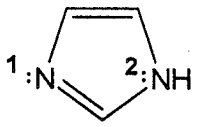
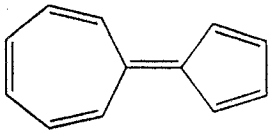
March 24, 2008 CHM 202 Heller T2

1. Imidazole, a heterocyclic aromatic, is shown at right. In which atomic orbitals do the labeled lone pairs **1** and **2** reside, respectively?



a. sp^2, sp^2
b. sp, sp^2
c. p, sp^2
d. sp^2, p
e. sp^2, sp

2. As the molecule at right is shown, indicate the direction of the dipole moment, if any.

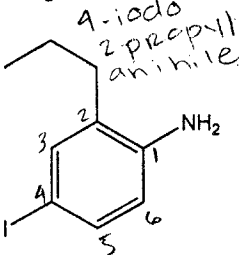


a.
b.
c.
d.
e. no dipole

Provide the IUPAC name for the following:

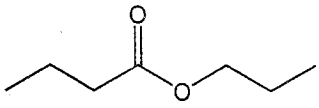
3.

a. 2-amino-4-iodo-1-propylbenzene
b. 1-iodo-3-propyl-4-aniline
c. 2-propyl-4-iodoaniline
d. 1-amino-2-propyl-4-iodobenzene
e. 4-iodo-2-propylaniline



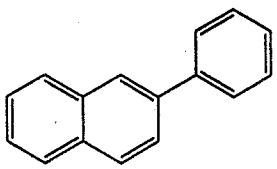
4.

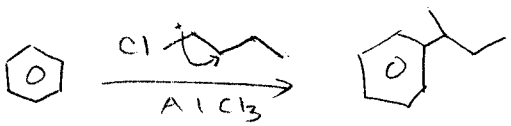
a. butyl propanoate
b. 3-oxaheptanoate
c. 3-oxaoctanoate
d. 5-oxaoctanoate
e. propyl butanoate



5.

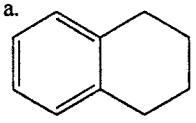
a. naphthalene
b. 2-phenylnaphthalene
c. anthracene
d. phenanthrene
e. 1,2,4-tribenzene



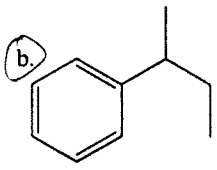


6. Indicate the major organic product upon treating benzene with 1-chlorobutane and $AlCl_3$.

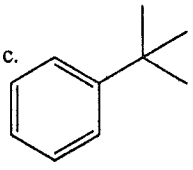
a.



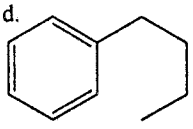
b.



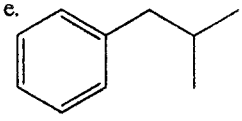
c.



d.



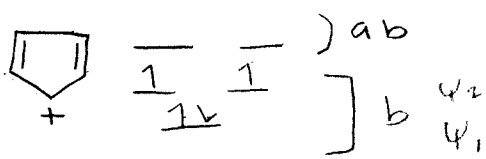
e.



7. How many bonding and anti-bonding π-molecular orbitals does cyclopentadienyl cation have, respectively; and in which orbitals do the π-electrons reside in the ground state?

a. 2, 2; 2 are in ψ_1 and 1 each are in ψ_2 and ψ_3
b. 2, 3; 2 are in ψ_1 and 1 each are in ψ_2 and ψ_3
c. 3, 2; 2 are in ψ_1 and 2 are in ψ_2
d. 3, 1; 2 are in ψ_1 and 2 are in ψ_2
e. None of the above

anti



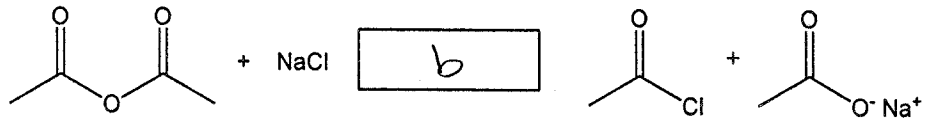
acyl chloride
anhydride
ether
amide

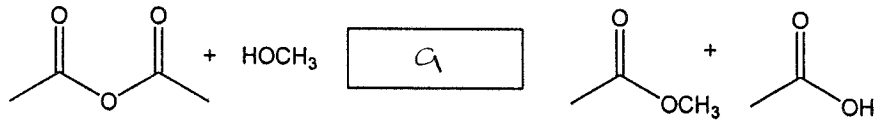
Indicate the position of the thermodynamic equilibrium.
"a" is to the right, "b" is to the left, "c" is roughly equally right and left.

