CHM 130: Chapter 14 Blackboard Homework Answers

1) Check all of the statements below that are **true**:
b) The solubility of a gas in a liquid decreases as temperature increases.
c) The solubility of a solid in a liquid increases as temperature increases.
e) The solubility of a gas in a liquid increases as the partial pressure of the gas above the liquid increases.

2) The "like dissolves like" rule indicates which of the following:
a) A nonpolar solid will dissolve in a nonpolar solvent.
b) A polar solid will dissolve in a polar solvent.
e) A nonpolar liquid is miscible with a nonpolar solvent.
f) A polar liquid is miscible with a polar solvent.

Explanation: The "like dissolves like" rule indicates that like substances will mix with or dissolve in one another.

3) Check all of the statements below that are **true**:
d) An ionic compound will never dissolve in a nonpolar solvent.
e) Check the Solubility Rules to determine if a particular ionic compound dissolves in a polar solvent.

4) Check all of the substances below that are soluble in or miscible with water:
a) ammonia, NH_3 (l) c) ethanol, C_2H_5OH (l) f) Li_2CO_3 h) $Sr(OH)_2$

Explanation: Polar molecules will be soluble in or miscible with water. Thus, the following polar molecules will be soluble in or miscible with water: NH_3 (l) and C_2H_5OH (l).

Some ionic compounds will be soluble in water. From the Solubility Rules the following ionic compounds are soluble in water: Li_2CO_3 and $Sr(OH)_2$. The other ionic compounds ($PbCl_2$ and $BaCO_3$) are insoluble in water.

Nonpolar molecules are never soluble in or miscible with water. Thus, the following nonpolar molecules are not soluble in or miscible with water: vegetable oil, C_5H_{12} (l) and iodine, I_2 (s).

5) Check all of the substances below that are soluble in or miscible with bromine, Br_2 (l):
b) vegetable oil e) pentane, C_5H_{12} (l) g) iodine, I_2 (s)

Explanation: Bromine is a nonpolar solvent. Only nonpolar molecules will be soluble in or miscible with bromine. Thus, only the following nonpolar molecules will be soluble in or miscible with bromine: C_5H_{12} (l), vegetable oil, and I_2 (s).

Ionic compounds and polar molecules will never be soluble in or miscible with nonpolar compounds like bromine. Thus, the following ionic compounds and polar molecules will not be soluble in or miscible with bromine: NH_3 (l), C_2H_5OH (l), $PbCl_2$, and Li_2CO_3.

6) Check all of the statements that will **increase the rate of dissolving** sugar in water:
a) Shaking the solution. (This is similar to stirring the solution.)
c) Using boiling water. (This is similar to heating the solution.)

7) Putting a few packets of sugar in a glass of iced tea and stirring the solution still leaves undissolved sugar crystals at the bottom of the glass. The iced tea is now _____________ solution because it now holds the maximum amount of sugar it can hold at that temperature.
b) a saturated

8) Dissolving the maximum amount of solid that can be dissolved in a solvent at a higher temperature then allowing the solution to cool without disturbing it will result in __________ solution. The excess solid dissolved in the solution will recrystallize if disturbed at the lower temperature.
c) a supersaturated.

9) Putting a few granules of sugar in a glass of iced tea and stirring the solution results in _____________ solution because the solution can hold more sugar than it currently holds.
a) an unsaturated

10) Calculate the mass percent concentration for 15.0 g of $CaCl_2$ dissolved in 250.0 g of solution.

$$\text{Mass percent concentration} = \frac{\text{mass of solute}}{\text{mass of solution}} \times 100\% = \frac{15.00 \text{ g } CaCl_2}{250.0 \text{ g solution}} \times 100\% = 6.00\% \ CaCl_2$$

11) Calculate the mass percent concentration for 7.50 g of KBr in 100.0 g of water.

$$\text{Mass percent concentration} = \frac{\text{mass of solute}}{\text{mass of solution}} \text{x}100\% = \frac{\text{mass of solute}}{\text{mass of solute + mass of solvent}} \text{x}100\%$$

$$\frac{7.50 \text{ g of KBr}}{7.50 \text{ g of KBr} + 100.0 \text{ g water}} \text{x}100\% = \frac{7.50 \text{ g of KBr}}{107.5 \text{ g solution}} \text{x}100\% = \textbf{6.98\% KBr}$$

12) What mass of water is present in 100 g of a 5.00% NaCl solution? (100 g solution – 5.00 g NaCl = 95.00 g water)

Assuming 100 g of solution, a 5.00% NaCl solution contains 5.00 g NaCl and 95.00 g water.

