CONCEPT: SOLUBILITY RULES

- **Solubility**: A chemical property that deals with the ability of a solute to become dissolved in a solvent.
  - □ **Soluble**: Refers to a solute that can be dissolved into _____ when placed in a solvent.

    $AlBr_3$ (s) ⟶
  - □ **Insoluble**: Refers to a solute that cannot be dissolved when placed in a solvent.

    AgBr (s) ⟶

EXAMPLE: How many ions will the following soluble compound produce: Na_2SO_4?

Solubility Rules

- The Solubility Rules are a convenient set of guidelines to help us determine if a compound will be *soluble* or *insoluble*.

MEMORY TOOL

" The bank robber was **GANA CASH** his loot, but the **COPS** stopped him "

- **GANA CASH** is used for **Soluble Ionic Solutes**, with the **exceptions** creating an insoluble solute called a _____.
  - □ **Exceptions: "SH**hhh! Keep quiet about the cash."

Soluble Compounds

Group	Structures	Exceptions	Explanation
G_____	Li, Na, K	None	
A_____	$C_2H_3O_2^-$	None	
N_____	NO_3^-	None	
A_____	NH_4^+	None	
C_____	ClO_3^- / ClO_4^-	None	
A_____			
S_____	SO_4^{2-}	CBS HAPpy	□ Creates a solid when connected to: C__ , B__ , S__ , H__ , A__ , P__
H_____	F, Cl, Br, I	HAPpy	□ Creates a solid when connected to: H__ , A__ , P__

EXAMPLE: According to the solubility rules, which of the following ionic compounds will be insoluble?

a) $NaNO_3$ b) $Ca(C_2H_3O_2)_2$ c) $BaSO_4$ d) $(NH_4)_2CO_3$ e) $CoClO_4$

CONCEPT: SOLUBILITY RULES

- **COPS** is used for **Insoluble Ionic Solutes**, with the **exceptions** creating a _____ ionic compound.
  - □ **Exceptions: "Oh Snap! It's the cops!"**

Insoluble Compounds

Group	Structures	Exceptions	Explanation
C_____	CO_3^{2-} / CrO_4^{2-}	None	
O_____ 	O^{2-} / OH^-	**CBS**	□ Creates a soluble aqueous compound when connected to: **C**__ , **B**__ , **S**__
P_____	PO_4^{3-}	None	
S_____ 	S^{2-}	**CBS**	□ Creates a soluble aqueous compound when connected to: **C**__ , **B**__ , **S**__

EXAMPLE: Based on the chart shown above, determine which of the following substances will be soluble in water.

a) $Al(OH)_3$ b) $Zn_3(PO_4)_2$ c) Ag_2CO_3 d) CaS e) $MgCrO_4$

PRACTICE: Based on your understanding of the solubility rules, which of the following ionic compounds will be insoluble?

a) Zinc chloride b) Manganese (V) chlorate c) Lead (II) sulfate d) Gallium acetate

PRACTICE: Which pair of compounds is insoluble in water?

a) $PbSO_4$ and $Pb_3(PO_4)_2$

b) Na_2S and CuS

c) $(NH_4)_2SO_4$ and AgI

d) $AgNO_3$ and KNO_3