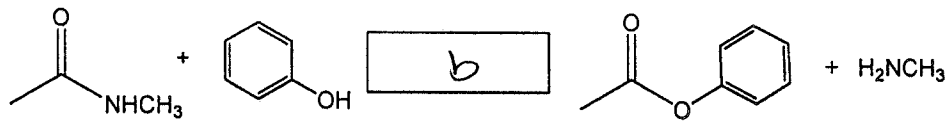
a

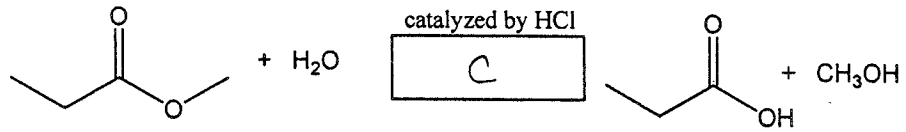
b

c

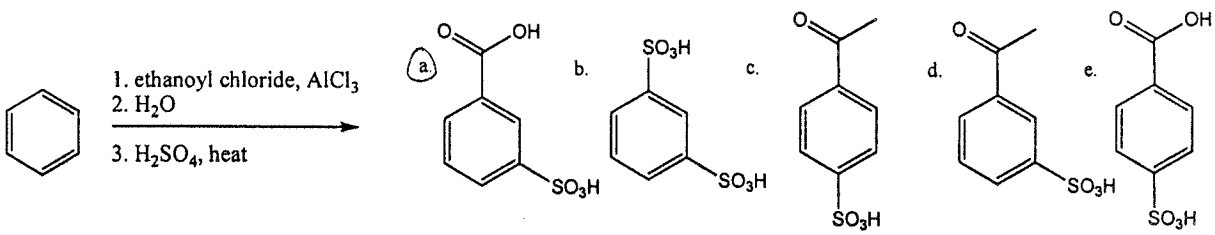
8. 

9. 

10. 

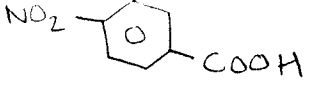
11. 

12. Indicate the major product.



13. Which is the preferred method of making *m*-dibromobenzene starting from benzene?

a. excess Br_2, $FeBr_3$
b. 1. Br_2, $FeBr_3$ 2. H_2SO_4, HNO_3 3. $NaNO_2$, HBr, 0° C 4. CuBr
c. 1. H_2SO_4, HNO_3 2. Br_2, $FeBr_3$ 3. Sn, HCl 4. NaOH 5. $NaNO_2$, HBr, 0° C 6. CuBr
d. 1. H_2SO_4, HNO_3 2. HBr/peroxide 3. H_2SO_4, HNO_3 4. Sn, HCl 5. NaOH 6. $NaNO_2$, HBr, 0° C 7. CuBr
e. 1. H_2SO_4, HNO_3 2. Br_2, $FeBr_3$ 3. Sn, HCl 4. H_3PO_2 5. Br_2, $FeBr_3$

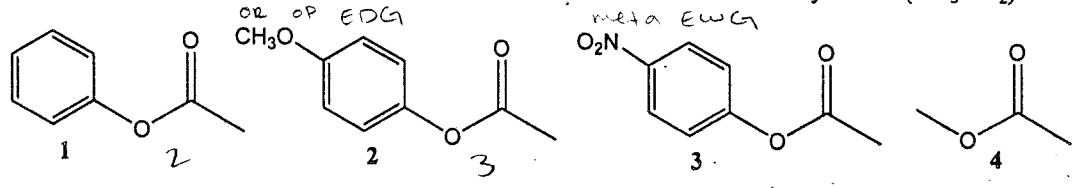


14. Which is the preferred method of making *o*- and *p*-nitrobenzoic acid starting from benzene?

a.	1. CH_3Cl, $AlCl_3$	2. H_2SO_4, HNO_3	3. $Na_2Cr_2O_7$, H^+, Δ
b.	1. CH_3Cl, $AlCl_3$	2. $Na_2Cr_2O_7$, H^+, Δ	3. H_2SO_4, HNO_3
c.	1. H_2SO_4, HNO_3	2. CH_3Cl, $AlCl_3$	3. $Na_2Cr_2O_7$, H^+, Δ
d.	1. H_2SO_4, HNO_3	2. $Na_2Cr_2O_7$, H^+, Δ	3. CH_3Cl, $AlCl_3$
e.	1. $Na_2Cr_2O_7$, H^+, Δ	2. CH_3Cl, $AlCl_3$	3. H_2SO_4, HNO_3

-Cl
-anhydride
-ether
-amide

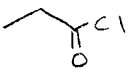
15. Rank the following from most reactive to least when treated with methylamine (CH_3NH_2).

