Tutorial Letter 201/0/2018

CHE1502

Semester 2

Department Of Chemistry

This tutorial letter contains the key to assignment 01.

BARCODE

KEY TO ASSIGNMENT 01

1. Correct Answer: (4) In a carbon atom, the 2s an 2p orbitals are equal in energy

The above statement is incorrect with regards to the properties of the carbon atom. The 2p orbitals are slightly higher in energy than the 2s because the average location of the electron in a 2p orbital is farther from the nucleus. All the other options are correct.

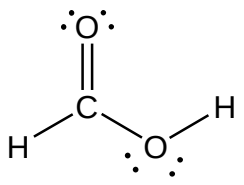
2. Correct Answer: (3) Most of the electron density in a π molecular orbital is centered above and below the internuclear axis. All the other options are incorrect

(1) When two atoms are connected by a double bond, both of these bonds are π bonds. This statement is incorrect, as all single bonds in organic compounds are sigma bonds and every double or triple bonds contain one sigma bonds. So a double bonded structure contains a sigma and a pi bond.

(3) π molecular orbitals are cylindrically symmetric. This statement is incorrect since sigma bonds are cylindrically symmetrical whilst pi bonds are not as they involve parallel overlaps rather than the linear overlap of sigma bonds.

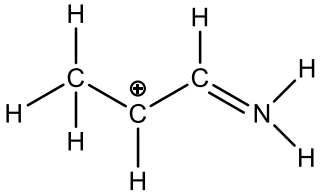
(4) Both statements (1) and (3) are correct. As explained above, both statements are incorrect

3. Correct Answer: (4)



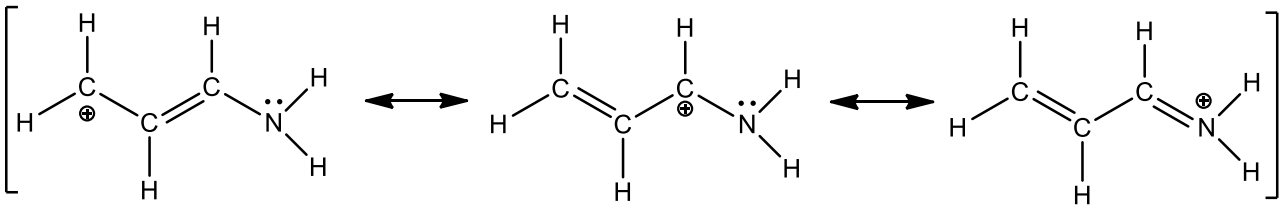
The above structure is the correct Lewis structure for the molecule with molecular formula of CH_2O_2.

4. Correct Answer: (4)

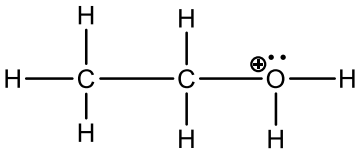


The above is not a reasonable resonance structure of the cation shown below because there is an additional hydrogen on the first shown carbon.

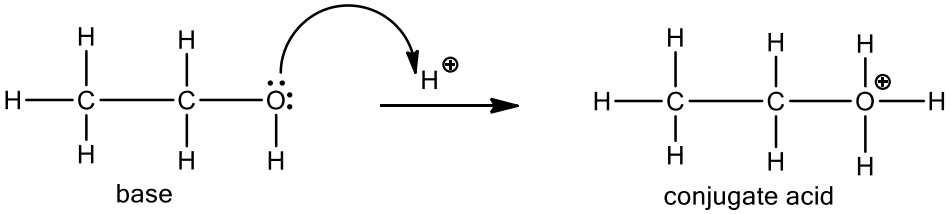
The resonance delocalization of this cation takes place as follows:



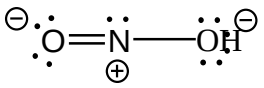
5. Correct Answer: (4)



The compound, CH_3CH_2OH, is a Lewis base which can donate a pair of electrons to a proton to form the conjugate acid of CH_3CH_2OH as follows:



6. Correct Answer: (1)

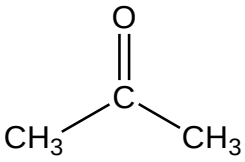


The above structure is NOT a valid Lewis structure for the molecule with molecular formula of NO_2^-.

7. Correct Answer: (2) Both (1) and (4)

The above answer is the correct one for the covalently bonded structures where electrons are shared. KBr is an ionic compound where electrons are transferred from one atom to another, in this case Potassium loses an electron while Bromine accepts it to attain the configurations of noble atoms,

8. Correct Answer: (2)

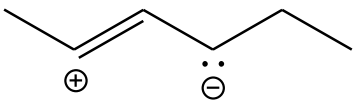


(1) One sp^3 ($-CH_3$) and two sp^2 (two carbons of the double bond)

(3) One sp^3 ($-CH_3$) and two sp (two carbons of the triple bond)

(4) One sp^3 ($-CH_3$)

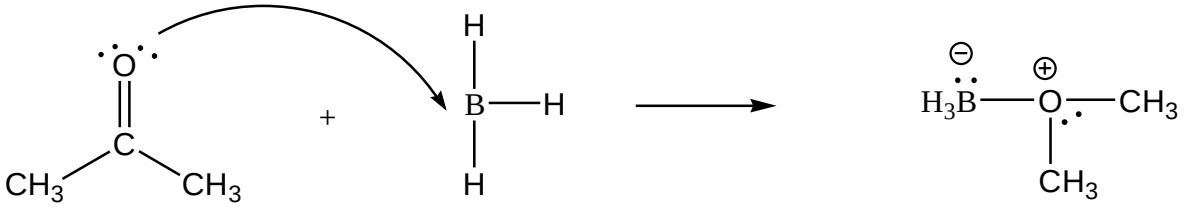
9. Correct Answer: (2)



The above structure is NOT a proper resonance form of 1,3-hexadiene. All the other options are correct resonance structures.

