

## Chapter 4: Review Worksheet

The following topics are in Chapter 4

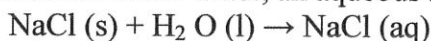
1. Solute versus solvent (solution formation)
2. Electrolytes and non-electrolytes
3. Double Displacement Reactions (molecular equations, complete ionic equations, net ionic equations, spectator ions, solubility rules)
4. Single Replacement Reactions and activity series
5. Decomposition and synthesis reactions
6. Concentration and dilution
7. Acid Base Reactions/Neutralization
8. Redox Reactions (assigning oxidation numbers and balancing)
9. Titration (both acid base and redox)

**We WILL NOT formally cover topics 1-6 (these are all things you have learned already). We WILL formally cover topics 7-9**

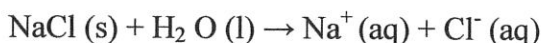
**I expect you to know how to do topics 1-6. If you do not remember, revisit or ASK for help. This worksheet is a review of the topics we will not formally cover in class. We will just refresh our memory on them but not relearn them.**

### Topics 1 and 2: Solutions and Electrolytes

1. What is the difference between a solute and a solvent. Give a specific example.
2. How do you know if a solute will dissolve in a solvent or not? Likes dissolve likes
3. When solid NaCl is dissolved in water, an aqueous solution forms as shown here:

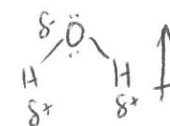
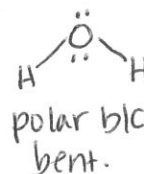


NaCl (aq) means the cation is split from the anion, dissociation, and you really have:

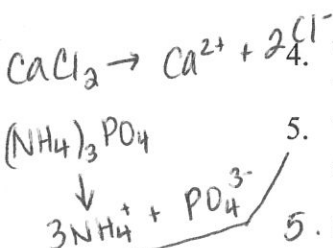


Each ion is solvated, surrounded by water through dipole-dipole interactions.

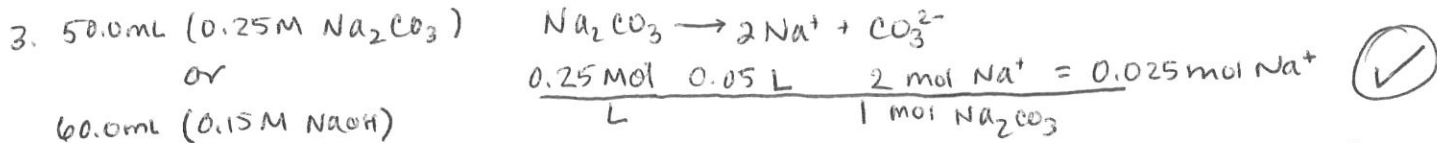
- a. Draw the Lewis structure of water and add the partial charges (show how it is polar).
- b. Which end of water is attracted to the cation and which is attracted to the anion? This process is called solvation.



O end ( $\delta^-$ ) attracted to  $\oplus$  cation.  
H ( $\delta^+$ )  $\cdots$  anion



4. When calcium chloride dissolves in water, what ions are present in the solution? What about ammonium phosphate?
5. What is an electrolyte? What determines whether you are a strong, weak, or non-electrolyte? Give an example of strong, a weak, and a non-electrolyte.
5. electrolyte  $\rightarrow$  conducts electricity. Charged particle  
strong  $\rightarrow$  full dissociation  $\rightarrow$  soluble ionics, strong acid, strong bases.  
non  $\rightarrow$  no dissociation  $\rightarrow$  insoluble ionics, covalent  
weak  $\rightarrow$  partial dissociation  $\rightarrow$  weak Acid/base. slightly sol.



**Topic 6: Concentration and dilution**      NaOH → Na<sup>+</sup> + OH<sup>-</sup>       $\frac{0.15 \text{ mol}}{\text{L}} \cdot 0.06 \text{ L} = 0.009 \text{ mol Na}^+$

