

# Chemistry 150

# Exam 4

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 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

$c = \lambda\nu = 3.00 \times 10^8$  m/sec

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

$E_{\text{photon}} = h\nu$

1 foot = 12 inches

1 inch = 2.54cm (exactly)

1 pound = 453.6 g = 16 ounces

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

Density of Water =  $1.000^{\text{g}}/\text{mL}$

$R = 0.08206$  L $\cdot$ atm/mol $\cdot$ K

$PV = nRT$

1 calorie = 4.184 J = 0.001Calorie

$h = 6.626 \times 10^{-34}$  Jsec

$\lambda = h/mv$

1 J = 1 kg (m/sec)<sup>2</sup>

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		116						

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)

1. A covalent bond:
  - a. Involves sharing electrons
  - b. Is always polar
  - c. Forms ions in solution
  - d. Always contains a metal
  - e. Always has high bond energy
2. Electronegativity
  - a. Is the negative charge of an ion
  - b. Is the energy required to remove an electron from an atom in the gas phase
  - c. Is the energy required to remove a *pair* of electrons from an atom
  - d. Is a measure of how strongly an atom attracts electrons in a covalent bond
  - e. Is determined by assigning one electron to each atom of a bond
3. Electronegativity *increases*:
  - a. In the center of the Periodic Table
  - b. As the quantum number “n” increases
  - c. Top to bottom on the Periodic Table
  - d. Left to right across the Periodic Table
  - e. As atoms get larger
4. What orbital hybridization gives a *see-saw molecular shape*?
  - a. sp
  - b. sp<sup>2</sup>
  - c. sp<sup>3</sup>
  - d. sp<sup>3</sup>d
  - e. sp<sup>3</sup>d<sup>2</sup>

Periodic Trends: For each of the following, circle the correct response (1pts) and give a *brief* explanation of your choice (5pts).

5. Which atom is smaller? Explain:

Mg vs. Sc

6. Which atom is larger? Explain:

Si vs. P

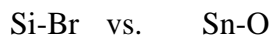
7. Which bond is shorter? Explain:



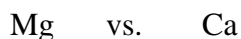
8. Which CO bond is longer? Explain:



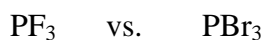
9. Which bond is less polar? Explain:



10. Which has a smaller first ionization energy? Explain:



11. Which X-P-X angle is smaller? Explain:



For each of the following, write out a correct electron configuration. You may use noble gas shorthand notation for species below the 2<sup>nd</sup> row of the Periodic Table. (6pts each)

12. Bismuth (At.# = 83)

13. Aluminum (At.# = 13)

14. Bromide ion (At.# = 35)

15. Germanium(II) ion (At.# = 32)

16. What are the 3 most likely charges (+ or -) of a silicon ion (At.# = 14)? Explain your answers. (16pts)

For each of the following, draw a correct Lewis Structure, determine the formal charge on each atom, name the electronic geometry, draw an appropriate VSEPR structure, name the molecular shape, and show the dipole moment of any polar molecules/ions. (16pts each)

17.  $\text{TeCl}_4$

18.  $\text{IF}_4^-$

19.  $\text{ICl}_2^+$