Name: _____KEY_____

EXAM #2 WEDNESDAY, OCTOBER 18, 2006
ORGANIC CHEMISTRY II 4:122

Instructions: Print your name in the spaces provided on every sheet of the exam. Failure to do so will lead to loss of credit.

Make sure that you do the problems on the front and back of every sheet.

On multiple choice questions, clearly circle the answer that you think is correct.

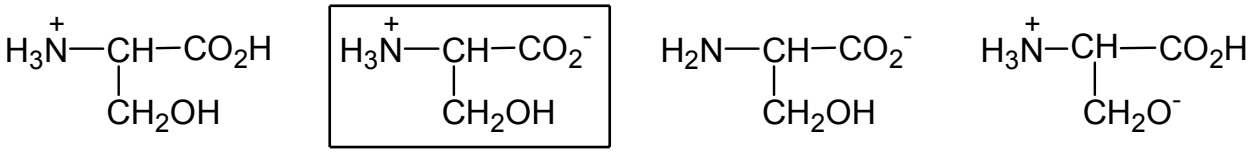
Exams that are done in pencil, red ink, erasable ink, or that have white-out on them will not be regraded.

Question #	Possible Points	Point Scored
1	30	_____
2	14	_____
3	12	_____
4	16	_____
5	20	_____
6	8	_____
	100	

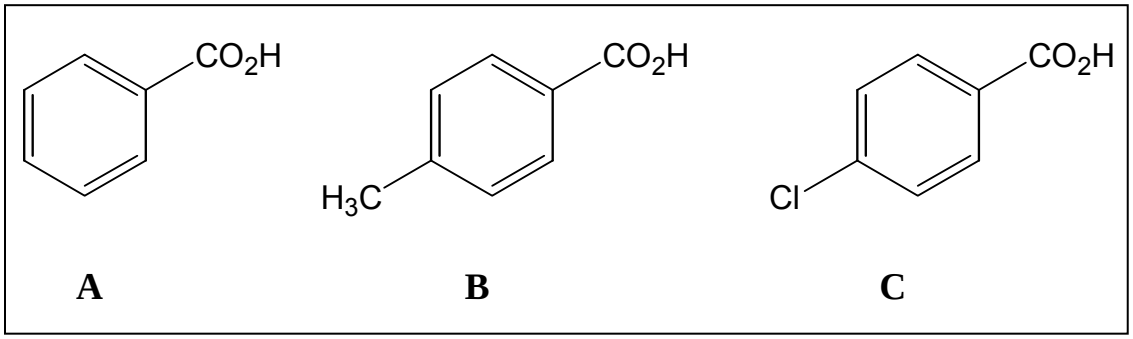
TOTAL

1. Multiple Choice Questions. Clearly circle your chosen answer. (30 points; 3 apiece)

a) Which is the structure of serine at its isoelectric point? (Problem 19.57b, p 682)



b) Rank the compounds in the box in order of increasing acidity. (Problem 19.19a, p 670)



A **B** **C**

A < B < C **C < B < A** **B < A < C** **C < A < B**

c) Which compound is caproic acid? (Table 19.1, p 655)

HCO_2H $HO_2C(CH_2)_4CO_2H$ $CH_3CH_2CH_2CO_2H$ $CH_3(CH_2)_4CO_2H$

d) Which of the following substituents is the most powerful ring activator in electrophilic aromatic halogenation reactions?

$-N^+R_3$ $-CH_3$ $-NR_2$ $-NHCOR$

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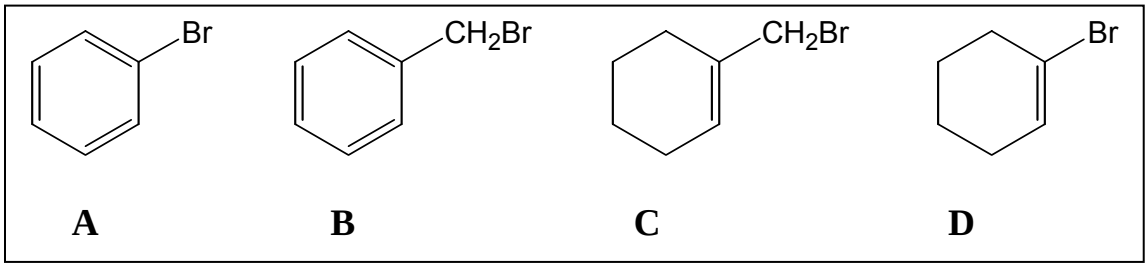
e) Which compounds in the box do not react as the electrophile in Friedel-Crafts alkylation reactions? (Problem 18.9, p 617)

