

Key

1. What are the properties of a true solution?

① Composed of Solute & Solvent  
 ② Will not separate  
 ③ Solute distributed evenly throughout.

2. Define the terms solute and solvent. How would you recognize them in a liquid/liquid solution?

Solute - Substance being dissolved (minor part)

Solvent - Substance doing the dissolving (major part)

3. There are 9 different types of solutions (see your notes). List 6, and give an example of each.

a. Gas - Gas (Atmosphere)

b. Solid - Gas (charcoal filters)

c. Solid - Solid (jewelry)

d. Liquid - Solid (ocean)

e. Liquid - Gas (soda pop)

f. Liquid - Liquid (lemon-aid)

4. State the difference between homogeneous and heterogeneous solutions.

Homogeneous - same throughout, cannot identify components

Heterogeneous - different throughout, can identify components.

5. Explain the difference between saturated, unsaturated and supersaturated solutions. State any conditions (temp/press./etc) that are necessary.

Sat - contains max amt. of solute at given temp

unsat - can hold more solute at given temp

Super - contains more than max amt. of solute at given temp.

6. Describe how you would prepare a supersaturated solution.

Heat a saturated sol<sup>n</sup>, add more solute, cool gently

7. List three ways to make a substance dissolve more quickly. Will these methods work all the time? Why/Why not?

- increase temp

- stir

- decrease Particle Size ( $\uparrow$  Surface Area)

\* Some compounds are never soluble.

8. Explain how pressure affects the solubility of a gas. Give an example.

Pressure increases, solubility increases.

ex) Coke

9. Explain, at the molecular level, the difference between dissolving sugar (covalent compound) and salt (ionic compound) in water.

SALT - ionic - will dissociate into ions.  $\rightarrow$  electrolyte

SUGAR - covalent - dissolves as whole molecule  $\rightarrow$  non-electrolyte

10. Calculate the concentration of a solution in which 0.125 mol of NaOH solute has been dissolved in 200 mL of solution. (0.625 mol/L)

$$\frac{0.125 \text{ mol}}{0.2 \text{ L}} = 0.625 \text{ mol/L}$$

11. Calculate the concentration of a solution if 40.0 g of  $\text{K}_2\text{SO}_4$  is dissolved in 150 mL of solution. (1.53 mol/L)

$$40 \text{ g} \times \frac{1 \text{ mol}}{174.3 \text{ g}} = 0.23 \text{ mol} \quad \frac{0.23 \text{ mol}}{0.15 \text{ L}} = 1.53 \text{ mol/L}$$

12. What mass of  $\text{MgCO}_3$  would be required to make 75.0 mL of a 0.450 mol/L solution? (2.87 g)

$$0.45 \frac{\text{mol}}{\text{L}} \times 0.075 \text{ L} = 0.034 \text{ mol} \times \frac{84.3 \text{ g}}{1 \text{ mol}} = 2.87 \text{ g}$$

13. What volume of solution would be required to dissolve 15.0 g of aluminum oxide to make a 0.125 mol/L solution? (1.18 L)

$$15 \text{ g} \times \frac{1 \text{ mol}}{102 \text{ g}} = 0.147 \text{ mol}$$

~~0.147 mol~~ answer.

$$0.147 \text{ mol} \times \frac{1 \text{ L}}{0.125 \text{ mol}} = 1.18 \text{ L}$$

14. If 50.0mL of a 0.750mol/L solution of HCl is added to 75.0mL of a 0.550mol/L solution of HCl determine the final concentration. (0.63mol/L)

$$M_1V_1 + M_2V_2 = M_fV_f$$

$$(0.750 \frac{\text{mol}}{\text{L}})(0.050\text{L}) + (0.550 \frac{\text{mol}}{\text{L}})(0.075\text{L}) = M_f(0.125\text{L})$$

$$M_f = 0.63 \frac{\text{mol}}{\text{L}}$$

15. What volume of water must be added to 125mL of 1.25mol/L solution of  $\text{MgSO}_4$  to make a 0.475mol/L solution? (204mL)

$$M_1V_1 = M_2V_2$$

$$(1.25 \frac{\text{mol}}{\text{L}})(0.125\text{L}) = (0.475 \frac{\text{mol}}{\text{L}})(V_2)$$

