

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

$32.00^\circ\text{F} = 0.000^\circ\text{C} = 273.15\text{K}$

1 foot = 12 inches

1 inch = 2.54cm (exactly)

1 pound = 453.6 g = 16 ounces

1 gallon = 3.785L

1 amu =  $1.6605 \times 10^{-24}$  g

Masses of subatomic particles:

Proton  $1.00728\text{amu} = 1.6726 \times 10^{-24}$  g

Neutron  $1.00866\text{amu} = 1.6749 \times 10^{-24}$  g

Electron  $0.000549\text{amu} = 9.1094 \times 10^{-28}$  g

1 <b>H</b> 1.0079																	2 <b>He</b> 4.0026
3 <b>Li</b> 6.941	4 <b>Be</b> 9.0122											5 <b>B</b> 10.811	6 <b>C</b> 12.011	7 <b>N</b> 14.007	8 <b>O</b> 15.999	9 <b>F</b> 18.998	10 <b>Ne</b> 20.180
11 <b>Na</b> 22.990	12 <b>Mg</b> 24.305											13 <b>Al</b> 26.982	14 <b>Si</b> 28.086	15 <b>P</b> 30.974	16 <b>S</b> 32.066	17 <b>Cl</b> 35.453	18 <b>Ar</b> 39.948
19 <b>K</b> 39.098	20 <b>Ca</b> 40.078	21 <b>Sc</b> 44.956	22 <b>Ti</b> 47.88	23 <b>V</b> 50.942	24 <b>Cr</b> 51.996	25 <b>Mn</b> 54.938	26 <b>Fe</b> 55.847	27 <b>Co</b> 58.933	28 <b>Ni</b> 58.69	29 <b>Cu</b> 63.546	30 <b>Zn</b> 65.39	31 <b>Ga</b> 69.723	32 <b>Ge</b> 72.61	33 <b>As</b> 74.922	34 <b>Se</b> 78.96	35 <b>Br</b> 79.904	36 <b>Kr</b> 83.80
37 <b>Rb</b> 85.468	38 <b>Sr</b> 87.62	39 <b>Y</b> 88.906	40 <b>Zr</b> 91.224	41 <b>Nb</b> 92.906	42 <b>Mo</b> 95.94	43 <b>Tc</b> (98)	44 <b>Ru</b> 101.07	45 <b>Rh</b> 102.91	46 <b>Pd</b> 106.42	47 <b>Ag</b> 107.87	48 <b>Cd</b> 112.41	49 <b>In</b> 114.82	50 <b>Sn</b> 118.71	51 <b>Sb</b> 121.76	52 <b>Te</b> 127.60	53 <b>I</b> 126.90	54 <b>Xe</b> 131.29
55 <b>Cs</b> 132.91	56 <b>Ba</b> 137.33	57 <b>La</b> 138.91	72 <b>Hf</b> 178.49	73 <b>Ta</b> 180.95	74 <b>W</b> 183.84	75 <b>Re</b> 186.21	76 <b>Os</b> 190.23	77 <b>Ir</b> 192.22	78 <b>Pt</b> 195.08	79 <b>Au</b> 196.97	80 <b>Hg</b> 200.59	81 <b>Tl</b> 204.38	82 <b>Pb</b> 207.2	83 <b>Bi</b> 208.98	84 <b>Po</b> (209)	85 <b>At</b> (210)	86 <b>Rn</b> (222)
87 <b>Fr</b> (223)	88 <b>Ra</b> 226.03	89 <b>Ac</b> 227.03	104 <b>Rf</b> (261)	105 <b>Db</b> (262)	106 <b>Sg</b> (263)	107 <b>Bh</b> (262)	108 <b>Hs</b> (265)	109 <b>Mt</b> (266)	110 <b>(269)</b>	111 <b>(272)</b>	112 <b>(277)</b>		114 <b>(279)</b>		116 <b>(289)</b>		

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

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

- Which of the following sets of elements contains a metal, a metalloid and a nonmetal?
  - Cu, Te, N
  - Na, Sr, Co
  - F, Ar, Ti
  - Mg, Ru, Pb
  - P, I, Ne
- Which of the following organic molecules has the *most carbon atoms*?
  - Hexene
  - Butanol
  - Ethane
  - Methyl amine
  - Propyne
- Which of the following formulas is *most ionic*?
  - RbBr
  - Fe<sub>2</sub>S<sub>3</sub>
  - SF<sub>6</sub>
  - PbO
  - FrCl
- Different isotopes of an element:
  - Have the same charge
  - Have the same number of electrons
  - Have the same mass number
  - Have the same number of protons
  - Have the same number of neutrons
- Which of the following represents the *smallest mass*?
  - $1.62 \times 10^8 \mu\text{g}$
  - 7.25g
  - $9.37 \times 10^{-9} \text{ kg}$
  - 0.112mg
  - $4.38 \times 10^{-7} \text{ g}$
- Which of the following polyatomic ions has the *fewest oxygen atoms*?
  - hydroxide
  - cyanide
  - perchlorate
  - phosphite
  - nitrite

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

<i>Symbol</i>	<i>Number of Protons</i>	<i>Number of Neutrons</i>	<i>Number of Electrons</i>	<i>Atomic Number</i>	<i>Mass Number</i>	<i>Charge</i>
				15	33	0
Fe			23		57	
	34	46	36			
Cu		37	29			

**Multiple Choice Calculations** (9pts each):

8. What is the formula weight of rubidium carbonate? (Atomic # of rubidium = 37)
- 316.412 g/mol
  - 246.943 g/mol
  - 230.944 g/mol
  - 145.476 g/mol
  - 97.479 g/mol
9. How many vanadium atoms are present in a 17.681g sample of vanadium (Atomic # = 23)?
- $6.022 \times 10^{23}$  atoms
  - $4.629 \times 10^{23}$  atoms
  - $2.090 \times 10^{23}$  atoms
  - 406.7 atoms
  - 0.3471 atoms
10. 3.116mols of phosphorus (Atomic # = 15) has a mass of how many grams?
- 96.51 g
  - 46.74 g
  - 30.974 g
  - 9.940 g
  - 0.1006 g
11. What is the mass of a sample of zirconium (Atomic # = 40) that contains  $1.31 \times 10^{24}$  Zr atoms?
- $7.20 \times 10^{49}$  g
  - $8.65 \times 10^{45}$  g
  - 198 g
  - 87.0 g
  - 2.18 g

12. The flow of the Red River yesterday was approximately  $2.434 \times 10^4$  gallons every second. What is this volume in milliliters?
- $9.213 \times 10^7$  mL
  - $2.434 \times 10^7$  mL
  - $6.431 \times 10^6$  mL
  - 92.13 mL
  - 6.431 mL

**Problems:**

13. The element Ubiquium (Ub) is found in all interstellar space and has two stable isotopes.  $^{382}\text{Ub}$  has a mass of 382.993 amu and 18.374% abundant. If the average atomic mass of Ub is 385.114 amu, what is the mass of the other isotope? (13pts)
14. You are working in a facility that produces a new energy drink and have found a barrel of one of the ingredients, but the label has fallen off. From inventory records, you know that it is either aspartame which has a molecular weight near  $300 \text{ g/mol}$  or niacin which has a molecular weight of about  $125 \text{ g/mol}$ . You send a sample for analysis and receive the following results: %C = 57.14, %H = 6.16, %N = 9.52, %O = 27.18. What is the *empirical* formula of this substance? What is the molecular weight of this empirical formula? Does the barrel contain aspartame or niacin? Explain. (14pts)