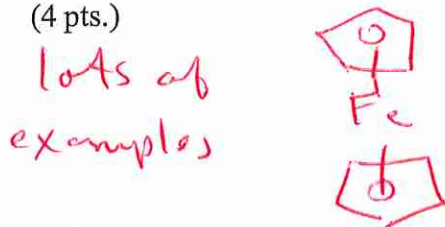


Name: _____

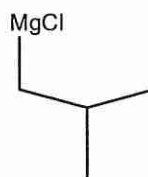
Directions: The exam is worth 106 points but scored out of 100.

- 1) Draw an organometallic complex that has eighteen electrons, has ligands, and an iron metal.
(4 pts.)



- 2) Draw a Triphenyltin hydroxide (3 pts.)

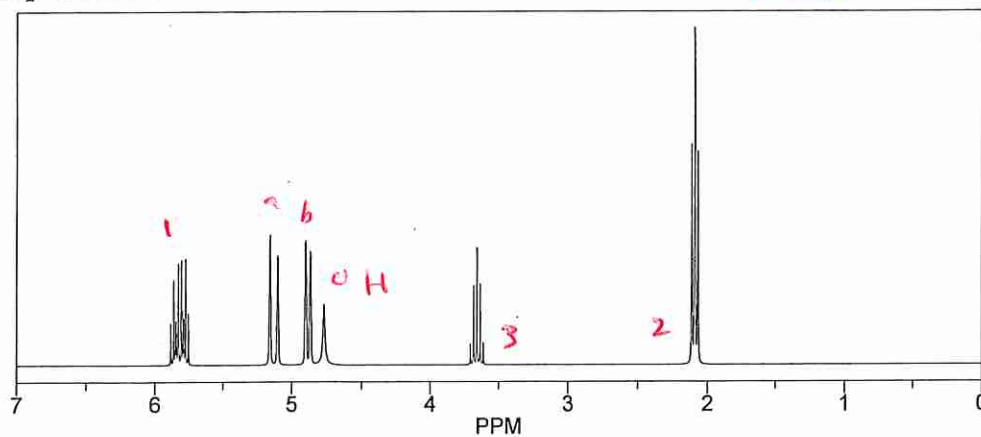
b) Name



(3 pts.)

- c) Draw 4-Fluorophenyl zinc bromide (3 pts.)

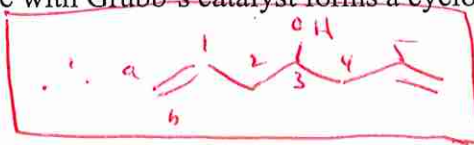
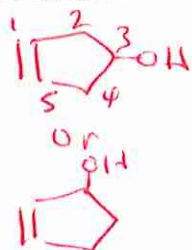
- 3) Give the structure of a molecule that fits the molecular formula $C_7H_{12}O$ that has the following characteristics. (4 pts.)

IR: Has a broad peak at 3200 cm^{-1} 

Proton NMR:

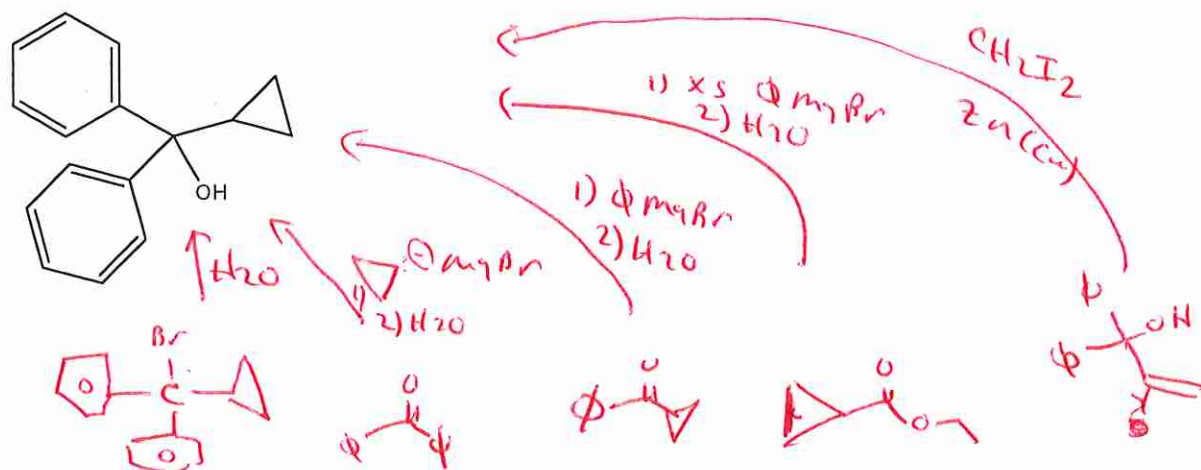
Grubb's catalyst: Treatment of the molecule with Grubb's catalyst forms a cyclopentenol.

