Chemistry 115
Dr. Cary Willard
Exam 4B

Name _____Key_____

May 20, 2009

	Points Earned	Points Possible
Part 1 multiple choice		30
Page 2		30
Page 3		23
Page 4		17
Total		100

All work must be shown to receive credit. Show all answers to the proper number of significant figures.

$N_A = 6.022 \times 10^{23}/mol$

$K = {}^{o}C+273.16$

$0^{o}C=273.16\ K$

Grossmont College
Periodic Table

IA												IIIA	IVA	VA	VIA	VIIA	NOBLE GASES
1 **H** 1.008	IIA															1 **H** 1.008	2 **He** 4.002
3 **Li** 6.941	4 **Be** 9.012											5 **B** 10.81	6 **C** 12.01	7 **N** 14.01	8 **O** 16.00	9 **F** 19.00	10 **Ne** 20.18
11 **Na** 23.00	12 **Mg** 24.30	IIIB	IVB	VB	VIB	VIIB	VIII	VIII	VIII	IB	IIB	13 **Al** 27.00	14 **Si** 28.09	15 **P** 30.97	16 **S** 32.06	17 **Cl** 35.45	18 **Ar** 39.95
19 **K** 39.10	20 **Ca** 40.08	21 **Sc** 44.96	22 **Ti** 47.90	23 **V** 50.94	24 **Cr** 52.00	25 **Mn** 54.94	26 **Fe** 55.85	27 **Co** 58.93	28 **Ni** 58.70	29 **Cu** 63.55	30 **Zn** 65.38	31 **Ga** 69.72	32 **Ge** 72.59	33 **As** 74.92	34 **Se** 78.96	35 **Br** 79.90	36 **Kr** 83.80
37 **Rb** 85.47	38 **Sr** 87.62	39 **Y** 88.91	40 **Zr** 91.22	41 **Nb** 92.91	42 **Mo** 95.94	43 **Tc** (99)	44 **Ru** 101.1	45 **Rh** 102.9	46 **Pd** 106.4	47 **Ag** 107.9	48 **Cd** 112.4	49 **In** 114.8	50 **Sn** 118.7	51 **Sb** 121.8	52 **Te** 127.6	53 **I** 126.9	54 **Xe** 131.3
55 **Cs** 132.9	56 **Ba** 137.3	57 **La** 138.9	72 **Hf** 178.5	73 **Ta** 180.9	74 **W** 183.9	75 **Re** 186.2	76 **Os** 190.2	77 **Ir** 192.2	78 **Pt** 195.1	79 **Au** 197.0	80 **Hg** 200.6	81 **Tl** 204.4	82 **Pb** 207.2	83 **Bi** 209.0	84 **Po** (209)	85 **At** (210)	86 **Rn** (222)
87 **Fr** (223)	88 **Ra** 226.0	89 **Ac** 227.0	104 **Rf** (261)	105 **Db** (262)	106 **Sg** (263)	107 **Bh** (262)	108 **Hs** (265)	109 **Mt** (266)	110 **??** (269)								

Lanthanide series	58 **Ce** 140.1	59 **Pr** 140.9	60 **Nd** 144.2	61 **Pm** (147)	62 **Sm** 150.4	63 **Eu** 152.0	64 **Gd** 157.3	65 **Tb** 158.9	66 **Dy** 162.5	67 **Ho** 164.9	68 **Er** 167.3	69 **Tm** 168.9	70 **Yb** 173.0	71 **Lu** 175.0
Actinide series	90 **Th** 232.0	91 **Pa** 231.0	92 **U** 238.0	93 **Np** (237)	94 **Pu** (244)	95 **Am** (243)	96 **Cm** (247)	97 **Bk** (247)	98 **Cf** (251)	99 **Es** (252)	100 **Fm** (257)	101 **Md** (258)	102 **No** (259)	103 **Lr** (260)

Part 1 – Multiple Choice (30 points)

1. At which pressure would nitrogen gas be most soluble?
   a. 1.0 atm
   b. 2.5 atm
   c. 1.5 atm
   d. 2.0 atm
   e. Unable to determine

