CHEM 5, Spring 2016 Name_____

Exam #4 (Chp 7 & 8) SOLUTIONS & 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 _____in this mixture.

3. (7.1) Methane is the _____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.	$HCl(g) \xrightarrow{H_2O} H^+(aq) + Cl^-(aq)$	A) Strong electrolyte
5.	$NH_3(g) + H_2O \rightleftharpoons NH_4^+(aq) + OH^-(aq)$	B) Weak electrolyte
6.	$CH_3OH\ (l) \xrightarrow{H_2O} CH_3OH\ (aq)$	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) NO_2 (a polar gas) B) CCl_4 (a nonpolar liquid) C) CH_4 (a nonpolar gas) D) 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

30 pt

(7.4) (4 pt) Write a balanced equation for $CaCl_2(s)$, a strong electrolyte, when it dissolves in water. *Use appropriate subscripts for the symbols in your equaton.*

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 ^oC, how would you describe a solution that has 0.65 g in 55 g water?
A) unsaturated B) saturated C) supersaturated

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

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

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

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

(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?

<u>28 pt</u>

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) 3 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?

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 _____solution.

16. (7.5) It the temperature of a solution increases, the solubility of most solid solutes will_____.

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

18. (7.5) When a bottle of soda is opened the solubility of the CO_2 will_____.

(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.

$$HAc_{(aq)} + NaOH_{(aq)} \rightarrow H_2O_{(l)} + NaAc_{(aq)}$$

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

42 pt

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.

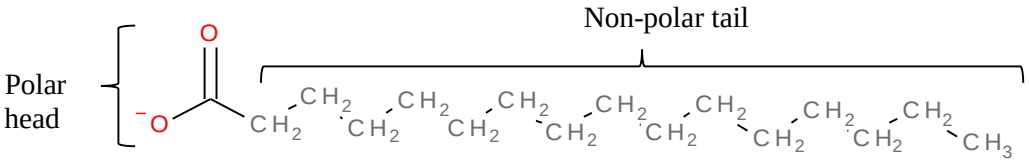
Use the answers on the right for Questions 11-16

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

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

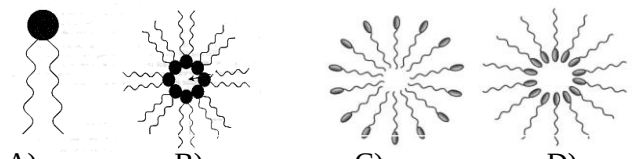
24. (7.9) Mayonnaise, fog and milk are examples of this.	A) solution
25. (7.9) Normal saline, Ringers and 5% glucose are examples of this.	B) suspension
26. (7.9) This is a mixture like muddy water where the particles settle out over time.	C) colloid

(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.



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?



24 pt

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 $Cr_2O_7^{2-}$ 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: $H_2S\underline{O}_4$
A) +1 B) +2 C) -2 D) +6 E) +4

34. What is the oxidation state of the underlined element in the compound: $\underline{C}O_2$
A) +1 B) +2 C) -2 D) +4 E) +6

35. What is the oxidation state of the underlined element in the reaction: $NaHCO_3 + H\underline{Cl} \rightarrow NaCl + CO_2 + H_2O$
A) 0 B) +1 C) -1 D) +2 E) -2

36. Identify the substance being reduced in the following reaction: $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$
A) CH_4 B) O_2 C) CO_2 D) H_2O E) none of the above

37. What statement is <u>correct</u> about this oxidation-reduction reaction? $2\ SO_{2(g)} + O_{2(g)} \rightarrow 2\ SO_{3(g)}$
A) O_2 is the reducing agent.
B) SO_2 is the reducing agent.
C) O_2 is oxidized.
D) The sulfur in SO_2 gains electrons

18 pt

DILUTION

$M_1V_1 = M_2V_2$

$C_iV_i = M_fV_f$

Where:
"C" is concentration
"i" is initial
"f" is final

USEFUL CONVERSION FACTORS AND RELATIONSHIPS

Length
SI unit: meter (m)