Grubb's catalyst



fits NMR

4) Give four different ways to make cyclopropyldiphenylmethanol. (4 pts.)



5) Give an example for each of the following terms (if they exist.) (2 pts. each)

1) a) Give a substituent that when present on a benzene ring is an ortho/para deactivator for Electrophilic Aromatic Substitution.

any halide F, Cl, Br, I

b) Give a substituent that when present on a benzene ring is an ortho/para activator for Electrophilic Aromatic Substitution.

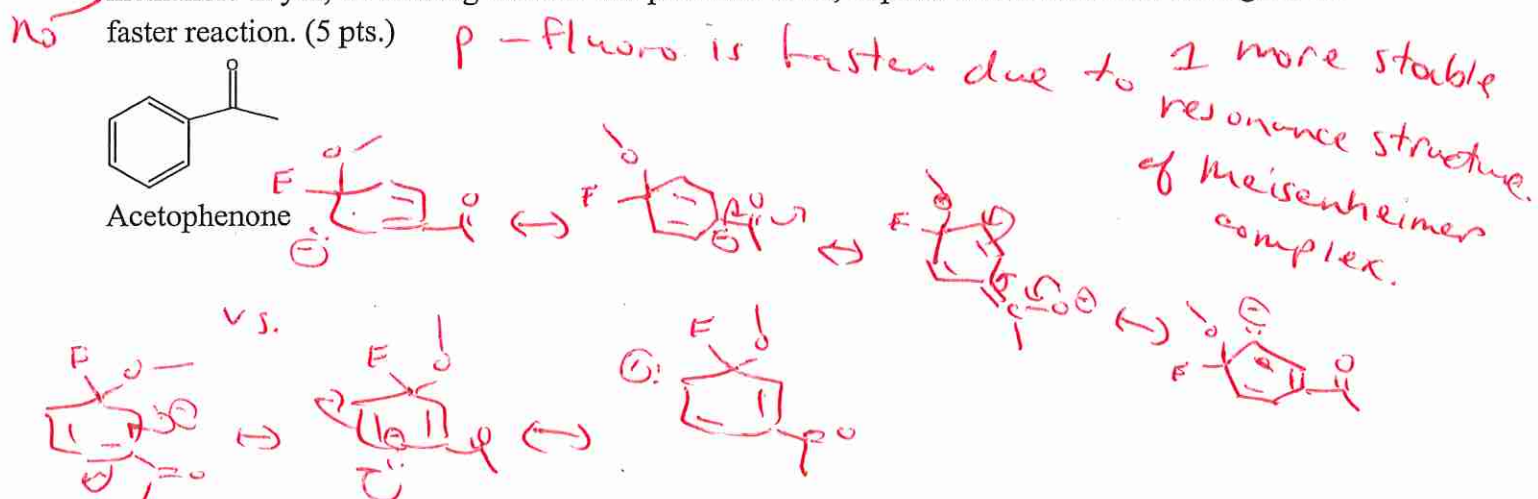
anything with a \ominus charge \therefore OH, NH₂, CH₃
or on partial \ominus charge

c) Give a substituent that when present on a benzene ring is a ortho/para director for Nucleophilic Aromatic Substitution.

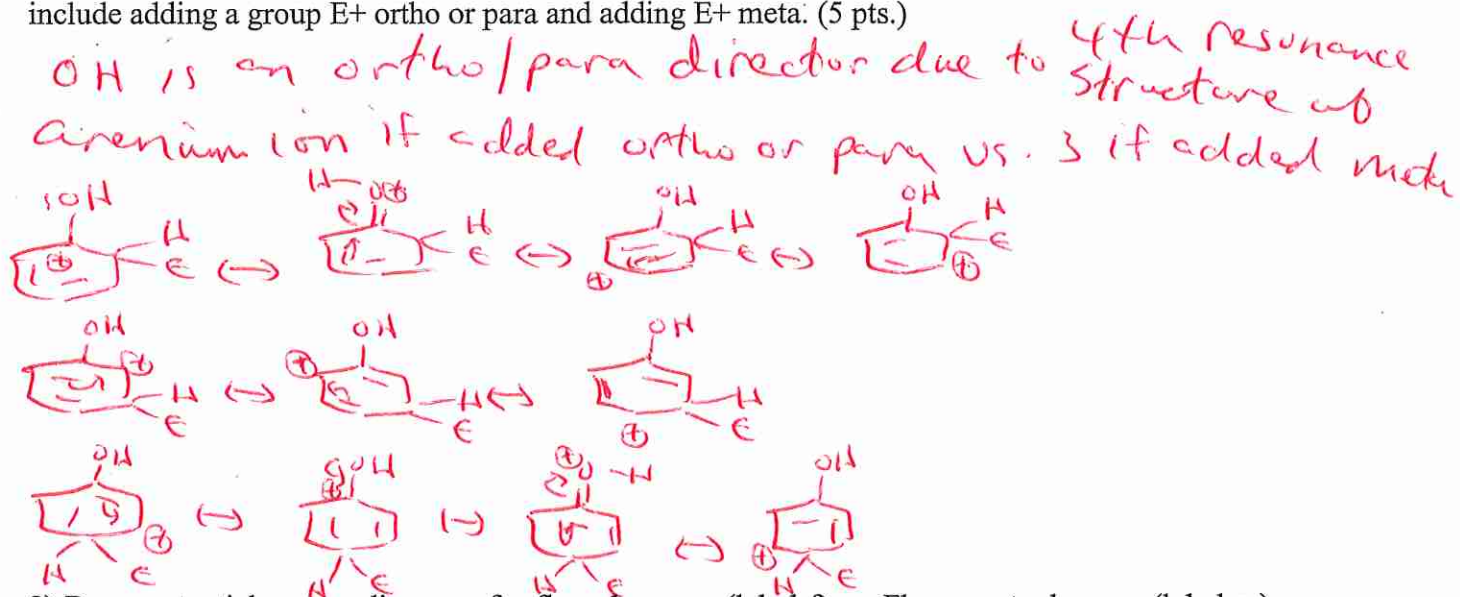
NAS does not have directors

6) RESONANCE STRUCTURES REQUIRED FOR # 6.

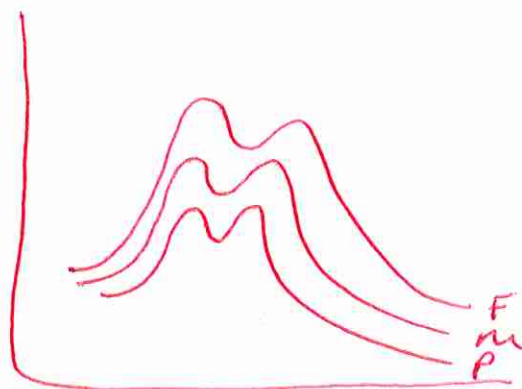
Do m-Fluoroacetophenone and p-Fluoroacetophenone undergo Nucleophilic Aromatic substitution at equal rates under the Addition/Elimination mechanism with sodium methoxide in methanol? If yes, do nothing else for this problem. If no, explain which molecule undergoes the faster reaction. (5 pts.)



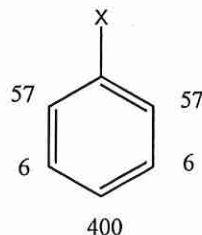
7) Resonance structures REQUIRED for # 7. How does OH direct in EAS reactions? You must include adding a group E+ ortho or para and adding E+ meta. (5 pts.)



8) Draw potential energy diagrams for fluorobenzene (label f), m-Fluoroacetophenone (label m) and p-Fluoroacetophenone (label p) undergoing Nucleophilic Aromatic substitution under the Addition/Elimination mechanism with sodium methoxide in methanol on the SAME graph. (5 pts.)



9) Of the groups shown, circle the most likely candidate(s) for substituent X based on the partial rate factors for chlorination. (4 pts.)



-CF₃

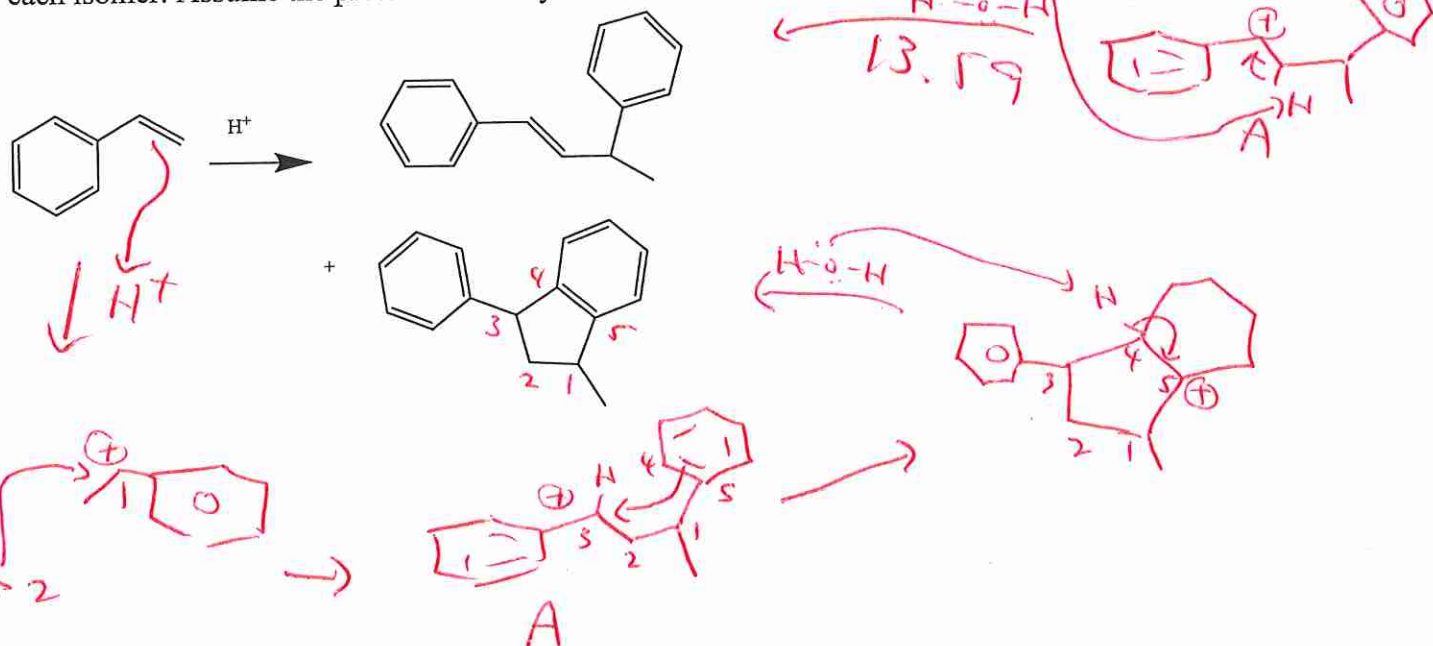
-C(CH₃)₃

-Br

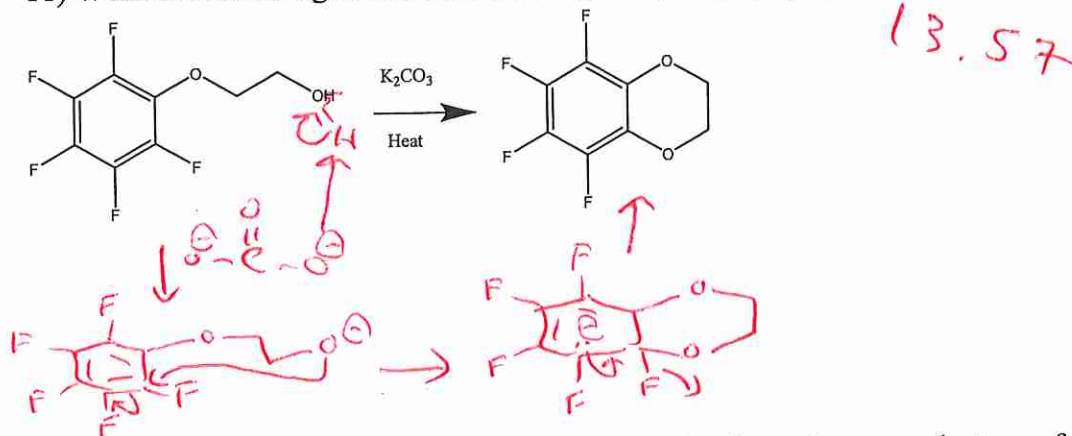
-SO₃H

Trick question. None of them are X.

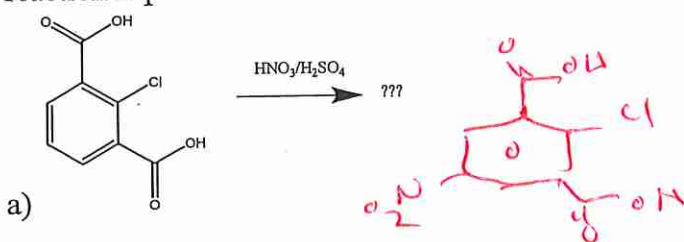
10) When styrene is heated with aqueous sulfuric acid, the two "styrene dimers" shown are the major products. Ignoring stereochemistry, suggest