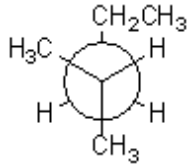
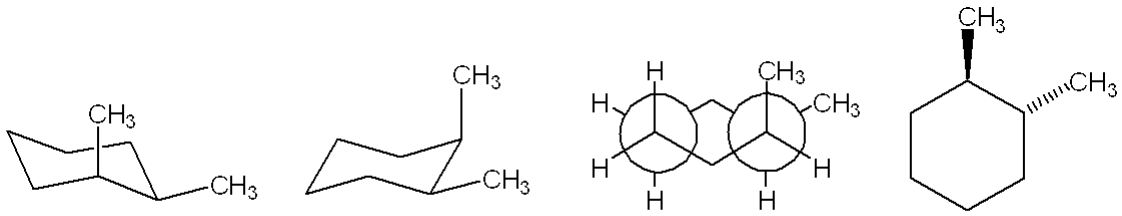
1. Provide a Newman projection of the most stable conformation of 2-methylpentane, $(CH_3)_2CHCH_2CH_2CH_3$, looking along the C2-C3 bond

ANS:



2. Which one of the following structures represents a different compound from the other three?

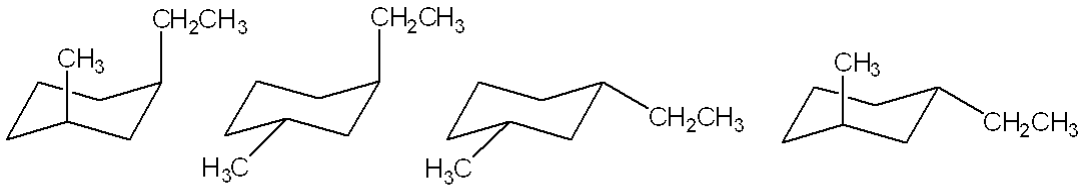


1 **2** **3** **4**

a. **1**
b. **2**
c. **3**
d. **4**

ANS: D

3. Which of the following is the most stable conformation of *trans*-1-ethyl-3-methylcyclohexane?

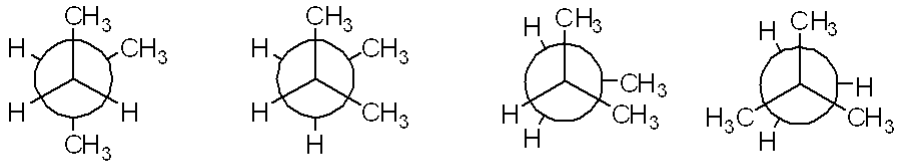


1 **2** **3** **4**

a. **1**
b. **2**
c. **3**
d. **4**

ANS: D

4. Which of the following Newman projections represents the most stable conformation of 2-methylbutane?

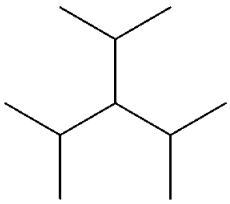


1 **2** **3** **4**

a. **1**
b. **2**
c. **3**
d. **4**

ANS: A

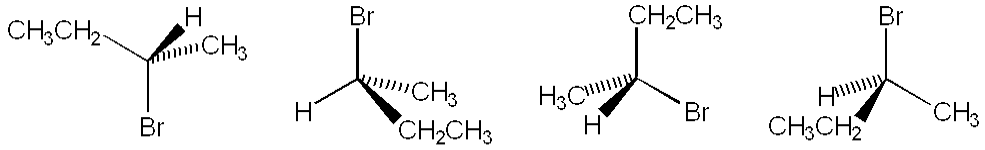
5. Name the following compound:



a. 2,4-dimethyl-3-isopropyl-pentane
b. 3-isopropyl-1,5-dimethylpentane
c. 3-isopropyl-2,4-dimethylpentane
d. triisopropylmethane

ANS: C

6. Which of the following structures is different from the other three?

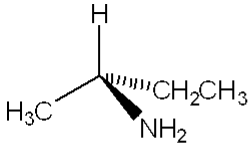


1 **2** **3** **4**

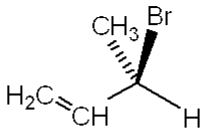
a. **1**
b. **2**
c. **3**
d. **4**

ANS: C

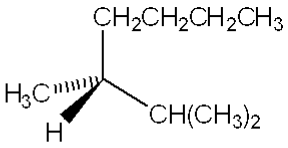
7. Which of the following have the *R* configuration?



1



2

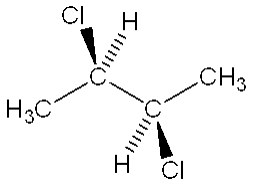


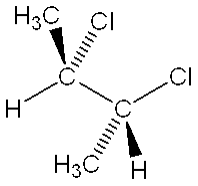
3

a. only **1**
b. only **2**
c. only **1** and **2**
d. **1**, **2** and **3**

ANS: D

8. What is the relationship between the following pair of structures?

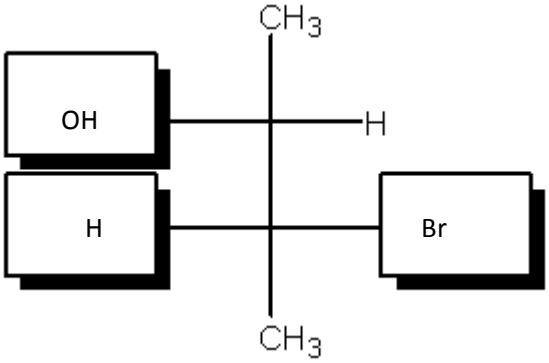




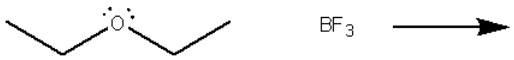
a. They are enantiomers
b. They are diastereomers
c. The are constitutional isomers
d. They are identical

ANS: D

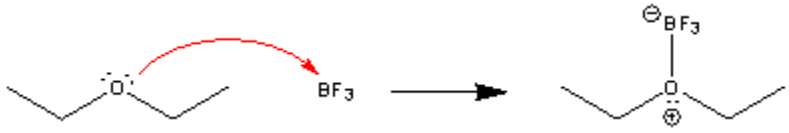
9. Complete the following Fischer diagram so that it represents (2*R*,3*R*)-3-bromobutan-2-ol.



