Organic 212 Test # 1 REWORK March 2021

Name:_____

Directions: Work the questions that you missed not including the multiple choice questions. If you got the question correct, you can skip the question on the rework.

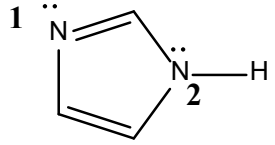
Section B – Problems, short answers, drawings, mechanisms,

1) a) Draw the LUMO molecular orbital of butadiene using the + or – nomenclature.

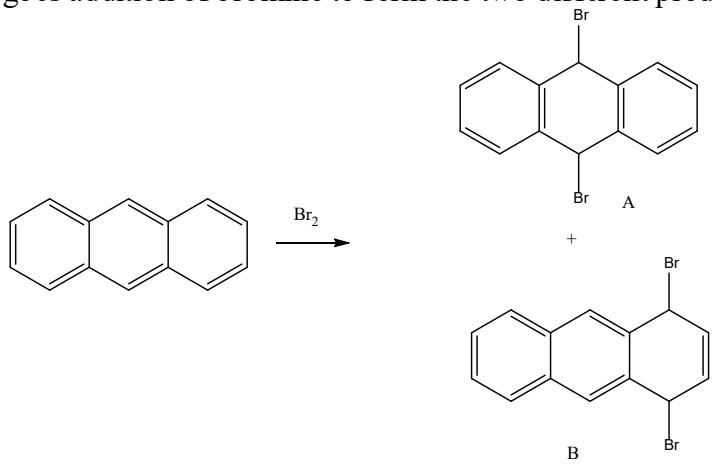
b) Draw the orbital right below in energy of the one you drew in part a using the + or – nomenclature. (if it exists).

c) Draw the orbital right above in energy of the one you drew in part a using the + or – nomenclature. (if it exists.)

2) Explain your answer from # 4 (which nitrogen is the stronger base) with resonance structures.



3) Anthracene undergoes addition of bromine to form the two different products below.



a) Is A or B the major product?

b) Explain your answer above with resonance structures. Draw ALL of the resonance structures for A.

c) Draw ALL of the resonance structures for B.

4) a) Using a Frost's circle, give the energy levels for the six molecular orbitals of benzene.

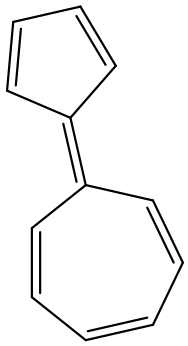
b) Draw one of the molecular orbitals (π_2, π_3,π_4 or π_5) using the + and – nomenclature.

5) a) How does the NH_2 group direct in electrophilic aromatic substitution? RESONANCE STRUCTURES REQUIRED OF THE ARENIUM ION AFTER ADDITION OF E+.

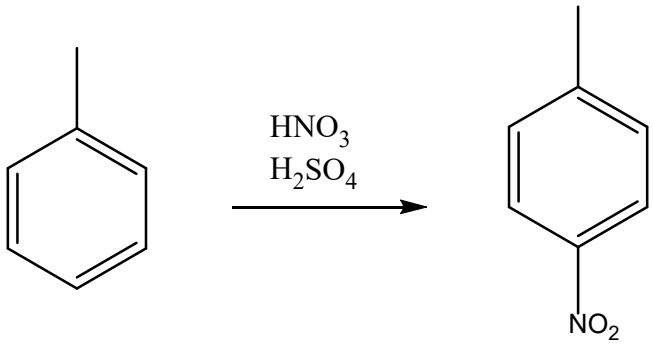
b) How does the $(^+)NH_3$ group direct in electrophilic aromatic substitution? RESONANCE STRUCTURES REQUIRED OF THE ARENIUM ION AFTER ADDITION OF E+.

6) PUT ALL THREE TRACES ON THE SAME POTENTIAL ENERGY DIAGRAM. Draw the energy trace for benzene undergoing electrophilic aromatic substitution to form a more stable product. Label this trace Z. Put the energy trace for NH_2 from #15a above also undergoing electrophilic aromatic substitution to form a more stable product. Label it a. Finally, put the energy trace for NH_3 from #15b above also undergoing electrophilic aromatic substitution. Label it b.

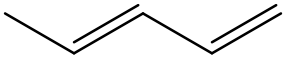
7) The following molecule has a significant dipole. Why? Resonance structures required.



8) Give (that means push the arrows) the mechanism for the following reaction. Show every step.



9) The pKa of molecule A below has been estimated to be about 35. Give the structure of one of its resonance structures for the conjugate base. Draw the other possible resonance structures that are possible for the conjugate base.



A

10) Give a structure that gives all the spectra on the following spectral sheet.

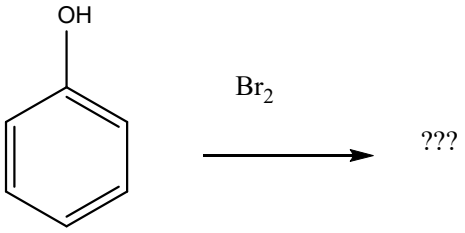
Part C – Reactions, synthesis, and free question.

11) Outline a synthesis of m-nitrobenzoic acid from benzene using any necessary organic, or inorganic reagents. (4 pts.)

12) Outline a synthesis of o-bromotoluene from toluene that results in a high yield of ortho. Use any necessary organic, or inorganic reagents. (5 pts.)

13) Give the missing products.

a)



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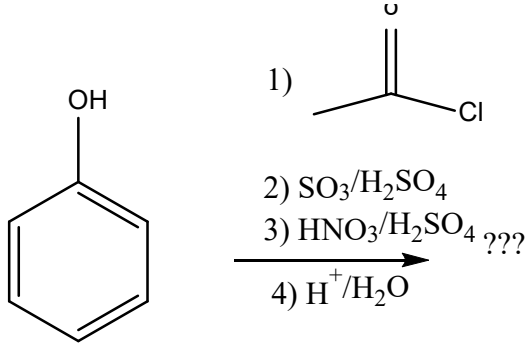
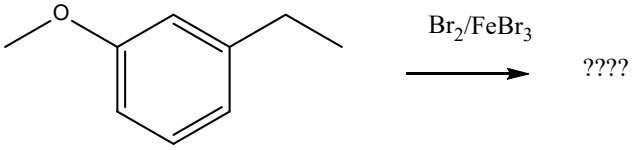
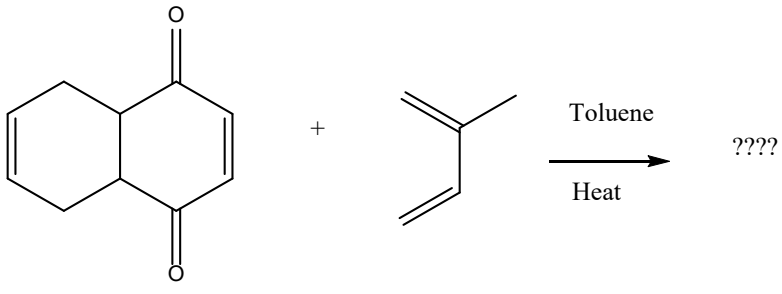


c)



d)



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