

***ALE 18. Reactions in Solution: The Role of Water as a Solvent +
Molecular, Ionic and Net Ionic Equations for Precipitation Reactions***

(Reference: Chapter 4 - Silberberg 5th edition)

Important!! For answers that involve a calculation you must show your work neatly using dimensional analysis with correct significant figures and units to receive full credit. No work, no credit. Report numerical answers to the correct number of significant figures. **CIRCLE ALL NUMERICAL RESPONSES.**

Section 4.1 The Role of Water as a Solvent (Read section 4.1 before answering questions 1 – 10.)

1. What two factors cause water to be polar?

i.)

ii.)

2. a.) What types of substances are most likely to be soluble in water?

i.)

ii.)

b.) State whether each of the following substances is likely to be very soluble in water. Explain your reasoning.

i.) Lithium nitrate, formula = _____: soluble or insoluble in water? (circle one)

ii.) Glycine, $\text{H}_2\text{NCH}_2\text{COOH}$, an amino acid: soluble or insoluble in water? (circle one)

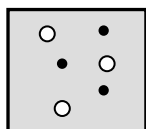
iii.) n-Pentane, C_5H_{12} : soluble or insoluble in water? (circle one)

iv.) Ethylene Glycol (antifreeze), $\text{HOCH}_2\text{CH}_2\text{OH}$: soluble or insoluble in water? (circle one)

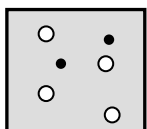
3. What occurs at the molecular level when an ionic compound dissolves in water?

4. Why are some *ionic compounds* soluble in water and others not?

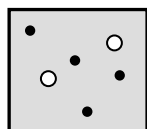
5. Which of the following best represents a solution of magnesium nitrate? Explain your reasoning.
(White sphere = magnesium ion; Black sphere = nitrate ion)



A



B



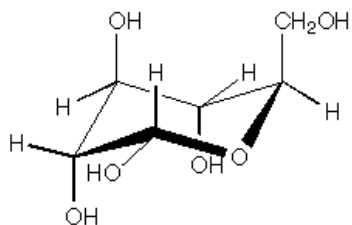
C

6. Why are some *covalent compounds* soluble in water and others are not?

7. State whether an aqueous solution of each of the following substances conducts an electric current.
Explain your reasoning in each case.

a) Sodium hydroxide

b) Glucose, $C_6H_{12}O_6$:



8. Calculate how many total moles of ions are released in solution when each of the following dissolves completely in water. Show your work and circle your answers.

a.) 0.805 mol Cs_2SO_4

b.) 0.382 mol K_2HPO_4

c.) 6.80 g $\text{MgSO}_4 \cdot 7 \text{H}_2\text{O}$

d.) 6.188×10^{21} formula units of NiCl_2

9. Calculate many moles and numbers of ions of each type are present in 3.8 mL of 1.88 M magnesium chloride. Show your work and circle your answers.

10. Calculate many moles of hydrogen ions, H^+ , are present 425 mL 0.27 M nitric acid. Show your work and circle your answer.

Sections 4.2 – 4.3 Writing Equations for Aqueous Ionic Reactions and Precipitation Reactions

11. Use the solubility rules in [Table 4.1](#) to determine which of the following combinations of reactants leads to a precipitation reaction. If a reaction occurs, write the name and formula of the precipitate, if not write **N.R.** (no reaction) after the arrow.
- a.) Calcium nitrate (*aq*) + Potassium chloride (*aq*) \rightarrow
- b.) Sodium chloride (*aq*) + Lead (II) nitrate (*aq*) \rightarrow
- c.) How can you determine the spectator ions in reactions that form a precipitate?
12. Use the solubility rules in [Table 4.1](#) to determine which of the following combinations of reactants leads to a precipitation reaction. If a reaction occurs, write the name and formula of the precipitate, if not write N.R. (no reaction) after the arrow.
- a.) Potassium carbonate (*aq*) + Barium hydroxide (*aq*) \rightarrow
- b.) Aluminum nitrate (*aq*) + sodium phosphate (*aq*) \rightarrow
13. Complete the following precipitation reactions with balanced molecular, total ionic and net ionic equations and identify the spectator ions.
- a.) Balanced Molecular Equation: $CaCl_2(aq) + Cs_3PO_4(aq) \rightarrow$

Total Ionic Equation:

Net Ionic Equation:

Spectator Ions:

b.) Balanced Molecular Equation: $\text{Na}_2\text{S} (aq) + \text{ZnSO}_4(aq) \rightarrow$

Total Ionic Equation:

Net Ionic Equation:

Spectator Ions:

14. If 25.0 mL of silver nitrate solution reacts with excess potassium chloride solution to yield 0.842 g of precipitate, what is the molarity of silver ion in the original silver nitrate solution? Show your work and circle your answer.

Balanced Molecular Equation: