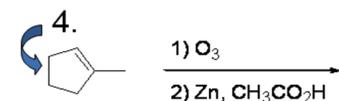
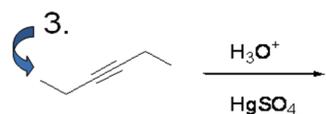
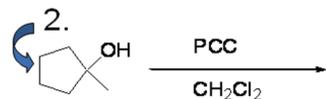
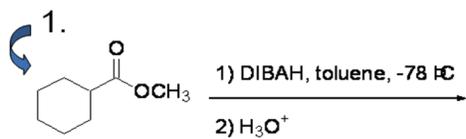
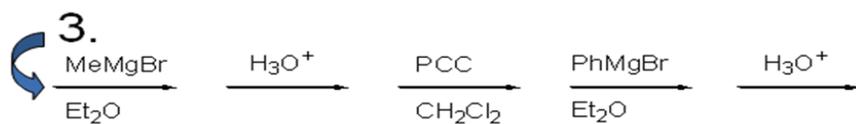
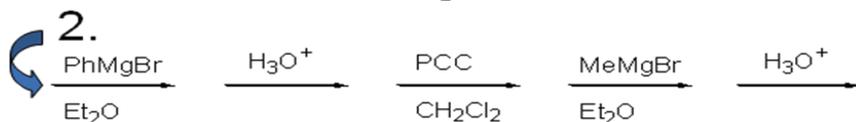
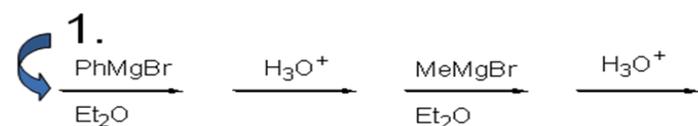
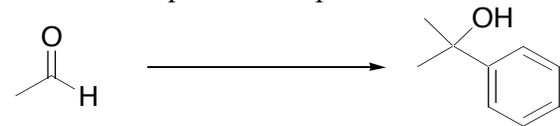


1. Which of the following will not produce an aldehyde or a ketone ?



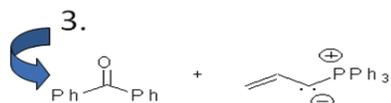
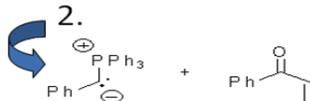
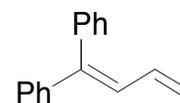
2. Which sequence will produce the following transformation?



4. Both (1) and (2) are possible

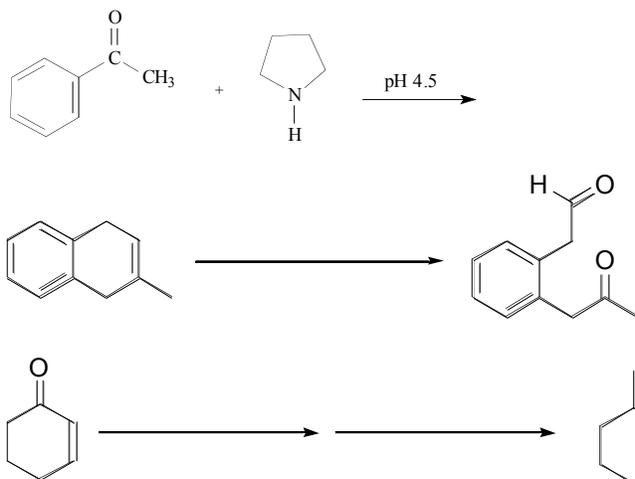
5. Both (2) and (3) are possible

3. Which combination of reagents will yield the following compound?

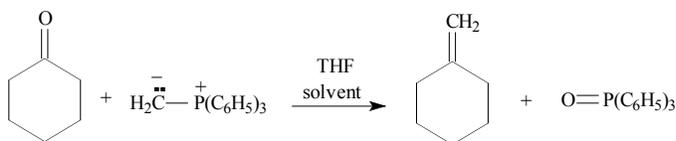


5. Both (2) and (3)

4. Supply the missing starting material(s), product(s), or reagents (s).



5. In the Wittig reaction, a phosphorus ylide adds to a ketone or aldehyde to yield an alkene. Write the complete stepwise mechanism for the Wittig reaction shown below. Show all intermediate structures and all electron flow with arrows.

