Fundamentals of Solutions – Sample Questions

1. Which of the following is the correct definition of "solute"?

   A. ? a mixture of a solid and a liquid

   B. ? a substance dissolved in a solvent to form a solution

   C. ? the dissolving medium in a solution

   D. ? none of the above

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2. Which of the following is the definition of "saturated"?

   A. ? the solution contains as much solute as can be dissolved in that solution

   B. ? a homogeneous mixture

   C. ? a solution in which more solute can be dissolved than is dissolved already

   D. ? none of the above

3) An unsaturated solution is one that _____.

   A) has no double bonds

   B) has a concentration lower than the solubility

   C) contains no solute

   D) contains the maximum concentration of solute possible, and is in equilibrium with undissolved solute

   E) contains more dissolved solute than the solubility allows

4) A solution with a concentration higher than the solubility is _____.

   A) is not possible

   B) is saturated

   C) is supercritical

   D) is unsaturated

   E) is supersaturated

9. In a solution of ammonia gas in water:

A. ? the water is the solute and ammonia is the solvent

B. ? both the ammonia and the water are solutes

C. ? both the ammonia and the water are solvents

D. ? the ammonia is the solute and water is the solvent

14. When a solid or gas dissolves easily in a liquid to form a solution, the solid or gas is said to be _____ in the liquid.

A. ? heterogeneous

B. ? soluble

C. ? compatible

D. ? endothermic

SOLUBILITY CHARTS – *use the graph to the right*

13. What is the solubility of NaCl at 25°C?

14. What is the solubility of KNO_3 at 70°C?

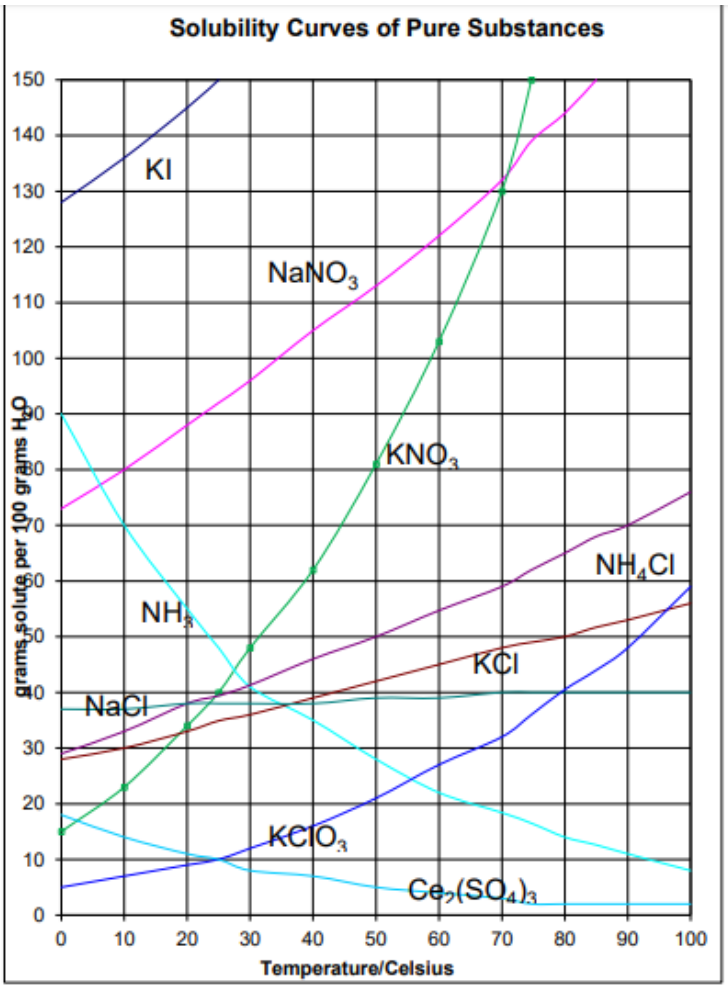
15. At what temperature is the solubility of $NaNO_3$ 90g/100mL H_2O? *Remember the density of water is 1.0 g/mL.*

16. How many grams of $KClO_3$ dissolve in 200 mL H_2O at 30°C?

17. How many grams of KCl would dissolve in 40 mL H_2O at 80°C?

18. How many grams of NH_3 would dissolve in 500 mL H_2O at 80°C?

19. If 30 grams of KNO_3 are dissolved in 100 mL H_2O at 20°C, will the solution be saturated or unsaturated? Explain why.



ANSWERS:

1. **B**
2. **A**
3. **B**
4. **E**
9. **D**
14. **B**

Solubility Curve:

13. $\frac{38 \text{ g NaCl}}{100 \text{ g } H_2O}$. at 25°C

14. $\frac{130 \text{ g } KNO_3}{100 \text{ g } H_2O}$. at 70°C

15. 22°C

16. $\frac{12 \text{ g } KClO_3}{100 \text{ g } H_2O}$. at 30°C therefore, $\frac{24 \text{ g } KClO_3}{200 \text{ g } H_2O}$.

Answer

17. $\frac{50 \text{ g KCl}}{100 \text{ g } H_2O}$.

$$40 \text{ ml } H_2O \left(\frac{1 \text{ g } H_2O}{1 \text{ ml } H2O}\right)\left(\frac{50 \text{ g KCl}}{100 \text{ g } H_2O}\right) = 20 \text{ g KCl in 40 ml } H_2O \text{ (at 80°C)}$$

18. $500 \text{ ml } H_2O \left(\frac{1 \text{ g } H_2O}{1 \text{ ml } H_2O} \right) \left(\frac{14 \text{ g } NH_3}{100 \text{ g } H_2O} \right) = 70 \text{ g } NH_3 \text{ in } 500 \text{ ml } H_2O$ (at 80°C)

19. **UNSATURATED**

Saturated at 30oC could hold 48 g KNO_3 per 100 g H_2O