Name: KEY Date: _____ Period: _____

Review Chemistry Unit 12: Solution Chemistry

1. A solution consists of a solute dissolved in a solvent.
2. A solution is a homogeneous mixture. (which means uniform throughout)

   Is this type of mixture a pure substance, a compound, both, or (neither?) (***circle one***)
3. Classify the following materials as: **solution** (SO) or **colloid** (C) or **Suspensions** (SP)

C	a. smoky air	SO	g. salt water ($NaCl + H_2O$)
SO	b. sugar water ($C_{12}H_{22}O_{11} + H_2O$)	C	h. milk
SO	c. vinegar ($HC_2H_3O_2 + H_2O$)	SP	i. soda with bubbles
C	d. mayonnaise	SP	j. oil-based paint
SP	e. Italian salad dressing	C	k. fog
SP	f. cereal	SO	l. ethanol in water ($C_2H_5OH + H_2O$)

4. There is a relatively large amount of solute dissolved in a (concentrated) / dilute solution. (***circle one***)
   There is much more solvent than solute in a dilute solution.
5. Molarity is the ratio of moles of solute per liter of solution.
   A 3.0 molar solution (3.0 *M*) has 3.0 mole(s) of solute in every 1.0 liter(s) of solution.
6. To dilute a solution, you can add more solvent which will change the molarity of the solution, but will not change the number of moles of solute.
7. Complete the phrase that describes the types of substances that will generally dissolve in each other:
   like dissolves like.

   Therefore, polar solvents (like water) can dissolve polar solutes (like alcohols, sugars, ionic compounds, etc.).

   But nonpolar solutes (like fats, oils, hydrocarbons, etc.) will dissolve in polar solvents.
8. A solution is formed by adding methanol, CH_3OH, to water. Identify each of the following intermolecular attractions as breaking or forming in the solution process: (*circle answers*)

   breaking / (forming) methanol – methanol

   breaking / (forming) water – water

   (breaking) / forming methanol – water
9. In general, the stronger the intermolecular attractions between solute and solvent molecules, the greater the solubility.
10. In general, the weaker the intermolecular attractions between solute and solute molecules, the lower the solubility.

11. A tincture of iodine can be used as a disinfectant. This solution is can be made by mixing:

2 g of solid iodine (I_2) — 55 g of liquid ethanol (C_2H_5OH)

3 g of sodium iodide (NaI) — 40 g of water (H_2O)

The solvent in this mixture is best identified as C because there is more of it.

A. I_2
B. NaI
C. C_2H_5OH
D. H_2O

12. Three factors that typically cause a solid to dissolve faster in a liquid are:

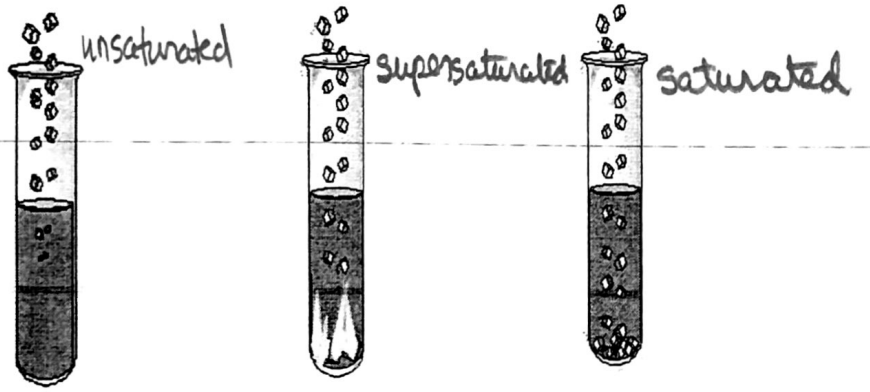
increase / decrease stirring

increase / decrease (crushing) so more surface area

increase / decrease temperature

13. Gases dissolve faster in liquids at low temperatures and at higher pressure.

14. ***Label*** each solution as saturated, unsaturated, or supersaturated based on the addition of solute:



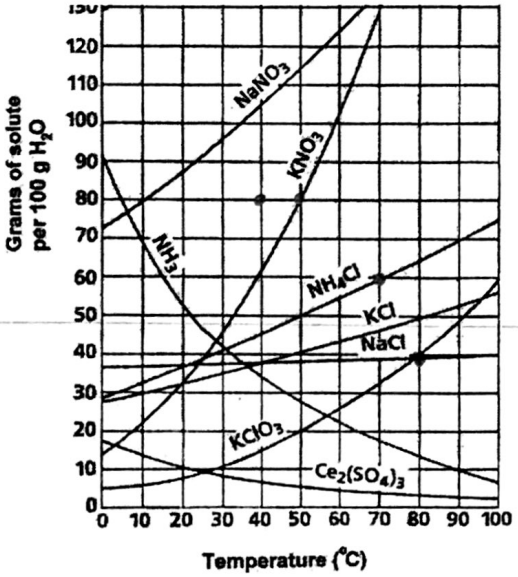
15. A solution that contains less solute than can be dissolved at that temperature is unsaturated.

16. If solute crystals are added to a saturated solution, the crystals will…

not dissolve + fall to the bottom.

17. If the addition of a seed crystal causes dissolved solute to crystallize, the original solution was supersaturated.

For # 18-22, consider the graph of solubility curves below.



18. Which substance has the lowest solubility at 20°C?

$Ce_2(SO_4)_3$

19. If 40 g of KCl is dissolved in 100 g of water at 80°C, then the solution is unsaturated.

20. If 80 g of KNO_3 is dissolved in 100 g of water at 40°C, then the solution is supersaturated.

21. If 80 g of KNO_3 is dissolved in 100 g of water at 50°C, then the solution is saturated.

22. How many grams of NH_4Cl can dissolve in 100 g of water at 70°C? 60 g

23. Which of the following usually makes a substance dissolve faster in a solvent?

(a.) agitating the solution
b. increasing the particle size of the solute
c. lowering the temperature
d. decreasing the number of particles

24. Which of the following pairs of factors affects the solubility of a particular substance?

(a.) temperature and the nature of solute and solvent
b. temperature and degree of mixing
c. particle size and degree of mixing
d. particle size and temperature

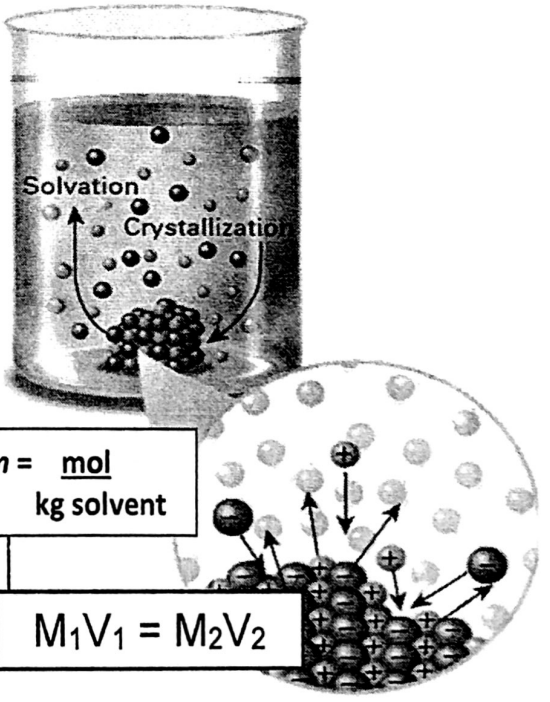
25. Which of the following substances is less soluble in hot water than in cold water?