a reasonable mechanism for the formation of each isomer. Assume the proton donor in your mechanism is H_3O^+ . (6 pts.)

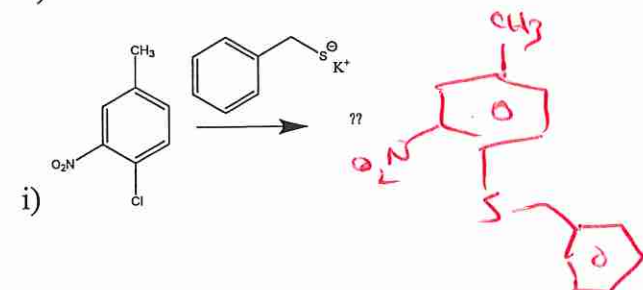
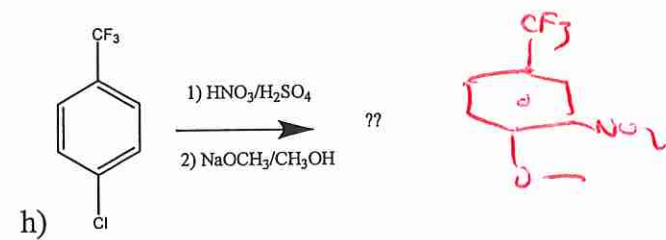
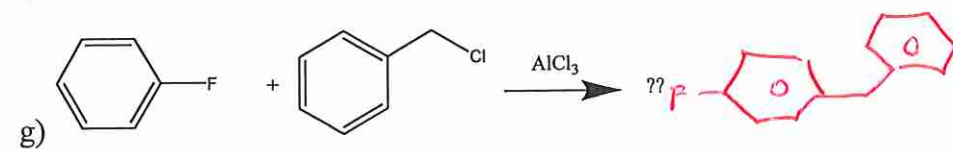
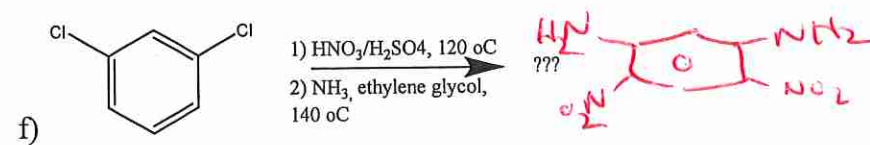
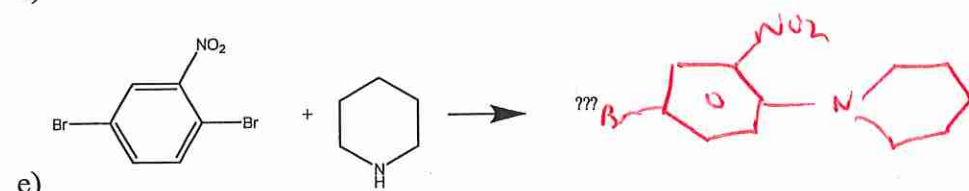
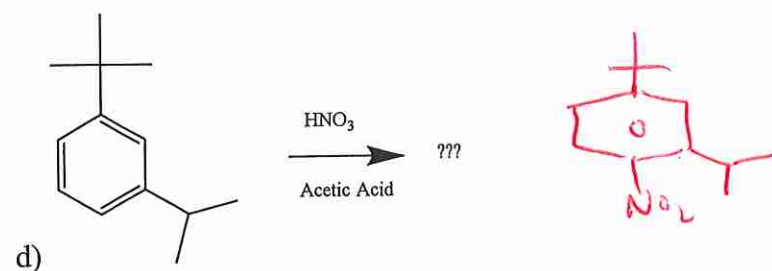
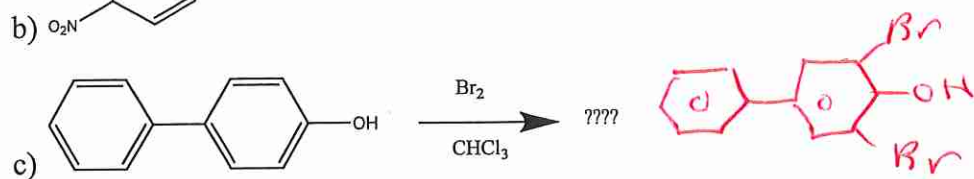
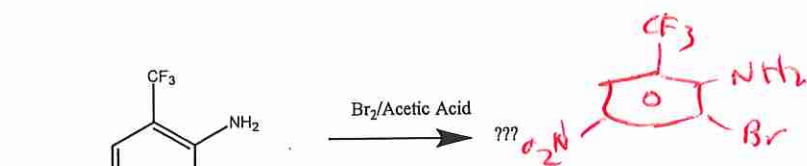


