**Final Exam : Chem 1114 Fall 2014**

**Version B 150 points**

YOUR NAME: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1.1 How many cats does Doc have at home ? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1.2. Where did Doc get his Ph.D In Chemistry ? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2.1. What is the magnitude associated with a n ? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2.2. Convert 0.000001 s to its equivalent, prefixed form: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2.3. The magnitude 10+6 has what prefix name (not symbol) associated with ? \_\_\_\_\_\_\_\_\_\_\_\_\_

3.1. 10 ms = \_\_\_\_\_\_\_\_\_\_\_s (2 pts each)

3.2. 0.00005 mm = \_\_\_\_\_\_\_\_\_ nm

3.3. 65 mg = \_\_\_\_\_\_\_\_\_\_\_ cg

4.1. How many significant figures are in each of the numbers below ?

a) 0.0040\_\_\_\_\_\_\_\_\_\_ b) 10005000\_\_\_\_\_\_\_

c) 0.01100\_\_\_\_\_\_\_\_\_ d) 6\*1060000 \_\_\_\_\_\_\_\_\_\_\_\_

4.2. Compute to the correct significant figure count: ( 2 pts each)

 0.0011 + 0.011 + 0.1 + 40 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 1- 0.03+0.1 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 5.1. Compute to correct sig fig count: (4+0.00014)= \_\_\_\_\_\_\_\_\_ 2 pts

 4.000\*0.5

 5.2. Compute to the correct sig fig count:

 3.0-0.102000 + 12.00\*6.0 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 2 pts

 9.02\*1.999

6.1. electrons are: ***heavier lighter the same mass*** as neutrons. (Circle your choice)

6.2. How many neutrons in 16N ?. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

6.3. Provide names or symbols for the elements below: (spelling counts)

As\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ silver\_\_\_\_\_\_\_ Mn\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Sn\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ gallium\_\_\_ Co \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_/32

**Final exam version B(continued) p. 2/7**

7.1. Fill in the missing information (4 points per line)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Atomic # | Mass # | symbol | #p | #n | #e | Atom charge |
|  |  |  | 26 | 28 |  | 0 |
|  | 67 | Zn |  |  | 30 |  |

7.2. Compute the average atomic mass of the hypothetic element Du given the information below: (2 pts)

Du mass # % abundance=Pk

410.0 10

412.0 40 average mass of Du= \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ( to nearest 0.1)

418.0 50

8.1. Provide the name or formula for the compounds below. (You may use your Periodic Table as an aid.)

Note: CO32- = carbonate C2H3O2- = acetate spelling counts ! (2 pts each)

As3S4 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ copper(II) carbonate = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Mg(C2H3O2)2 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cobolat(II) nitride= \_\_\_\_\_\_\_\_\_\_\_\_\_

9.1 The MW of PCl5 is 208 g/mol How many moles of are in 2912 grams of it?

 (2 pts)

 \_\_\_\_\_\_\_\_\_\_\_mol PCl5

9.2. How many grams are in 2.8942\*1023 molecules of PCl5? Assume 1 mole count=6.02\*1023 .

 The molecular weight ofPCl5 = 208 g/mol (round answer to nearest gram) ( 2 pts)

 \_\_\_\_\_\_\_\_ g PCl5

10.1. The molecular mass of SO3 is 80 g/mol. Given that 1 mole count =6.02\*1023, how many molecules of SO3 are in 664.45g SO3 ? (4 pts)

 \_\_\_\_\_\_\_\_\_\_\_molecules SO3

\_\_\_\_\_\_/26

**Final Exam version B(continued) p. 3/7**

11.1. The formula for calcium acetare is CaC4H6O4 whose molecular weight is 98 g/mol. A chemist analyzes a sample of this compound for calcium content and finds it contains 384 grams of O (atomic weight 16 g/mol) . How many moles of calcium acetate are present ? (3 pts)