13) What mass of solute is present in 75.0 g of a 5.00% HNO_3 (aq) solution

Assuming 100 g of solution, a 5.00% HNO_3 solution contains 5.00 g HNO_3 and 95.00 g water.

$$75.0 \text{ g solution x} \frac{5.00 \text{ g } HNO_3 \text{ solution}}{100 \text{ g solution}} = \textbf{3.75 g } \mathbf{HNO_3}$$

14) What mass of solution contains 15.0 g of solute in a 5.25% KOH solution?

Assuming 100 g of solution, a 5.25% KOH solution contains 5.25 g KOH and 94.75 g water.

$$15.0 \text{ g of KOH x} \frac{100 \text{ g solution}}{5.25 \text{ g KOH}} = \textbf{286 g solution}$$

15) What mass of water is required to dissolve 25.0 g of NaCl to prepare a 5.00% NaCl solution?

Assuming 100 g of solution, a 5.00% NaCl solution contains 5.00 g NaCl and 95.00 g water.

$$25.0 \text{ g solution x} \frac{95.00 \text{ g water}}{5.00 \text{ g NaCl}} = \textbf{475 g water}$$

16) Calculate the molarity (or molar concentration) for a solution prepared by dissolving 0.500 moles of NaCl to make 2.00 L of solution.

Molarity (or molar concentration) is the moles of solute per liter of solution. Thus, to solve for molarity of NaCl (shown as [NaCl]), put moles of solute in the numerator and liters of solution in the denominator:

$$[\text{NaCl}] = \frac{0.500 \text{ moles NaCl}}{2.00 \text{ L}} = \textbf{0.250 M NaCl}$$

17) Calculate the molarity (or molar concentration) for a solution prepared by dissolving 25.0 g of NaOH to make 1.50 L of solution.

$$25.0 \text{ g NaOH x} \frac{\text{moles NaOH}}{40.00 \text{ g NaOH}} = 0.625 \text{ moles NaOH}$$

$$[\text{NaOH}] = \frac{0.625 \text{ moles NaOH}}{1.50 \text{ L}} = \textbf{0.417 M NaOH}$$

18) Calculate the molarity (or molar concentration) for a solution prepared by dissolving 50.0 of KBr to make 500.0 mL of solution.

$$50.0 \text{ g KBr x} \frac{\text{mole KBr}}{119.00 \text{ g KBr}} = 0.420 \text{ moles KBr}$$

$$500.0 \text{ mL x} \frac{1 \text{ L}}{1000 \text{ mL}} = 0.5000 \text{ L}$$

$$[\text{KBr}] = \frac{0.420 \text{ moles KBr}}{0.5000 \text{ L}} = \textbf{0.840 M KBr}$$

19) Calculate the number of moles of NaOH present in 150.0 mL of a 1.25M NaOH solution.

$$150.0 \text{ mL x} \frac{1 \text{ L}}{1000 \text{ mL}} \text{ x} \frac{1.25 \text{ moles NaOH}}{\text{L}} = 0.188 \text{ moles NaOH}$$

20) Calculate the mass of NaCl present in 250.0 mL of a 2.50 M NaCl solution.

$$250.0 \text{ mL x} \frac{1 \text{ L}}{1000 \text{ mL}} \text{ x} \frac{2.50 \text{ moles NaCl}}{\text{L}} \text{ x} \frac{58.44 \text{ g NaCl}}{\text{mole NaCl}} = \textbf{36.5 g NaCl}$$