

Chemistry 121
Spring 2004
Test 3
FORM A

Name: KEY

Instructions: You have 75 minutes to complete this 100-point exam. You may use a simple scientific calculator. No calculators allowed.

$$^{\circ}F = \left(\frac{9^{\circ}F}{5^{\circ}C}\right)(^{\circ}C) + 32^{\circ}F$$

$$^{\circ}C = \left(\frac{5^{\circ}C}{9^{\circ}F}\right)(^{\circ}F - 32^{\circ}F)$$

$$1 \text{ in} = 2.54 \text{ cm}$$

$$1000\text{g} = 1\text{kg}$$

$$1000 \text{ mg} = 1 \text{ g}$$

I. MULTIPLE CHOICE: (30 pts, 3 points each) Carefully and clearly circle the best answer. If you circle two answers, *one of which is correct*, you will receive 1 point.

1. What type of orbital is designated $n = 3, l = 2, m_l = 0$?

- D
- a. 2s
 - b. 3s
 - c. 3p
 - d. 3d

0 S
1 P
2 d
3 f

2. What is the maximum number of orbitals possible when $l = 1$?

- C
- a. Zero
 - b. One
 - c. Three
 - d. Five

3. When $l = 3$, what set of orbitals is designated?

- A
- a. f
 - b. p
 - c. s
 - d. d

4. The lowest-energy state of an atom is called its _____.

- C
- a. wave function
 - b. node
 - c. ground state
 - d. orbital

5. The quantum number m_l represents the _____.

- C
- a. number of valence electrons.
 - b. shape of the orbital.
 - c. orientation of the orbital.
 - d. momentum of the electron.

6. Which of the following elements is a d-block element?

- A a. Copper
b. Chlorine
c. Aluminum
d. Sodium

7. What element has the electron configuration $1s^2 2s^2 2p^6 3s^2 3p^3$?

- B a. C
b. N
c. O
d. F

8. Which of the following atoms has the largest radius?

- C a. C
b. N
c. Si
d. P

9. Which of the following atoms has the largest ionization energy?

- D a. P
b. N
c. S
d. O

10. Which of the following bonds is more polar?

- D a. Si - C
b. Si - N
c. Si - O
d. Si - F

II. Short Answer and Calculations (80 pts): Clearly indicate your answer in the space provided. Partial credit will be given for correct work. If I cannot read the work, it will not be graded.

1. (10 pts) Please indicate whether or not the following orbitals can exist. (Y or N)

- a. 3s Y
b. 4f Y
c. 4p Y
d. 2d N
e. 3f N

2. (5pts) What two properties of electrons make it impossible to pinpoint their exact location? (The Heisenberg Uncertainty Principle)

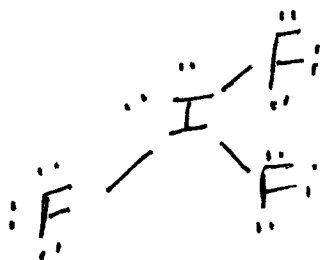
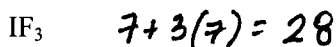
- a. wave like
b. particle like

3. (10 pts) Write the noble gas electron configurations for the following atoms or ions and determine whether they are diamagnetic or paramagnetic.

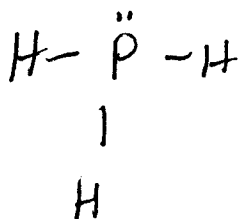
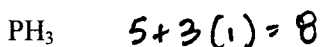
		Dia or Para?
a. Sc	$[Ar] 4s^2 3d^1$	P
b. Cr	$[Ar] 4s^1 3d^5$	P
c. Si	$[Ne] 3s^2 3p^2$	P
d. S^{2-}	$[Ne] 3s^2 3p^6$	D
e. Br	$[Ar] 4s^2 3d^{10} 4p^5$	P

4. (40 pts) For each of the following molecules,

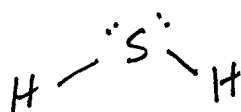
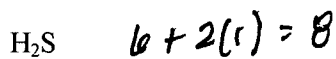
- Draw the correct Lewis Dot Structure.
- Give the AXE notation.
- Determine the molecular geometry.
- Determine the orbital geometry.
- Give the hybridization of the central atom.
- Determine if it is polar or nonpolar.



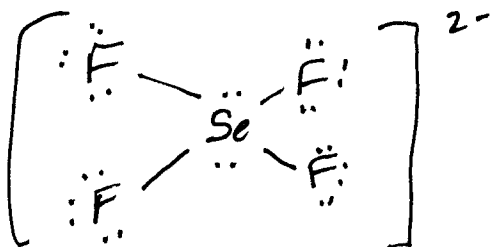
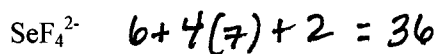
AXE: AX_3E_2
Molecular Geometry: T-shaped
Orbital Geometry: trigonal bipyramidal
Hybridization: sp^3d
Polar or Nonpolar: polar



AXE: AX_3E
Molecular Geometry: trigonal pyramidal
Orbital Geometry: tetrahedral
Hybridization: sp^3
Polar or Nonpolar: polar

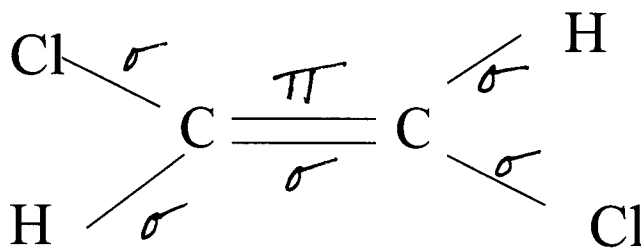


AXE: AX₂E₂
 Molecular Geometry: bent
 Orbital Geometry: tetrahedral
 Hybridization: sp³
 Polar or Nonpolar: polar



AXE: AX₄E₂
 Molecular Geometry: square planar
 Orbital Geometry: octahedral
 Hybridization: sp³d²
 Polar or Nonpolar: nonpolar

5. (5 pts) Describe the bonding in the following molecule and indicate whether it is *cis* or *trans*.



trans