 \_\_\_\_\_\_\_\_ mol calcium acetate

12.1 The compound sucrose has the formula: C12H22O11 and a molecular mass of 342 g/mol.

a) How many moles of O are found in 621.1818 g of sucrose ? (show work or no credit)

 \_\_\_\_\_\_ mol O 3 pts

b) How many grams of C are in 4.75 grams of sucrose ? (atomic mass of C=12 g/mol)

 \_\_\_\_\_\_ g C 3 pts

13.1 A brown powder contains 26.08 g C, 4.348 g H and 69.56% O. What is the powder’s empiric

 formula ?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Element** | **Mass (g)** | **Atomic mass (g/mol)** |  |  |
| **C** |  | **12** |  |  |
| **H** |  | **1** |  |  |
| **O** |  | **16** |  |  |

 Empiric formula = C H O 3 pts

13.2. The molecular mass of the brown powder in 13.1 is 552 g/mol. What is the molecular formula for

 the compound ?

Molecular formula = C H O 3 pts

14.1 A hydrocarbon with the formula CxHy is burned to form 22 grams CO2 and 9 grams of H2O.

 Given the molecular weights : CO2 = 44 g/mol, H2O=18 g/mol, provide a whole-numbered

 formula for CxHy.

 \_\_\_\_\_\_\_\_\_\_\_whole # formula for CxHy 3 pts

15.1. 4. Balance the reactions below: (1 pt each/8 pts total)

a) \_\_KOH + \_\_\_\_CuCl2🡪 \_\_\_Cu(OH)2 + \_\_\_\_KCl

b) \_\_C7H16 +\_\_\_\_O2🡪 \_\_\_\_CO2 + \_\_\_H2O

\_\_\_\_\_\_/26

**Final Exam version B (continued) p. 4/7**

16.1 Pentane (C5H12) burns according to the stoichiometrically balanced reaction below:

C5H12 +8 O2 🡪 5CO2 + 6H2O

 MW (g/mol) 72 32 44 18

 a) How many grams of H2O form when we burn 4.0 grams of C5H12 ? (Show work !)

\_\_\_\_\_\_\_ g H2O 3 pts

b)How many grams of CO2 form from 6.5673\*1023 molecules of O2. (1 mol count = 6.02\*1023 molecules)

 \_\_\_\_\_\_\_ g CO2 3 pts

17.1 Butane burns according to the balanced equation:

 2C4H10 + 13O2 🡪 8CO2 +10H2O

MW 58 32 44 18

a) If we combine 26.364 g C4H10 and 208 g O2 how many grams of CO2 can you form ?

 \_\_\_\_\_\_ g CO2 3 pts

b) How many molecules of H2O form by burning 8\*1022 molecules of C4H10 and 5.5464 g O2 ?

(1 mol count=6\*1023 molecules)

 \_\_\_\_\_\_\_ molecules H2O 3 pts

c) A 10 gram sample of butane is burned in excess O2 to form 7.7586 g H2O. What is the percent yield of

 the reaction ?

 \_\_\_\_\_\_\_\_\_\_ % yield of reaction 3 pts

18.1 In the Bronsted acid-base theory

 A base is a(n)\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

18.2 Write out the hydrolysis reaction for CO3 2- in water:

\_\_\_/17

**Final Exam version B (continued) p. 5/7**

19.1. What are the conjugate acid (CA) and conjugate base (CB) in the reaction below:

HCO32- + PO33- 🡪 CO33- + HPO32-

CA=\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ CB= \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

20.1. What are the oxidation numbers of all the elements in the compounds below: (1 pt each)

 a) NO3 N oxidation #=\_\_\_\_ O oxidation # = \_\_\_\_\_\_

20.2 What are elements oxidized and reduced in the reactions below:

 CuO + Mg 🡪 Cu + MgO

 \_\_\_\_ oxidized \_\_\_\_\_ reduced

21.1 Given the following conversions:

1 atm = 15 psi = 760 mm Hg = 101 kPa =32 feet of H2O

 Convert 404 kPa to psi: 404 kPa=\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ psi 1 pt

22.1 A gas at fixed temperature starts at a pressure P1=3 atm. It ends at pressure

 P2=0.2 atm and a volume , V2, of 30 L . What was the intial gas volume , V1 ?

