Name: **Mrs. Piersa**

Regents Chemistry **Solutions Unit Review**

1. At STP, two 5.0-gram solid samples of different ionic compounds have the same density. These solid samples could be differentiated by their

   A) mass C) temperature
   B) volume **D) solubility in water**

2. Which compound is insoluble in water?

   A) $BaSO_4$ C) $KClO_3$
   B) $CaCrO_4$ D) Na_2S

3. According to Reference Table F, which substance is most soluble?

   A) AgI C) $PbCl_2$
   B) $CaSO_4$ **D) $(NH_4)_2CO_3$**

4. Which compound is *least* soluble in water at 60. °C?

   A) $KClO_3$ C) NaCl
   B) KNO_3 D) NH_4Cl

5. An unsaturated aqueous solution of NH_3 is at 90°C in 100. grams of water. According to Reference Table *G*, how many grams of NH_3 could this unsaturated solution contain?

   A) 5 g B) 10. g C) 15 g D) 20. g

6. The solubility of $KClO_3(s)$ in water increases as the

   A) temperature of the solution increases
   B) temperature of the solution decreases
   C) pressure on the solution increases
   D) pressure on the solution decreases

7. According to Reference Table *G*, how many grams of KNO_3 would be needed to saturate 200 grams of water at 70ºC?

   A) 43 g B) 86 g C) 134 g **D) 268 g**

8. Carbon dioxide gas is most soluble in water under conditions of

   A) high pressure and low temperature
   B) high pressure and high temperature
   C) low pressure and low temperature
   D) low pressure and high temperature

9. At which temperature can water contain the most dissolved oxygen at a pressure of 1 atmosphere?

   A) 10.ºC B) 20.ºC C) 30.ºC D) 40.ºC

10. Based on Table *F*, which equation represents a saturated solution having the lowest concentration of Cl^- ions?

    A) $NaCl(s) \rightleftharpoons Na^+(aq) + Cl^-(aq)$
    B) $AgCl(s) \rightleftharpoons Ag^+(aq) + Cl^-(aq)$
    C) $NH_4Cl(s) \rightleftharpoons NH_4^+(aq) + Cl^-(aq)$
    D) $KCl(s) \rightleftharpoons K^+(aq) + Cl^-(aq)$

11. A solute is added to water and a portion of the solute remains undissolved. When equilibrium between the dissolved and undissolved solute is reached, the solution must be

    A) dilute C) unsaturated
    B) saturated D) supersaturated

12. A saturated solution of $NaNO_3$ is prepared at 60.ºC using 100. grams of water. As this solution is cooled to 10.ºC, $NaNO_3$ precipitates (settles) out of the solution. The resulting solution is saturated. Approximately how many grams of $NaNO_3$ settled out of the original solution?

    A) 46 g B) 61 g C) 85 g D) 126 g

13. Which expression could represent the concentration of a solution?

    A) 3.5 g C) 3.5 mL
    B) 3.5 M D) 3.5 mol

14. How many total moles of KNO_3 must be dissolved in water to make 1.5 liters of a 2.0 M solution?

    A) 0.50 mol **C) 3.0 mol**
    B) 2.0 mol D) 1.3 mol

15. What is the molarity of a solution that contains 0.50 mole of NaOH in 0.50 liter of solution?

    A) 1.0 M C) 0.25 M
    B) 2.0 M D) 0.50 M

16. How many milliliters of 12.0 M HCl(aq) must be diluted with water to make exactly 500. mL of 3.00 M hydrochloric acid?

    A) 100. mL C) 200. mL
    B) 125. mL D) 250. mL

17. A 2400.-gram sample of an aqueous solution contains 0.012 gram of NH_3. What is the concentration of NH_3 in the solution, expressed as parts per million?

    A) 5.0 ppm C) 20. ppm
    B) 15 ppm D) 50. ppm

Base your answers to questions **21** through **23** on the information below and on your knowledge of chemistry.

Seawater contains dissolved salts in the form of ions. Some of the ions found in seawater are $Ca^{2+}, Mg^{2+}, K^+, Na^+, Cl^-, HCO_3^-$, and SO_4^{2-}.

An investigation was conducted to determine the concentration of dissolved salts in seawater at one location. A 300.-gram sample of the seawater was placed in an open container. After a week, all the water had evaporated and 10. grams of solid salts remained in the container.

