KEY

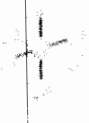
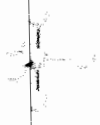
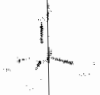
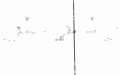
TEST 3, VERSION A

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?

D

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?

B

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

heaviest

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: ___ $B_2O_3(s)$ + 6 $HF(l)$ → 2 $BF_3(g)$ + 3 $H_2O(l)$

B

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 + 3 O_2 → 2 CO_2 + 2 H_2O

A

A. 3
B. 4
C. 6
D. 1
E. 2

6. Arrange aluminum, nitrogen, phosphorus and indium in order of increasing electronegativity.

A

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?

E

strongest dispersion forces, heaviest

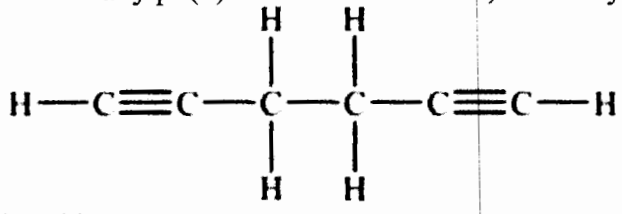
A. CBr_4
B. CCl_4
C. CH_4
D. CF_4
E. CI_4

8. Arrange oxygen, sulfur, calcium, rubidium and potassium in order of decreasing electronegativity.

E

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?



B

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

10. The strongest intermolecular interactions between pentane (C_5H_{12}) molecules arise from

C

A. hydrogen bonding.
B. carbon-carbon bonds.
(C.) London dispersion forces.
D. dipole-dipole forces.
E. ion-dipole interactions.

11. Balance the following equation: $\_\_UO_2(s) + \underline{4}\,HF(l) \rightarrow \_\_UF_4(s) + \underline{2}\,H_2O(l)$

B

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?

C

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?

$\_\_Ca_3(PO_4)_2 + \underline{3}\,H_2SO_4 \rightarrow \underline{3}\,CaSO_4 + \underline{2}\,H_3PO_4$

B

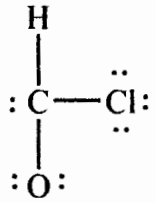
A. 11
(B.) 3
C. 10
D. 8
E. None of these

14. Which of these atoms is the *most* electronegative?

E

A. Na
B. As
C. Cs
D. Ge
(E.) P

15. What is wrong with this Lewis structure?



E

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.

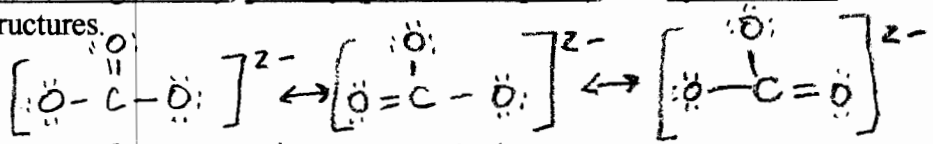
1. (10 pts) Magnesium reacts with iron(III) chloride to form magnesium chloride (which can be used in fireproofing wood and in disinfectants) and iron. If 175 g of $FeCl_3$ is allowed to react with excess Mg, how much $MgCl_2$ will be produced? (MM of $FeCl_3$ = 162.2 g/mol, MM of $MgCl_2$ = 95.21 g/mol)

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

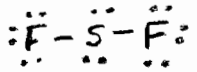
175g ??g

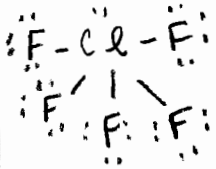
$$175g\ FeCl_3 \times \frac{1\ mol\ FeCl_3}{162.2g\ FeCl_3} \times \frac{3\ mol\ MgCl_2}{2\ mol\ FeCl_3} \times \frac{95.21g\ MgCl_2}{1\ mol\ MgCl_2} = 154g\ MgCl_2$$

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-} 24e⁻ 

b. ClF_5 42e⁻ EG: trigonal planar MG: trigonal planar nonpolar, sp^2

c. SF_2 20e⁻  EG: tetrahedral MG: bent polar sp^3

 EG: octahedral MG: square pyramidal polar sp^3d^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]