1 km = 0.62137 mi
1 mi = 5280 ft
= 1.6093 km
1 m = 1.0936 yd
1 in. = 2.54 cm (exactly)
1 cm = 0.39370 in.
1 Å = 10^{-10} m

Mass
SI unit: kilogram (kg)

1 kg = 2.2046 lb
1 lb = 453.59 g
= 16 oz
1 amu = 1.6605402 x 10^{-24} g

Temperature
SI unit: Kelvin (K)

0 K = −273.15°C
= −459.67°F
K = °C + 273.15
°C = $\frac{5}{9}$ (°F − 32°)
°F = $\frac{9}{5}$ °C + 32°

Energy (derived)
SI unit: joule (J)

1 J = 1 kg-m^2/s^2
1 J = 0.2390 cal
= 1 C x 1 V
1 cal = 4.184 J
1 eV = 1.602 × 10^{-19} J

Pressure (derived)
SI unit: Pascal (Pa)

1 Pa = 1 N/m^2
= 1 kg/m-s^2
1 atm = 101,325 Pa
= 760 torr
= 14.70 lb/in^2
1 bar = 10^5 Pa

Volume (derived)
SI unit: cubic meter (m^3)

1 L = 10^{-3} m^3
= 1 dm^3
= 10^3 cm^3
= 1.0567 qt
1 gal = 4 qt
= 3.7854 L
1 cm^3 = 1 mL
1 in^3 = 16.4 cm^3

PERIODIC CHART OF THE ELEMENTS

1 H 1.00797																1 H 1.00797	2 He 4.0026
3 Li 6.939	4 Be 9.0122											5 B 10.811	6 C 12.0112	7 N 14.0067	8 O 15.9994	9 F 18.9984	10 Ne 20.183
11 Na 22.9898	12 Mg 24.312											13 Al 26.9815	14 Si 28.086	15 P 30.9738	16 S 32.064	17 Cl 35.453	18 Ar 39.948
19 K 39.102	20 Ca 40.08	21 Sc 44.956	22 Ti 47.90	23 V 50.942	24 Cr 51.996	25 Mn 54.9380	26 Fe 55.847	27 Co 58.9332	28 Ni 58.71	29 Cu 63.54	30 Zn 65.37	31 Ga 69.72	32 Ge 72.59	33 As 74.9216	34 Se 78.96	35 Br 79.909	36 Kr 83.80
37 Rb 85.47	38 Sr 87.62	39 Y 88.905	40 Zr 91.22	41 Nb 92.906	42 Mo 95.94	43 Tc (99)	44 Ru 101.07	45 Rh 102.905	46 Pd 106.4	47 Ag 107.870	48 Cd 112.40	49 In 114.82	50 Sn 118.69	51 Sb 121.75	52 Te 127.60	53 I 126.904	54 Xe 131.30
55 Cs 132.905	56 Ba 137.34	✳57 La 138.91	72 Hf 178.49	73 Ta 180.948	74 W 183.85	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.09	79 Au 196.967	80 Hg 200.59	81 Tl 204.37	82 Pb 207.19	83 Bi 208.980	84 Po (210)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra (226)	‡89 Ac (227)	104 Rf (261)	105 Db (262)	106 Sg (266)	107 Bh (262)	108 Hs (265)	109 Mt (266)	110 ? (271)	111 ? (272)	112 ? (277)						

Numbers in parenthesis are mass numbers of most stable or most common isotope.

Atomic weights corrected to conform to the 1963 values of the Commission on Atomic Weights.

The group designations used here are the former Chemical Abstract Service numbers.

✳ Lanthanide Series

58 Ce 140.12	59 Pr 140.907	60 Nd 144.24	61 Pm (147)	62 Sm 150.35	63 Eu 151.96	64 Gd 157.25	65 Tb 158.924	66 Dy 162.50	67 Ho 164.930	68 Er 167.26	69 Tm 168.934	70 Yb 173.04	71 Lu 174.97

‡ Actinide Series

90 Th 232.038	91 Pa (231)	92 U 238.03	93 Np (237)	94 Pu (242)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (249)	99 Es (254)	100 Fm (253)	101 Md (256)	102 No (256)	103 Lr (257)