21. At standard pressure, compare the freezing point of seawater to the freezing point of distilled water.

22. Explain why the evaporation that occurred during the investigation is an endothermic process.

23. Determine the concentration, expressed as parts per million, of the dissolved salts in the original sample of seawater.

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18. Compared to the freezing point of 1.0 M KCl(aq) at standard pressure, the freezing point of 1.0 M $CaCl_2$ (aq) at standard pressure is

A) lower C) the same
B) higher

19. When ethylene glycol (an antifreeze) is added to water, the boiling point of the water

A) decreases, and the freezing point decreases
B) decreases, and the freezing point increases
C) increases, and the freezing point decreases
D) increases, and the freezing point increases

20. Which concentration of a solution of CH_3OH in water has the *lowest* freezing point?

A) 0.1 M C) 0.001 M
B) 0.01 M D) 0.0001 M

Base your answers to questions **24** through **26** on the information below and on your knowledge of chemistry.

Hydrazine, N_2H_4, is a compound that is very soluble in water and has a boiling point of 113°C at standard pressure. Unlike water, hydrazine is very reactive and is sometimes used as a fuel for small rockets. One hydrazine reaction producing gaseous products is represented by the balanced equation below.

$$N_2H_4(\ell) \rightarrow N_2(g) + 2H_2(g) + \text{heat}$$

24. Explain, in terms of intermolecular forces, why the boiling point of hydrazine at standard pressure is higher than the boiling point of water as standard pressure.

25. Explain, in terms of molecular polarity, why N_2H_4 is very soluble in water.

26. Based on Table *S*, determine the electronegativity difference for the N-H bond in hydrazine.

Base your answers to questions **27** through **30** on the information below and on your knowledge of chemistry.

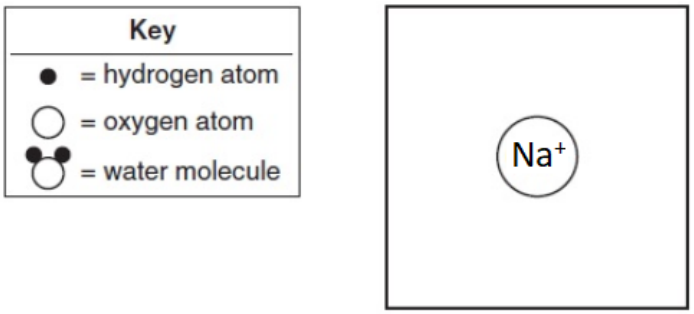
A 2.50-liter aqueous solution contains 1.25 moles of dissolved sodium chloride. The dissolving of NaCl(s) in water is represented by the equation below.

$$NaCl(s) \xrightarrow{H_2O} Na^+(aq) + Cl^-(aq)$$

27. Determine the molarity of this solution.

28. Compare the freezing point of this solution to the freezing point of a solution containing 0.75 mole NaCl per 2.50 liters of solution.

29. Using the key, draw *two* water molecules in the box, showing the orientation of *each* water molecule toward the sodium ion.



30. Explain, in terms of ions, why an aqueous solution of sodium chloride conducts an electric current.

Answer Key
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1. **D**
2. **A**
3. **D**
4. **A**
5. **A**
6. **A**
7. **D**
8. **A**
9. **A**
10. **B**
11. **B**
12. **A**
13. **B**
14. **C**
15. **A**
16. **B**
17. **A**
18. **A**
19. **C**
20. **A**
21. — Water has a higher freezing point than seawater. — Seawater's is lower.
22. — Energy is needed to overcome the intermolecular forces. — Energy is required to change liquid to water vapor. — The heat of vaporization is positive.
23.
24. —The intermolecular forces in hydrazine must be greater than the intermolecular forces in water. —The intermolecular forces in H_2O are weaker.
25. —Hydrazine is very soluble in water because the molecular polarity of hydrazine is similar to the molecular polarity of water. —Water and hydrazine are both polar.
26. 0.8 *or* .8
27. — 0.500 M — 0.50 M — .5 M
28. — The solution that contains 1.25 moles of NaCl has a lower freezing point. — lower for the first one –higher for the solution with 0.75 mol —The 0.30 M solution has a higher freezing point than the 0.50 M solution. –This solution has a lower f.p.
29.
30.