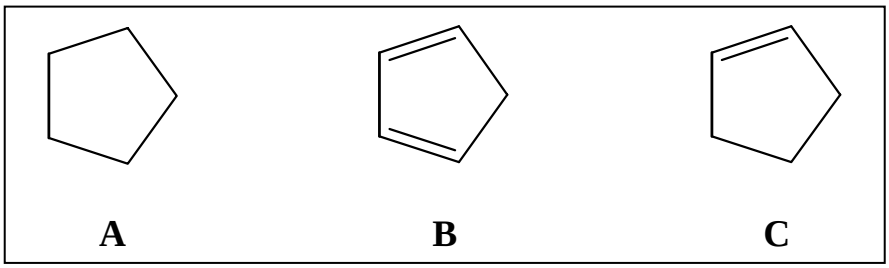


A only | **A and D** | **A, B and D** | **all of them**

f) For EAS reactions, which substituent possesses all of the following properties:
1) inductive electron withdrawer; 2) electron donor by resonance; 3) ring deactivator?

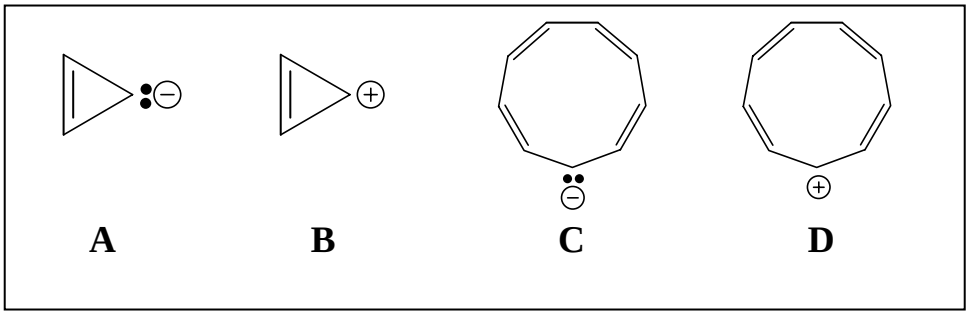
−Cl	$-NO_2$	$-COCH_3$	$-OCH_3$

g) Rank the compounds in the box in order of increasing acidity. (Problem 17.16, p 595)



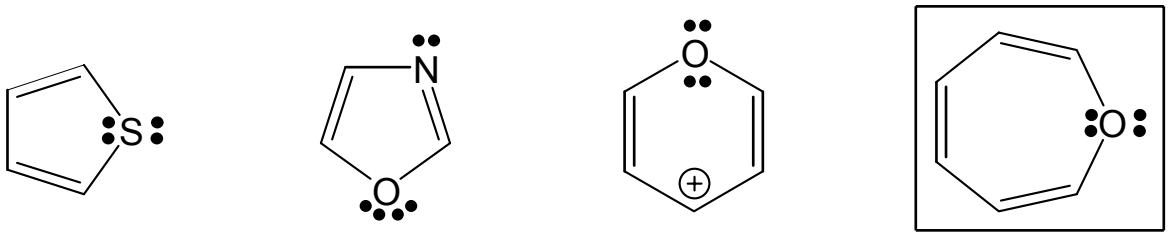
A < B < C | **C < A < B** | **B < C < A** | **A < C < B**

h) Which ions are aromatic? Assume the rings are planar. (Problem 17.18, p 595)

