1. Molecular solutions do not conduct electricity because they contain

   A. molecules only
   B. cations and anions
   C. molecules and anions
   D. molecues and cations

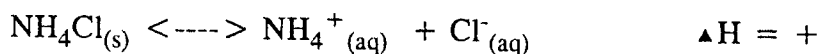2. To determine the solubility of a solute in water, a solution must be prepared that is

   A. saturated
   B. unsaturated
   C. concentrated
   D. supersaturated

3. Froms the list of salts below, how many are considered soluble at 25°C?

   $CuCl_2$ $CaSO_4$ PbS Ag_3PO_4
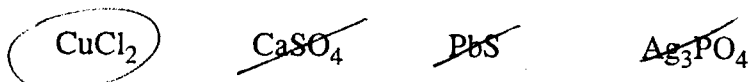
   A. none
   B. one
   C. two
   D. three

4. Consider the following equilibrium:

   $$NH_4Cl_{(s)} <----> NH_4^+{}_{(aq)} + Cl^-{}_{(aq)} \qquad ▲H = +$$

   Which of the following will increase the solubility of ammonium chloride?

   A. stirring the solution
   B. adding water
   C. adding NH_4Cl
   D. heating

5. Na_2SO_4 solution is slowly added to a solution which contains 0.10 M Ba^{2+} and 0.10 M Pb^{2+}. Which of the following statements describes the result of the addition of Na_2SO_4?

   A. $BaSO_4$ precipitates first because it is more soluble. 1.1×10^{-10}
   B. $PbSO_4$ precipitates first because it is more soluble. 1.8×10^{-8}
   C. $BaSO_4$ precipitates first because it is less soluble.
   D. $PbSO_4$ precipitates first because it is less soluble.

6. Identify the most soluble sulphide.

   A. HgS $K_{sp} = 1.6 \times 10^{-54}$
   B. PbS $K_{sp} = 7.0 \times 10^{-29}$
   C. FeS $K_{sp} = 3.7 \times 10^{-19}$
   D. MnS $K_{sp} = 2.3 \times 10^{-13}$

7. Four samples of a solution were analyzed and the following data were collected:

Anion added	observation
S^{2-}	nothing
SO_4^{2-}	precipitate
OH^-	nothing
CO_3^{2-}	precipitate

   Which one of the following group II cations is found in the unknown solution?
   A. Mg^{2+}
   B. Ca^{2+}
   C. Sr^{2+}
   D. Ba^{2+}

8. The $[OH^-]$ is measured to be 3.3×10^{-3} mol/L in a 100 mL sample of a saturated solution of $Al(OH)_3$. What is the solubility of $Al(OH)_3$?

   A. 1.1×10^{-4} mol/L
   B. 3.3×10^{-4} mol/L
   C. 1.1×10^{-3} mol/L
   D. 3.3×10^{-3} mol/L

9. Which of the following salts has the lowest solubility?
   A. copper I chloride
   B. ammonium sulphide
   C. potassium hydroxide
   D. mercury II sulphate

10. The mixture that could produce a precipitate of two compounds is

    A. $HgSO_4$ and $FeCl_2$
    B. $AgNO_3$ and $MgCl_2$
    C. K_2CO_3 and $CuSO_4$
    D. $ZnSO_4$ and $Ba(OH)_2$

11. In a saturated solution of zinc hydroxide, at 40°C, the $[Zn^{2+}] = 1.8 \times 10^{-5}$ M. What is the K_{sp} of the compound?

    A. 5.8×10^{-15}
    B. 2.3×10^{-14}
    C. 1.8×10^{-14}
    D. 6.5×10^{-10}

12. When equal volumes of 0.060 M $AgNO_3$ and 0.00090 M $BaBrO_2$ are mixed, the trial ion product is
    A. less than K_{sp} and a precipitate forms. * $\text{TIP } 27 \times 10^{-5}$
    B. greater than K_{sp} and a precipitate forms.
    C. less than K_{sp} and no precipitate forms. $k_{sp} \cdot 5.3 \times 10^{-5}$
    D. greater than K_{sp} and no precipitate forms.

13. What is the maximum amount of sodium sulphate that will dissolve in 1.0 L of 0.10 M $Pb(NO_3)_2$ without forming a precipitate?

    A. 1.8×10^{-8} mol
    B. 1.8×10^{-7} mol
    C. 1.3×10^{-4} mol
    D. 1.0×10^{-1} mol

14. Which one of the following equilibrium systems is described by a K_{sp} ?

    A. $CaCO_{3(s)} <----> CaO_{(s)} + CO_{2(g)}$
    B. $CaCO_{3(s)} <----> Ca^{2+}_{(aq)} + CO_3^{2-}_{(aq)}$
    C. $Ca^{2+}_{(aq)} + CO_3^{2-}_{(aq)} <----> CaCO_{3(s)}$
    D. $Ca(OH)_{2(aq)} + H_2CO_{3(aq)} <----> CaCO_{3(s)} + 2H_2O_{(l)}$

15. In an experiment, a student mixes equal volumes of 0.0020 M Pb^{2+} ions with 0.0040 M I^- ions. What is TIP?

    A. 4.0×10^{-9}
    B. 3.2×10^{-8}
    C. 1.3×10^{-7}
    D. 8.0×10^{-6}

16. A 0.50 L solution of $CuBr_2$ contains 0.30 mol Br^- ions. What are the ionic concentrations in the solution?

    A. $[Cu^{2+}] = 0.15$ M $[Br^-] = 0.30$ M
    B. $[Cu^{2+}] = 0.30$ M $[Br^-] = 0.60$ M
    C. $[Cu^{2+}] = 0.60$ M $[Br^-] = 0.60$ M
    D. $[Cu^{2+}] = 0.60$ M $[Br^-] = 1.20$ M