text{SO}_2 + \text{I}_2$	A.R may be iodide
Solid salt + conc H ₂ SO ₄	Reddish brown vapor of NO ₂ in the presence of Cu $2\text{KNO}_3 + \text{H}_2\text{SO}_4 \rightarrow \text{K}_2\text{SO}_4 + 2\text{HNO}_3$ $4\text{HNO}_3 + \text{Cu} \rightarrow \text{Cu}(\text{HNO}_3)_2 \rightarrow \text{NO}_2 + \text{H}_2\text{O}$	A.R may be nitrate
Solid salt + conc H ₂ SO ₄	-Ve	gp (2) is absent

EXP	CHLORIDES
Salt soln + Pb(CH ₃ COO) ₂	Give dense white p.p.t $2\text{NaCl} + \text{Pb}(\text{CH}_3\text{COO})_2 \rightarrow 2\text{CH}_3\text{COONa} + \text{PbCl}_2\downarrow$
Salt soln + AgNO ₃ ده مش معانا	Give dense white p.p.t. in soluble in dil HNO₃ $\text{NaCl} + \text{AgNO}_3 \rightarrow \text{NaNO}_3 + \text{AgCl}\downarrow$
Salt soln + Hg ₂ (NO ₃) ₂	White p.p.t $\text{Hg}_2(\text{NO}_3)_2 + 2\text{NaCl} \rightarrow 2\text{NaCl} + \text{Hg}_2\text{Cl}_2\downarrow$

EXP	BROMIDES
Salt soln + Pb(CH ₃ COO) ₂	Give white p.p.t $2\text{NaBr} + \text{Pb}(\text{CH}_3\text{COO})_2 \rightarrow 2\text{CH}_3\text{COONa} + \text{PbBr}_2\downarrow$
Salt soln + AgNO ₃	Give pale yellow p.p.t. soluble in dil HNO ₃ $\text{NaBr} + \text{AgNO}_3 \rightarrow \text{NaNO}_3 + \text{AgBr} \downarrow$
EXP	IODIDES
Salt soln + Pb(CH ₃ COO) ₂	Give yellow p.p.t $2\text{NaI} + \text{Pb}(\text{CH}_3\text{COO})_2 \rightarrow 2\text{CH}_3\text{COONa} + \text{PbI}_2 \downarrow$
Salt soln + AgNO ₃	Give cancer yellow p.p.t $\text{NaI} + \text{AgNO}_3 \rightarrow \text{NaNO}_3 + \text{AgI} \downarrow$
Salt soln + Hg ₂ (NO ₃) ₂	Give reddish brown p.p.t disappear by increasing of solution $2\text{KI} + \text{HgCl}_2 \rightarrow 2\text{KCl} + \text{HgI}_2\downarrow$ $2\text{KI} + \text{HgI}_2 \rightarrow \text{K}_2\text{HgI}_4$
EXP	NITRATE
Salt soln + freshly prepared FeSO ₄ + 2drops of conc H ₂ SO ₄	Give brown or black ring disappear by shacking the solution $2\text{KNO}_3 + 6\text{FeSO}_4 + 4\text{H}_2\text{SO}_4 \rightarrow \text{K}_2\text{SO}_4 + 3\text{Fe}(\text{SO}_4)_3 + 2\text{NO} + \text{H}_2\text{O}$ $\text{FeSO}_4 + \text{NO} \rightarrow \text{FeSO}_4.\text{NO}$
Salt soln + Zn dust + NaOH	Give odor of ammonia $\text{NaNO}_3 + 4\text{Zn} + 7\text{NaOH} \rightarrow 4\text{Na}_2\text{ZnO}_2 + 2\text{H}_2\text{O} + \text{NH}_3\uparrow$

GROUP (3)

- Sulphate (SO₄²⁻), Phosphate (PO₄³⁻), and Borate (B₄O₇²⁻)
- Prepare a conc solution of salt and add BaCl₂, this gives white p.p.t and according to the solubility of this precipitate in dil HCl or excess of BaCl₂ we can predict the acidic radical as

ACIDIC RADICAL	Dil HCl	Excess BaCl ₂
Sulphate	Insoluble	In soluble
Phosphate	Soluble	In soluble
borate	soluble	Soluble

- $\text{Na}_2\text{SO}_4 + \text{BaCl}_2 \rightarrow 2\text{NaCl} + \text{BaSO}_4\downarrow$
- $\text{Na}_2\text{HPO}_4 + \text{BaCl}_2 \rightarrow 2\text{NaCl} + \text{BaHPO}_4\downarrow$
- $\text{Na}_2\text{B}_4\text{O}_7 + \text{BaCl}_2 \rightarrow 2\text{NaCl} + \text{Ba}(\text{BO}_3)_2\downarrow + 2\text{H}_3\text{BO}_3$

• **Conformal tests for group (3)**

EXP	SULPHATE	PHOSPHATE	BORATE
Salt soln + $\text{Pb}(\text{CH}_3\text{COO})_2$	Give white p.p.t $\text{Na}_2\text{SO}_4 + \text{Pb}(\text{CH}_3\text{COO})_2 \rightarrow 2\text{CH}_3\text{COONa} + \text{PbSO}_4\downarrow$	-ve	-Ve
Salt soln + AgNO_3	Give white p.p.t not affect by heating $\text{Na}_2\text{SO}_4 + 2\text{AgNO}_3 \rightarrow 2\text{NaNO}_3 + \text{Ag}_2\text{SO}_4\downarrow$	Give yellow p.p.t $\text{Na}_3\text{PO}_4 + 3\text{AgNO}_3 \rightarrow 3\text{NaNO}_3 + \text{Ag}_3\text{PO}_4\downarrow$	Give white p.p.t change into brown by heating $\text{Na}_2\text{B}_4\text{O}_7 + 2\text{AgNO}_3 + 3\text{H}_2\text{O} \rightarrow 2\text{NaNO}_3 + 2\text{H}_3\text{BO}_3 + 2\text{AgBO}_2\downarrow$ $2\text{AgBO}_2 + 3\text{H}_2\text{O} \rightarrow 2\text{H}_3\text{BO}_3 + \text{Ag}_2\text{O}$
Salt soln + HgCl_2	-Ve	-ve	Reddish brown p.p.t soluble in dil HCl $\text{HgCl}_2 + \text{Na}_2\text{B}_4\text{O}_7 \rightarrow 2\text{NaCl} + \text{Hg}(\text{BO}_2)_2\downarrow + \text{B}_2\text{O}_3$