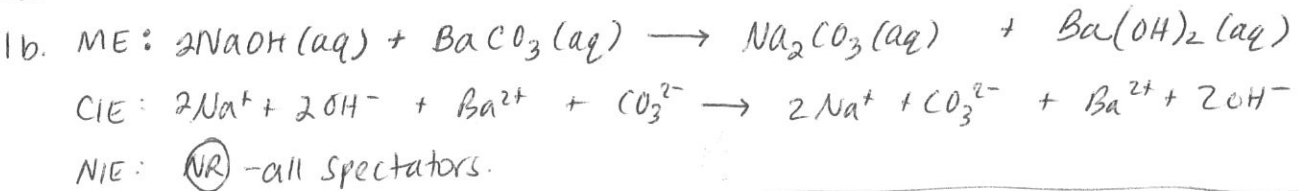
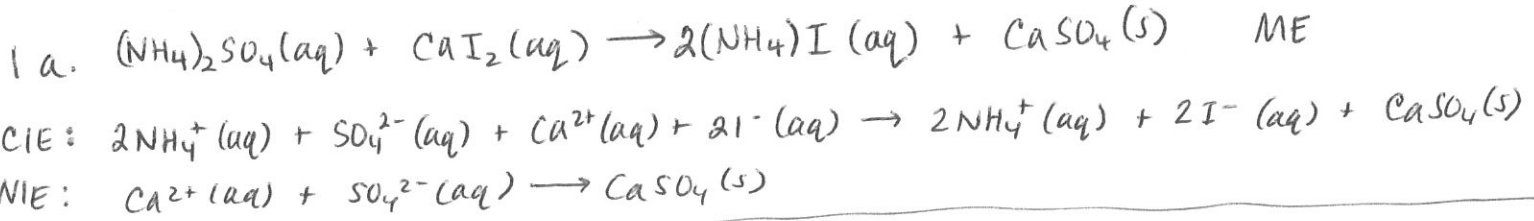
- The main concentration unit is molarity, M. Define that.  $M = \frac{\text{mol solute}}{\text{L solution}}$
- What is the concentration, M, of solution prepared by mixing 4.25 g NaCl in 100.0 mL of water? Convert g → mol then ÷ by Liters       $M = 0.0733 \text{ mol} / 0.100 \text{ L} = 0.733 \text{ M}$
- Which has more sodium ions: 50.0 mL of 0.25 M sodium carbonate solution or 60.0 mL of 0.15 M sodium hydroxide solution?
- How many mL of a stock solution of 10.0 M nitric acid would you need to prepare 450.0 mL of a 0.500 M dilute solution? dilution  $M_1V_1 = M_2V_2$
- How many mL of water will you add in question #4?  $10.0 \text{ M}(x \text{ mL}) = 0.500 \text{ M}(450.0 \text{ mL})$   
 $x = 22.5 \text{ mL}$   
 need 22.5 mL of acid, want 450 mL total  
 so  $450 - 22.5 = 427.5 \text{ mL H}_2\text{O}$

**Topic 3: Double Displacement**

You should be able to write molecular equations (ME), complete ionic equations (CIE) and net ionic equations (NIE). You will need to MEMORIZE the solubility rules.

- A molecular equation shows the substances as compounds, regardless of solubility properties.
- CIE shows all reactants and products as ions, not molecules, depending on solubility. If a compound is soluble, has aq label, then it exists as ions. If a compound is not soluble, gas or solid, then it exists as a compound (g) or (s).
- NIE removes the spectators from the CIE and shows only the species that react.

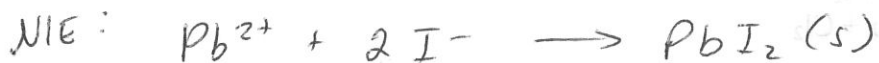
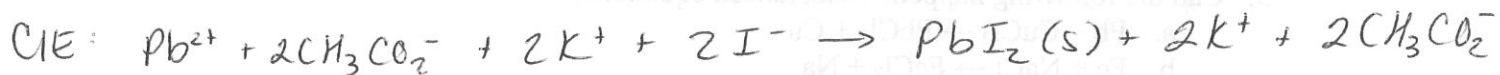
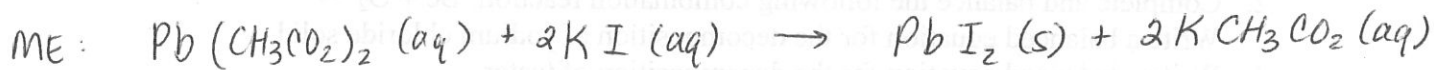
- Write balanced ME, CIE and NIE for the following:
  - Reaction of aqueous solutions of ammonium sulfate with calcium iodide
  - Reaction of aqueous solutions of sodium hydroxide with barium carbonate
- If 50.0 mL of a 0.05 M solution of lead (II) acetate is mixed with 60.0 mL of a 0.10 M potassium iodide solution
  - Write the molecular, complete ionic, and net ionic equations.
  - What is the formula and name of the precipitate?
  - Identify the spectator ions.
  - Identify the limiting and excess reagents.
  - How many grams of the precipitate will be produced?



2. next page

# Topic 3

#2 a.

