Solutions, Acids & Bases Test Review **Name:** Key

Definitions:

f 1. solution
C 2. solute
g 3. solvent
a 4. soluble
b 5. aqueous solution
g 6. electrolyte

a. capable of being dissolved
b. solution with water as the solvent
c. substance that is dissolved in a solution
d. substance that dissolves in water to form a solution that conducts an electric current
f. homogeneous mixture of two or more substances in a single physical state
g. substance that does the dissolving in a solution

You must know:

7. List 3 ways you can increase the rate of dissolving.
   heat
   stir
   crush
8. Explain what the phrase "like dissolves like" means in relation to solution formation.
   polar dissolves polar
   nonpolar dissolves nonpolar
9. Explain how temperature affects the solubility of each of the following
   a. solids ↑ temp, ↑ solubility
   b. liquids ↑ temp, ↑ solubility
   c. gases ↑ temp, ↓ solubility
10. Explain how pressure affects the solubility of each of the following
   a. solids doesn't
   b. liquids doesn't
   c. gases ↑ pressure, ↑ solubility

You must be able to solve problems similar to the following:
Molarity:

11. What mass of CH_3OH is required to prepare 1.50 liters of 3.00 M solution?

$M = \frac{mol}{L}$ $\quad 3.00M = \frac{X}{1.50L}$

$$X = \frac{4.50 mol\ CH_3OH}{1} \left| \frac{32.042\ g\ CH_3OH}{1\ mol\ CH_3OH} \right. = 144 g\ CH_3OH$$

12. What volume of 0.750 M solution can be prepared using 90.0 grams of NH_4Cl?

$$\frac{90.0 g\ NH_4Cl}{53.492 g} \left| \frac{1\ mol}{} \right. = 1.68 mol$$

$0.750M = \frac{1.68 mol}{X}$

$X = 2.24L$

13. What is the molarity of a solution that contains 85.0 grams Na_2SO_4 in 325mL of solution?

$$\frac{85.0 g\ Na_2SO_4}{142.05 g} \left| \frac{1\ mol}{} \right. = 0.598 mol$$

$$\frac{325 mL}{1000 mL} \left| \frac{1\ L}{} \right. = 0.325 L$$

$M = \frac{0.598 mol}{0.325 L} = 1.84\ M$

Dilutions:

14. How many milliliters of a stock solution of 2.00 M $MgSO_4$ would you need to prepare 100. mL of 0.400 M $MgSO_4$?

$M_1V_1 = M_2V_2$

$(2.00M)(x) = (0.400M)(100.mL)$

$x = 20.0mL$

15. How many mL of a solution of 4.50 M HCl would you need to prepare 200mL of 1.00 M HCl?

$M_1V_1 = M_2V_2$

$(4.50M)(x) = (1.00M)(200mL)$

$x = 40mL$

Mass Percent:

16. Calculate the mass percent of a solution made from 25g of sugar and 300g of water.

$\% = \frac{g\ solute}{g\ solution} \times 100$

$\% = \frac{25g\ sugar}{(300g + 25g)} \times 100 = 7.7\%$

17. What mass of solution is needed to prepare a 15.6% solution using 26.9g of potassium chloride?

$15.6\% = \frac{26.9g}{X} \times 100$

$.156 = \frac{26.9}{X} \rightarrow X = 172g\ solution$

Molality:

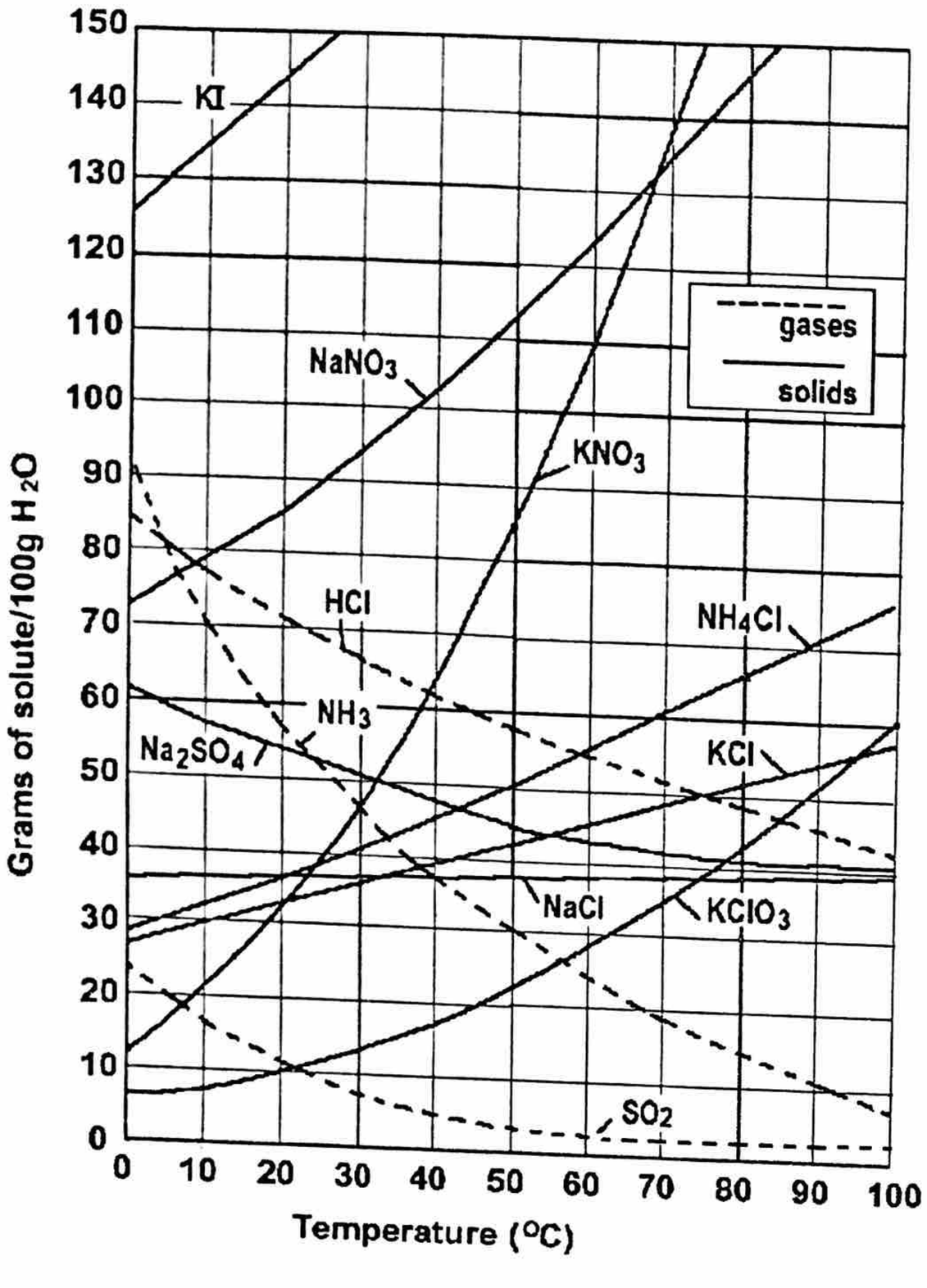
18. Calculate the molality of a solution made from 25.0 g of sodium chloride and 4,200 g of water.

19. What mass of calcium chloride is dissolved in 35 grams of water to make a 2.5 molal solution?

Colligative Properties:

1. What are the 2 colligative properties we discussed?
   freezing point depression & boiling point elevation
2. How does a solute affect the freezing point of a solvent?
   It lowers the freezing point b/c the solute particles get in the way of forming the solid crystals.
3. How does a solute affect the boiling point of a solvent?
   It elevates the boiling point b/c the vapor pressure within the solution decreases so it needs more energy to equal the atmospheric pressure.
4. Why does the department of transportation put salt on the roads when they are icy?
   Since the freezing point lowers, it take energy from the surroundings to melt the ice.

You must be able to analyze a solubility curve and answer questions similar to:



23. What mass of ammonium chloride is needed to produce a saturated solution at 80°C with 100g of water?

66g

24. What mass of potassium nitrate will produce a saturated solution at 50°C with 400g of water?

$\frac{85\text{g } KNO_3}{100\text{g } H_2O} = \frac{x}{400\text{g } H_2O}$ = 340g KNO_3

25. Identify the following as saturated, unsaturated, or supersaturated

a. 100g of water containing 32g of sodium nitrate at 40°C.

unsaturated

b. 100g of water containing 30g of sodium chloride at 80°C.

unsaturated

c. 100g of water containing 45g of potassium chlorate at 10°C.

supersaturated

26. Which substance is most soluble at 60°C?

KI

27. Which substance is least soluble at 60°C

SO_2

28. As the temperature increases, usually the solubility of solids increases; however, according to the graph which solid decreases in solubility as the temperature increase?