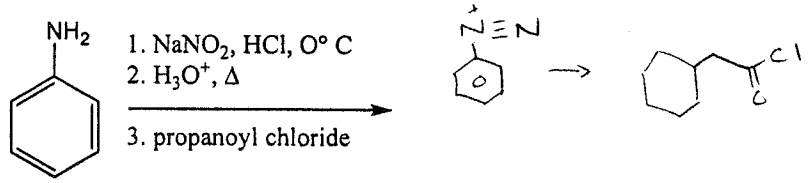


a. 1 > 3 > 4 > 2
b. 2 > 1 > 3 > 4
c. 4 > 2 > 1 > 3
d. 3 > 4 > 2 > 1
e. 3 > 1 > 2 > 4

3 2

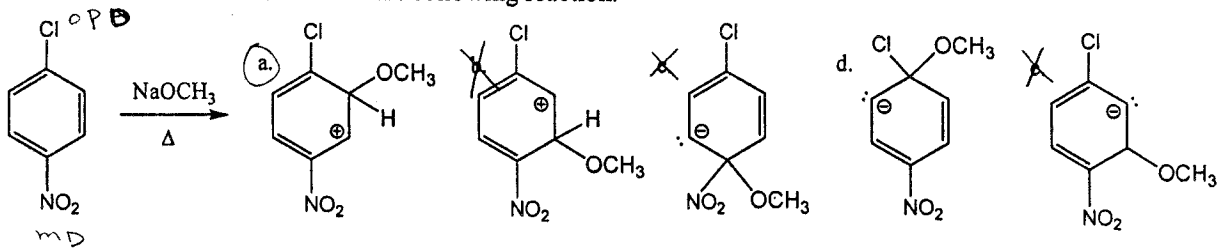
16. The major organic product of the following reaction scheme is a(n):



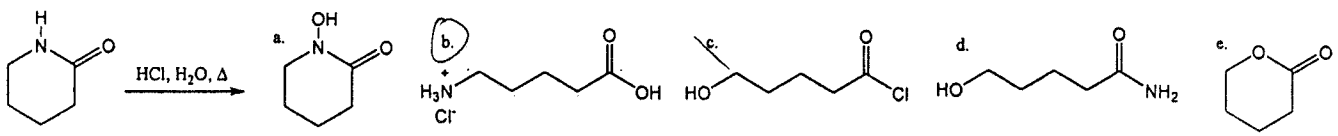


a. alcohol b. aldehyde c. ester d. ketone e. acid chloride

17. Indicate the intermediate in the following reaction.

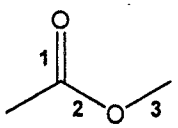


18. Indicate the product.



19. There are three carbon-oxygen bonds in the compound shown.
Rank them from longest to shortest.

3 2 1



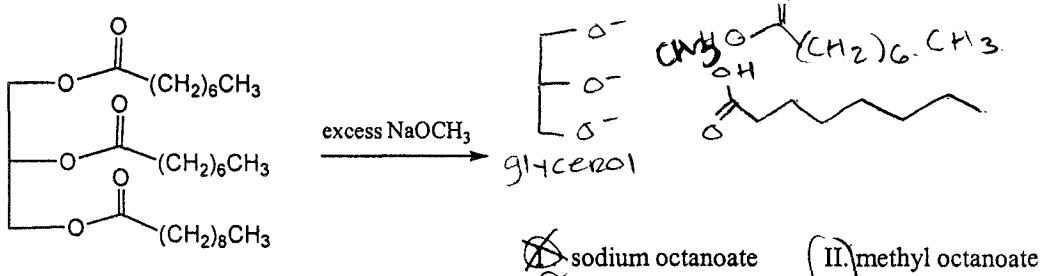
a. 1 > 2 > 3
b. 2 > 1 > 3
c. 3 > 2 > 1
d. 3 > 1 > 2
e. 2 > 3 > 1

meta = EWG
o/p = EDG

20. With regard to electrophilic aromatic substitution, halogens as substituents are deactivators because they EW, and are *ortho/para* directors because they _____.

