Chem 10113, Quiz 6

November 14, 2018

Name: _____
(Please Print)

	IA (1)												IIIA (13)	IVA (14)	VA (15)	VIA (16)	VIIA (17)	VIIIA (18)
1	1 H 1.0080	IIA (2)																2 He 4.0026
2	3 Li 6.9410	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 20.179
3	11 Na 22.990	12 Mg 24.305	IIIB (3)	IVB (4)	VB (5)	VIB (6)	VIIB (7)	. . . . . (8)	VIIIB (9)	. . . . . (10)	IB (11)	IIB (12)	13 Al 26.982	14 Si 28.086	15 P 30.974	16 S 32.066	17 Cl 35.453	18 Ar 39.948
4	19 K 39.098	20 Ca 40.078	21 Sc 44.956	22 Ti 47.880	23 V 50.942	24 Cr 51.996	25 Mn 54.938	26 Fe 55.847	27 Co 58.933	28 Ni 58.690	29 Cu 63.546	30 Zn 65.380	31 Ga 69.723	32 Ge 72.610	33 As 74.922	34 Se 78.960	35 Br 79.904	36 Kr 83.800
5	37 Rb 85.468	38 Sr 87.620	39 Y 88.906	40 Zr 91.224	41 Nb 92.906	42 Mo 95.940	43 Tc 98.907	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 121.75	52 Te 127.60	53 I 126.90	54 Xe 131.29
6	55 Cs 132.91	56 Ba 137.33	57 La 138.91	72 Hf 178.49	73 Ta 180.95	74 W 183.85	75 Re 186.21	76 Os 190.20	77 Ir 192.22	78 Pt 195.09	79 Au 196.97	80 Hg 200.59	81 Tl 204.38	82 Pb 207.20	83 Bi 208.98	84 Po 208.98	85 At 209.99	86 Rn 222.02
7	87 Fr 223.02	88 Ra 226.03	89 Ac 227.03	104 Unq 261.11	105 Unp 262.11	106 Unh 263.12	107 Uns 262.12											

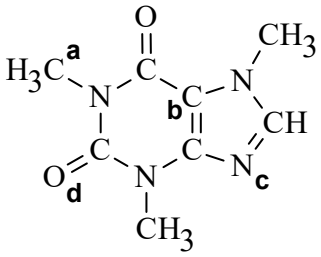
1. (4 points) The bromine-centered molecule O_2BrF_3 is known from experiment to be ***polar***. Write a complete Lewis electron dot formula for O_2BrF_3 and clearly draw its 3-D structure as predicted by VSEPR Theory (and consistent with its polarity).

2. (4 points) Hydroxide ion reacts with carbon dioxide to produce the hydrogen carbonate ion as shown below. Write ***complete Lewis electron dot formulas*** for all three species this reaction.

$$OH^- + CO_2 \longrightarrow HCO_3^-$$

3. (4 points) Refer to the same molecules and ions in questions 1 and 2 above.
   (a) The hybridization at C is _____ in CO_2 and _____ in HCO_3^-.
   (b) The hybridization at Br in O_2BrF_3 is _____.
   (c) The C-O bond order in HCO_3^- is _____.
   (d) The 3-D shape of O_2BrF_3 is best described as _____.

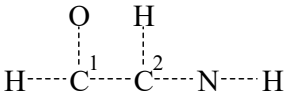
4. (3 points) The molecular structure of caffeine is shown below. (The lower case letters **a-d** are simply labels to designate certain atoms.) Complete the dot formula by inserting all of the ***lone pairs*** that are not shown. State the hybridization at each of the atoms labelled **a** through **d** in the structure.



a _____ b _____

c _____ d _____

5. Consider the simple organic compound C_2H_3NO, whose skeletal framework is indicated by dotted lines in the figure below. The numbers on the structure are just meant to distinguish the carbon atoms in the questions below.



(a) (2 point) In the space above, complete the Lewis electron dot formula for C_2H_3NO.

(b) (1 point) The O—C^1— C^2 bond angle is *about* _____ degrees.

(c) (1 point) The C^2— N—H bond angle is *about* _____ degrees.

(d) (7 points) **Describe the bonding** in C_2H_3NO using **Valence Bond concepts** (i.e., hybrid atomic orbitals, etc.). ***Draw and clearly label one or more pictures*** to show the ***types of orbitals*** that you are using to form the various σ and/or π bonds. Also clearly show the 3-D structure of the molecule, including the relative geometric arrangements around O, C^1, C^2, and N.