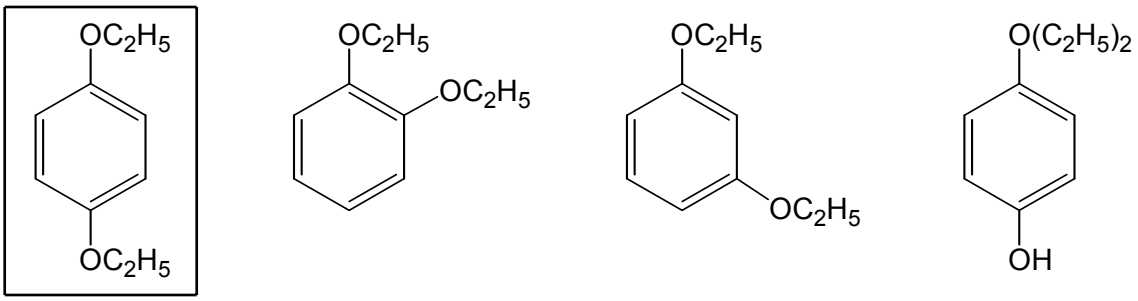


B and C **C only** **A, B and C** **none of them**

i) Which heterocycle is antiaromatic? (Problem 17.29, p 603)



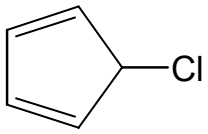
j) What is the structure of a compound $C_{10}H_{14}O_2$ that has a strong IR absorption at 3150 – 2850 cm^{-1} and gives the following ^1H NMR data: δ1.4 ppm (triplet, 6H); δ4.0 ppm (quartet, 4H); δ6.8 ppm (singlet, 4H)? (Problem 17.5, p 584)

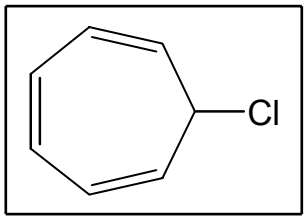


Name: _____KEY_____

2. Comparison Questions. Clearly circle your chosen answer. (14 points; 2 apiece)

a) Which compound is more reactive in S_N1 reactions? (Problem 17.35, p 604)





b) Which compound reacts faster in electrophilic aromatic bromination reactions? (Problem 18.43e, p 647)

$C_6H_5NH_2$ $C_6H_5CH_2NH_2$

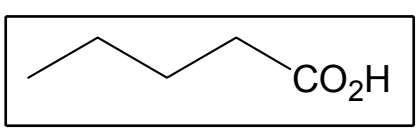
c) Which compound has the stronger conjugate base? (Problem 19.36d, p 679)

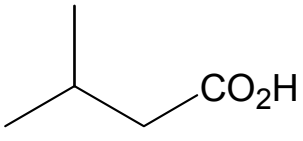
CH_3CO_2H $N{\equiv}CCH_2CO_2H$

d) Which compound has the higher boiling point? (Problem 19.31a, p 679)

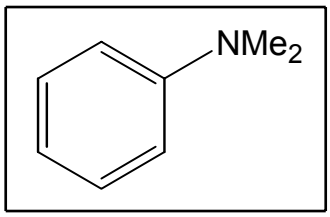
$CH_3CH_2CH_2CH_2CO_2H$ $CH_3CH_2CH_2CH_2CH_2CH_2OH$

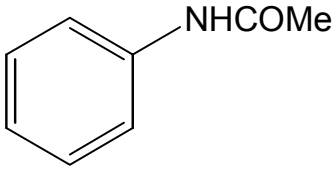
e) Which compound gives the following ^{13}C NMR data: peaks at 14, 22, 27, 34, 181 ppm? (Problem 19.54, p 682)





f) Which compound does not undergo Friedel-Crafts alkylation with CH_3Cl and $AlCl_3$? (Problem 18.23, p 633)



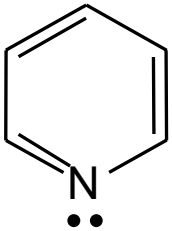


g) When analyzed by the inscribed polygon method, which species has unfilled molecular orbitals? (Sample Problem 17.1 and problem 17.20, p 600)