2. Which is the hydroxide ion?
   a. H^{+1}
   b. H_3O^{+1}
   c. OH^{-1}
   d. OH_2^{-1}
   e. H_2OOH

3. What is the conjugate base of HS^{-1}?
   a. H^{+1}
   b. OH^{-1}
   c. HS^{+1}
   d. H_2S
   e. S^{-2}

4. All nuclides of which element must be radioactive?
   a. Strontium
   b. Plutonium
   c. Arsenic
   d. Sulfur
   e. Carbon

5. An alpha particle consists of
   a. One proton and one neutron
   b. One proton and two neutrons
   c. Two protons and one neutron
   d. Two protons and two neutrons
   e. Two protons and fourneutrons

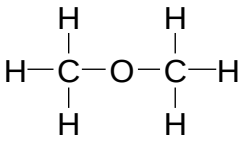
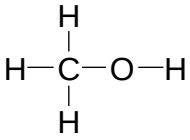
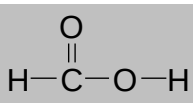
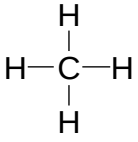
6. In which type of reaction do the nuclei of two light elements unite to form a heavier nucleus?
   a. Fusion
   b. Fission
   c. Alpha decay
   d. Beta decay
   e. Electron capture

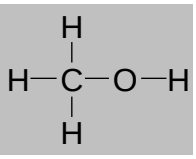
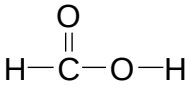
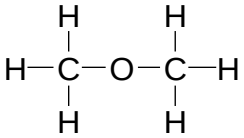
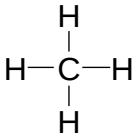
7. How many neutrons are in the nucleus of cobalt-60?
   a. 29
   b. 31
   c. 27
   d. 33
   e. 60

8. Which hydrocarbon series contains a triple covalent bond between carbon atoms?
   a. Alkatrienes
   b. Alkines
   c. Alkynes
   d. Alkanes
   e. Alkenes

9. Two or more different compounds with the same molecular formula are
   a. Isotopes
   b. Hypermeres
   c. Isomers
   d. Hypertopes
   e. Mollimers

10. $CH_3CH=CHCH_2CH_3$ is
   a. Pentane
   b. 2-pentene
   c. Pentyne
   d. 3-pentene
   e. Pen-2-ene

11. Which is a carboxylic acid?
   a. 
   b. 
   c. 
   d. 

12. Which is an alcohol?
   a. 
   b. 
   c. 
   d. 

13. The simplest carbohydrates are
   a. Peptides
   b. Dipeptides
   c. Monosaccharides
   d. Disaccharides
   e. Potatoes

14. What are the primary constituents of proteins?
   a. Proteases
   b. Rabbits
   c. Nucleic acids
   d. Monosaccharides
   e. Amino acids

15. Fats and oils are
   a. Carbohydrates
   b. Lipids
   c. Nucleic acids
   d. Proteins
   e. Hydrocarbons

Part 2 – Problems and Questions (70 points)

1. (4 points) Give the proper IUPAC names for the following acids

   a. H_2SO_4

   Sulfuric acid

   b. HCl

   Hydrochloric acid

2. (8 points) Determine the type of emissions (alpha, beta, or gamma) that occurred in each of the following transitions.

$$^{234}_{90}Th \rightarrow {}^{4}_{2}He + {}^{230}_{88}Ra$$

$$^{230}_{88}Ra \rightarrow {}^{230}_{88}Ra + {}^{0}_{0}\gamma$$

3. (6 points) Strontium-90 has a half-life of 28 years. If a 4.00 mg sample was stored for 168 years, what mass of Sr-90 would remain?

$$4.00mg \overset{1}{\rightsquigarrow} 2.00mg \overset{2}{\rightsquigarrow} 1.00mg \overset{3}{\rightsquigarrow} 0.50mg \overset{4}{\rightsquigarrow} 0.25mg \overset{5}{\rightsquigarrow} 0.125mg \overset{6}{\rightsquigarrow} 0.063mg$$

