

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)

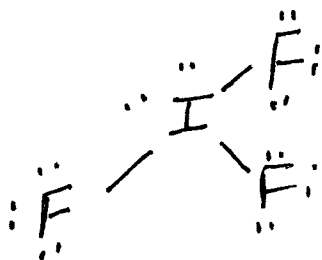
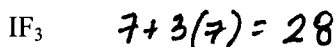
- a. wave like
b. particle like

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

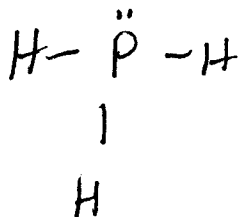
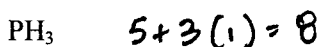
| | | Dia or Para? |
|-------------|--------------------------|--------------|
| a. Sc | $[Ar] 4s^2 3d^1$ | P |
| b. Cr | $[Ar] 4s^1 3d^5$ | P |
| c. Si | $[Ne] 3s^2 3p^2$ | P |
| d. S^{2-} | $[Ne] 3s^2 3p^6$ | D |
| e. Br | $[Ar] 4s^2 3d^{10} 4p^5$ | P |

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

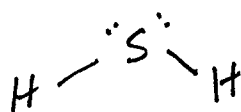
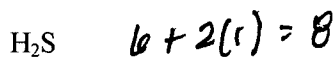
- Draw the correct Lewis Dot Structure.
- Give the AXE notation.
- Determine the molecular geometry.
- Determine the orbital geometry.
- Give the hybridization of the central atom.
- Determine if it is polar or nonpolar.



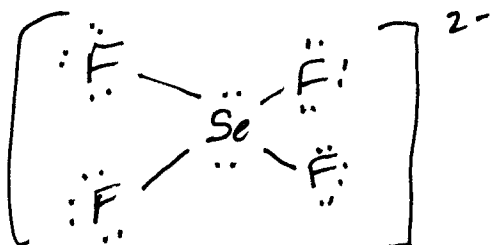
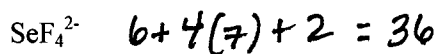
AXE: AX_3E_2
Molecular Geometry: T-shaped
Orbital Geometry: trigonal bipyramidal
Hybridization: sp^3d
Polar or Nonpolar: polar



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

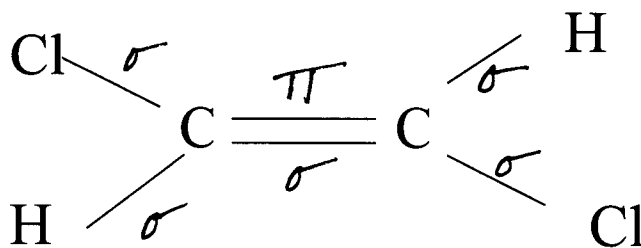


AXE: AX₂E₂
 Molecular Geometry: bent
 Orbital Geometry: tetrahedral
 Hybridization: sp³
 Polar or Nonpolar: polar



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