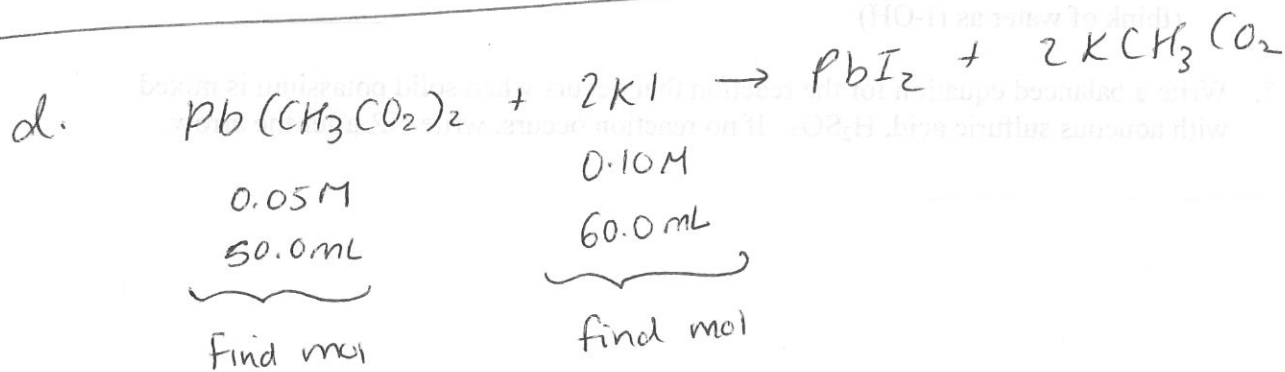


b. ppt =  $\text{PbI}_2$  lead (II) iodide

---

c.  $\text{CH}_3\text{CO}_2^-$  &  $\text{K}^+$  are spectators

---



$$0.05 \text{ M Pb}(\text{CH}_3\text{CO}_2)_2 \times 0.050 \text{ L} = 0.0025 \text{ mol Pb}(\text{CH}_3\text{CO}_2)_2$$

└───────────┬───────────> 0.0025 mol  
PbI<sub>2</sub>

$$0.10 \text{ M KI} \times 0.060 \text{ L} = 0.006 \text{ mol KI} \rightarrow 0.003 \text{ mol PbI}_2$$

LR =  $\text{Pb}(\text{CH}_3\text{CO}_2)_2$ ; can only make 0.0025 mol  $\text{PbI}_2 (\text{s})$

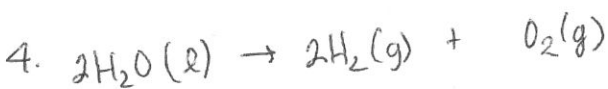
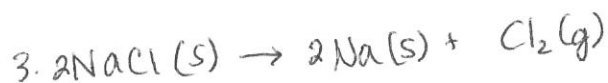
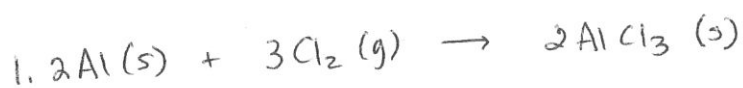
---

e.  $0.0025 \text{ mol PbI}_2 \times \text{MM PbI}_2 = 1.15 \text{ g PbI}_2$

461 g/mol

## Topics 4 and 5: Single Replacement, Synthesis and Decomposition

- Write a balanced equation for the formation of aluminum chloride from its elements.
- Complete and balance the following combination reaction:  $\text{Be} + \text{O}_2 \rightarrow$
- Write a balanced equation for the decomposition of sodium chloride solid.
- Write a balanced equation for the decomposition of water.
- Can the following happen? (unbalanced equations)
  - $\text{Pb} + \text{CuCl}_2 \rightarrow \text{PbCl}_2 + \text{Cu}$
  - $\text{Fe} + \text{NaCl} \rightarrow \text{FeCl}_2 + \text{Na}$
  - $\text{Br}_2 + \text{NaI} \rightarrow \text{NaBr} + \text{I}_2$
  - $\text{Br}_2 + \text{NaCl} \rightarrow \text{NaBr} + \text{Cl}_2$
- Complete the following equations and balance. If no reaction occurs, write NR after the arrow.
  - $\text{Fe}(\text{s}) + \text{Pb}(\text{NO}_3)_2(\text{aq}) \rightarrow$   
(assume  $\text{Fe}^{2+}$ ) Can Fe bump Pb? YES  $\rightarrow \text{Fe}(\text{NO}_3)_2 + \text{Pb}(\text{s})$
  - $\text{Cl}_2(\text{aq}) + \text{NaI}(\text{aq}) \rightarrow$   
Can Cl bump I? YES  $\rightarrow \text{NaCl} + \text{I}_2$  then balance
  - $\text{Ca}(\text{s}) + \text{H}_2\text{O}(\text{l}) \rightarrow$   
(think of water as H-OH)  
Can Ca bump H? YES  $\rightarrow \text{Ca}(\text{OH})_2 + \text{H}_2$  then balance
- Write a balanced equation for the reaction that occurs when solid potassium is mixed with aqueous sulfuric acid,  $\text{H}_2\text{SO}_4$ . If no reaction occurs, write NR after the arrow.



5. need activity series

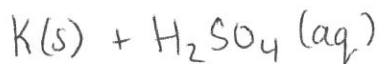
(a) is  $\text{Pb} > \text{Cu}$ ? YES

(b) is  $\text{Fe} > \text{Na}$ ? No = NR

(c) is  $\text{Br} > \text{I}$ : YES

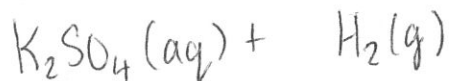
(d) is  $\text{Br} > \text{Cl}$ : NR

7.



can K bump H? YES

↓



then balance