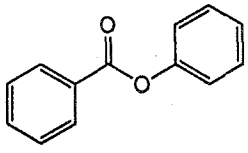
a. withdraw electrons inductively; withdraw electrons through resonance
b. withdraw electrons inductively; donate electrons through resonance
c. donate electrons inductively; donate electrons through resonance
d. donate electrons inductively; withdraw electrons through resonance

21. Biodiesel fuel is produced by reacting sodium methoxide ($NaOCH_3$) with plant oils. Assume the following oil molecule is used, what biodiesel is produced?



I. sodium octanoate
II. methyl octanoate
III. sodium decanoate
IV. methyl decanoate

a. I, III b. I, IV c. II, III d. II, IV e. I, II, III, IV

22. Which of the following will produce  starting from benzoic acid?

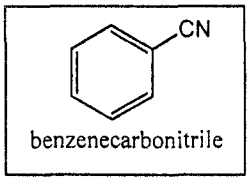
a. excess phenol, catalytic HCl
b. 1. $SOCl_2$ 2. phenol
c. 1. P_2O_5 2. phenol
d. more than one, but not all of the above (a-c)
e. all of the above (a-c)

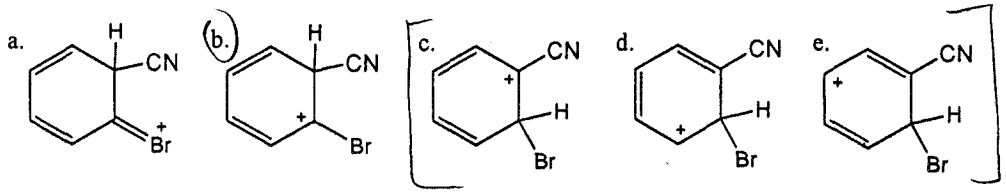
23. Rank the following monosubstituted benzenes (C_6H_5Z) from most reactive to least in an electrophilic aromatic substitution, say for example, chlorination. EAS

Z= I. —COOH (3) II. —NH_3^+ (4) III. —NH_2 (1) IV. —NHCCH$_3$ (2)

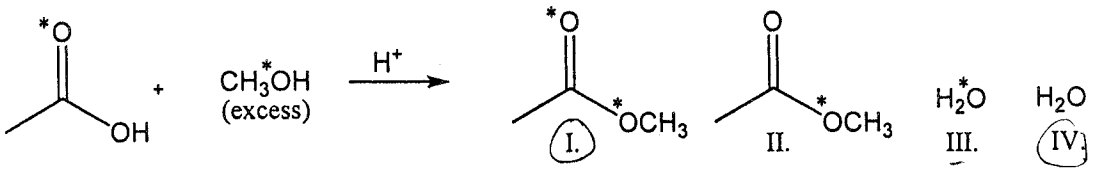
a. II > I > III > IV
b. II > III > IV > I
c. 1 > IV > III > II
d. III > I > IV > II
e. III > IV > I > II

24. Which of the following resonance contributors best explain why an *ortho* product is disfavored in the bromination of benzenecarbonitrile.

