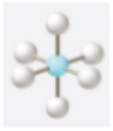
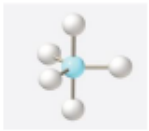
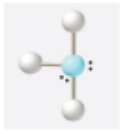
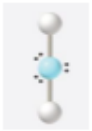
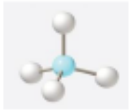
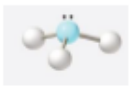
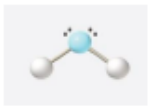
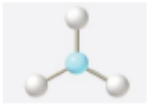
TEST 3, VERSION A

CHEM 1110.24492

Spring 2016, Dr. Potts

Put your **NAME, TEST VERSION,** and **ALL YOUR ANSWERS** on the **SCANTRON** and submit the scantron for grading. Do not wait until the end of the test to transfer your answers.

REPRESENTATIVE VSEPR STRUCTURES

					
Bonding Domains	6	5	4		
Nonbonding Domains	0	1	2		
Electron Geometry	Octahedral	Octahedral	Octahedral		
Molecular Geometry	Octahedral	Square pyramidal	Square planar		
Hybridization	sp^3d^2	sp^3d^2	sp^3d^2		
					
Bonding Domains	5	4	3	2	
Nonbonding Domains	0	1	2	3	
Electron Geometry	Trigonal bipyramidal	Trigonal bipyramidal	Trigonal bipyramidal	Trigonal bipyramidal	
Molecular Geometry	Trigonal bipyramidal	See-saw	T-Shaped	Linear	
Hybridization	sp^3d	sp^3d	sp^3d	sp^3d	
					
Bonding Domains	4	3	2		
Nonbonding Domains	0	1	2		
Electron Geometry	Tetrahedral	Tetrahedral	Tetrahedral		
Molecular Geometry	Tetrahedral	Trigonal pyramidal	Bent		
Hybridization	sp^3	sp^3	sp^3		
					
Bonding Domains	3	2			
Nonbonding Domains	0	1			
Electron Geometry	Trigonal planar	Trigonal planar			
Molecular Geometry	Trigonal planar	Bent			
Hybridization	sp^2	sp^2			
					
Bonding Domains	2				
Nonbonding Domains	0				
Electron Geometry	Linear				
Molecular Geometry	Linear				
Hybridization	sp				

Part I (60pts). 15 multiple-choice questions worth 4 points each. Choose the ***best*** answer from the options given, and ***record your final answer on your scantron***.

1. A *nonpolar* covalent bond (i.e., pure covalent) would form in which of these pairs of atoms?
   A. H – Cl
   B. Se – Br
   C. Na – Cl
   D. Br – Br
   E. Li – Br

2. Which substance should exhibit hydrogen bonding in the liquid phase?
   A. CH_4
   B. CH_3OH
   C. PH_3
   D. He
   E. H_2S

3. For which of the following species are the dispersion forces strongest?
   A. C_8H_{18}
   B. C_4H_{10}
   C. C_6H_{14}
   D. C_5H_{12}
   E. C_7H_{16}

4. Balance the following equation: ___$B_2O_3(s)$ + ___$HF(l)$ → ___$BF_3(g)$ + ___$H_2O(l)$
   A. $B_2O_3(s) + 2HF(l) \rightarrow 2BF_3(g) + H_2O(l)$
   B. $B_2O_3(s) + 6HF(l) \rightarrow 2BF_3(g) + 3H_2O(l)$
   C. $B_2O_3(s) + H_6F_6\ (l) \rightarrow B_2F_6(g) + H_6O_3(l)$
   D. $B_2O_3(s) + 3HF(l) \rightarrow 2BF_3(g) + 3H_2O(l)$
   E. $B_2O_3(s) + 6HF(l) \rightarrow 2BF_3(g) + 6H_2O(l)$

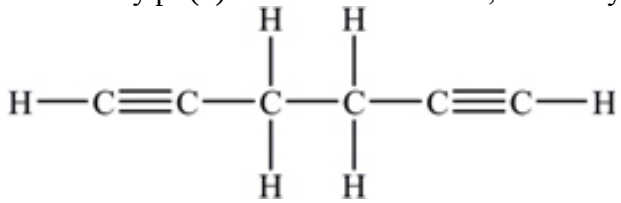
5. What is the coefficient of O_2 when the following equation is properly balanced with the smallest set of whole numbers?
   __ C_2H_4 + __ O_2 → __ CO_2 + __ H_2O
   A. 3
   B. 4
   C. 6
   D. 1
   E. 2

6. Arrange aluminum, nitrogen, phosphorus and indium in order of increasing electronegativity.
   A. In < Al < P < N
   B. Al < In < N < P
   C. In < P < Al < N
   D. P < In < N < Al
   E. Al < In < P < N

7. Which pure substance has the highest boiling point?
   A. CBr_4
   B. CCl_4
   C. CH_4
   D. CF_4
   E. CI_4

8. Arrange oxygen, sulfur, calcium, rubidium and potassium in order of decreasing electronegativity.
   A. O > S > Ca > Rb > K
   B. O > S > Rb > Ca > K
   C. O > S > Rb > K > Ca
   D. None is correct.
   E. O > S > Ca > K > Rb

9. How many pi (π) bonds are there in 1,5-hexadiyne?



A. 11
B. 4
C. 6
D. 15
E. 2

10. The strongest intermolecular interactions between pentane (C_5H_{12}) molecules arise from
A. hydrogen bonding.
B. carbon-carbon bonds.
C. London dispersion forces.
D. dipole-dipole forces.
E. ion-dipole interactions.

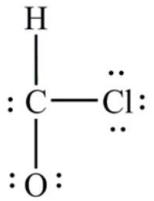
11. Balance the following equation: ___$UO_2(s)$ + ___$HF(l)$ → ___$UF_4(s)$ + ___$H_2O(l)$
A. $UO_2(s) + 2HF(l) \rightarrow UF_4(s) + H_2O(l)$
B. $UO_2(s) + 4HF(l) \rightarrow UF_4(s) + 2H_2O(l)$
C. $UO_2(s) + 2HF(l) \rightarrow UF_4(s) + H_2O(l)$
D. $UO_2(s) + 4HF(l) \rightarrow UF_4(s) + 4H_2O(l)$
E. $UO_2(s) + H_4F_4(l) \rightarrow UF_4(s) + H_4O_2(l)$

12. Which is required for determination of the VSEPR model and the molecular shape?
A. Atomic mass
B. None of these
C. Lewis structure
D. Oxidation number
E. Number of protons

13. What is the coefficient of H_2SO_4 when the following equation is properly balanced with the smallest set of whole numbers?
___ $Ca_3(PO_4)_2$ + ___ H_2SO_4 → ___ $CaSO_4$ + ___ H_3PO_4
A. 11
B. 3
C. 10
D. 8
E. None of these

14. Which of these atoms is the *most* electronegative?
A. Na
B. As
C. Cs
D. Ge
E. P

15. What is wrong with this Lewis structure?



A. The C atom does not have an octet.
B. There are too few electrons.
C. There are too many electrons.
D. There is nothing wrong.
E. The O atom does not have an octet.

Part 2 (40pts). Molecules/Calculations: Clearly (**and legibly**) show all work on the blank space on the scantron answer sheet for full credit. Do not wait until the end of the test to transfer your answers.

1. (10 pts) Magnesium reacts with iron(III) chloride to form magnesium chloride (which can be used in fireproofing wood and in disinfectants) and iron. If 175 g of $FeCl_3$ is allowed to react with excess Mg, what mass of $MgCl_2$ will be produced? (MM of $FeCl_3$ = 162.2 g/mol, MM of $MgCl_2$ = 95.21 g/mol)

$$3Mg(s) + 2FeCl_3(s) \rightarrow 3MgCl_2(s) + 2Fe(s)$$

2. (30 pts) For each of the following molecules or ion, draw the correct Lewis Dot Structure and give the electron geometry, molecular geometry, polarity (polar or nonpolar), and hybridization. Include all possible resonance structures.

   a. CO_3^{2-}

   b. ClF_5

   c. SF_2

	IA												IIIA	IVA	VA	VIA	VIIA	VIIIA
1	1 **H** 1.008	IIA																2 **He** 4.00
2	3 **Li** 6.94	4 **Be** 9.01											5 **B** 10.81	6 **C** 12.01	7 **N** 14.01	8 **O** 16.00	9 **F** 19.00	10 **Ne** 20.18
3	11 **Na** 22.99	12 **Mg** 24.31	IIIB	IVB	VB	VIB	VIIB	VIIIB			IB	IIB	13 **Al** 26.98	14 **Si** 28.09	15 **P** 30.97	16 **S** 32.06	17 **Cl** 35.45	18 **Ar** 39.95
4	19 **K** 39.10	20 **Ca** 40.08	21 **Sc** 44.96	22 **Ti** 47.90	23 **V** 50.94	24 **Cr** 52.00	25 **Mn** 54.94	26 **Fe** 55.85	27 **Co** 58.93	28 **Ni** 58.71	29 **Cu** 63.55	30 **Zn** 65.37	31 **Ga** 69.72	32 **Ge** 72.59	33 **As** 74.92	34 **Se** 78.96	35 **Br** 79.90	36 **Kr** 83.80
5	37 **Rb** 85.47	38 **Sr** 87.62	39 **Y** 88.91	40 **Zr** 91.22	41 **Nb** 92.91	42 **Mo** 95.94	43 **Tc** [98]	44 **Ru** 101.1	45 **Rh** 102.9	46 **Pd** 106.4	47 **Ag** 107.9	48 **Cd** 112.40	49 **In** 114.8	50 **Sn** 118.7	51 **Sb** 121.8	52 **Te** 127.60	53 **I** 126.90	54 **Xe** 131.30
6	55 **Cs** 132.9	56 **Ba** 137.3	71 **Lu** 175	72 **Hf** 178.5	73 **Ta** 181	74 **W** 183.9	75 **Re** 186.2	76 **Os** 190.2	77 **Ir** 192.2	78 **Pt** 195.1	79 **Au** 197	80 **Hg** 200.59	81 **Tl** 204.4	82 **Pb** 207.2	83 **Bi** 209	84 **Po** [209]	85 **At** [210]	86 **Rn** [222]
7	87 **Fr** [223]	88 **Ra** [226]	103 **Lr** [262]	104 **Rf** [267]	105 **Db** [268]	106 **Sg** [271]	107 **Bh** [272]	108 **Hs** [270]	109 **Mt** [276]	110 **Ds** [281]	111 **Rg** [280]	112 **Uub** [285]	113 **Uut** [284]	114 **Uuq** [289]	115 **Uup** [288]	116 **Uuh** [293]		118 **Uuo** [294]

57 **La** 138.9	58 **Ce** 140.1	59 **Pr** 140.9	60 **Nd** 144.2	61 **Pm** [145]	62 **Sm** 150.4	63 **Eu** 152	64 **Gd** 157.3	65 **Tb** 158.9	66 **Dy** 162.5	67 **Ho** 164.93	68 **Er** 167.3	69 **Tm** 168.9	70 **Yb** 173
89 **Ac** [227]	90 **Th** 232	91 **Pa** [231]	92 **U** 238	93 **Np** [237]	94 **Pu** [244]	95 **Am** [243]	96 **Cm** [247]	97 **Bk** [247]	98 **Cf** [251]	99 **Es** [252]	100 **Fm** [257]	101 **Md** [258]	102 **No** [259]