

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 = 6.022×10^{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 amu = 1.6605×10^{-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 = $1.000^{\text{g}}/\text{mL}$

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

$PV = nRT$

1 calorie = 4.184 J = 0.001 Calorie

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

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?
 - $n = 4, \ell = 3, m_\ell = -2, m_s = +1/2$
 - $n = 1, \ell = 2, m_\ell = +1, m_s = +1/2$
 - $n = 2, \ell = 0, m_\ell = 0, m_s = +1/2$
 - $n = 3, \ell = 2, m_\ell = +2, m_s = -1/2$
 - $n = 3, \ell = 1, m_\ell = -1, m_s = -1/2$
- Electronegativity
 - Is the negative charge of an ion
 - 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 energy required to remove a *pair* of electrons from an atom
 - Is a measure of how strongly an atom attracts electrons in a covalent bond
- A covalent bond:
 - Always contains a metal
 - Always has high bond energy
 - Is always polar
 - Forms ions in solution
 - Involves sharing electrons
- Electronegativity **increases**:
 - Top to bottom on the Periodic Table
 - In the center of the Periodic Table
 - As the quantum number “n” increases
 - As atoms get larger
 - Left to right across the Periodic Table
- What orbital hybridization gives a **square 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).

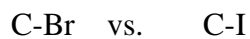
6. Which atom is smaller? Explain:

Zn vs. Si

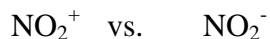
7. Which ion is larger? Explain:

Cl⁻ vs. K⁺

8. Which bond is shorter? Explain:



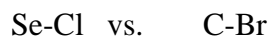
9. Which NO bond is longer? Explain:



10. Which element is less 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. Nickel (At.# = 28)

13. Silicon (At.# = 14)

14. Oxide ion (At.# = 8)

15. Gallium(III) ion (At.# = 31)

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

Fall 2009

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. POF_3 18. BrO_3^- 19. SeF_5^+