

## Exam #4 (Chp 7 &amp; 8) SOLUTIONS &amp; OXIDATION REDUCTION

(130 points total)

Mark answers on your scantron for Questions 1-37. Mark only one answer unless directed otherwise. Each question is worth 2 pt.

CHP 7 SOLUTIONS

1. (7.1) Which of the following statements about solutions is CORRECT?

- A) For a solution to form the solute and solvent must chemically react with one another.  
 B) The solutes in a solution will settle out with time if the solution is left undisturbed.  
☒ C) A solution may contain more than one solute.  
 D) A solution is a heterogeneous mixture of two or more pure substances.

A 5 gallon tank filled with methane (gas) and a small amount of methyl mercaptan gives a noticeable odor.

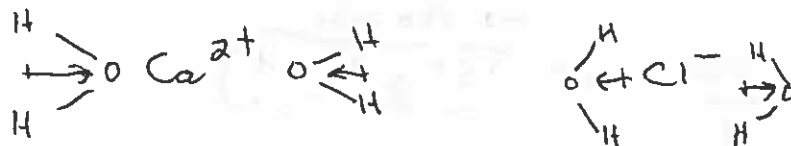
Use these answers for Questions 2 and 3.

A) solvent

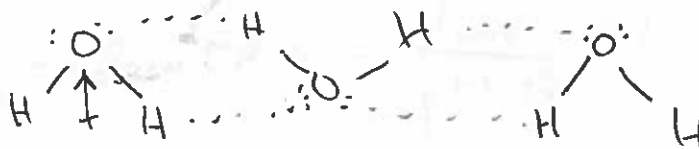
B) solution

C) solute

D) water

2. (7.1) Methyl mercaptan is the C in this mixture.3. (7.1) Methane is the A in this mixture.(7.3) (6 pt) Draw a diagram showing the hydrated ions of calcium chloride when it dissolves in water.

(7.3) (6 pt) Draw a picture of the hydrogen bonds that occur between water molecules and draw a symbol showing the dipole in the water molecule.



(7.4) Select the answer on the right that corresponds to each of the following solubility equations.

4.	$\text{HCl(g)} \xrightarrow{\text{H}_2\text{O}} \text{H}^+(\text{aq}) + \text{Cl}^-(\text{aq})$	<u>A</u>	A) Strong electrolyte
5.	$\text{NH}_3(\text{g}) + \text{H}_2\text{O} \rightleftharpoons \text{NH}_4^+(\text{aq}) + \text{OH}^-(\text{aq})$	<u>B</u>	B) Weak electrolyte
6.	$\text{CH}_3\text{OH(l)} \xrightarrow{\text{H}_2\text{O}} \text{CH}_3\text{OH(aq)}$	<u>C</u>	C) Non-electrolyte

7. (7.4) In Question 6, the solute is A) totally ionic ☒ B) only molecular C) both ionic and molecular.

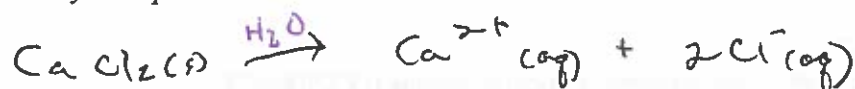
8. (7.4) Which is most soluble in water?

- ☒ A)  $\text{NO}_2$  (a polar gas) B)  $\text{CCl}_4$  (a nonpolar liquid) C)  $\text{CH}_4$  (a nonpolar gas) D)  $\text{CO}_2$  (a nonpolar gas)

9. (7.5) Which of the following would increase the solubility and the rate of dissolving a solid solute in a liquid solvent?

- ☒ A) heating the solvent B) cooling the solvent C) leaving the solute/solvent mixture as still as possible

(7.4) (4 pt) Write a balanced equation for  $\text{CaCl}_2(\text{s})$ , a strong electrolyte, when it dissolves in water. Use appropriate subscripts for the symbols in your equation.



10. (7.5) A saturated solution:

- A) contains as much solvent as it can hold
- B) contains no double bonds
- ☒ C) contains dissolved solute in equilibrium with undissolved solid
- D) will rapidly precipitate if a seed crystal is added.

11. (7.5) If silver sulfate has a solubility of 1.08 g per 100 g water at 50 °C, how would you describe a solution that has 0.65 g in 55 g water?