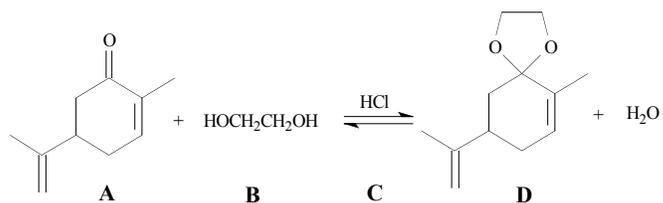


6. Show how the Wittig reaction might be used to prepare each of the following alkenes. Identify the alkyl halide and the carbonyl components that would be used in each synthesis.



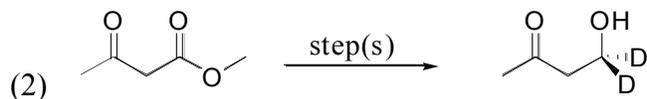
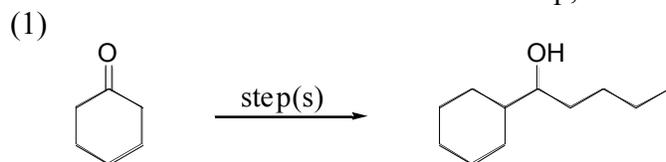
7. **A** ($\text{C}_5\text{H}_{12}\text{O}$) reacts rapidly with aqueous HCl to give **B** ($\text{C}_5\text{H}_{11}\text{Cl}$). Treatment of **B** with KOH in alcohol gives **2-methyl-2-butene** as the major product. Draw the structure of **A**.

8. Consider the reaction below to answer the following questions.



- (1) The nucleophile in this reaction is _____; The catalyst in this reaction is _____
- (2) The product of this reaction is called _____ (choices are: an ylide, an acetal, a *gem* diol, a hydrate)
- (3) Write the complete stepwise mechanism for this reaction. Show all electron flow with arrows and show all intermediate structures.

9. Show how the following conversions might be accomplished. Show all reagents and all intermediate structures. More than one step, but less than four steps are required.



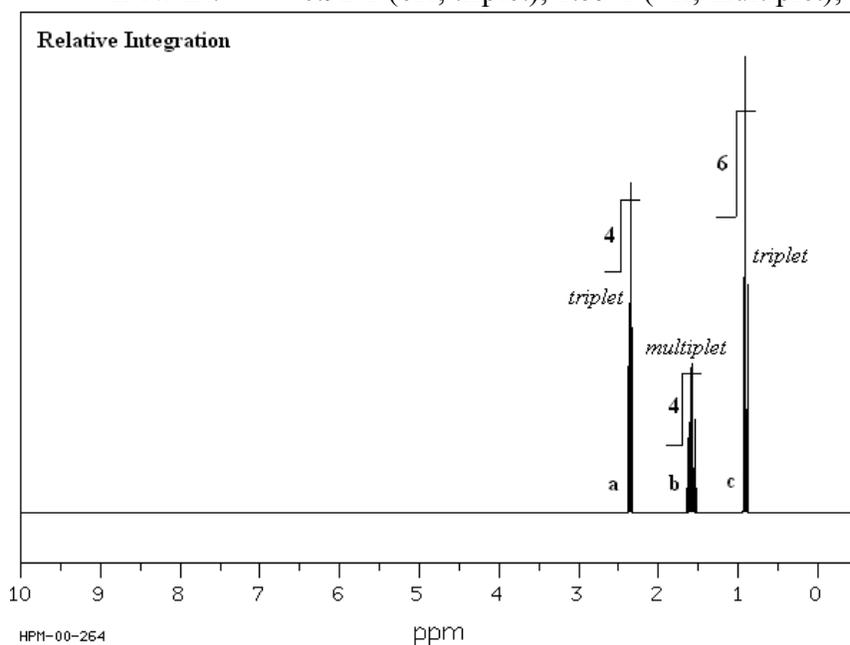
10. Consider the data below to answer the following questions.

Molecular formula: $C_7H_{14}O$

IR: 1715 cm^{-1}

MS: M^+ at $m/z = 114$, α -cleavage fragment at $m/z = 71$,

$^1\text{H NMR}$: $0.92\ \delta$ (6H, triplet), $1.59\ \delta$ (4H, multiplet), $2.36\ \delta$ (4H, triplet)



- (1) Calculate the degree of unsaturation for this compound.
- (2) What functional group is indicated by the IR data?
- (3) What fragment is indicated by MS data?
- (4) Propose a structure that is consistent with the provided spectroscopic data.
- (5) In your final structure label the non-equivalent hydrogens with **a**, **b**, **c**... as indicated in the NMR spectrum.