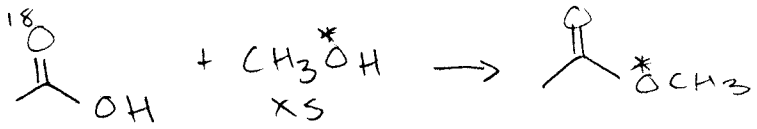




25. Indicate the products. (*O indicates an ^{18}O-labeled compound).



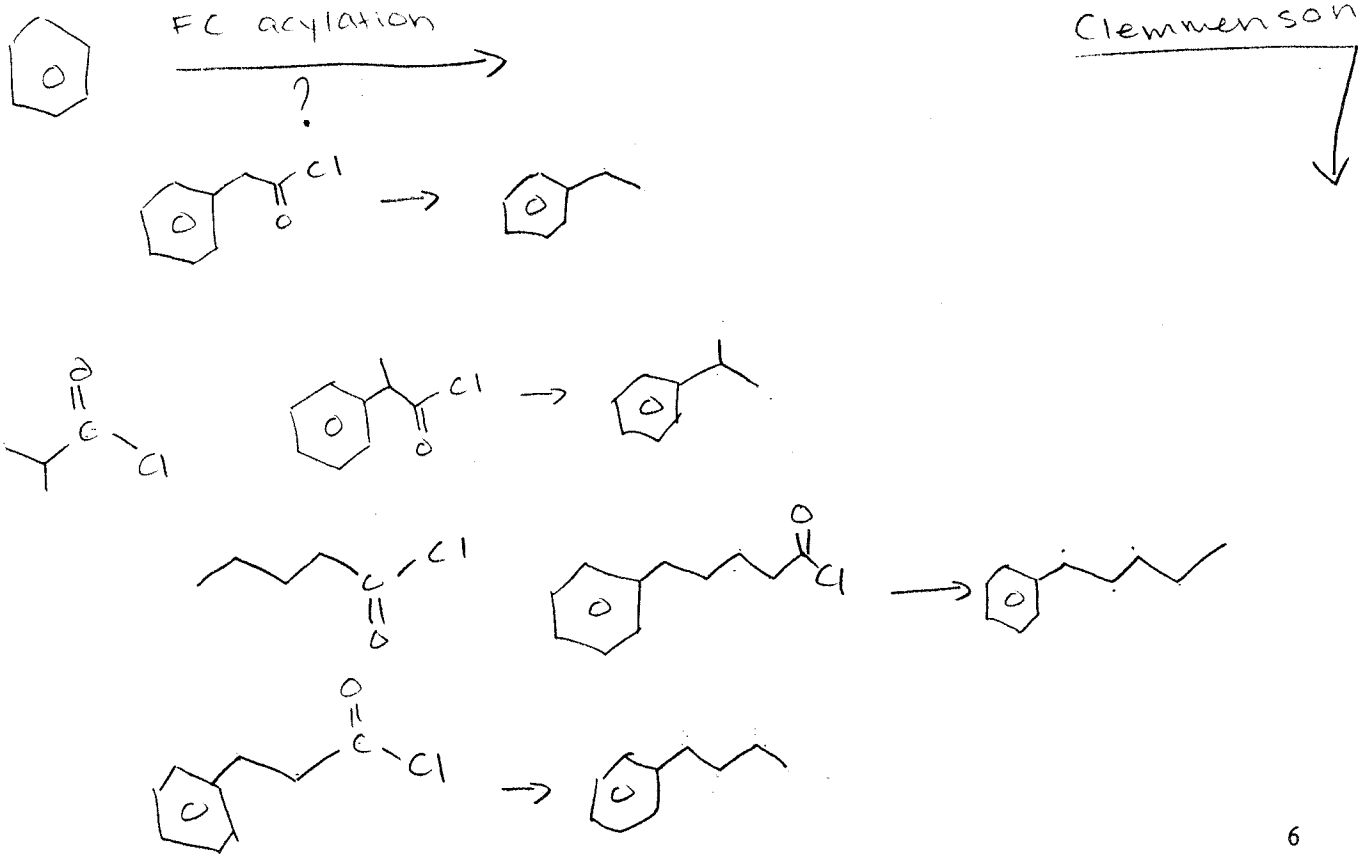
a. I, III (b.) I, IV c. II, III d. II, IV e. I, II, III, IV



26. Benzene underwent a Friedel-Crafts acylation following by a Clemmensen reduction (Zn(Hg)/HCl). The product gave the following ^1H NMR data. What acyl chloride was used in the Friedel-Crafts acylation?

~~a.~~ propanoyl chloride
~~b.~~ 2-methylpropanoyl chloride
(c.) butanoyl chloride
d. 2-methylbutanoyl chloride
~~e.~~ pentanoyl chloride

δ	# H's	multiplicity
0.9	3	triplet
1.4	2	multiplet
1.6	2	multiplet
2.6	2	triplet
7.1-7.3	5	multiplet



Your Answer(1- 50): CCEEBBCBAB CACAEEABCB DDEBBC

Correct Answer : DA....E... .D...CD... .E.CE.

Possible Points: 26 Number Omitted: 0

Score: 17.0 Number Double Coded: 0

Percent Correct: 65.4 Guessing Penalty: none

Group Number: 1 Seat Number:

Form Number: 2

. =Right, * =Double Mark, - =Omitted, # =Question Dropped, + =Free Question