 V1 = \_\_\_\_\_\_\_\_\_ L 3 pts

22.2  **Pinitial(N2) =12 atm Pinitial (H2) = 5 atm**

 **V­initial (N2) = 5 Vinitial(H2) = 3 L**



 Two gas volumes initially separated

 by a closed stopcock have the individual

 volumes and pressures shown.

If all the gas in the left hand volume

Is forced into the right hand volume, leaving the left hand volume in vacuum, what is the final pressure of both H2 and N2 in the right hand volume ?

 Final total P=\_\_\_\_\_\_\_\_\_ atm 3pts

23.1) A sample of gas weighing 25 grams occupies 5 L at 2.46 atm and 300 K. Given that

 R=0.082 atm L/K mole what is the molecular weight of the gas ?

MW(g/mol)=\_\_\_\_\_\_\_\_\_ 3 pts

\_\_\_/16

**Final Exam Version B (continued) p. 6/7**

23.2 Circle all the true features of the Ideal Gas law below: (2 points)

a) PV=nRT irrespective of gas identity b) It explains why all gases condense

c) Equal volumes, equal moles d) R varies with mole count

24.1. The ratio of the electron orbit to nuclear radius is:

a) 100:1

b) 1000:1

c) 10,000:1

d) 100,000:1

24.2 . A pea is about 0.15 inches in radius. A pair of students have assigned the pea the role of atomic nucleus, and assigned the radius of the electron cloud the distance from the Alfred bell tower to the stoplight at the campus entrance, a distance of 0.27 miles. Compute their implied ratio of the electron cloud radius to the nuclear radius, given:

 12 inches=1 foot 1 mile =5280 feet

 Electronic radius/nuclear radius=\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 (don’t round ! ) 2 pts

25.1) A photon has an energy of 3.978\*10-18 J. What is the wavelength, λ, of the photon in

 meters(m) given c= 3\*108 m/s and h=6.63\*10‑34 J\*s.

 λ= \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_m 2 pts

26.1 .) DeBroglie theorized:

 a) H atom is a series of circular electron orbits

 b) Plum Pudding model of atom

 c) matter has wave-like properties: mv=h/λ

 d) E=mc2

27.1. Provide the complete electronic configurations for the elements below:

(1 pt each/2 pts total)

1. S\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. F\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

28.1. Provide the correct pigeonhole descriptions for the elements and ions below:

 (2 pts each/ 4 pts total

1. Ag [ ]
2. Co3+ [ ]

\_\_\_/14

**Final Exam Version B (continued) p. 7/7**

29.1 Predict the likely formulas for the ionic compounds below: (2 pts each/ 4 pts total)

1. Ca + P= \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Al + O= \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

30.1 Draw the Lewis structures for the compounds below assuming the octet rule is

 obeyed making sure to show all lone pairs: (2 pts each/6 pts total)

SO3 N2 CO2

31.1. Indicate the formal charges on each element in the Lewis structure below:

OB

\_\_\_\_H \_\_\_\_S \_\_\_\_OA \_\_\_\_\_OB



OA

Trivia:

1) What district in the Hunger Games was hidden and thought dead ? \_\_\_\_\_\_\_\_\_\_\_\_\_\_

2) Who wrote **Rhapsody in Blue ?** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3) How many hobbits made the trip in the Ring Trilogy ? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

4) What is the dragon’s name in the **Hobbit** ? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

5) Any day doing chemistry is a good day True True

(CIRCLE YOU’RE CHOICE)

\_\_\_/19