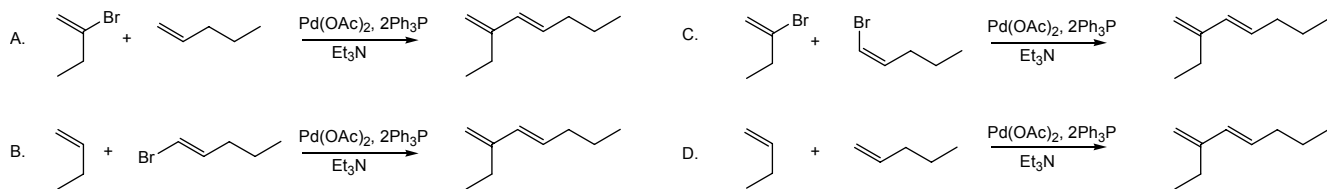


Multiple Choice 60 points

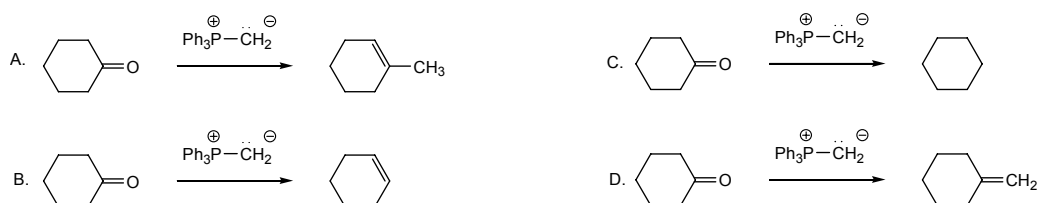
1. Choose the reaction that is correctly shown.

A



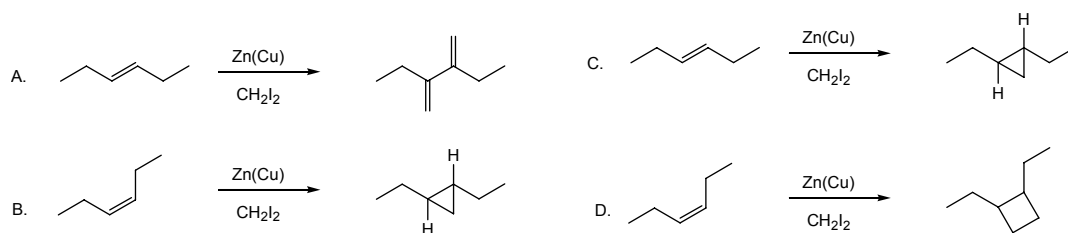
2. Choose the reaction that is correctly shown.

D



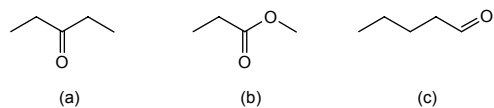
3. Choose the reaction that is correctly shown.

C



4. Choose the correct statement about the following carbonyl compounds.

D

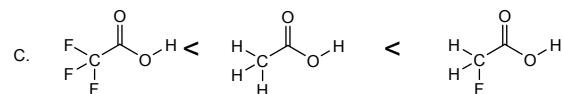
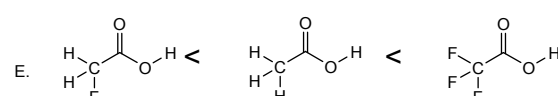
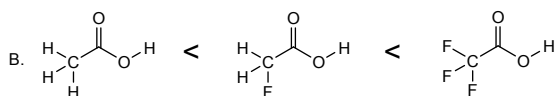
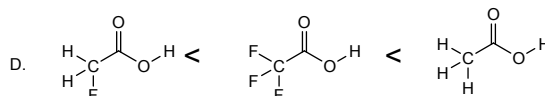
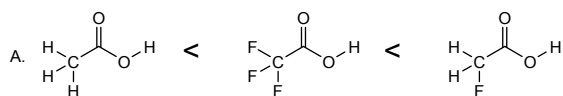


- A. Ketone (a) reacts faster with methyl lithium than aldehyde (c).
- B. Ketone (a) reacts faster with sodium borohydride than aldehyde (c).
- C. Ester (b) reacts faster with lithium aluminum hydride than ketone (a).
- D. Aldehyde (c) reacts faster with lithium aluminum hydride than ketone (a).
- E. Ester (b) reacts faster with lithium aluminum hydride than aldehyde (c).