Na_2SO_4

29. What happens to the solubility of gases as you increase the temperature?

the solubility decreases

Properties of Acids & Bases

30. List four properties of an acid.
electrolyte, sour, sticky, produce gas when react with metal
↳ anything that can conduct in solution (acids + bases become ions in solution, allowing there to be free floating charges to conduct the electricity)

31. What ions exist in acid solution?
H^+

32. List three properties of a base.
electrolyte, bitter, slippery

33. What ions exist in basic solution?
OH^-

34. What forms when an acid reacts with a base?
salt + water

35. What are some of the properties that acids and bases have in common?
electrolyte, can burn through various materials

36. I am a substance who turns blue litmus red, neutralizes bases, and tastes sour. What am I?
acid

37. I am a species who turns red litmus blue, neutralizes acids, and tastes bitter. What am I?
base

38. An aqueous solution of an ionic compound turns red litmus blue. Conducts electricity, and reacts with an acid to form a salt and water. This could be
a. HCl b. NaI c. KNO_3 d. LiOH

39. Which substance can be classified as an Arrhenius acid?
a. HCl b. NaCl c. LiOH d. KOH

40. What will react with hydrochloric acid and produce $H_2(g)$?
a. S b. P c. Mg d. H_2O

$HCl + \_\_\_\_ \rightarrow H_2 + \_\_$

* Think about what is capable of kicking H out of HCl

41. According to the Arrhenius theory, a substance that is classified as an acid will yield
a. OH^- b. NH_4^+ c. H^+ d. CO_3^{2-}

42. Which substance is classified as an Arrhenius base?
a. HCl b. NaOH c. $LiNO_3$ d. $KHCO_3$

43. State the following observations indicate an acid or a base.

a. A solution conducts electricity and feels slippery. base

b. A solution conducts electricity and reacts with metal. acid

c. A solution is sour and turns blue litmus paper red. acid

d. A solution reacts with an acid and produce salt. base

44. Circle one.

a. $HC_2H_3O_2$ is a(n) (acid, base, salt).

b. NH_4Cl is a(n) (acid, base, salt).

c. KOH is a(n) (acid, base, salt).

d. H_3PO_4 is a(n) (acid, base, salt).

e. $Ca(NO_3)_2$ is a(n) (acid, base, salt).

Neutralization Reactions

45. The generic products of an acid-base reaction are

salt + water

46. Complete the following reaction

$HCl + NaOH \rightarrow NaCl + HOH$

47. Write the balanced reaction for:

Hydrobromic Acid reacts with Aluminum hydroxide.

$3\,HBr + Al(OH)_3 \rightarrow AlBr_3 + 3\,HOH$

Sulfuric Acid reacts with Iron (III) hydroxide

$3\,H_2SO_4 + 2\,Fe(OH)_3 \rightarrow Fe_2(SO_4)_3 + 6\,HOH$

pH / pOH / [H+] / [OH-] Calculations

48. What is the pH of a solution that has a hydrogen concentration of 1×10^{-5} M

$pH = -\log(H^+) = -\log(1 \times 10^{-5}\,M) = 5$

49. What is the pOH if the pH is 9?

$14 = pOH + pH$

$pOH = 5$

50. What is the pOH of a solution that has a hydroxide concentration of 2.3×10^{-4}?

$pOH = -\log(OH^-) = -\log(2.3 \times 10^{-4}) = 3.6$

51. What is the pH of a solution that has a hydroxide concentration of 4.5×10^{-9}M?

$[OH^-] = 4.5 \times 10^{-9}\ M$

$pOH = -\log(4.5 \times 10^{-9}) = 8.3$

$14 - 8.3 = 5.7 = pH$

52. What is the hydrogen concentration if the pH is 3?

$[H^+] = 10^{-pH} = 10^{-3} = 1 \times 10^{-3}\ M$

53. What is the hydroxide concentration if the pOH is 9.87?

$[OH^-] = 10^{-pOH} = 10^{-9.87} = 1.35 \times 10^{-10}\ M$

54. What is the hydrogen concentration if the pOH is 2?

$pOH = 2$

$pH = 14 - 2 = 12$

$[H^+] = 10^{-12} = 1 \times 10^{-12}\ M$

55. What is the hydroxide concentration if the pH is 1.23?

$pH = 1.23$

$pOH = 14 - 1.23 = 12.77$

$[OH^-] = 10^{-12.77} = 1.70 \times 10^{-13}\ M$

Titrations

56. What is the concentration of 20 mL of HCl (1 H^+) that has been neutralized with 30 mL of 2.0M NaOH? (1 OH^-)

$(\#H)(M_A)(V_A) = (\#OH)(M_B)(V_B)$

$(1)(x)(20mL) = (1)(2.0M)(30mL)$

$x = 3\ M$

57. What is the molarity of 45.9mL of H_2SO_4 that has been titrated with 78.3mL of 3.0M NaOH?

$(\#H)(M_A V_A) = (OH)(M_B V_B)$

$(2)(x)(45.9mL) = (1)(3.0M)(78.3mL)$

$x = 2.6\ M$

58. What is the molarity of 55.9mL aluminum hydroxide solution that has been neutralized by 98.4mL of 2.0M acetic acid? $HC_2H_3O_2$ $Al(OH)_3$

