Chemistry 150   Exam 1

Be sure to put your name on each page. This page can be removed from your exam so that you will have a Periodic Table handy throughout the exam, it does not need to be turned in. Show all your work for non-multiple choice problems which require any sort of calculation, no credit will be given for answers without work shown. If you have shown a significant amount of work or multiple drawings for a problem, draw a box around what you consider your final answer.

Avogadro's Number = 6.022×10^{23} $^{units}/_{mol}$

$32.00^{o}F = 0.000^{o}C = 273.15K$

1 foot = 12 inches

1 inch = 2.54cm (exactly)

1 pound = 453.6 g = 16 ounces

1 amu = 1.6605×10^{-24} g

Masses of subatomic particles:

Proton   1.00728amu = 1.6726×10^{-24} g

Neutron   1.00866amu = 1.6749×10^{-24} g

Electron 0.000549amu = 9.1094×10^{-28} g

1																	2
H 1.0079																	**He** 4.0026
3 **Li** 6.941	4 **Be** 9.0122											5 **B** 10.811	6 **C** 12.011	7 **N** 14.007	8 **O** 15.999	9 **F** 18.998	10 **Ne** 20.180
11 **Na** 22.990	12 **Mg** 24.305											13 **Al** 26.982	14 **Si** 28.086	15 **P** 30.974	16 **S** 32.066	17 **Cl** 35.453	18 **Ar** 39.948
19 **K** 39.098	20 **Ca** 40.078	21 **Sc** 44.956	22 **Ti** 47.88	23 **V** 50.942	24 **Cr** 51.996	25 **Mn** 54.938	26 **Fe** 55.847	27 **Co** 58.933	28 **Ni** 58.69	29 **Cu** 63.546	30 **Zn** 65.39	31 **Ga** 69.723	32 **Ge** 72.61	33 **As** 74.922	34 **Se** 78.96	35 **Br** 79.904	36 **Kr** 83.80
37 **Rb** 85.468	38 **Sr** 87.62	39 **Y** 88.906	40 **Zr** 91.224	41 **Nb** 92.906	42 **Mo** 95.94	43 **Tc** (98)	44 **Ru** 101.07	45 **Rh** 102.91	46 **Pd** 106.42	47 **Ag** 107.87	48 **Cd** 112.41	49 **In** 114.82	50 **Sn** 118.71	51 **Sb** 121.76	52 **Te** 127.60	53 **I** 126.90	54 **Xe** 131.29
55 **Cs** 132.91	56 **Ba** 137.33	57 **La** 138.91	72 **Hf** 178.49	73 **Ta** 180.95	74 **W** 183.84	75 **Re** 186.21	76 **Os** 190.23	77 **Ir** 192.22	78 **Pt** 195.08	79 **Au** 196.97	80 **Hg** 200.59	81 **Tl** 204.38	82 **Pb** 207.2	83 **Bi** 208.98	84 **Po** (209)	85 **At** (210)	86 **Rn** (222)
87 **Fr** (223)	88 **Ra** 226.03	89 **Ac** 227.03	104 **Rf** (261)	105 **Db** (262)	106 **Sg** (263)	107 **Bh** (262)	108 **Hs** (265)	109 **Mt** (266)	110 (269)	111 (272)	112 (277)		114		116		

58 **Ce** 140.12	59 **Pr** 140.91	60 **Nd** 144.24	61 **Pm** (145)	62 **Sm** 150.36	63 **Eu** 151.97	64 **Gd** 157.25	65 **Tb** 158.93	66 **Dy** 162.50	67 **Ho** 164.93	68 **Er** 167.26	69 **Tm** 168.94	70 **Yb** 173.04	71 **Lu** 174.97
90 **Th** 232.04	91 **Pa** 231.04	92 **U** 238.03	93 **Np** 237.05	94 **Pu** (244)	95 **Am** (243)	96 **Cm** (247)	97 **Bk** (247)	98 **Cf** (251)	99 **Es** (252)	100 **Fm** (258)	101 **Md** (258)	102 **No** (259)	103 **Lr** (260)

Score

Multiple Choice: Circle the letter of the most correct response. (5pts. per question)

1. Which of the following is *not* part of Atomic Theory?
   a. A chemical reaction involves joining, separating or rearranging atoms
   b. All matter is composed of atoms
   c. All atoms of a given element have the same chemical properties
   d. Compounds are formed by the chemical combination of two or more different kinds of atoms
   e. **The atomic number of an atom is equal to the number of protons in the nucleus**