- A) unsaturated
- B) saturated
- ☒ C) supersaturated

$$1.18 \text{ g} / 100 \text{ g}$$

Answer all of the following question using a 15% (m/v) aqueous solution of NaCl

(7.5) (6 pt) How many grams of NaCl are present in 1.0 L of this solution?

$$\frac{15 \text{ g NaCl}}{100 \text{ mL}} \times \frac{1000 \text{ mL}}{1 \text{ L}} = 150 \text{ g NaCl}$$

(7.5) (4 pt) How many moles of NaCl are there in 1.0 L of this solution? The molar mass of NaCl is = 58.44 g/mol

$$150 \text{ g NaCl} \times \frac{1 \text{ mol}}{58.44 \text{ g}} = 2.57 \text{ mol} = 2.6 \text{ mol NaCl}$$

2 s.f.

(7.5) (4 pt) What is the molarity of NaCl in 1 L of this solution?

$$\frac{2.6 \text{ mol NaCl}}{1 \text{ L}} = 2.6 \text{ M}$$

(7.5) (6 pt) What volume (L) will 1 L of this solution have to be diluted to in order to make a 0.90% aqueous solution of NaCl?

$$\frac{15\% (1 \text{ L})}{0.90\%} = 16.67 \text{ L} \approx 17 \text{ L}$$

12. (7.5) Which solution has the highest concentration of hydrochloric acid?  
 A) 0.09 M HCl      B) 1.0 M HCl      C) 0.005 M HCl      **D) 8 M HCl**

13. (7.5) What is the molar mass of calcium chloride?  
 A) 75.53      B) 47.46      C) 82.91      **D) 110.98**

14. (7.5) What is the mass of 3.61 moles of Ca?  
 A) 0.090 g      **B) 145 g**      C) 40.0 g      D) 150 g

(7.5) (10 pt) What is the concentration in ppm (m/v) and ppb (m/v) of a solution that contains 45 mg of lead in 1750 mL of solution?

$$\frac{45 \text{ mg Pb}}{1750 \text{ mL}} \times \frac{1 \text{ g}}{1000 \text{ mg}} \times 10^6 = 25.7 \text{ ppm} = \boxed{26 \text{ ppm Pb}}$$

2 s.f.

Use these answers for Questions 15 and 18.

A) unsaturated

B) saturated

C) increase

D) decrease

E) stay the same

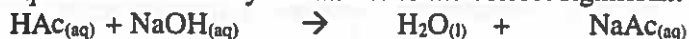
15. (7.5) A pinch of salt, added to a pot of boiling water makes a A solution.

16. (7.5) If the temperature of a solution increases, the solubility of most solid solutes will C.

17. (7.5) If the pressure above a solution increases, the solubility of a gaseous solute will C.

18. (7.5) When a bottle of soda is opened the solubility of the  $\text{CO}_2$  will D.

(7.6) (10 pt) Calculate the molarity of acetic acid (HAc) in vinegar if 5.00 mL vinegar is titrated with 15.50 mL 0.2243 M NaOH. Use this equation and round your answer to the correct significant figures.



$$15.50 \text{ mL} \times \frac{1 \text{ L}}{1000 \text{ mL}} = 0.01550 \text{ L} \times 0.2243 \frac{\text{mol NaOH}}{\text{L}} = 0.00348 \text{ mol NaOH}$$

$$0.00348 \text{ mol NaOH} \times \frac{1 \text{ mol HAc}}{1 \text{ mol NaOH}} = 0.00348 \text{ mol HAc} \times \frac{1}{5.00 \text{ mL}} \times \frac{1000 \text{ mL}}{1 \text{ L}} = \frac{0.695 \text{ mol HAc}}{1 \text{ L}} = \boxed{0.695 \text{ M HAc}}$$

(7.6) (8 pt) How many liters of 0.150 M HCl will react with 7.55 g of  $\text{Ca}(\text{OH})_2$ ?  
 Molar mass of  $\text{Ca}(\text{OH})_2$  is 74.10 g/mole

$$7.55 \text{ g Ca}(\text{OH})_2 \times \frac{1 \text{ mol}}{74.10 \text{ g}} = 0.102 \text{ mol Ca}(\text{OH})_2 \times \frac{2 \text{ mol HCl}}{1 \text{ mol Ca}(\text{OH})_2} =$$

$$0.204 \text{ mol HCl} \times \frac{1 \text{ L}}{0.150 \text{ mol}} = \boxed{1.36 \text{ L}}$$

0.150 M HCl

19. (7.7) When it comes to osmosis through a membrane in an aqueous solution

- A) The hypotonic solution is the one which has a higher water concentration  
 B) The isotonic solution is one where the solute concentration is greater.  
 C) The hypertonic solution has the higher water concentration.  
 D) The hypertonic solution has the lower solute concentration.

