

Name: KEY

Chemistry 121
Fall 2003
Exam 3
75 minutes/100 pts

FORM A

Instructions: You have 75 minutes to complete this 100-point exam. Indicate your exam form on the line marked "SUBJECT" on the scantron. NO CALCULATORS OF ANY KIND ARE ALLOWED.

I. MULTIPLE CHOICE: (80 pts, 4 points each) Indicate the best answers on the scantron using a #2 pencil.

1. If an atom has a valence shell electron configuration of ns^1 , which group of elements in the periodic table does it belong?
- D
- a. Transition Metals
 - b. Alkaline Earth Metals
 - c. Halogens
 - d. Alkali Metals
2. The orbitals of 2p electrons are often represented as being:
- C
- a. Elliptical.
 - b. Pyramidal.
 - c. Dumbbell shaped.
 - d. Tetrahedral.
3. The ground-state electronic configuration of manganese (Mn) is:
- D
- a. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 4d^5$
 - b. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^7$
 - c. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 4p^5$
 - d. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^5$
4. The noble gas configuration of a neutral atom of atomic number 24 is best represented by:
- C
- a. $[\text{Ar}]4s^2 4d^4$
 - b. $[\text{Kr}]4s^2 3d^4$
 - c. $[\text{Ar}]4s^1 3d^5$
 - d. $[\text{Kr}]4s^1 3d^5$
5. If an electron moves from one energy level in an atom to another energy level further from the nucleus:
- A
- a. Energy is absorbed.
 - b. Energy is emitted.
 - c. There is no energy change.
 - d. Light is emitted.
6. Which set of quantum numbers is possible for an electron in an atom?
- | | n | l | m_l | m_s |
|----|-------------------------------------|-----|-------|----------------|
| a. | 3 | 0 | 1 | $-\frac{1}{2}$ |
| b. | 2 | 2 | -2 | $-\frac{1}{2}$ |
| C | <input checked="" type="radio"/> c. | 5 | 2 | $\frac{1}{2}$ |
| d. | 4 | 3 | -4 | $-\frac{1}{2}$ |

7. Which is an acceptable set of quantum numbers for a 3d electron?

	n	l	m_l	m_s
A <input checked="" type="radio"/> a.	3	2	1	$\frac{1}{2}$
b.	3	3	1	$\frac{1}{2}$
c.	2	2	-1	$\frac{1}{2}$
d.	2	3	2	$\frac{1}{2}$

8. Which element has the *smallest* atomic radius?

- B a. Cl
 b. F
 c. Br
 d. I

9. Which would be expected to be the most electronegative?

- B a. As
 b. P
 c. Si
 d. Al

10. Which element has the largest ionization energy?

- C a. Na
 b. Cs
 c. F
 d. I

11. How many valence electrons are there in the Lewis structure of CO?

- B a. 8
 b. 10
 c. 14
 d. 28
- $4 + 6 = 10$

12. What orbital geometry is associated with an *sp* hybridized atom?

- D a. Pyramidal
 b. Tetrahedral
 c. Trigonal planar
 d. Linear

13. Which molecule is polar? (the molecular geometry is in parenthesis)

- B a. CO₂ (linear)
 b. SO₂ (bent)
 c. CF₄ (tetrahedral)
 d. BF₃ (trigonal planar)

14. Substances with the same molecular formula but different structures are called

- A a. Isomers.
 b. Polymers.
 c. Isoelectronic.
 d. Resonance.

A

15. The energy of a mole of photons with a frequency of $2.00 \times 10^{14} \text{ s}^{-1}$ is best calculated using the following:

- a. $\frac{(6.626 \times 10^{-34})(2.00 \times 10^{14})}{6.02 \times 10^{23}}$
b. $\frac{(6.02 \times 10^{23})(2.00 \times 10^{14})}{6.626 \times 10^{-34}}$
c. $\frac{(6.626 \times 10^{-34})(6.02 \times 10^{23})}{2.00 \times 10^{14}}$
d. $(6.626 \times 10^{-34})(2.00 \times 10^{14})(6.02 \times 10^{23})$

D

16. The change in energy for a reaction is -256 kJ . This reaction is

- a. Endothermic.
b. Exothermic.
c. Physical.
d. Allotropic.

B

17. Which of the following pairs of bonded atoms would be expected to have the longest bond length?

- a. C - Si
b. C - S
c. C - P
d. C - Cl

A

18. The most stable electron configuration of an atom is that with the highest number of unpaired electrons according to:

- a. Pauli Exclusion Principle
b. Aufbau Principle
c. Hund's Rule
d. Bohr's Rule

C

19. Which of the following statements is not true about valence electrons?

- a. They are the most accessible.
b. They participate in bonding.
c. They determine the chemical properties of the element.
d. They are the closest to the nucleus.

