

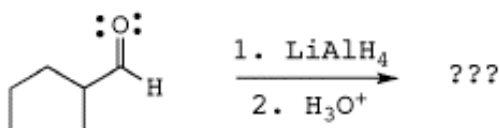
CHM 234, Spring 2018  
QUIZ #4 ANSWER KEY

(hit the RETURN Button to return to the Main Quiz Page)

QUESTION 1

MC29s

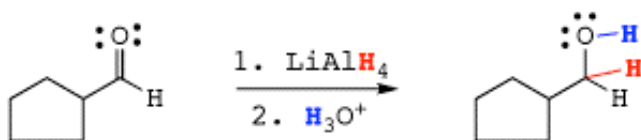
Identify the following reaction as indicated  
(stereochemistry is ignored)



- A addition and neither oxidation or reduction
- B elimination and neither oxidation or reduction
- C addition and reduction
- D elimination and oxidation

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we tend to not practice this type of notation enough, so the purpose of this question is to reinforce understanding of notation that is often taken for granted



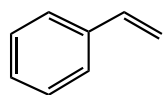
this is a reduction of the C=O bond, 2 H atoms are added to the C=O bond, the red one comes from the  $\text{AlH}_4^-$  ion, the blue one comes from the  $\text{H}_3\text{O}^+$  that was part of the acid workup at the end of the reaction

this is also clearly an addition reaction, 2 H atoms were added to the C=O bond

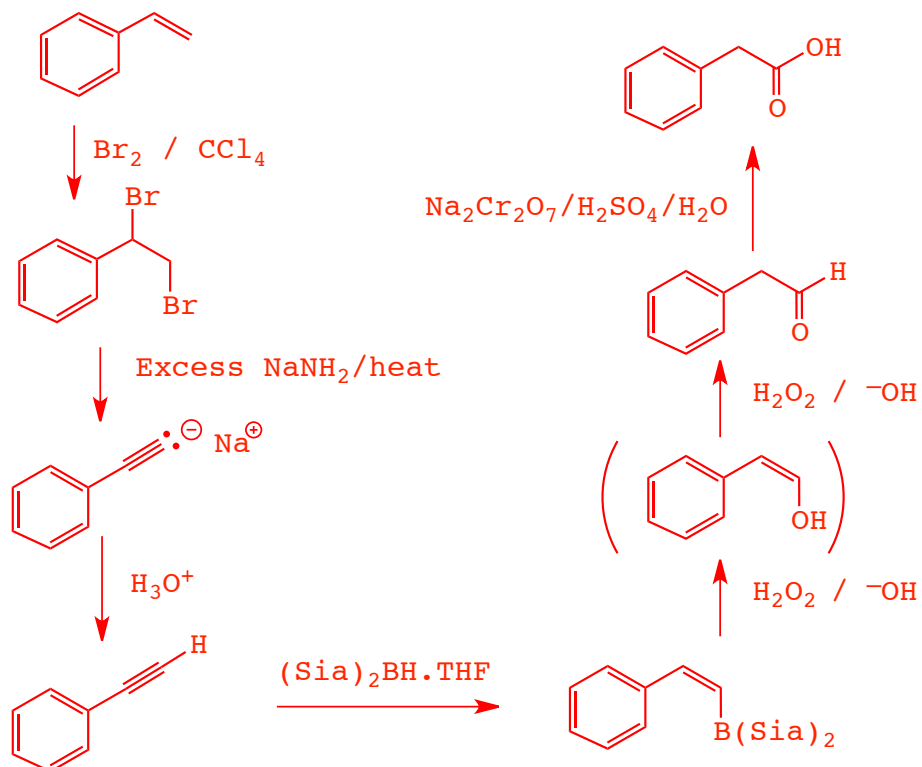
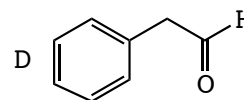
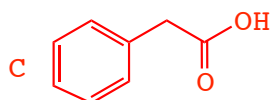
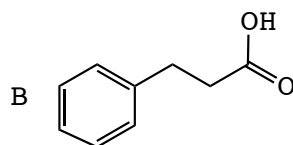
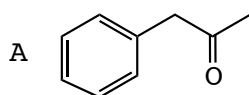
## QUESTION 2

