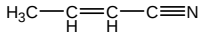
CHEM 164/261, A2 **Quiz Practice Questions, Answers** 2010 09 27
HT

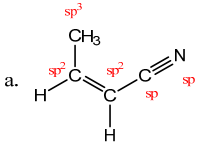
1. Consider the F atom in its ground state.

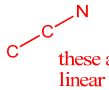
a. How many s orbitals are doubly occupied? 2

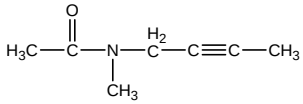
b. How many p orbitals are doubly occupied? 2

2. Consider  (geometry deliberately incorrect)

a. Indicate the hybridization at all C and N atoms.
b. Indicate the area of the molecule that is linear.

a. 

b. 
these atoms in one line;
linear portion

3. Consider  (again incorrect geometry)

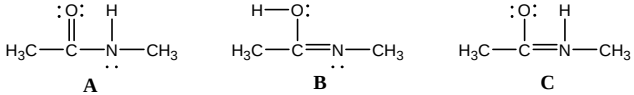
a. How many electrons are in nonbonding orbitals? 6

b. How many electrons are in the π bonds of the molecule? 6

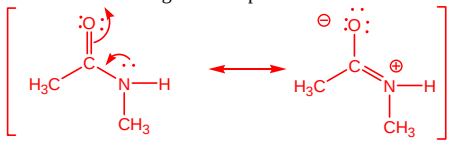
c. What is the number of π bonds? 3

d. How many double bonds are present? 1

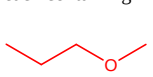
4. a. Which of the following are related by resonance? A & C

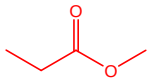

A **B** **C**

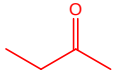
b. Select those that are related by resonance and indicate the resonance phenomenon by curved arrows.
c. Also show formal charges where present.



5. Give bond-line and molecular formulas for a. an ether, b. an ester and c. a ketone; each containing 4 carbon atoms.

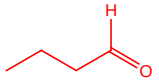
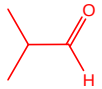

$C_4H_{10}O$
a.


$C_4H_8O_2$
b.

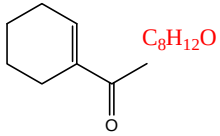

C_4H_8O
c.

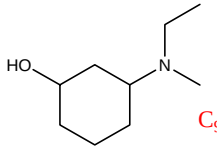
Note:
Others are possible!

6. Show two isomeric aldehydes with the formula C_4H_8O.

7. What are the molecular formulas for

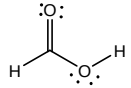

$C_8H_{12}O$


$C_9H_{19}NO$

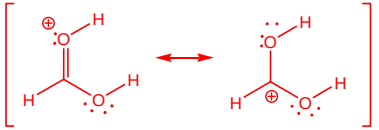
8. Which one of the following is not a Lewis acid?

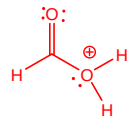
BF_3 NH_2^- NH_4^+ HCl CH_3CO_2H

9. Formic acid (HCOOH) has two(2) different conjugate acids.
Show them and indicate which is the more stable one.

The structure of formic acid is 

The two O atoms are basic sites, have lone pairs; each one can act as H^+ acceptor.
Therefore, we have 2 conjugate acids, a.) and b.)


a.)

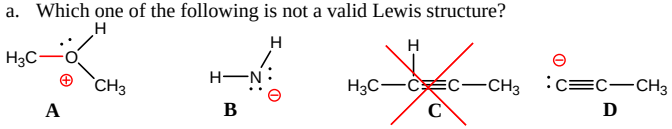

b.)

a.) is the more stable conjugate acid, because it is stabilised by resonance

10. Consider the terms : e^- donor, H^+ acceptor, nucleophile, lone pair electrons, cation. Which one is out of place?

cation is an e^- acceptor (acid), while all others are e^- donors (bases)

11. a. Which one of the following is not a valid Lewis structure?



A **B** **C** **D**

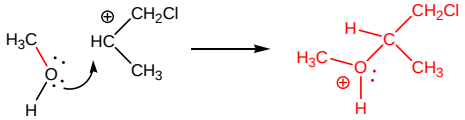
C is invalid, violates octet rule, 10 e^- around one of the carbons.

b. Indicate formal charges on any of the valid ones; *see above.*

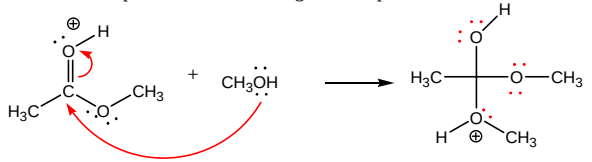
12. What will happen if 1 mole of ROH_2^+ is mixed with 2 moles of NH_2^- ?

Overall, 1 mole of RO^- and 2 moles NH_3 will be produced.
In the first step,1 mole ROH and 1 mole NH_3 will be produced.
The mixture now contains: 1 mole ROH, 1 mole NH_3 and 1 mole NH_2^-
In the second step then ,1mole ROH will react with 1 mole NH_2^- to give the overall result.
The reason is, of course, that ROH_2^+ and ROH are both stronger acids than NH_3.

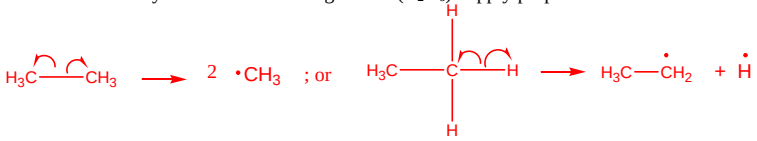
13. What structure will be formed if curved arrows are applied as follows. Show lone pairs and formal charges.



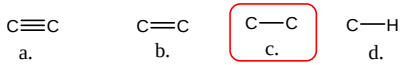
14. Place curved arrows to indicate the following transformation. Also show lone pairs and formal charges in the product.



15. Show a homolytic reaction involving ethane (C_2H_6). Apply proper e^- flow arrows.

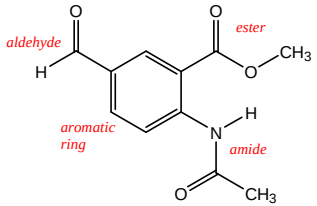


16. Which of the following bonds will give an IR peak at the lowest wavenumber.

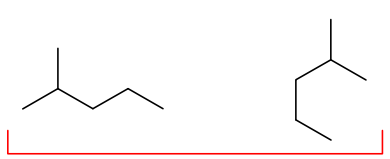


a. b. c. d.

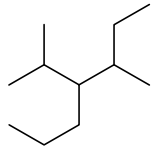
17. Identify the functional groups in the following structure.



18. Provide systematic names for the following.

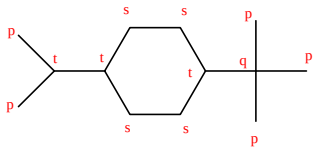


these are identical structures:
2-methylpentane



4-isopropyl-3-methylheptane

19. a. Identify primary (p), secondary (s), tertiary (t) and quaternary (q) carbon atoms in



b. What is the number of secondary hydrogen atoms? *8*

20. Give an example of a secondary alcohol.

the simplest is: C_3H_8O,  *; of course, there are many others*