Name: _____

Chem 1110, Spring 2011
Test 3A

I. Multiple Choice (52 pts): Clearly circle the correct answer.

1. What are all the possible m_l values for orbitals that have an $n = 2$?
   A) 0
   B) 0, 1
   C) -1, 0, 1
   D) -2, -1, 0, 1, 2
   E) None of these

2. What two properties of light make it useful for studying atoms?
   A) wavelength and frequency
   B) particle-like and color
   C) frequency and color
   D) wave-like and color
   E) wave-like and particle-like

3. What principal states the electrons are placed in orbitals starting from the lowest energy orbital?
   A) Aufbau
   B) Heisenberg
   C) Einstein
   D) Pauli
   E) Schrödinger

4. Which element has the following noble gas configuration: $[Ar]4s^2 3d^5$
   A) magnesium
   B) chromium
   C) manganese
   D) iron
   E) cobalt

5. Which one of the molecules/ions below is isoelectronic with CO_3^{2-}
   A) SO_3^{2-}
   B) NO_3^-
   C) SO_4^{2-}
   D) CO_2^{2-}
   E) NO_2^+

6. What is the correct electron configuration for Cu^{+1}
   A) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 3d^{10}$
   B) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^8$
   C) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10}$
   D) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^9$
   E) None of these

7. Gallium is _____magnetic and has _____ valence electrons(s)
   A) dia, 31
   B) dia, 3
   C) para, 31
   D) para, 3
   E) para, 13

8. Which element below has the smallest atomic radii?
   A) C
   B) S
   C) P
   D) Cl
   E) Ge

9. Which element below has the smallest first ionization energy?
   A) C
   B) S
   C) P
   D) Cl
   E) Ge

10. Which one of the following sets of quantum numbers cannot exist?
    A) n=1, l=0, m_l=0, m_s=1/2
    B) n=7, l=3, m_l=-5, m_s=-1/2
    C) n=4, l=0, m_l=0, m_s=1/2
    D) n=8, l=0, m_l=0, m_s=1/2
    E) n=3, l=3, m_l=0, m_s=-1/2

11. Which of the following elements is not an exception to the octet rule when found in a molecule?
    A) H
    B) He
    C) B
    D) C
    E) S

12. The extent to which an element attracts bonding electrons is called:
    A) ionization energy.
    B) atomic size.
    C) electronegativity.
    D) isoelectronic structure.
    E) resonance.

13. Which one of the following shapes most accurately describes a p-orbital?
    A) basketball
    B) football
    C) pencil
    D) infinity symbol
    E) hockey puck

II. Part B: Clearly show all work for full credit.

1. (8 pts) One photon of an argon/krypton laser has energy equal to 3.499×10^{-22} kJ.

    A. What is the frequency (in s^{-1}) of the photon?

    B. What is the wavelength (in m) of the photon?

2.(40 pts) For each of the following molecules or ions: draw the correct Lewis Dot Structure, give the BD and NBD, determine the molecular geometry, give the hybridization of the central atom and determine if the molecule is polar or nonpolar. **Include all resonance structures.**

AsF_5

BD: _____
NBD: _____
Molecular Geometry: _____
Hybridization: _____
Polarity: _____

OCl_2

BD: _____
NBD: _____
Molecular Geometry: _____
Hybridization: _____
Polarity: _____

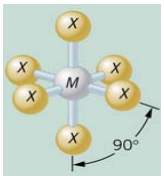
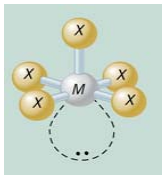
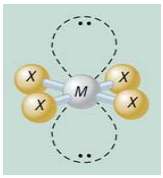
SO_2

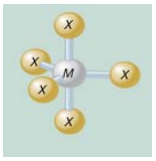
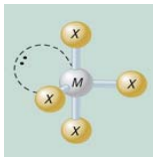
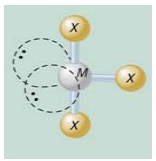
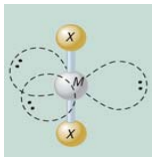
BD: _____
NBD: _____
Molecular Geometry: _____
Hybridization: _____
Polarity: _____