MC29i

Give the product of the following reaction sequence with the starting material shown



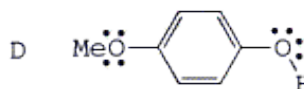
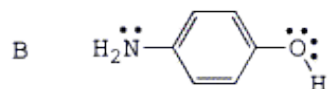
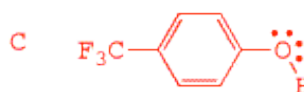
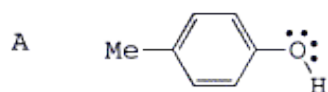
1.  $\text{Br}_2 / \text{CCl}_4$
  2. Excess  $\text{NaNH}_2$ /heat
  3.  $\text{H}_3\text{O}^+$
- 
4.  $(\text{Sia})_2\text{BH}\cdot\text{THF}$
  5.  $\text{H}_2\text{O}_2 / ^-\text{OH}$
  6.  $\text{Na}_2\text{Cr}_2\text{O}_7/\text{H}_2\text{SO}_4/\text{H}_2\text{O}$



### QUESTION 3

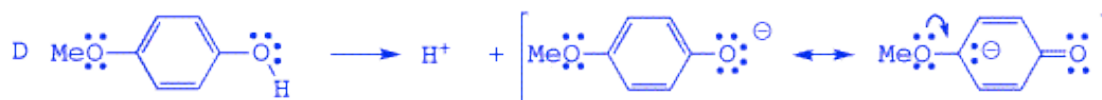
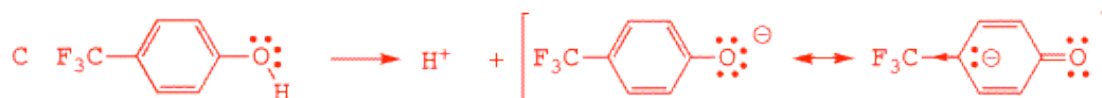
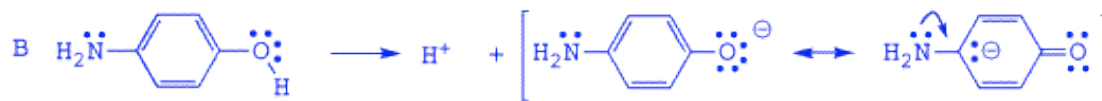
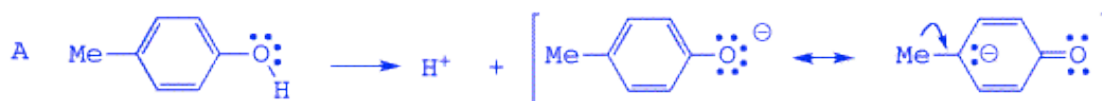
MC29p

Which is the STRONGEST Bronsted acid?



Bronsted acids donate a proton, so first we must identify the hydrogen atom that is most likely to be lost as a proton, i.e. the most acidic hydrogen atom on the molecule. In each structure, the proton attached to the oxygen will leave behind a negative charge on oxygen, and will generate a resonance stabilized conjugate base anion

below are shown only two of the possible resonance contributors for the conjugate base anion



the  $-CF_3$  substituent is termed an electron withdrawing group when attached to a pi-system such as this benzene ring, the withdrawing group stabilizes the anion base, resulting in a stronger conjugate acid C