4. (6 points) A solution is prepared by dissolving 31.6 grams of KOH in 386.0 grams of water Calculate the mass percent potassium hydroxide in a solution.

$$?\,\%\,KOH = \left(\frac{mass\ KOH}{mass\ solution}\right) \times 100\% = \left(\frac{31.6\ g\ KOH}{(386.0 + 31.6)\ g\ soln}\right) \times 100\%$$

$$= \left(\frac{31.6\ g\ KOH}{417.6\ g\ soln}\right) \times 100\% = \boxed{7.56\%\ KOH}$$

5. (6 points) Calculate the number of grams of calcium chloride in 53.6 mL of a 0.4288 M solution $CaCl_2$.

$$?\ g\ CaCl_2 = 53.6\ mL\ soln \times \frac{0.4288\ mol\ \ CaCl_2}{1000\ mL\ soln} \times \frac{110.98\ g\ CaCl_2}{1\ mol\ CaCl_2}$$
$$= \boxed{2.55\ g\ CaCl_2}$$

6. (6 points) 26.5 ml of 0.643 M $H_2C_2O_4$ is diluted to 150.0 ml. What is the molarity of the resulting solution?

$$M_1V_1 = M_2V_2 \quad \rightarrow \quad M_2 = M_1\left(\frac{V_1}{V_2}\right) = 0.643\ M\left(\frac{26.5\ mL}{150.0\ mL}\right) = 0.114\ M\ H_2C_2O_4$$

7. (8 points) A 14.7% solution of potassium phosphate (K_3PO_4) has a density of 1.39 g/mL. Calculate the molarity of the solution.

$$?\ [K_3PO_4] = \frac{mol\ K_3PO_4}{L\ soln} = \frac{1.39\ g\ soln}{1\ mL\ soln} \times \frac{14.7\ g\ K_3PO_4}{100\ g\ soln} \times \frac{1\ mol\ K_3PO_4}{212.3\ g\ K_3PO_4} \times \frac{1000\ mL\ soln}{1\ L\ soln}$$
$$= \boxed{0.962\ M\ K_3PO_4}$$

8. (6 points) A solution has an H_3O^+ concentration of 8.53 x 10^{-7} M.
   a. Determine the pH of the solution.

$$pH = -\log[H_3O^+] = -\log(8.53 \times 10^{-7}) = \boxed{6.069}$$

   b. Determine the pOH of the solution.

$$pOH = 14 - 6.069 = \boxed{7.931}$$

9. (3 points) A solution has a pH of 5.724. Calculate the hydronium ion concentration in the solution.

$$[H_3O^+] = 10^{-pH} = 10^{-5.724} = \boxed{1.89 \times 10^{-6} M}$$

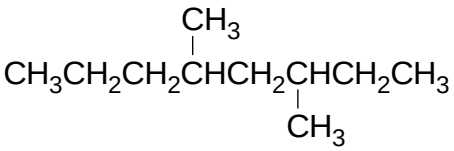
10. (8 points) A 25.00 ml sample of vinegar was titrated with 43.46 ml of 0.3155 M NaOH. Calculate the molarity of acetic acid in the vinegar sample.
    a. $HC_2H_3O_2$ + NaOH $\longrightarrow$ $NaC_2H_3O_2$ + H_2O

$$mol\ NaOH = 43.46\ mL \times \frac{0.3155\ mol\ NaOH}{1000\ mL} = 0.01371\ mol\ NaOH$$

$$mol\ HAc = mol\ NaOH = 0.01371\ mol\ HAc$$

$$M\ HAc = \frac{mol\ HAc}{L\ soln} = \frac{0.01371\ mol\ HAc}{0.02500\ L\ soln} = 0.5485\ M\ HAc$$

11. (3 points) Give the IUPAC name of



3,5-Dimethyl octane (best)

Or 2-ethyl-4-methyl heptanes

12. (3 points) Draw a condensed structural formula for 3-ethyl heptane.

$CH_3CH_2CH_2CHCH_2CH_3$
CH_2CH_3

13. (3 points) Explain how a saturated fat differs from an unsaturated fat in terms of its chemical structure.

A saturated fat has only single bonds and an unsaturated fat contains double bonds.