# Form 0

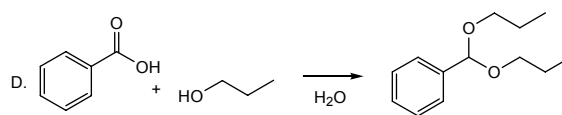
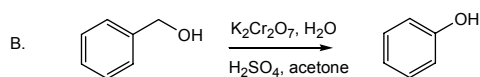
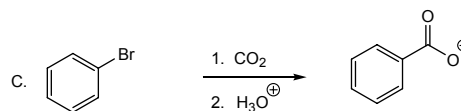
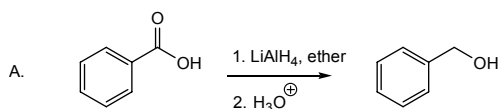
5. Choose the correct order of increasing acidity (most acidic on the right).

B

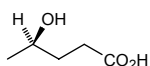


6. Choose the reaction that is correctly shown.

A



7. Choose a correct name for the structure shown on the right.

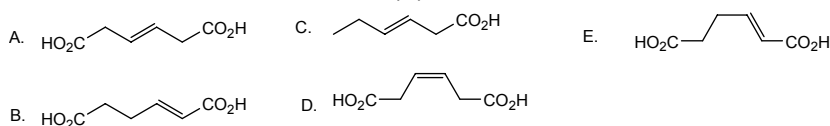


D

- A. (R)-3-hydroxybutanoic acid.
- B. (R)-3-hydroxypentanoic acid.
- C. 4-hydroxypentanoic acid.
- D. (R)-4-hydroxypentanoic acid.
- E. (R)-4-hydroxyhexanoic acid.

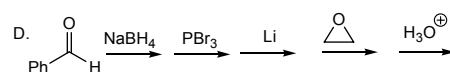
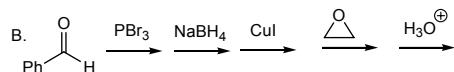
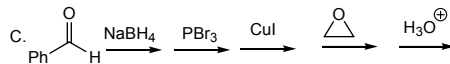
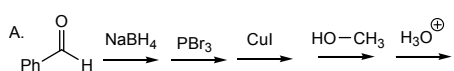
8. Choose the correct structure for (Z)-3-hexenedioic acid.

D



9. Select the method that could be used to prepare the compound shown on the right.

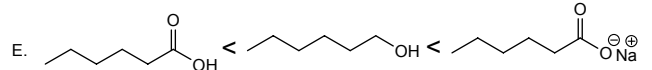
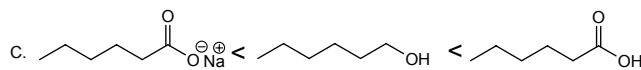
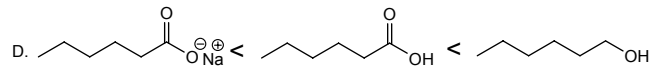
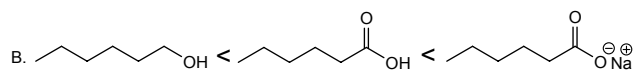
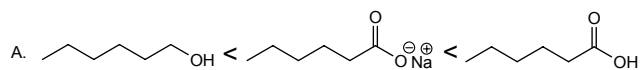
D



## Form 0

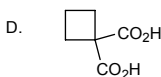
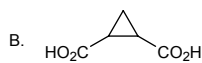
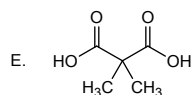
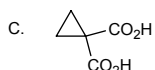
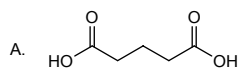
10. Choose the correct order for *increasing* solubility of the following compounds in water (most soluble on right).

B



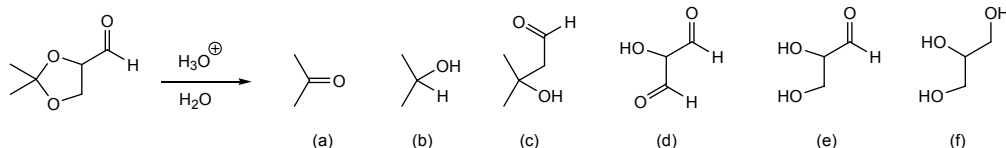
11. Choose the correct structure of the carboxylic acid with the formula  $C_5H_8O_4$  and the following  $^1H$ -NMR data:  $[\delta = 1.29$  (s, 6H);  $\delta = 11.3$  (s, 2H)].