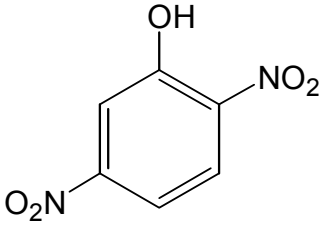
cyclopropyl cation **cyclobutadiene**

3. Draw structures or provide names for the following compounds. Names are right or wrong. No partial credit. (12 points; 4 apiece)

a) Pyridine



b) Problem 17.24g, p 603



2,5-dinitrophenol

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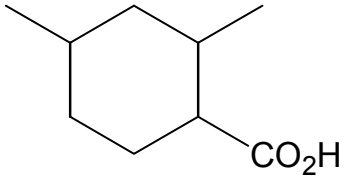
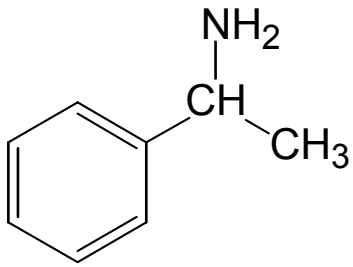
c) Problem 19.28f, p 678



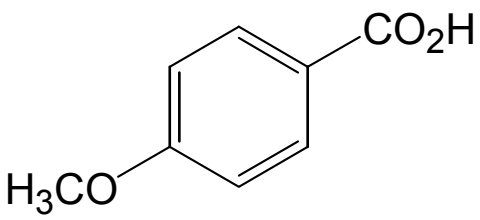
2,4-dimethylcyclohexanecarboxylic acid

4. Structures from Spectroscopic Data (16 points; 4 apiece)

a) Propose a structure for a compound $C_8H_{11}N$ that gives the following ^1H NMR data.
δ 1.4 ppm (doublet, 3H), δ 1.7 ppm (broad singlet, 2H)
δ 4.1 ppm (quartet, 1H), δ 7.3 ppm (multiplet, 5H)



b) Propose a structure for a compound $C_8H_8O_3$ that gives the following spectral data. (Problem19.50b, p 680)
IR: 3500 – 2500 cm^{-1}, 1688 cm^{-1}
^{1}NMR: δ 3.8 ppm (singlet, 3H), δ 7.0 ppm (doublet, 2H)
δ 7.9 ppm (doublet, 2H), δ 11.3 ppm (singlet, 1H)

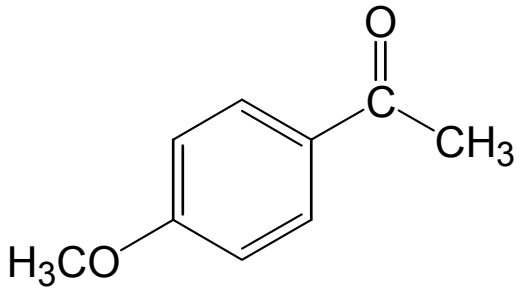


c) Propose a structure that is consistent with the following data. (Problem 17.48b, p 607)