$(\#H)(M_A V_A) = (OH)(M_B V_B)$

$(1)(2.0M)(98.4mL) = (3)(x)(55.9mL)$

$x = 1.2\ M$

59. What is the molarity of 22.9mL of nitric acid that has been neutralized by 37.9mL of 2.0 M magnesium hydroxide? HNO_3

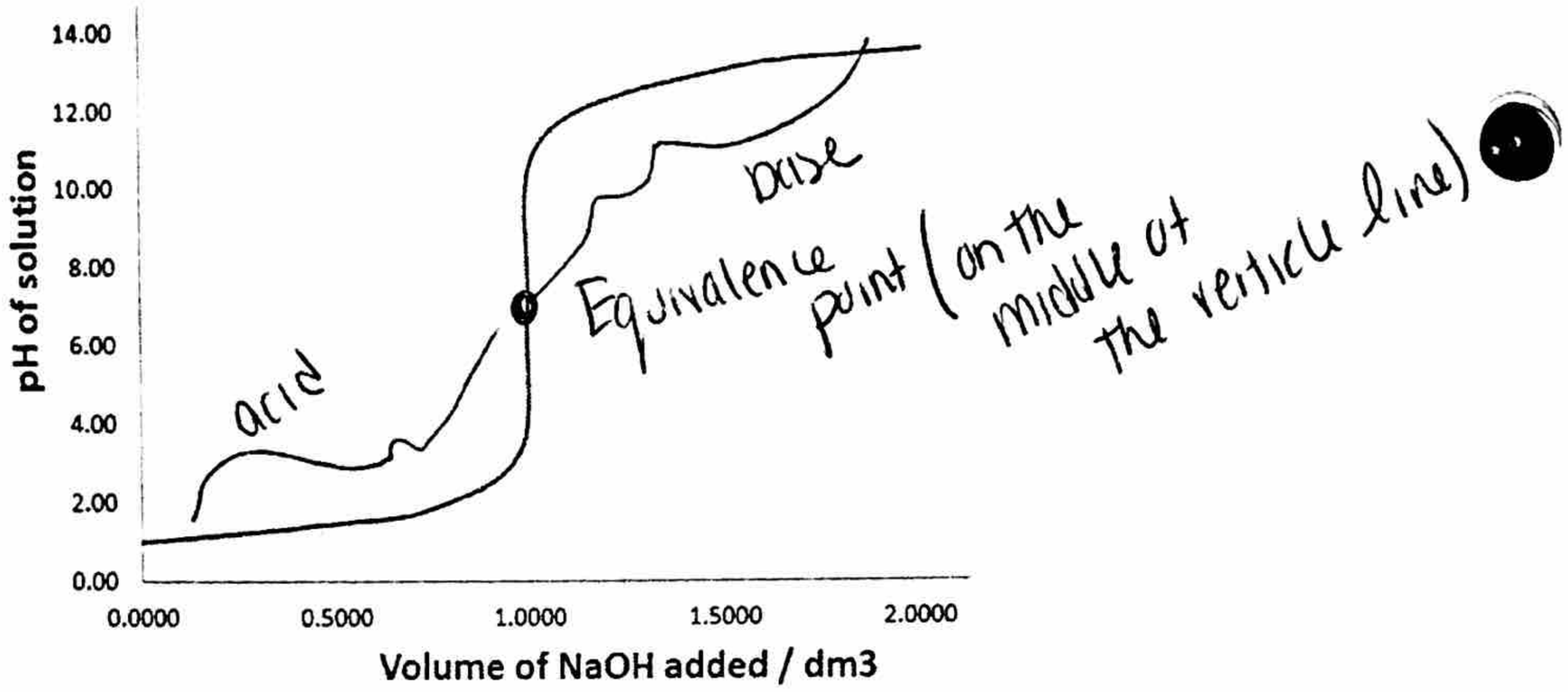
$Mg(OH)_2$

$(\#H)(M_A V_A) = (\#OH^-)(M_B V_B)$

$(1)(x)(22.9mL) = (2)(2.0M)(37.9mL)$

$x = 6.6\ M$

61. On the following titration curve label the following: acidic, neutral, basic, equivalence point.



a. What is the pH when 0.5000dm^3 of NaOH are added? 1.00

b. What volume of NaOH must be added to reach a pH of 10.00? 1.0000 dm^3

*make sure to go through your notes and be able to define all the words on the previous page! *
↳ and know the role they play in a titration