2. Which of the following ions has the *most negative charge*?
   a. Sulfide
   b. Perchlorate
   c. Nitrite
   d. **Phosphate**
   e. Hydroxide

3. Which of the following formulas is *least ionic*?
   a. GeO_2
   b. $Al(NO_3)_3$
   c. **ClBr**
   d. TiS_2
   e. $MgCO_3$

4. Which of the following sets of elements contains a metal, a metalloid and a nonmetal?
   a. N, O, F
   b. Li, Na, K
   c. Ru, Sn, Cl
   d. **Ne, As, Cu**
   e. La, He, K

5. Which of the following represents the *largest mass*?
   a. 98 mg
   b. 3.1×10^{-7} kg
   c. 20 ounces
   d. 1.1 pounds
   e. **5.6×10^8 mg**

6. Different isotopes of an element:
   e. **Have the same number of protons**
   d. Have the same mass number
   c. Have the same number of neutrons
   b. Have the same charge
   a. Have the same number of electrons

Score

7. Complete the following table (3pts per box):

Symbol	Number of Protons	Number of Neutrons	Number of Electrons	Atomic Number	Mass Number	Charge
Sn	50	66	46	**50**	**116**	**+4**
P	**15**	**17**	15	**15**	32	**0**
Cr	**24**	**5**	**21**	24	29	+3
Se	**34**	42	36	**34**	**76**	**-2**

Multiple Choice Calculations (9pts each):

8. A length of rope is found to be 18.29feet long. What is its length in meters?
    a. 0.5575 m
    b. 0.4646 m
    c. 0.0387 m
    d. 4.646 m
    e. 5.575 m

9. What is the formula weight of ammonium phosphate?
    a. 131.047 $^g/_{mol}$
    b. 85.090 $^g/_{mol}$
    c. 337.970 $^g/_{mol}$
    d. 149.086 $^g/_{mol}$
    e. 133.087 $^g/_{mol}$

10. What is the mass of a sample of beryllium (Atomic # = 4) that contains 6.81×10^{21} Be atoms?
    a. 9.01 g
    b. 11.3 mg
    c. 88.4 g
    d. 9.81 g
    e. 0.102 g

11. 2.516mols of strontium (Atomic # 38) has a mass of how many grams?
    a. 1.515×10^{24} g
    b. 220.452 g
    c. 95.608 g
    d. 66.21 mg
    e. 28.71 mg

Score

12. How many cobalt atoms are present in a 4.819g sample of cobalt (Atomic # = 27)?
    a. 0.08177 atoms
    b. 4.819 atoms
    c. **4.924×10^{22} atoms**
    d. 1.075×10^{23} atoms
    e. 2.902×10^{24} atoms

Problems:

13. Oxygen has two naturally occurring isotopes. The more abundant, ^{16}O, is 99.757% abundant and has a mass of 15.99491463amu. What is the mass of the less abundant isotope? (13pts)

$$(15.99491463\text{amu})(0.99757) + (x\ \text{amu})(0.00243) = 15.999\text{amu}$$
$$x = 17.7\text{amu}$$
The 15.999amu is the average atomic mass from the Periodic Table.

14. Many enzymes contain small clusters of iron and sulfur atoms. After isolating the iron-sulfur cluster from a naturally occurring enzyme, you find that it has the following composition: %Fe = 33.84; %S = 19.43; %C = 43.67; %H = 3.054. What is the *empirical* formula of this substance? Additional analysis reveals that each molecule of this substance contains 4 iron atoms. What is the molecular formula and molecular weight of this substance? (14pts)

Fe: 33.84g Fe / 55.847^g/$_{mol}$ = 0.6059mols Fe --> 1 Fe per Fe

S: 19.43g S / 32.066^g/$_{mol}$ = 0.6059mols S --> 0.6059mols S / 0.6059mols Fe = 1 S per Fe

C: 43.67g C / 12.011^g/$_{mol}$ = 3.6358mols C --> 3.6358mols C / 0.6059mols Fe = 6 C per Fe

H: 3.054g H / 1.0079^g/$_{mol}$ = 3.0301mols H --> 3.0301mols H / 0.6059mols Fe = 1 H per Fe

Therefore, the empirical formula of this iron-sulfur cluster is:
$FeSC_6H_5$

Since there are 4 irons per molecule, the *molecular* formula of the compound is:
$Fe_4S_4C_{24}H_{20}$

Formula mass = 660.074 ^{g}/$_{mol}$

Score