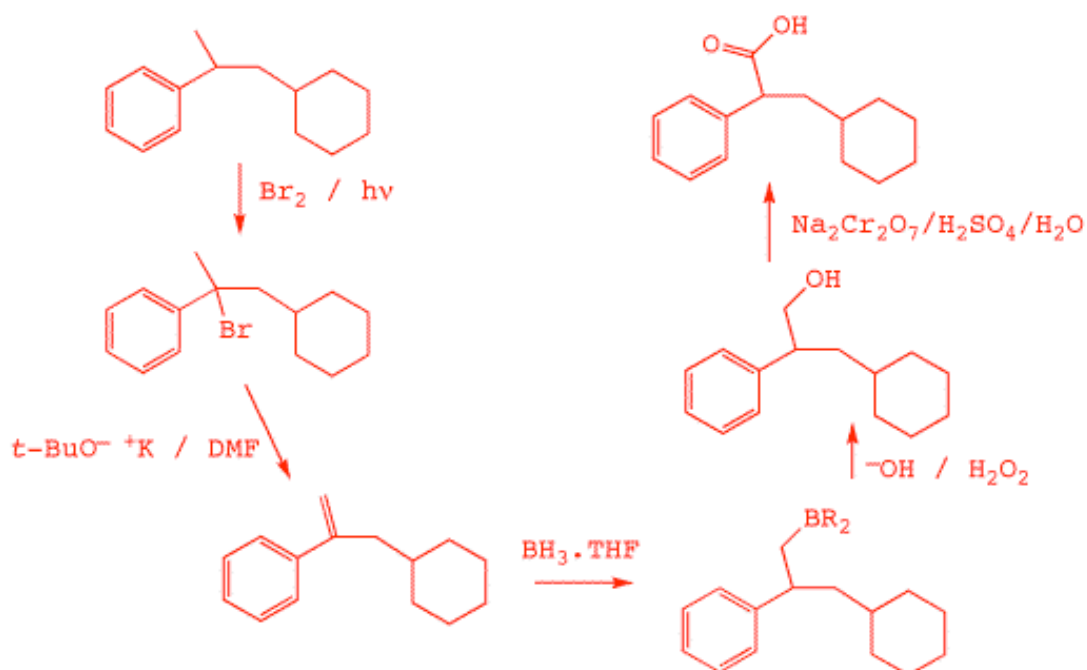
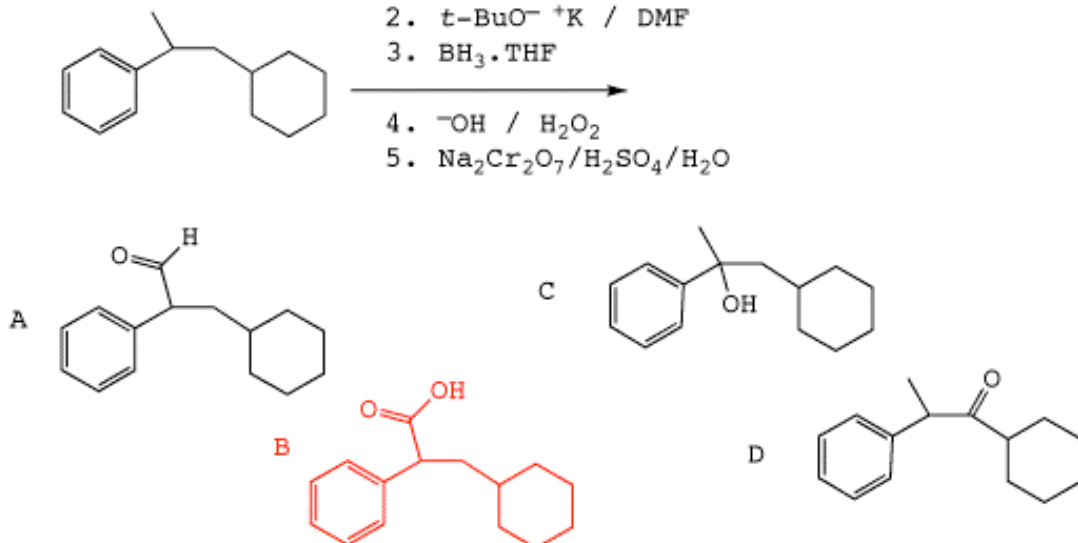
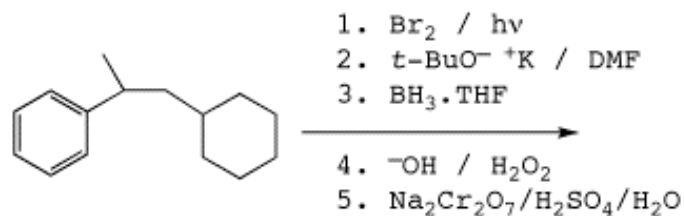
all 3 other substituents are termed electron donating on a pi-system, electron donation destabilizes the anions, resulting in weaker conjugate acids A, B and D