(a.) CO_2
b. NaCl
c. $NaNO_3$
d. KBr

26. What does NOT change when a solution is diluted by the addition of solvent?

a. volume of solvent
b. mass of solvent
(c.) number of moles of solute
d. molarity of solution

27. Circle the letter of ***each*** sentence that is TRUE about the **saturated solution** pictured here:



(A.) The total amount of dissolved solute remains constant.

B. The total mass of undissolved crystals remains constant.

(C.) When the rate of solvation equals the rate of crystallization, a state of dynamic equilibrium exists.

D. If more solute were added to the container, the total amount of dissolved solute would increase.

For #28-34, you may use the following formulas:

$$m = \frac{\text{mol}}{\text{kg solvent}}$$

$$M = \frac{\text{mol}}{\text{L}}$$

$$M_1V_1 = M_2V_2$$

28. What is the molarity of a solution that contains 9.50 moles of solute in 3.00 L of solution?

$$M = \frac{\text{mol}}{\text{L}} = \frac{9.50 \text{ moles}}{3.00 \text{ L}} = 3.17 M$$

29. How many moles of solute are in 3.20 L of a 1.50 *M* solution of sodium chloride?

$$\text{Mol} = M \times L = 1.50 \frac{\text{mol}}{\text{L}} \times 3.20 \text{L} = 4.80 \text{ mol NaCl}$$

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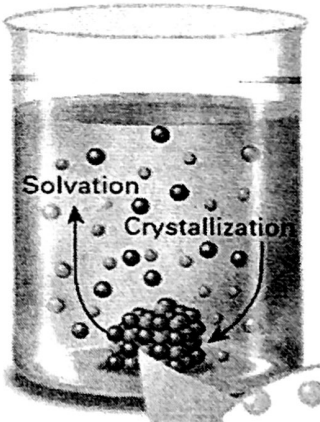

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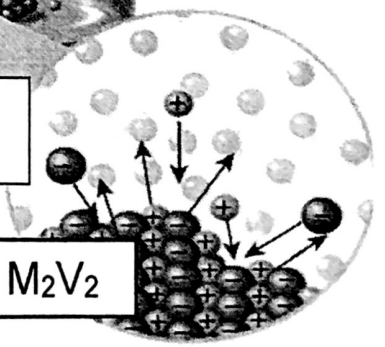

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30. How many moles of solute are in 40.0 g of water in a 0.615 *molal* solution? (Molality problem)

$m = \frac{mol}{kg} \rightarrow mol = m \times kg$

$(0.615\,m) \times (0.040\,kg) = 0.0246\,mol$

31. How many liters of a 0.510 *M* solution are contain 0.242 moles of solute?

$L = \frac{mol}{M} = \frac{0.242\,moles}{0.510\,M} = 0.475\,L$

32. What mass of glucose ($C_6H_{12}O_6$, 180.18 g/mol) is needed to make 5.00 mL of a 0.200 *M* solution?

$mol = M \times L = \left(0.200\frac{mol}{L}\right)(.00500\,L) = .001\,mol \left| \frac{180.18\,g}{mol} \right. = 0.180\,g\ C_6H_{12}O_6$

33. How many mL of a 0.150 *M* NaBr solution are needed to make 100 mL of 0.0500 *M* NaBr?

$V_1 = ?$ $V_2 = 100\,mL$

$M_1 = 0.150\,M$ $M_2 = 0.0500\,M$

$V_1 = \frac{(100\,mL)(0.0500\,M)}{(0.150\,M)} = 33.3\,mL$

34. If 20.0 mL of 12.1 *M* HCl is used to make a 5.00 L aqueous solution, what is the molarity of the dilute solution? (*hint*: choose mL or L, not both)

$(20.0\,mL)(12.1\,M) = (5000\,mL)X$

$0.0484\,M = M_2$

KEY for Calculations #28-34

28. 3.17 *M*
29. 4.80 mol
30. 0.0246 mol
31. 0.475 L
32. 0.180 g
33. 33.3 mL
34. 0.0484 *M*