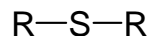


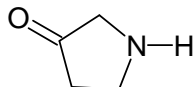
Problem Set 1 Chem 230

1. Which of the following best describes the functional group shown below:



- A. sulfone B. thiol C. sulfenide D. sulfanol E. sulfide

2. Which of the following best describes the compound shown below:

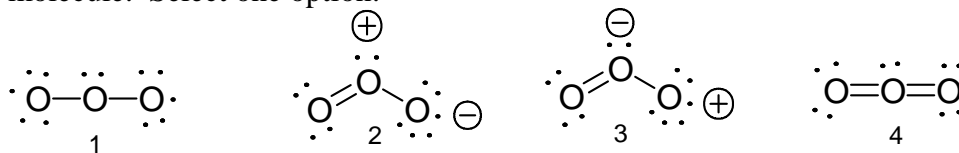


- A. secondary amide B. tertiary amine C. 2° amine D. ester E. 3° amide

3. What best describes the term “degeneracy”?

- A. Two orbitals have the same shape
B. Two orbitals merge into one
C. An orbital is so small it can't hold any electrons
D. Two orbitals have identical energy levels
E. An orbital has spherical shape

4. Consider the Lewis dot structures for ozone, below. This as an overall uncharged molecule. Select one option:

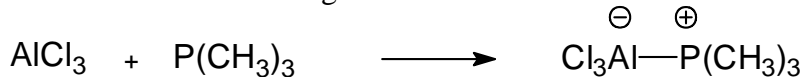


- A. Only structure 4 is correct
B. Structures 2 and 4 are both correct
C. Only structure 2 is correct
D. Only structure 3 is correct
E. Structures 2 and 3 are both correct

5. Which statement best describes a strong acid?

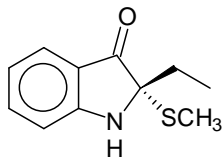
- A. It is a good electron pair donor
B. It has a high pK value
C. Its conjugate base is weak
D. It contains hydrogen
E. It is a liquid

6. Consider the following reaction and select the best answer:



- A. Trimethylphosphine ($\text{P}(\text{CH}_3)_3$) is a Bronstead acid
B. Trimethylphosphine is a Lewis base
C. Trimethylphosphine is a Lewis acid
D. Trimethylphosphine is a both a Lewis and a Bronsted base
E. This is not an acid-base reaction at all

7. What is the proper molecular formula for the compound below?

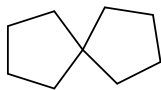


A. $C_{11}H_{15}NOS$ B. $C_{11}H_{13}NOS$ C. $C_{10}H_{10}NOSCH_3$ D. $C_{10}H_{13}N_1O_1S_1$ E. none of these

8. Which statement is TRUE?

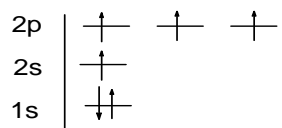
- A. In its ground state, carbon could form two bonds only
- B. A carbon atom hybridizes because its hybridized states are lower in energy than its ground state
- C. In contrast to carbon, oxygen and nitrogen **cannot** hybridize.
- D. Noble gases are **not** able to form chemical compounds
- E. Hydrocarbons, which contain sp hybridized carbon will also contain a triple bond

9. Consider the molecule below and select the best description of this molecule:



- A. Its central carbon must be sp^2 hybridized to accommodate its shape
- B. The molecule is twisted propeller-like around the central carbon
- C. This molecule has a lone pair, not shown here
- D. The central carbon of this molecule violates the octet rule
- E. The molecular formula of this molecule is C_9H_8 .

10. Consider the atomic orbital energy diagram below and select the most appropriate statement:

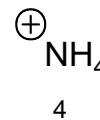
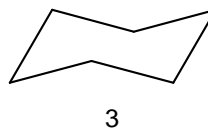
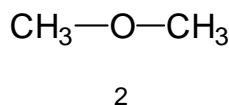
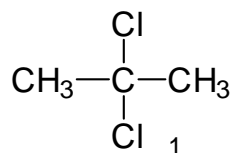


- A. This represents the ground state of nitrogen
- B. This represents sp^3 hybridized carbon
- C. This represents an excited, but unhybridized, state of carbon
- D. This represents sp hybridized carbon
- E. The diagram, as shown, violates the Pauli exclusion principle

11. Select the statement that best describes molecular orbital (MO) theory:

- A. It explains bonding in terms of overlapping atomic orbitals.
- B. It was developed by Einstein
- C. It explains bonding in terms of molecular orbitals, which can be bonding, non-bonding and anti-bonding
- D. It is just another name for valence bond theory, these terms are synonymous
- E. It states that each molecule will have exactly one orbital

12. Consider the molecules below and select one option:



- A. All of them have permanent dipole moments
- B. 1, 2, and 4 have permanent dipole moments
- C. Only 4 has a permanent dipole moment
- D. 1 and 2 have permanent dipole moments
- E. None of them have permanent dipole moments

13. Consider the acids HF, HCl, HBr and HI. Select the most appropriate statement:

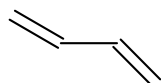
- A. HF is the strongest acid
- B. HI is the strongest acid
- C. All of them have similar acidities
- D. HCl is a good electron pair donor
- E. HF is called fluorohydric acid

14. Which of the following violate the octet rule?

1. borane (BH₃), 2. carbon monoxide 3. ozone, 4. atmospheric oxygen(O₂)

- A. All of them
- B. Ozone and borane
- C. Carbon monoxide and O₂
- D. Borane and O₂
- E. None of them

15. Select the best name for the compound below:



- A. butadiene
- B. 1,3-butadiene
- C. 1,2-dibutene
- D. butane-1,2-diene
- E. 1-3-dibutene

16. Which statement is CORRECT?

- A. Pauli stated that no more than one electron can reside in each orbital.
- B. Schrodinger developed the valence bond theory
- C. Bohr developed the uncertainty principle
- D. Heisenberg stated that electrons can only reside in discrete energy levels
- E. Rutherford's model of the atom violated fundamental concepts of electromagnetism

Key:

- 1 E
- 2 C
- 3 D
- 4 C
- 5 C
- 6 B
- 7 B
- 8 A
- 9 B
- 10 C
- 11 C
- 12 D
- 13 B
- 14 D
- 15 B
- 16 E