E



12. Choose the correct product(s) of the following reaction.

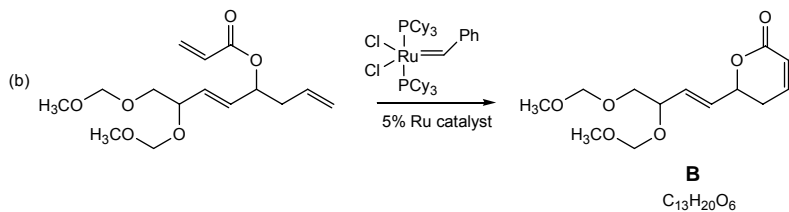
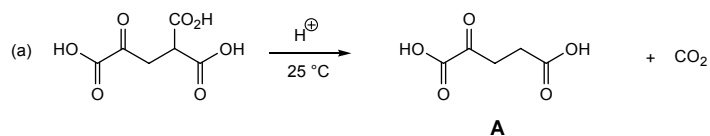
D



- A. (a) and (c)  
 B. (b) and (e)  
 C. (c) and (d)  
 D. (a) and (e)  
 E. (b) and (f)

## Short Answer. 40 points

13. Predict the products of the following reactions.

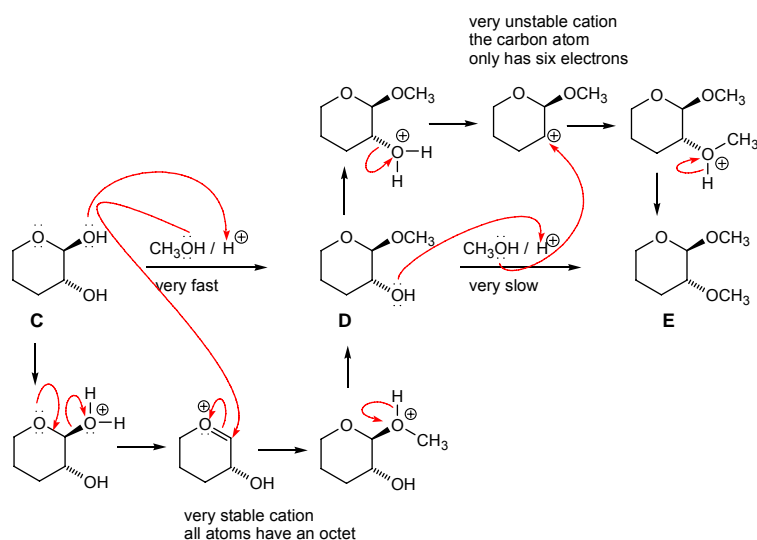


Form 0

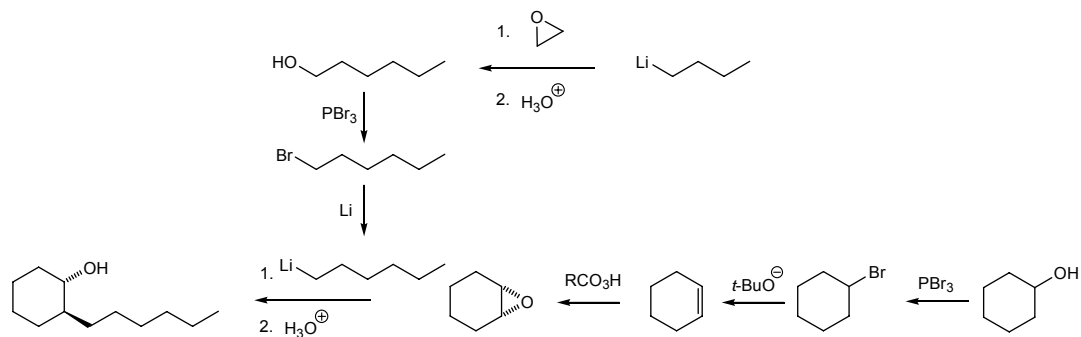
14. The conversion of C to D is very fast whereas the conversion of D to E is very slow.

(a) Using the curved arrow formalism, show the bond breaking and bond forming in the conversion of C to D.

(b) Give an explanation for why the conversion of D to E is slow compared to the conversion of C to D.



15. Propose a synthesis of the following compound from reactants containing four carbon atoms or less and cyclohexanol.



16. Propose a synthesis of the following ester from compounds containing four carbon atoms or less.