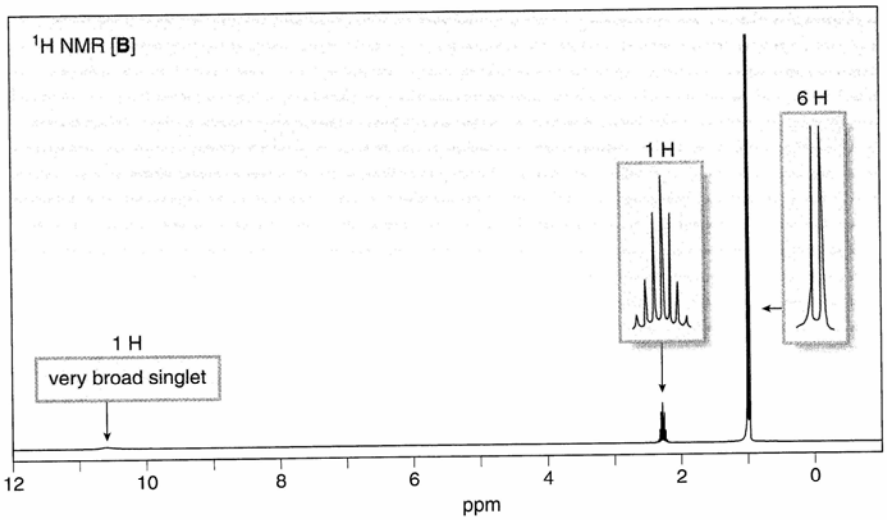
Molecular formula: $C_9H_{10}O_2$

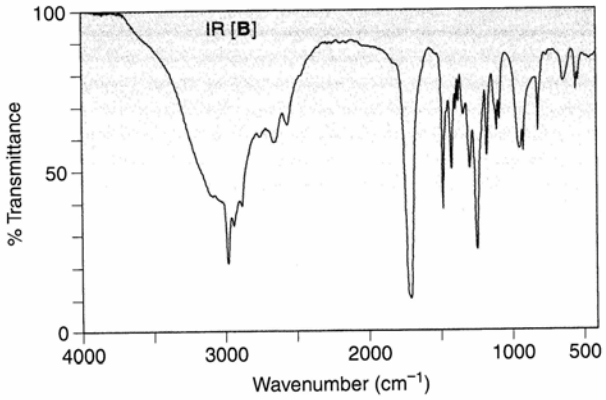
IR absorptions at 1669 cm^{-1} and 3150 – 2850 cm^{-1}

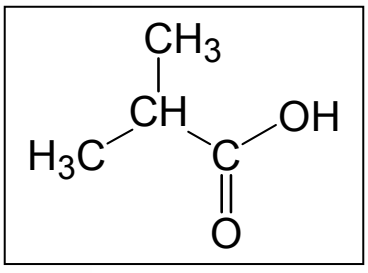
^1H NMR: δ 2.5 ppm (singlet, 3H), δ 3.8 ppm (singlet, 3H)
δ 6.9 ppm (doublet, 2H), δ 7.9 ppm (doublet, 2H)



d) Provide the structure of the compound $C_4H_8O_2$ that gives the following ^{1}NMR and IR spectra. (Problem 19.51, p 680-681)



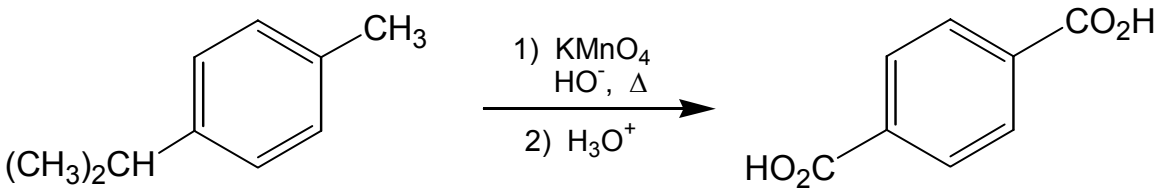




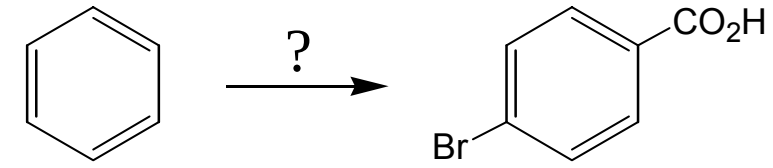
Name: _____KEY_____

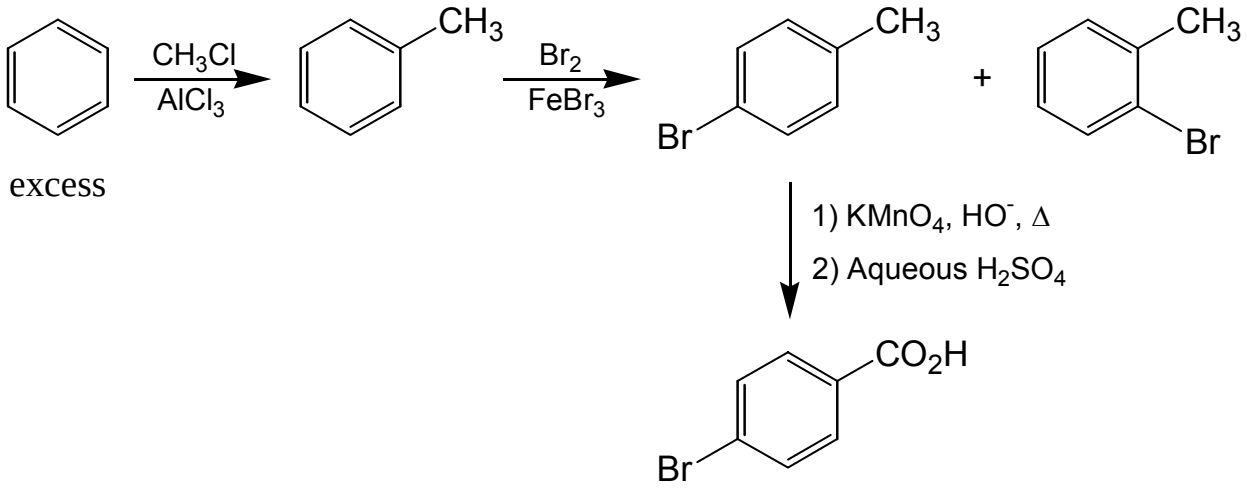
5. Provide the missing products or reactants for the following reactions. If more than one product is formed, indicate which is the major and which the minor product. If there is no reaction, so indicate. If multiple steps are required, clearly show reagents for each step. (20 points; 4 apiece)

