

Chemistry I Review Group Quiz: Unit 12-13

Solutions and Acids/ Bases

Unit 12: Solutions

water = polar

*Like dissolves like:

Polar & Polar = dissolves
 NP & NP = dissolves
 P & NP = Does NOT dissolve

- 1) Which of the following substances is soluble in water?
 (A) NaNO_3 (Ionic = ALWAYS polar) B) CH_4 (hydrocarbon) C) CO_2 (Lewis structure: $\text{O}=\text{C}=\text{O}$) D) methane (hydrocarbon)

- 2) What is the molarity of a solution containing 8 grams of a solute in 500 mL of solution? (MM of solute = 24 g/mol) $M = \frac{\text{mol}}{\text{L}}$ $\rightarrow \text{grams} \rightarrow \text{mol}$ $\rightarrow 0.500 \text{ L}$

(A) 0.7 M B) 0.1 M C) 0.5 M D) 1 M
 $8 \text{ g} \cdot \frac{1 \text{ mol}}{24 \text{ g}} = 0.33 \text{ mol} \therefore M = \frac{0.33 \text{ mol}}{0.50 \text{ L}} = 0.6667 \approx 0.7 \text{ M}$

- 3) What is the molality of a solution with 2.5 grams Na_2SO_4 with a mass of 1200 grams of water? (MM = 142 g/mol) $m = \frac{\text{mol}}{\text{kg}}$ $\rightarrow \text{grams} \rightarrow \text{mol}$ $\rightarrow 1,200 \text{ kg water}$

A) 0.55 m B) 0.015 m C) 15.0 m D) 2.08 m
 $2.5 \text{ g } \text{Na}_2\text{SO}_4 \cdot \frac{1 \text{ mol } \text{Na}_2\text{SO}_4}{142 \text{ g } \text{Na}_2\text{SO}_4} = 0.018 \text{ mol} \therefore m = \frac{0.018 \text{ mol}}{1.200 \text{ kg}} = 0.015 \text{ m}$

- 4) What volume (in mL) of 3M HCl is needed to make 300 mL of 0.1M HCl? dilution problem

(A) 10 mL B) 30 mL C) 90 mL D) 9 mL E) 100 mL
 $M_1 V_1 = M_2 V_2 \rightarrow (3 \text{ M}) V_1 = (0.1 \text{ M})(300 \text{ mL}) \rightarrow V_1 = 10 \text{ mL}$

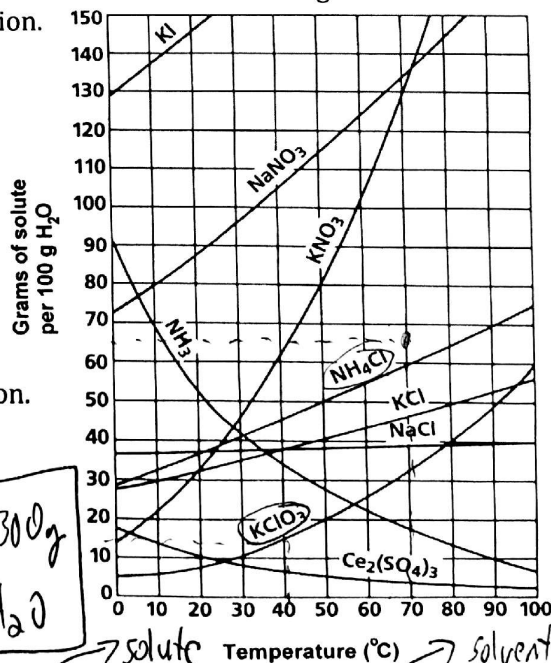
- 5) If more solute is added to a solution, this would cause the boiling point to \uparrow and the freezing point to \downarrow .

- A) increase, increase B) increase, decrease
 C) decrease, decrease D) decrease, increase

* colligative properties =
 • boiling point elevation
 • freezing point depression

- 6) According to the solubility curve below, 65 grams of ammonium chloride in 100 grams of water at 70 degrees Celsius will be considered a(n) _____ solution.

- A) unsaturated
 B) saturated
 C) supersaturated (above the solubility line)
 D) dilute



- 7) Using the same solubility curve, if about 15 g of potassium chlorate can dissolve in 100 g of water at 40 degrees Celsius, how many grams of water must be added to dissolve 45 g of this solute. The temperature remains the same. *Hint: set up proportion.

- A) 200 g
 B) 300 g
 C) 400 g
 D) 500 g

$\frac{15 \text{ g}}{100 \text{ g}} = \frac{45 \text{ g}}{X} \rightarrow X = 300 \text{ g H}_2\text{O}$

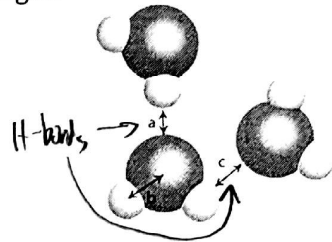
- 8) Calculate the percent by mass of the solute when 175.5 g of CaCl_2 is dissolved in 1150 g of water.
 A) 86.76% B) 15.26% C) 13.24% D) 18.01%

$\% \text{ mass} = \frac{\text{g solute}}{\text{g solution}} \cdot 100 \Rightarrow \% \text{ mass} = \frac{175.5}{(175.5 + 1150)} \cdot 100 = 13.24\%$

9) Which letter(s) represent(s) hydrogen bonding for picture on the right?

- A) c only
 B) b only
 C) a and b
 D) a and c

bonds from hydrogens of one molecule that is attracted to another molecule



10) To how much water should 55.5 mL of 12 M hydrochloric acid be added to produce a 2.0 M solution?