$$V_2 = 0.329\text{L}$$

$$* \text{V}_{\text{added}} = 329\text{ml} - 125\text{ml} = 204\text{ml}$$

16. Concentrated sulphuric acid is bought as a stock solution with a concentration of 18mol/L. If you need 250mL of 0.750mol/L solution, how much stock sulphuric acid solution would you need? (10mL)

$$M_1V_1 = M_2V_2$$

$$(18 \frac{\text{mol}}{\text{L}})(V_1) = (0.750 \frac{\text{mol}}{\text{L}})(0.250\text{L})$$

$$V_1 = 10\text{ml}$$

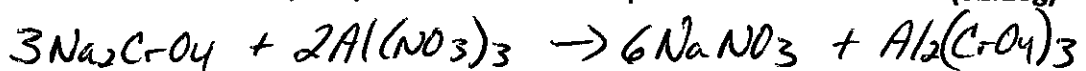
17. Describe how you would use a 200mL volumetric flask to make 200mL of 0.250mol/L solution of calcium hydrogen carbonate. Show any calculations necessary. (8.11g)

$$0.250 \frac{\text{mol}}{\text{L}} \times 0.2\text{L} = 0.05\text{mol}$$

$$0.05\text{mol} \times \frac{162.12\text{g}}{1\text{mol}} = 8.11\text{g}$$

- ① Add 8.11g  $\text{Ca}(\text{OH})_2$  to flask
- ②  $\frac{1}{2}$  fill & mix to dissolve
- ③ dilute to the mark.

18. If 40.5g of sodium chromate is mixed with an excess of aluminum nitrate, calculate the mass of aluminum chromate precipitate that would be produced. (32.16g)



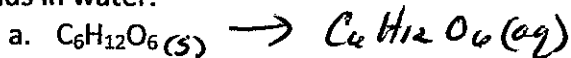
$$40.5\text{g} \times \frac{1\text{mol}}{162\text{g}} = 0.25\text{mol Na}_2\text{CrO}_4 \times \frac{1\text{mol Al}_2(\text{CrO}_4)_3}{3\text{mol Na}_2\text{CrO}_4} = 0.08\text{mol Al}_2(\text{CrO}_4)_3$$

$$0.08\text{mol Al}_2(\text{CrO}_4)_3 \times \frac{402\text{g}}{1\text{mol}} = 32.16\text{g Al}_2(\text{CrO}_4)_3$$

19. What is meant by the term "like dissolves like"?

Polar & Polar  
non polar & non polar } will mix, Polar & non-polar will not mix

20. Write the balanced equations (including states) showing the dissolving of the following solids in water:



Use your solubility curve to answer the following questions:

21. Which solid is most soluble at 40°C?

KI

22. Which solid is affected most by a change in temperature?

KNO<sub>3</sub>

23. What is the solubility of KNO<sub>3</sub> in g/25mL at 30°C?

@ 30°C → 47g / 100g H<sub>2</sub>O       $\frac{47g}{100g} = \frac{xg}{25g}$        $x = 11.75g / 25g H_2O$

24. At what temperature is the solubility of KNO<sub>3</sub> and KCl the same?

≈ 18°C

25. At what temperature does the solubility of KNO<sub>3</sub> begin to exceed the solubility of NaCl?

≈ 23°C

26. If a solution contains 60g KNO<sub>3</sub> at 50°C, describe (quantitatively) what can be done to saturate the solution.

@ 50°C KNO<sub>3</sub> can hold 85g      ∴ Add 25g KNO<sub>3</sub>  
OR cool solution to 38°C

27. How much solid would precipitate out of the solution if the temperature of a saturated KCl solution was dropped from 100°C to 0°C?

@ 100°C → 57g      57g - 26g = **31g**  
@ 0°C → 26g

28. How many grams of KClO<sub>3</sub> will dissolve in 150g of water at 30°C?

@ 30°C →  $\frac{11g}{100g H_2O} = \frac{xg}{150g}$        $x = 16.5g / 150g H_2O$

29. If 200g of KNO<sub>3</sub> are added to 100g of water at 40°C, how much will not dissolve?

@ 40°C →  $\frac{65g}{100g H_2O}$       200 - 65 = **135g**

30. Which compound(s) on the graph do you think are gases? Why?

SO<sub>2</sub>  
HCl  
NH<sub>3</sub> } All have lower solubilities at higher temps.