a) Problem 19.32b, p 678

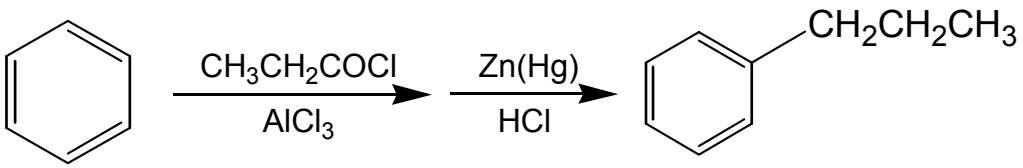


b) Problem 18.57h, p 649.

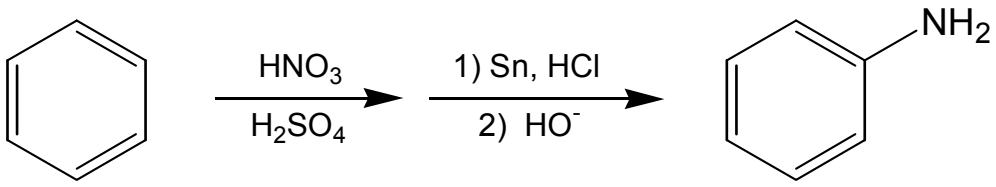




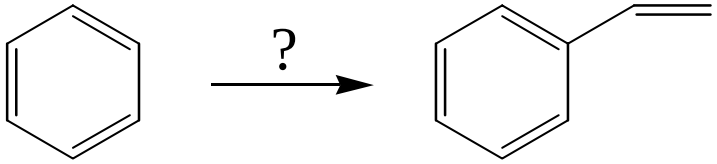
c)