D

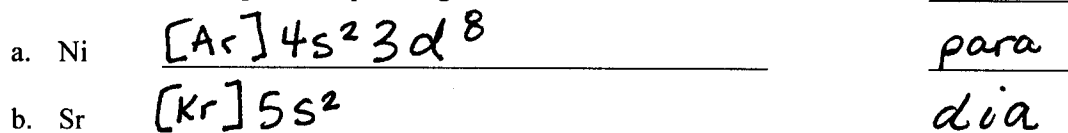
20. How many pure atomic orbitals of each type must be hybridized to form a set of sp^3d orbitals?

- a. One s and one p and one d
b. Two s and three p and one d
c. One s and three p and one d
d. Two s and three p and one d

C

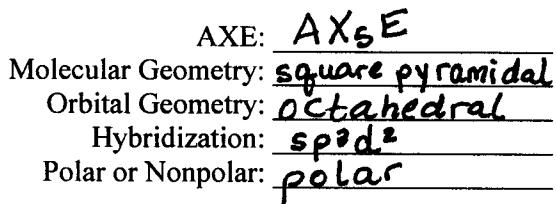
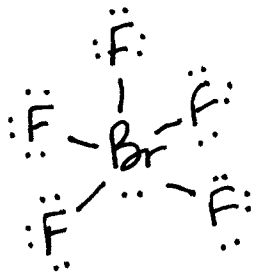
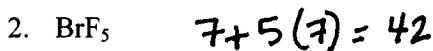
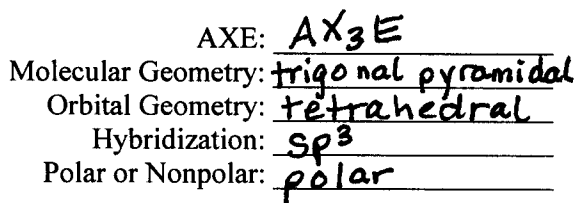
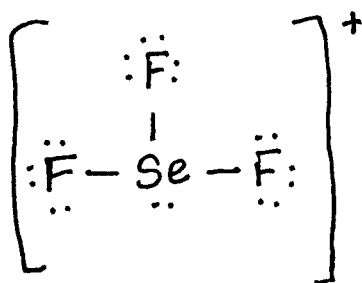
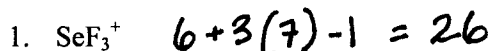
II. Molecular Geometry, Electron Configurations, Bonding and the Environment (30 pts): Clearly indicate your answer in the space provided. Partial credit will be given for correct work. If I cannot read the work, it will not be graded.

1. (4 pts) Write the noble gas electron configurations for the following atoms or ions and determine whether they are diamagnetic or paramagnetic. Dia or Para?

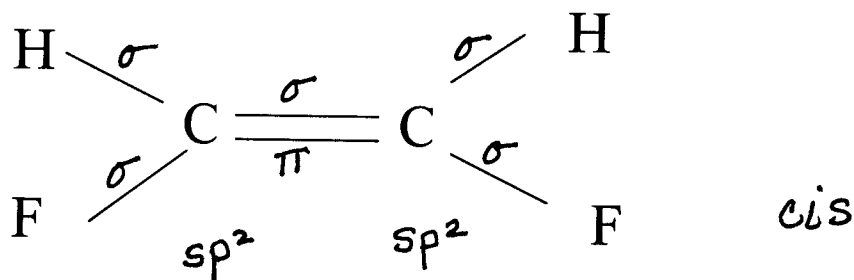


2. (10 pts) For each of the following molecules,

- Draw the 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.

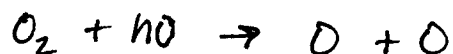


3. (6 pts) Describe the bonding in the following molecule and indicate whether it is *cis* or *trans*.



4. In Chapter 6, we discussed how radiation interacts with the Earth's atmosphere. In 3-4 grammatically correct sentences, describe the function of the thermosphere layer and any appropriate chemistry associated with it.

Nitrogen (N_2) and Oxygen (O_2) molecules in the thermosphere absorb high energy x-rays from the sun.



The reaction products are very unstable and they recombine to form N_2 and O_2 , releasing heat. As the solar radiation reaches the bottom of the thermosphere, nearly all the harmful x-rays have been removed.