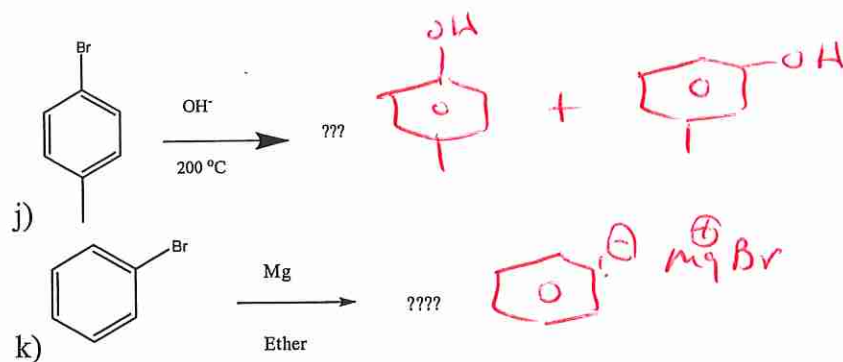
11) Work the following mechanism showing every step. (6 pts.)



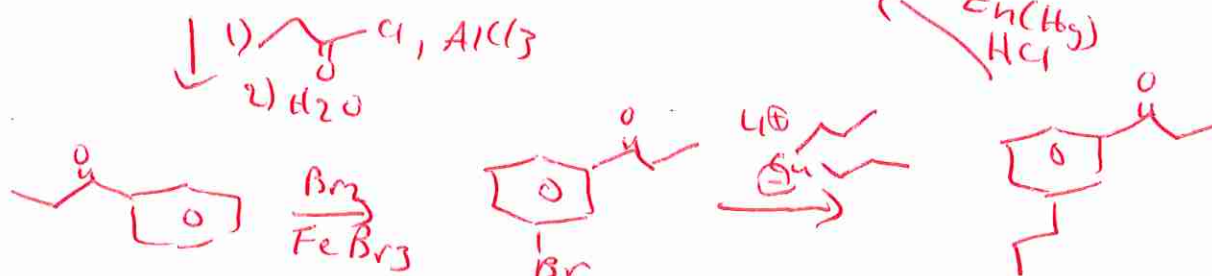
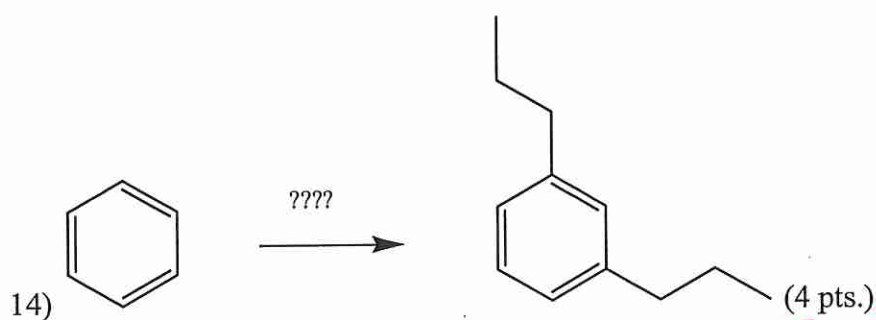
12) Give the products for the following reactions. If ortho and para products are formed, you may draw one of the them and write +o (if you drew para) or +p (if you drew ortho). Indicate if no reaction is possible. Assume multisubstitution for phenols and amines. (3 pts. each)







