

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

$c = \lambda\nu = 3.00 \times 10^8$ 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 = 1.6605×10^{-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·atm/mol·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)²

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. (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. sp²
 - c. sp³
 - d. sp³d
 - e. sp³d²

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 larger? Explain:

Mg vs. Sc

6. Which atom is smaller? Explain:

Si vs. P

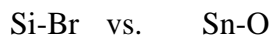
7. Which bond is longer? Explain:



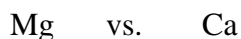
8. Which CO bond is shorter? Explain:



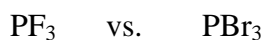
9. Which bond is more polar? Explain:



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



11. Which X-P-X angle is larger? 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. 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. TeCl_4

18. IF_4^-

19. ICl_2^+