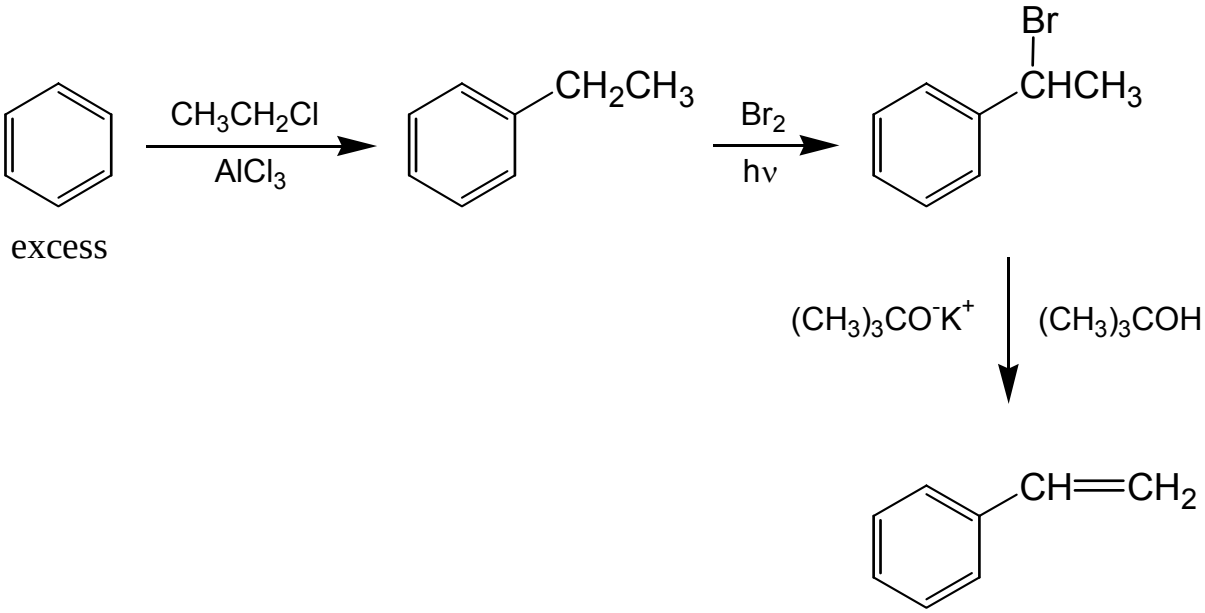


d) Problem 18.34h, p 646



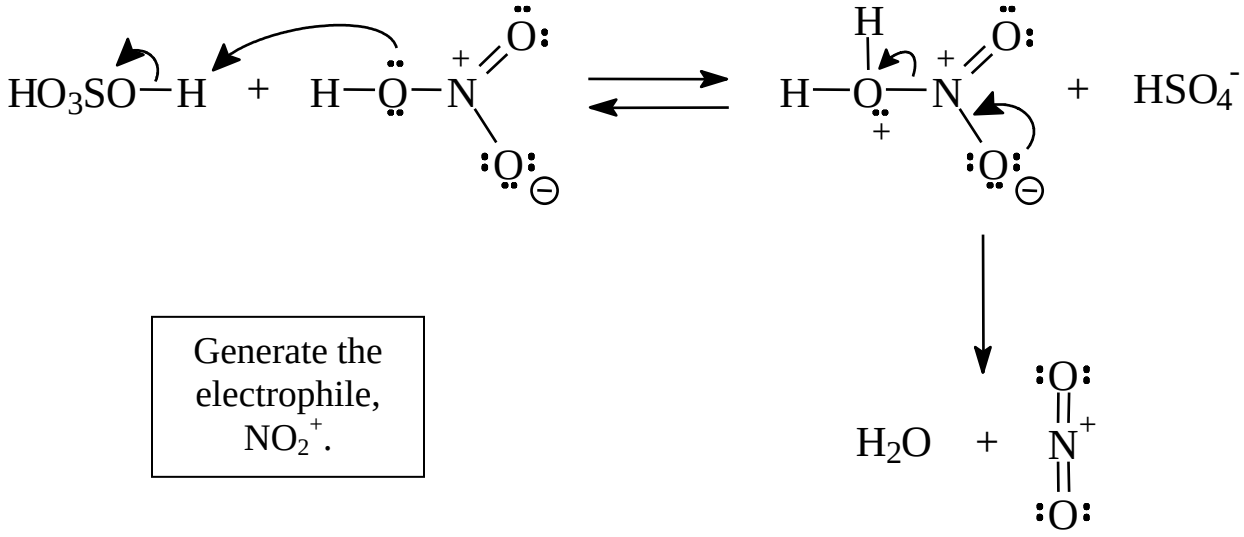
e)



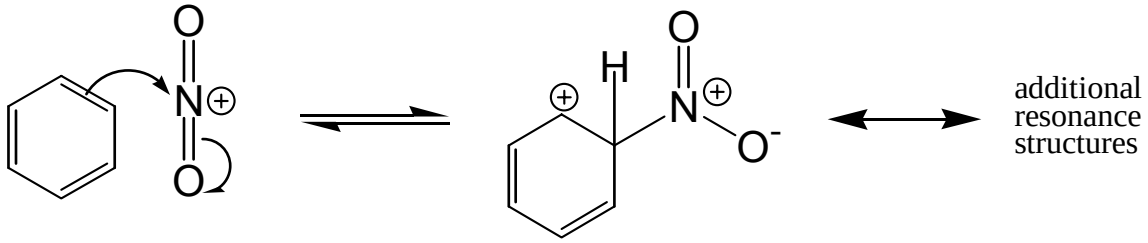


Name: _____KEY_____

6. Outline an electron-pushing mechanism for electrophilic aromatic nitration of benzene. Show all steps, including those that generate the electrophile. (8 points)



Formation of arenium ion intermediate:



Breakdown of arenium ion intermediate: