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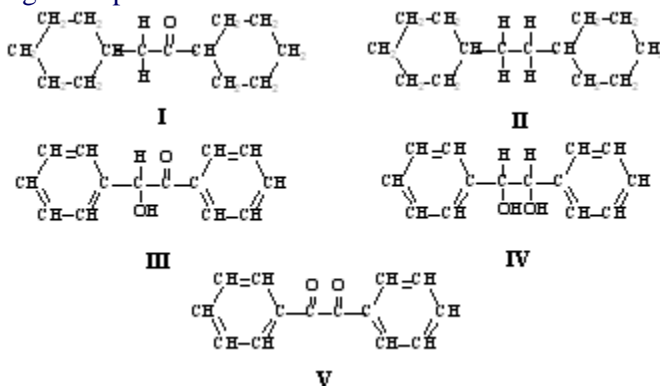
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1.

Which of the following would absorb photons closer to the red end of the visible region of the electromagnetic spectrum?



Student Response

1. I
2. II
3. III
4. IV
5. V

2.

The shortest C–O bond length would be found in

Student Response

1. CO.
2. CH₃OH.
3. CH₂O.
4. CO₂.
5. All have the same bond length.

3.

The carbon–carbon–oxygen bond angle in H₂CCO is

Student Response

1. 109°.
2. 150°.
3. 90°.
4. 180°.
5. 120°.

4.

According to valence bond theory, which of the following would produce maximum overlap?

Student Response

1. $3p - 3p$
2. $2p - 2p$
3. $2s - 2p$
4. $2p - 3p$
5. $2s - 2s$

5.

Which of the following molecules would have the shortest bond based on the valence bond theory?

Student Response

1. HF
2. Cl_2
3. HCl
4. BrCl
5. F_2

6.

What is the change in hybridization of the C atom in the following reaction: $\text{C}_2\text{H}_2 + 2 \text{H}_2 \rightarrow \text{C}_2\text{H}_6$?

Student Response

1. sp to sp^2
2. sp^3 to sp^2
3. sp^2 to sp^3
4. sp to sp^3
5. sp^2 to sp

7.

Which of the following bonds is not possible?

Student Response

1. N=N
2. O=H
3. C=O
4. N=O
5. C=C

8.

In the molecular structure for the ion $\text{CH}_2\text{CHCH}_2^+$, which of the following statements is (are) true?

- I. Sigma bonds are formed from unhybridized carbon orbitals.
- II. Pi bonds are formed from unhybridized orbitals.
- III. All carbons are sp^2 hybridized.

Student Response

- 1. II and III only
- 2. I, II, and III
- 3. II only
- 4. I and II only
- 5. I and III only

9.

N_2 interacts with a photon that results in a promotion of an electron from a bonding to an antibonding orbital. How many unpaired electrons are there in N_2 after the promotion of an electron? The order of the molecular orbital diagram is $(\sigma_{2s})(\sigma_{2s}^*)(\pi_{2p})(\sigma_{2p})(\pi_{2p}^*)(\sigma_{2p}^*)$.

Student Response

- 1. 4
- 2. 3
- 3. 1
- 4. 2
- 5. 0

10.

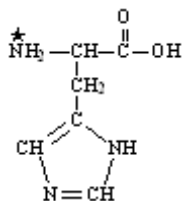
In which of the following species is C not sp^3 hybridized?

Student Response

- 1. CH_4
- 2. C_2H_6
- 3. CH_2Cl_2
- 4. CH_3OH
- 5. C_2H_4

11.

In a molecule of histidine as shown below, what is the hybridization on the nitrogen designated with the star?



Student Response

4. 4

5. 5

15.

Consider the bonding in the following using valence bond theory. For which would $\Delta_{\text{diss}}H$ be the smallest?

Student Response

1. SrH_2

2. BeH_2

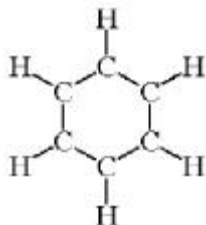
3. BaH_2

4. CaH_2

5. MgH_2

16.

The skeletal structure of benzene C_6H_6 is shown below.



Using standard enthalpies of formation, the enthalpy of formation from gaseous carbon and hydrogen atoms is -5525.6 kJ.



When calculated using bond energies, enthalpy of formation is calculated as -5310 kJ. Which of the following can explain the discrepancy in these two values:

- I. Benzene has delocalized orbitals.
- II. Bond energies are average energies of bonds.
- III. Carbon and hydrogen are in the gas phase.

Student Response

1. I and II only

2. III only

3. I only

4. I, II, and III

5. II only

17.

Which of the following species has a bond order of 2?

1. NO^-

2. O_2

3. O_2^-

Student Response

A. 3 only

- B. 1 and 3 only
- C. 2 only
- D. 1 only
- E. 1 and 2 only

18.

The hybridization of the central atom in a molecule is described as sp^2 . The arrangement in space of the hybrid orbitals about that atom is

Student Response

1. linear.
2. octahedral.
3. trigonal bipyramidal.
4. tetrahedral.
5. trigonal planar.

19.

Which of the following species would be expected to be paramagnetic?

Student Response

1. NO
2. NO_2^-
3. SO_3
4. OCN^-
5. NO_2^+

20.

When a carbon atom has sp^3 hybridization, it has

Student Response

1. one π bond and three σ bonds.
2. four σ bonds.
3. two π bonds and two σ bonds.
4. four π bonds.
5. three π bonds and one σ bond.