- A) 333.0 mL
 B) 277.5 mL
 C) 9.3 mL
 D) 111.0 mL

if they ask for water, you must do two steps

$M_1 V_1 = M_2 V_2$

$(12M)(55.5mL) = (2.0M)V_2$

$V_2 = 333$
mL

$V_{water} = V_2 - V_1$
 $= 333mL - 55.5mL$
 $= 277.5mL H_2O$

Unit 13: Acids & Bases

11) If the $[H^+]$ in a solution is 1×10^{-1} mol/L, what is the $[OH^-]$?

- A) 1×10^{-13} mol/L B) 1×10^{-1} mol/L C) 1×10^{-15} mol/L D) cannot be determined

use $[H^+][OH^-] = 1.0 \times 10^{-14} \rightarrow [1.0 \times 10^{-1}M][OH^-] = 1.0 \times 10^{-14}$

* solve for $[OH^-]$ algebraically

$[OH^-] = 1.0 \times 10^{-13} M$

12) If the pH is 9.0, what is the concentration of hydroxide ion?

- A) $1 \times 10^{-14} M$ B) $1 \times 10^{-1} M$ C) $1 \times 10^{-7} M$ D) $1 \times 10^{-5} M$

$[H^+] = 10^{-pH}$

$= 10^{-9.0} = 1.0 \times 10^{-9} M$

$[H^+][OH^-] = 1.0 \times 10^{-14}$

$[1.0 \times 10^{-9}M][OH^-] = 1.0 \times 10^{-14}$

$[OH^-] = 1.0 \times 10^{-5} M$

13) In the reaction, $NH_4^{+1} + H_2O \leftrightarrow NH_3 + H_3O^{+1}$, water is acting as a(n) _____

- A) Bronsted-Lowry base
 B) Arrhenius base
 C) Bronsted-Lowry acid
 D) Arrhenius acid

* Remember, according to

Bronsted-Lowry,

- acids donates H^+
- bases accepts H^+

14) Which of these solutions is the most basic? HINT: find pH!!

- A) $[H^+] = 1 \times 10^{-2}M \rightarrow pH = 2$
 B) $[OH^-] = 1 \times 10^{-13}M \rightarrow pOH = 13 \rightarrow pH = 1$
 C) $[OH^-] = 1 \times 10^{-4}M \rightarrow pOH = 4 \rightarrow pH = 10$
 D) $[H^+] = 1 \times 10^{-11}M \rightarrow pH = 11$ (Most basic)

basic: > 7

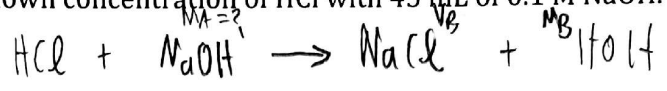
15) What is the name of H_2SO_3 ?

- A) hydrosulfite acid
 B) hyposulfuric acid
 C) sulfurous acid
 D) sulfuric acid
 E) hydrosulfuric acid

polyatomic acids: DO NOT use prefix hydro-
 Remember ate \rightarrow ic & ite \rightarrow ous
 $SO_3 =$ sulfite \therefore sulfurous acid

Use $(H^+) M_A V_A = (OH^-) M_B V_B$ count by looking @ subscript.

16) A scientist titrates 50 mL of an unknown concentration of HCl with 45 mL of 0.1 M NaOH. What is the concentration of the HCl?



- A) 11.11 M
- B) 5.56 M
- C) 0.09 M**
- D) Not enough information

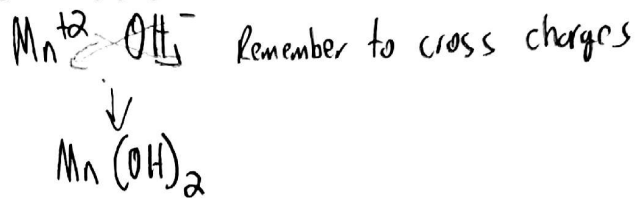
$(1) M_A (50.0 mL) = (1) (0.1 M) (45.0 mL)$

$M_A = 0.09 M$

17) Write the formula for manganese (II) hydroxide.

Type

- A) MgOH
- B) Mg₂OH
- C) MgOH₂
- D) Mg(OH)₂**



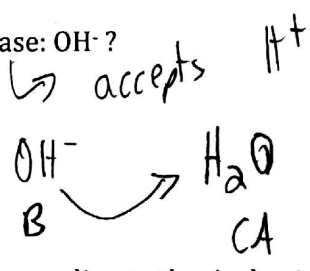
18) Calculate the [H⁺] concentration of a solution with a pH = 9.25.

- A) 5.62 x 10⁻¹⁰ M**
- B) 1.45 x 10⁻⁷ M
- C) 7.99 x 10⁻¹ M
- D) 4.82 x 10⁻¹³ M

$[H^+] = 10^{-pH} \rightarrow 10^{-9.25} = 5.62 \times 10^{-10} M$

19) What is the conjugate acid of the following base: OH⁻?

- A) O⁻²
- B) H₂O**
- C) H₃O⁺
- D) H⁺



20) Which of the following is matched correctly according to the Arrhenius theory?

- A) HF - base → acid
- B) NH₃C₂H₃O₂ - acid → covalent
- C) Ca(OH)₂ - base**
- D) K₃PO₄ - acid → salt

stated that
 • acids contain H⁺
 • bases contain OH⁻

• Know the difference between =
 - Arrhenius
 - Bronsted-Lowry
 - Lewis