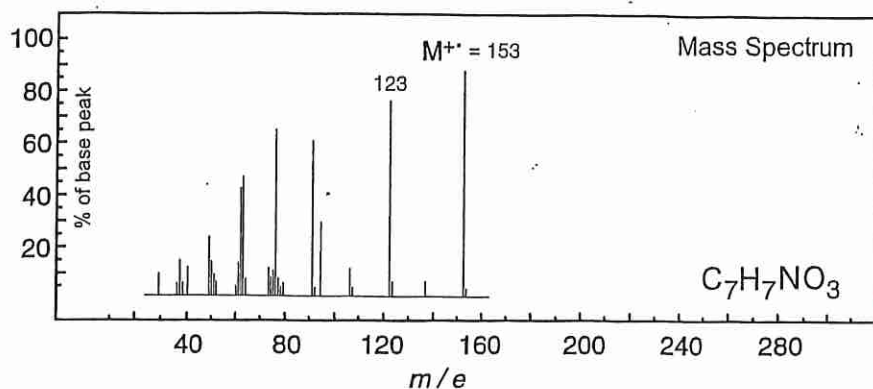
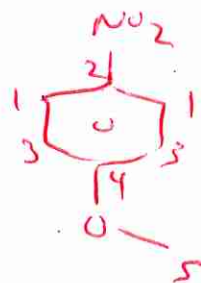
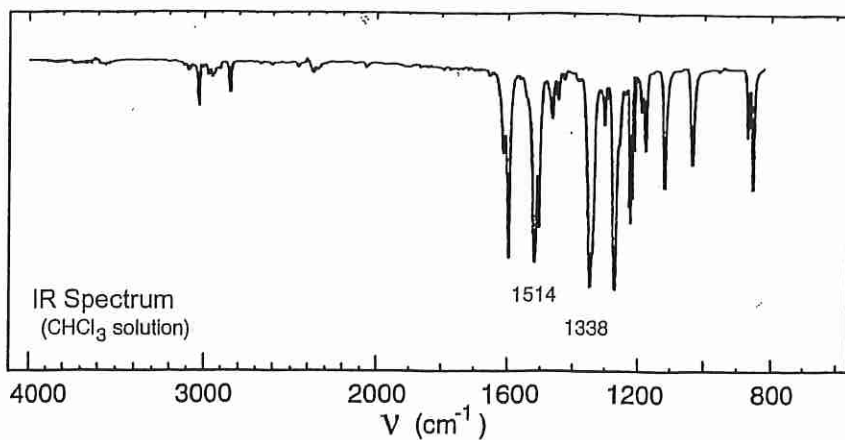
13) Given inorganic reagents of your choice (including D_2O), devise syntheses of the following molecule from 2-methylprop-1-ene. (4 pts.)



15) Give the structure of a molecule that gives the spectrum on the next page. (5 pts.)



16) Free question: Give something you studied that was not asked on this test. (4 pts.)



UV Spectrum

λ_{max} 227 nm ($\log_{10} \epsilon$ 3.9)

λ_{max} 305 nm ($\log_{10} \epsilon$ 4.0)