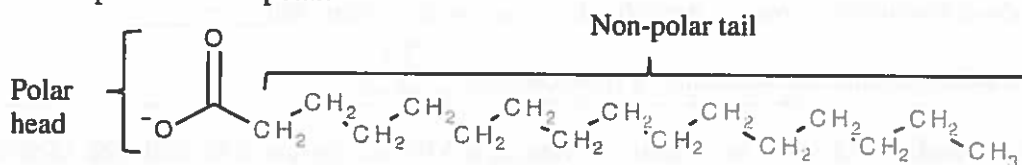
Use the answers on the right for Questions 11-16

Red blood cells are isotonic to 0.9% NaCl and 5% glucose solutions. Answer the following questions using this information.		
20. (7.7) When red blood cells are placed into pure water, the water is <u>C</u> to the cells.	A) swell (lysis)	AB) osmosis
21. (7.7) Red blood cells placed into 10% glucose will <u>B</u>	B) crenate (shrink)	AC) diffusion
22. (7.7) A red blood cell in 0.9% NaCl will <u>BC</u>	C) hypotonic	BC) neither crenate nor swell
23. (7.7) Water movement across a semipermeable membrane is <u>AB</u>	D) hypertonic	
	E) isotonic	

Identify the term (A-C) associated with each of the following descriptions in Questions 24-26.

24. (7.9) Mayonnaise, fog and milk are examples of this. <u>C</u>	A) solution
25. (7.9) Normal saline, Ringers and 5% glucose are examples of this. <u>A</u>	B) suspension
26. (7.9) This is a mixture like muddy water where the particles settle out over time. <u>B</u>	C) colloid

(7.9) (4 pt) Soap is a molecule that has both polar and non-polar parts. Explain why these parts of the molecule are polar and non-polar.



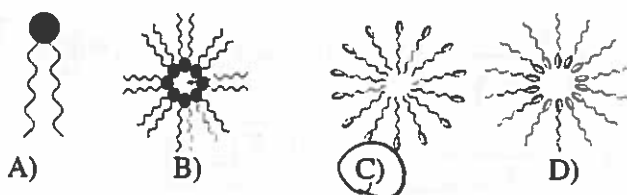
The polar head contains polar bonds and is ionic so it is polar!

the non-polar tail contains only C-C and C-H bonds which are non-polar bonds.

27. (7.9) What is the name for the kind of molecule that soap is?

- A) amphiphatic B) amphoteric C) esoteric D) hyperbaric

28. (7.9) Which picture best represents the formation of soap micelles in water?



**Chp 8 (Oxidation and Reduction)**

29. Oxidation involves:

- ☒ A) the loss of electrons.    B) the loss of oxygen.    C) the gain of electrons.    D) the gain of hydrogen.

30. When a substance is oxidized it is called the:

- A) oxidizing agent    ☒ B) reducing agent    C) both    D) neither

31. Which of the following are TRUE of an oxidizing agent?

1. It causes oxidation.
2. It gains electron(s).
3. It is the reduced substance.

- A) 1 and 2 only    B) 1 and 3 only    C) 2 and 3 only    ☒ D) All of 1, 2, and 3    E) Neither 1, 2, or 3

32. The oxidation number of Cr in  $\text{Cr}_2\text{O}_7^{2-}$  is

- A) +2    B) -2    C) +7    ☒ D) +6    E) none of the above

33. What is the oxidation state of the underlined element in the compound:  $\text{H}_2\text{S}\underline{\text{O}}_4$ 

- A) +1    B) +2    ☒ C) +2    D) +6    E) +4

34. What is the oxidation state of the underlined element in the compound:  $\underline{\text{C}}\text{O}_2$ 

- A) +1    B) +2    C) -2    ☒ D) +4    E) +6

35. What is the oxidation state of the underlined element in the reaction:  $\text{NaHCO}_3 + \text{H}\underline{\text{C}}\text{l} \rightarrow \text{NaCl} + \text{CO}_2 + \text{H}_2\text{O}$ 

- A) 0    B) +1    ☒ C) -1    D) +2    E) -2

36. Identify the substance being reduced in the following reaction:  $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$ 

- A)  $\text{CH}_4$     ☒ B)  $\text{O}_2$     C)  $\text{CO}_2$     D)  $\text{H}_2\text{O}$     E) none of the above

37. What statement is correct about this oxidation-reduction reaction?  $2\text{SO}_{2(g)} + \text{O}_{2(g)} \rightarrow 2\text{SO}_{3(g)}$ 

- A)  $\text{O}_2$  is the reducing agent.  
☒ B)  $\text{SO}_2$  is the reducing agent.  
C)  $\text{O}_2$  is oxidized.  
D) The sulfur in  $\text{SO}_2$  gains electrons

**18 pt**