NOTE, when we say that the withdrawing group stabilizes IT, the IT is the conjugate BASE of the acid, the most stable anion corresponds to the strongest acid

## QUESTION 4

MC29e

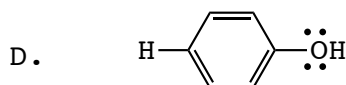
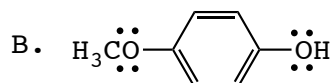
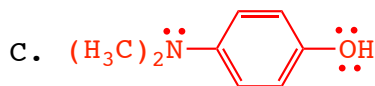
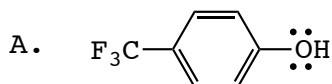
Give the product of the following reaction sequence with the starting material shown



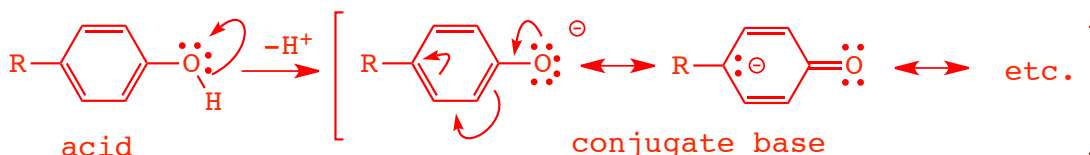
## QUESTION 5

MC291

Which is the *weakest* Bronsted acid?



as always with Bronsted acid/base questions, look at the conjugate base in each case. The weakest acid will correspond to the strongest conjugate base and vice versa. Determine the strongest conjugate base based on the usual factors that determine the energy, and thus reactivity, of the relevant non-bonding electrons.



-CF<sub>3</sub> substituent is inductive electron withdrawing, it thus stabilizes anion conjugate base, the anion with R = -CF<sub>3</sub> is thus the weakest base, thus the conjugate acid must be the strongest

-H neutral, intermediate acidity

-OCH<sub>3</sub> resonance electron donating substituent, destabilizes anion, results in higher energy, more reactive electrons, stronger base, thus weaker conjugate acid



resonance donating substituents on a  $\pi$ -system such as a benzene ring destabilize electrons of the negative charge, raising their energy, the resonance donation effect "wins" over any stabilizing inductive effect

-N(CH<sub>3</sub>)<sub>2</sub> is the strongest resonance electron donating of all the substituents, it destabilizes anion most, and results in strongest base and weakest conjugate acid. It is the strongest donating group because the non-bonding electrons are on a less electronegative element (N), are thus higher in energy, more likely to be involved in "resonance" donation

