

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.

$$\text{Avogadro's Number} = 6.022 \times 10^{23} \text{ units/mol}$$

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

$$1 \text{ foot} = 12 \text{ inches}$$

$$1 \text{ inch} = 2.54\text{cm (exactly)}$$

$$1 \text{ pound} = 453.6 \text{ g} = 16 \text{ ounces}$$

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

Masses of subatomic particles:

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

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

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

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

$$R = 0.08206 \text{ L}\cdot\text{atm/mol}\cdot\text{K}$$

$$PV = nRT$$

$$1 \text{ calorie} = 4.184 \text{ J} = 0.001 \text{ Calorie}$$

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

$$\lambda = h/mv$$

$$1 \text{ J} = 1 \text{ kg (m/sec)}^2$$

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

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

1 H 1.0079																	2 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	71 Lu 174.97	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	103 Lr (260)	104 Rf (261)	105 Db (262)	106 Sg (263)	107 Bh (262)	108 Hs (265)	109 Mt (266)	110 Ds (269)	111 Rg (272)	112 Cn (277)	113	114	115	116	117	118				

57 La 138.91	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
89 Ac 227.03	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)

Multiple Choice: Circle the letter of the most correct response. (6pts. per question)

- Which of the following is **not** a possible set of quantum numbers for an electron?
 - $n = 4, \ell = 3, m_\ell = -2, m_s = +1/2$
 - $n = 3, \ell = 2, m_\ell = +2, m_s = -1/2$
 - $n = 3, \ell = 1, m_\ell = -1, m_s = -1/2$
 - $n = 2, \ell = 0, m_\ell = 0, m_s = +1/2$
 - $n = 1, \ell = 2, m_\ell = +1, m_s = +1/2$
- Electronegativity
 - Is determined by assigning one electron to each atom of a bond
 - Is the energy required to remove an electron from an atom in the gas phase
 - Is the negative charge of an ion
 - Is a measure of how strongly an atom attracts electrons in a covalent bond
 - Is the energy required to remove a *pair* of electrons from an atom
- A covalent bond:
 - Is always polar
 - Forms ions in solution
 - Always contains a metal
 - Involves sharing electrons
 - Always has high bond energy
- Electronegativity **decreases**:
 - Top to bottom on the Periodic Table
 - Left to right across the Periodic Table
 - In the center of the Periodic Table
 - As the quantum number “n” decreases
 - As atoms get smaller
- What orbital hybridization gives a **trigonal pyramid molecular shape**?
 - sp
 - sp²
 - sp³
 - sp³d
 - sp³d²

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

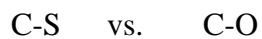
6. Which atom is larger? Explain:

Al vs. Fe

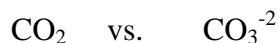
7. Which ion is larger? Explain:

Mn²⁺ vs. Mn³⁺

8. Which bond is shorter? Explain:



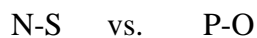
9. Which CO bond is shorter? Explain:



10. Which element is more electronegative? Explain:



11. Which bond is less polar? Explain:



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

12. Aluminum (At.# = 13)

13. Strontium (At.# = 38)

14. Sulfide ion (At.# = 16)

15. Chromium(III) ion (At.# = 24)

16. What are the 3 most likely charges (+ or -) of a germanium ion (At.# = 32)? Explain your answers. (15pts)

Fall 2010

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. (15pts each)

17. IF_3 18. NO_2^- 19. TeCl_4