10. Correct Answer: (4) This is an example of a substitution reaction

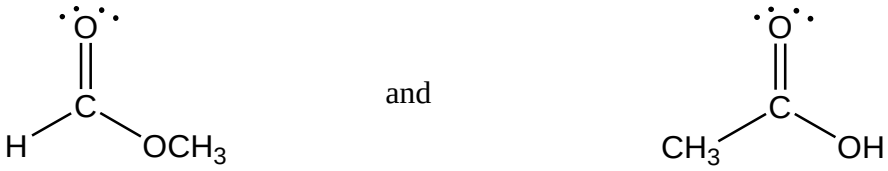
The above answer is INCORRECT. This is an example of Lewis acid-base reaction the nonbonding electrons from the base (CH_3OCH_3), a nucleophile, are donated to the acid (BH_3), an electrophile, to form a new bond. The reaction mechanism is shown below:



All the other option are correct and in line with the above mechanism.

11. Correct Answer: (4)

12. Correct Answer: (2)



The above is the correct pair of structural/ constitutional isomers. Other options:

(1) different structures with different molecular formular,C_4H_8O and $C_4H_{10}O$

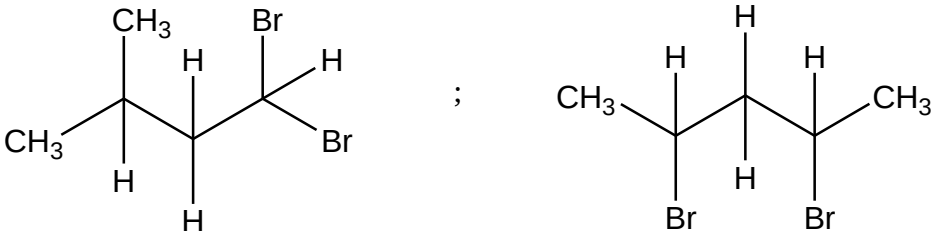
(3) different structures with different molecular formular, C_3H_8 and C_3H_6

(4) different structures with different molecular formular, C_3H_8O and C_3H_6O

13. Correct Answer: (3) 3-ethyl-1-cyclohexyl-2,5-dimethylhexane

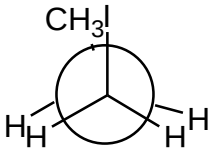
All the other options are INCORRECT

14. Correct Answer: (3)



All the other options are not constitutional isomers.

15. Correct Answer: (2)



The above compound is the LEAST STABLE structure (total eclipse) as two big groups of the compound are behind each other.

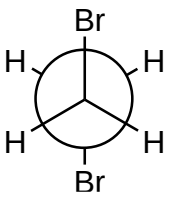
The other options are explained below:

(1) Its also an eclipse but lower in energy to the total eclipse

(3) This is the semi-staggered conformation known as gauche which is stable but less stable than the total staggered

(4) This is the most stable conformation- total staggered with two big groups furthest apart.

16. Correct Answer: (1)



The above structures is a representation of the most stable conformation

The other options are explained below:

(2) Its also a staggered but less stable than option (1)

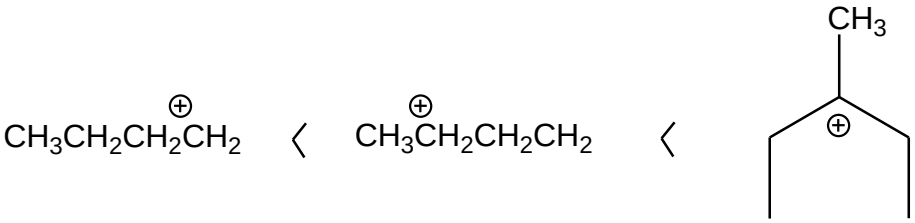
(3) This is also a staggered conformation but less stable than option (1)

(4) This is the least stable conformation- total eclipse with two big groups behind each other.

17. Correct Answer: (1) Carbocations are strongly basic

The above statement is INCORRECT as carbocations are electron deficient while strong bases are electron rich. All the other options are CORRECT.

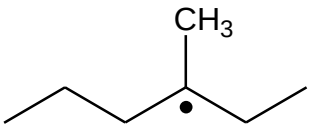
18. Correct Answer: (2)



The above is an increasing order of stability for a set of carbocations.

All the other either decreasing of show no order at all.

19. Correct Answer: (4)



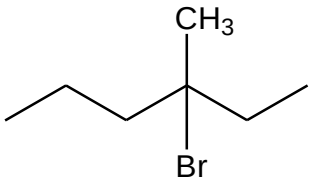
The above represents the most stable radical (tertiary). The other options:

(1) Represent a primary which is the least stable.

(3) Represent a primary radical.

(3) Represent a secondary radical which is less stable than a tertiary but more stable than the primary

20. Correct Answer: (4)



The above represents the major monobrominated product formed in the reaction. The reaction mechanism for the formation of the product via the most stable radical is shown below