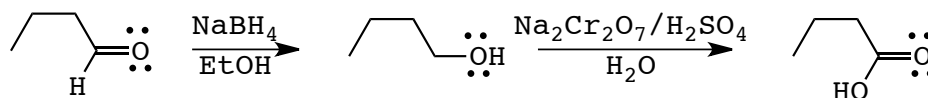
## QUESTION 6

MC29r

Identify the following reactions as indicated

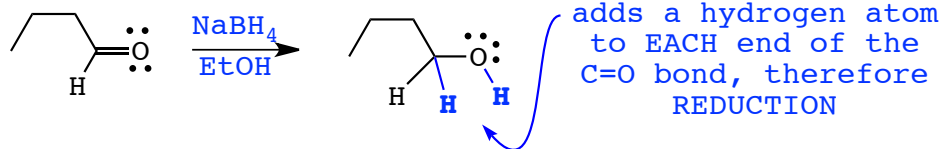
reaction 1

reaction 2

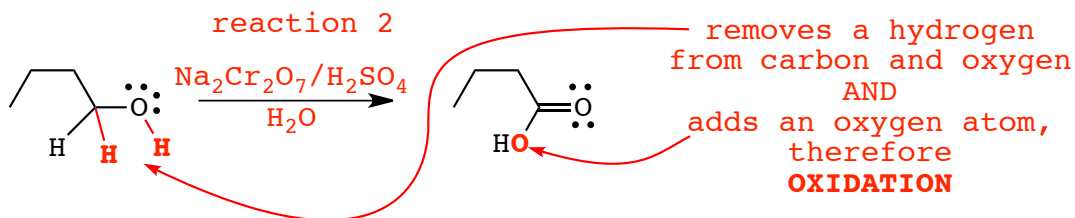


- A Reaction 1 is **oxidation** and Reaction 2 is **oxidation**
- B Reaction 1 is **oxidation** and Reaction 2 is **reduction**
- C Reaction 1 is **reduction** and Reaction 2 is **oxidation**
- D Reaction 1 is **reduction** and Reaction 2 is **reduction**
- 

reaction 1



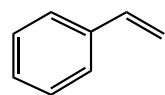
reaction 2



## QUESTION 7

MC29h

Give the product of the following reaction sequence with the starting material shown



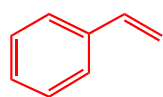
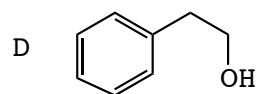
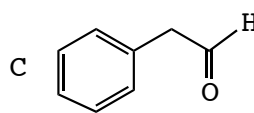
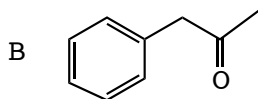
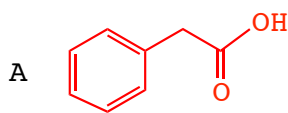
1.  $\text{Br}_2 / \text{CCl}_4$
2. Excess  $\text{NaNH}_2$ /heat
3.  $\text{H}_2\text{O}$

4.  $(\text{Sia})_2\text{BH}\cdot\text{THF}$

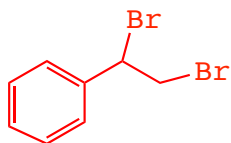
5.  $^- \text{OH} / \text{H}_2\text{O}_2$

6.  $\text{H}_2 / \text{Pt}$

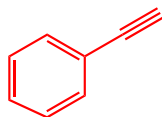
7.  $\text{Na}_2\text{Cr}_2\text{O}_7 / \text{H}_2\text{SO}_4$



$\text{Br}_2 / \text{CCl}_4$

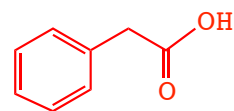


1. Excess  $\text{NaNH}_2$ /heat  
2.  $\text{H}_2\text{O}$

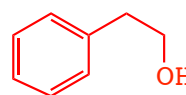


1.  $(\text{Sia})_2\text{BH}\cdot\text{THF}$

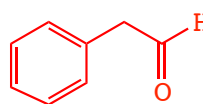
2.  $^- \text{OH} / \text{H}_2\text{O}_2$



$\text{Na}_2\text{Cr}_2\text{O}_7 / \text{H}_2\text{SO}_4$



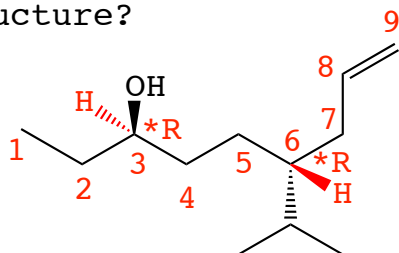
$\text{H}_2 / \text{Pt}$



## QUESTION 8

MC29n

Which is the correct IUPAC name for the following structure?



number to give the alcohol the lowest number, it takes priority

hydroxy is only used when the -OH is a substituent, and not the highest priority functional group

- A (3R)-hydroxy-(6S)-isopropylnon-1-ene
  - B (4R)-isopropylnon-1-en-(7R)-ol
  - C (6R)-isopropylnon-8-en-(3R)-ol
  - D (7R)-hydroxy-(4S)-isopropylnon-1-ene
-