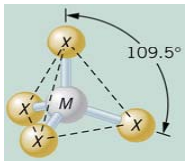
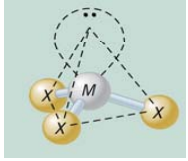
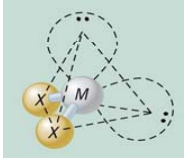
$SeBr_4^{2-}$

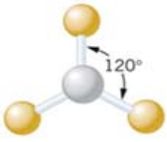
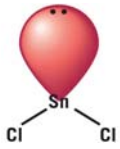
BD: _____
NBD: _____
Molecular Geometry: _____
Hybridization: _____
Polarity: _____

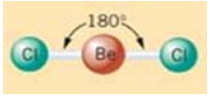
REPRESENTATIVE VSEPR STRUCTURES

	AX_6	AX_5E	AX_4E_2
			
	Octahedral	Square pyramidal	Square planar
Bonding Domains	6	5	4
Nonbonding Domains	0	1	2
Hybridization	sp^3d^2	sp^3d^2	sp^3d^2

	AX_5	AX_4E	AX_3E_2	AX_2E_3
				
	Trigonal bipyramidal	See-saw (distorted tetrahedral)	T-Shaped	Linear
Bonding Domains	5	4	3	2
Nonbonding Domains	0	1	2	3
Hybridization	sp^3d	sp^3d	sp^3d	sp^3d

	AX_4	AX_3E	AX_2E_2
			
	Tetrahedral	Trigonal pyramidal	Bent (angular)
Bonding Domains	4	3	2
Nonbonding Domains	0	1	2
Hybridization	sp^3	sp^3	sp^3

	AX_3	AX_2E
		
	Trigonal planar	Bent (angular)
Bonding Domains	3	2
Nonbonding Domains	0	1
Hybridization	sp^2	sp^2

	AX_2
	
	Linear
Bonding Domains	2
Nonbonding Domains	0
Hybridization	sp

Periodic Table of the Elements

	1 IA	2 IIA	3 IIIB	4 IVB	5 VB	6 VIB	7 VIIB	8	9 VIIIB	10	11 IB	12 IIB	13 IIIA	14 IVA	15 VA	16 VIA	17 VIIA	18 VIIIA
1	1 **H** 1.008																	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											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** 58.693	29 **Cu** 63.546	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** 101.07	45 **Rh** 102.91	46 **Pd** 106.4	47 **Ag** 107.87	48 **Cd** 112.40	49 **In** 114.82	50 **Sn** 118.69	51 **Sb** 121.75	52 **Te** 127.60	53 **I** 126.90	54 **Xe** 131.30
6	55 **Cs** 132.91	56 **Ba** 137.34	71 **Lu** 174.97	72 **Hf** 178.49	73 **Ta** 180.95	74 **W** 183.85	75 **Re** 186.21	76 **Os** 190.2	77 **Ir** 192.22	78 **Pt** 195.09	79 **Au** 196.97	80 **Hg** 200.59	81 **Tl** 204.37	82 **Pb** 207.19	83 **Bi** 208.98	84 **Po** [209]	85 **At** [210]	86 **Rn** [222]
7	87 **Fr** [223]	88 **Ra** [226]	103 **Lr** [262]	104 **Rf** [261]	105 **Db** [262]	106 **Sg** [263]	107 **Bh** [262]	108 **Hs** [265]	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]

DO NOT WRITE ON PERIODIC TABLE

57 **La** 138.91	58 **Ce** 140.12	59 **Pr** 140.91	60 **Nd** 144.24	61 **Pm** [145]	62 **Sm** 150.35	63 **Eu** 151.96	64 **Gd** 157.25	65 **Tb** 158.92	66 **Dy** 162.5	67 **Ho** 164.93	68 **Er** 167.26	69 **Tm** 168.93	70 **Yb** 173.04
89 **Ac** [227]	90 **Th** 232.04	91 **Pa** [231]	92 **U** 238.03	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]