

O R G A N I C C H E M I S T R Y I

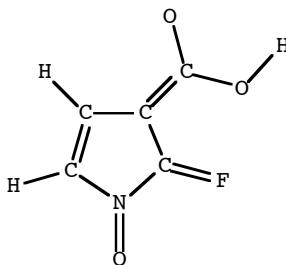
Sample exam # 1 questions

(1) Using solid lines to represent bonds or the location of unshared electron pairs in the plane of the paper, wedges to represent bonds or the location of unshared electron pairs pointing toward you, and dashes to represent bonds or the location of unshared electron pairs pointing away from you (see the model of SF₄ at right), draw the following molecules:



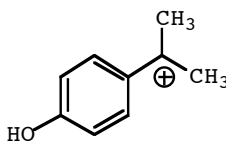
(a) HONH₂ (b) CH₃CHNH₂⁺ (c) HCCOH₂⁺

(2) All the atoms in this molecule have an octet of valence electrons, except for the hydrogens, which all have a duet of valence electrons; unshared electron pairs have not been shown. Write non-zero formal charges on the atoms that require them.

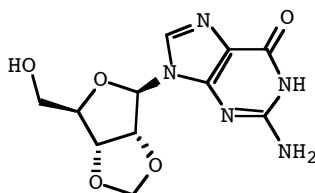


(3) Draw the structures of three C₅H₆O₂ constitutional isomers.

(4) Draw five reasonable resonance structures of this ion.

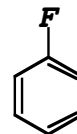
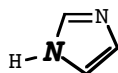
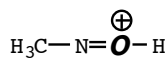


(5) What is the formula of this compound?

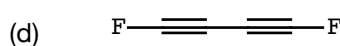
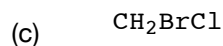
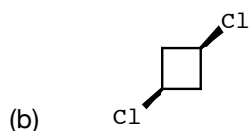
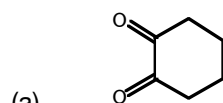


(6) Draw a three-dimensionally accurate picture of the bonding molecular orbitals of $\text{CH}_3\text{OCHCH}_2$. Include in your drawing any orbitals in which unshared electron pairs reside.

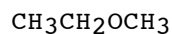
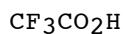
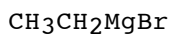
(7) Indicate the hybridization state of the atoms **in bold type**.



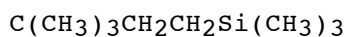
(8) Circle the molecules that have a non-zero molecular dipole moment.



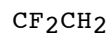
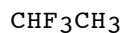
(9) Circle the molecules that have at least one ionic bond.



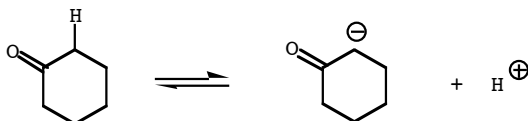
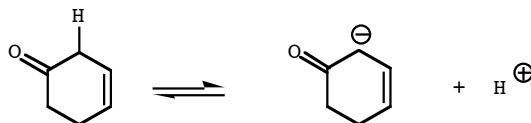
(10) Convert this condensed formula to a bond-line structure.



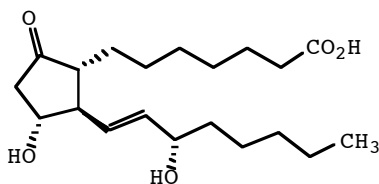
(11) Rank these compounds in order of the degree measure of the fluorine-carbon-carbon bond angle (1 = largest degree measure).



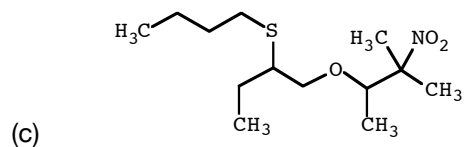
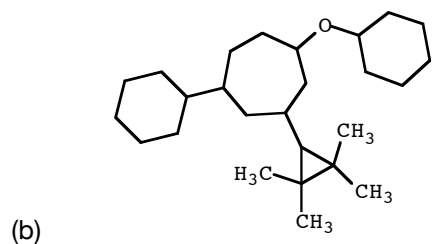
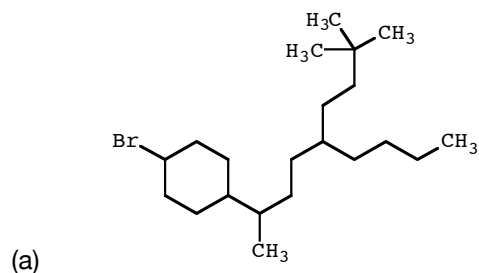
(12) Which of these two reactions is likely to have the greater equilibrium constant? Explain your answer.



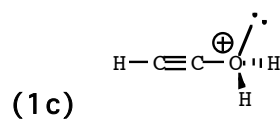
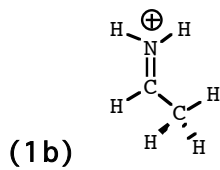
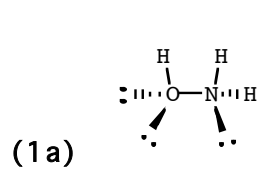
(13) Circle and identify the functional groups in this molecule. If the functional group is an amide, an amine, an alcohol, or a halide, classify it as 0°, 1°, 2° or 3°. If the functional group is an alkene, classify it as unsubstituted, monosubstituted, disubstituted, trisubstituted, or tetrasubstituted.



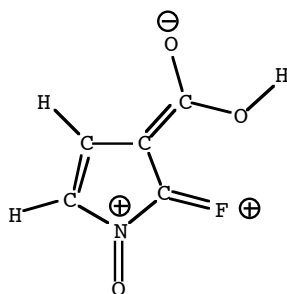
(14) Write the systematic name of these compounds. Do not write names employing *iso*, *sec*, *tert*, or any other nickname or common name.



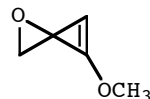
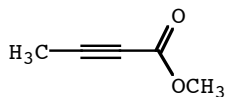
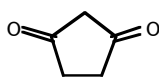
ANSWERS



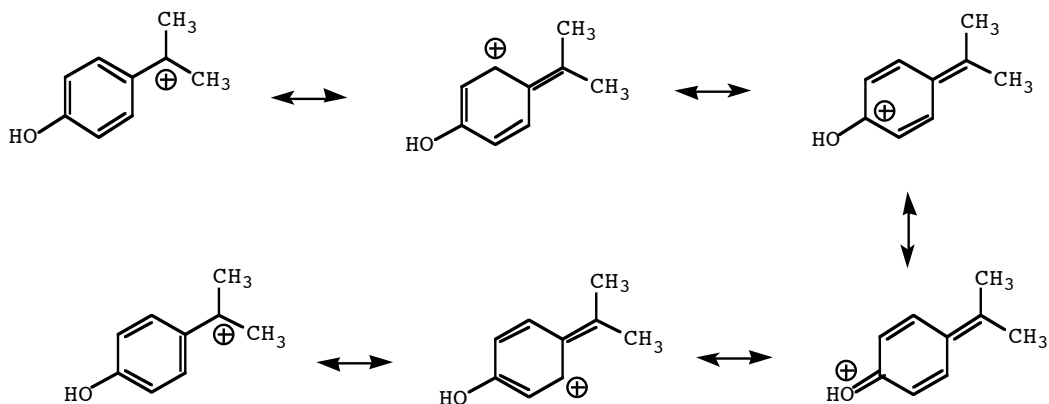
(2)



(3) There are many correct answers. The following are some possibilities.

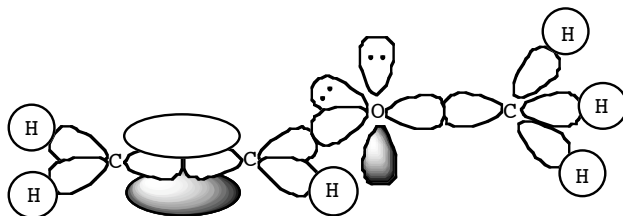


(4)

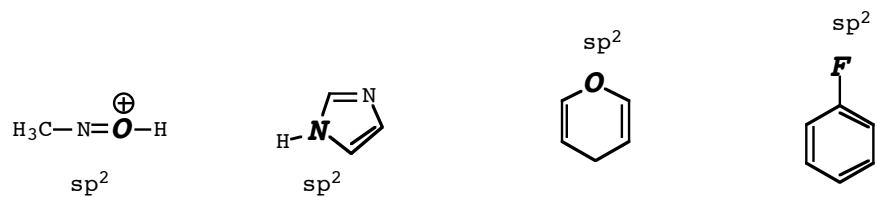


(5) C₁₁H₁₃N₅O₅

(6) Note that the oxygen is sp^2 .

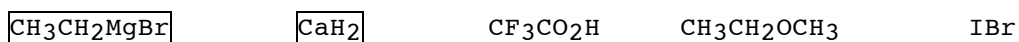


(7)

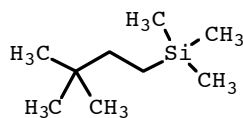


(8a), (8b), and (8c) have a non-zero molecular dipole moment.

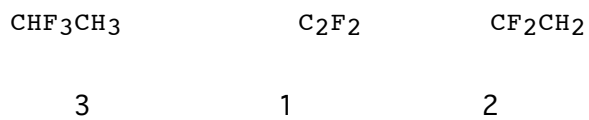
(9)



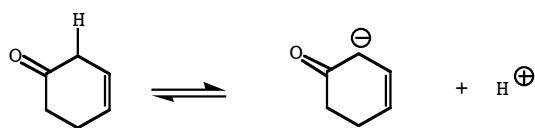
(10)



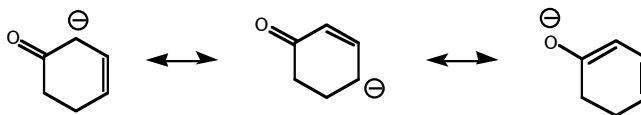
(11)



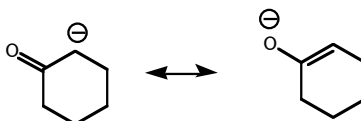
(12) The reaction



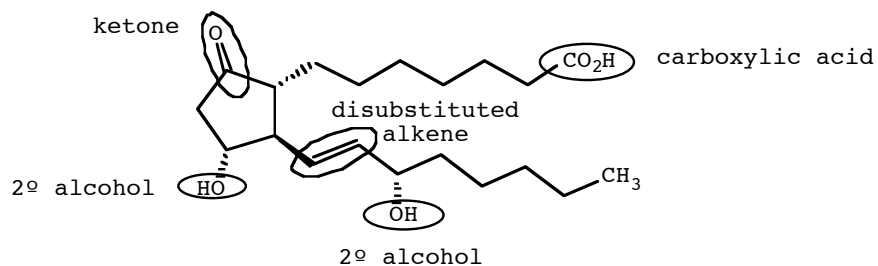
is likely to have the greater equilibrium constant because the product is more extensively resonance-stabilized:



versus



(13)



(14a) 8-(4-bromocyclohexyl)-5-butyl-2,2-dimethylnonane

(14b) 1-cyclohexoxy-5-cyclohexyl-3-(2,2,3,3-tetramethylcyclopropyl)cycloheptane

(14c) 3-(2-butylthiobutoxy)-2-methyl-2-nitrobutane