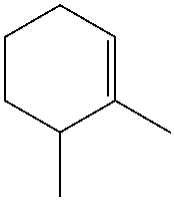
10. Use curved arrows to show the movement of pairs of electrons in the following reaction between a Lewis acid and a Lewis base, and show the structure of the product.



ANS:



11. What is the IUPAC name of the following compound?

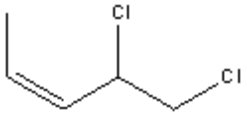


a. 1,2-dimethylcyclohexene
b. 2,3-dimethyl-1-cyclohexene
c. 1,2-dimethyl-2-cyclohexene
d. 1,6-dimethylcyclohexene

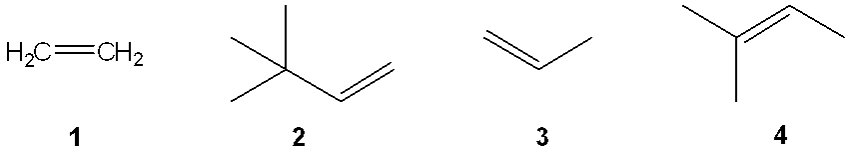
ANS: D

12. Provide the bond-line structure of (Z)-4,5-dichloro-2-pentene.

ANS:



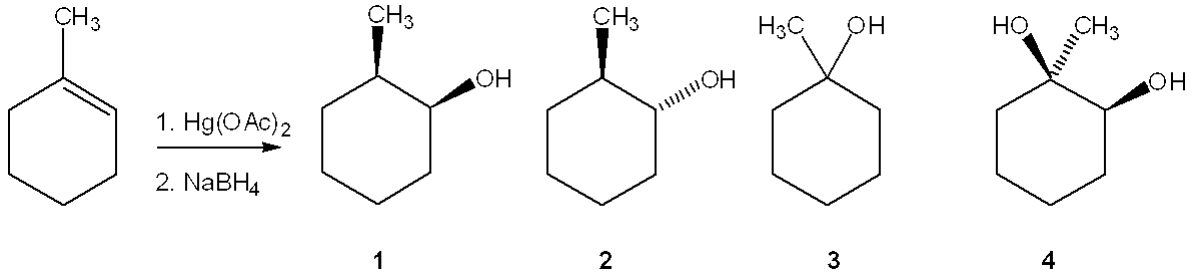
13. Which of the following alkenes is most likely to undergo rearrangement upon acid-catalyzed hydration (treatment with aqueous H_2SO_4)?



a. **1**
b. **2**
c. **3**
d. **4**

ANS: B

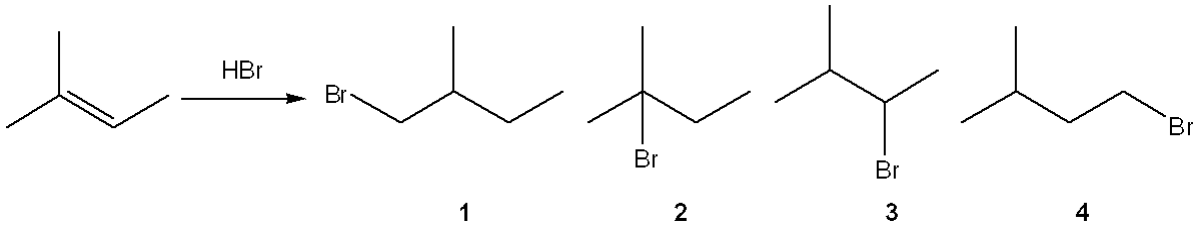
14. What is the major organic product obtained from the following reaction?



a. **1**
b. **2**
c. **3**
d. **4**

ANS: C

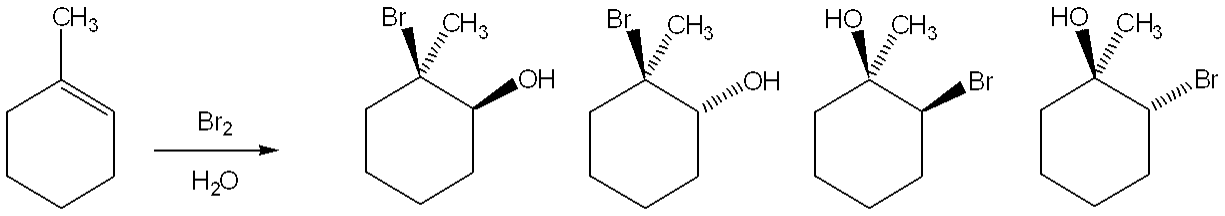
15. What is the major organic product obtained from the following reaction?



a. **1**
b. **2**
c. **3**
d. **4**

ANS: B

16. What is the major organic product obtained from the following reaction?

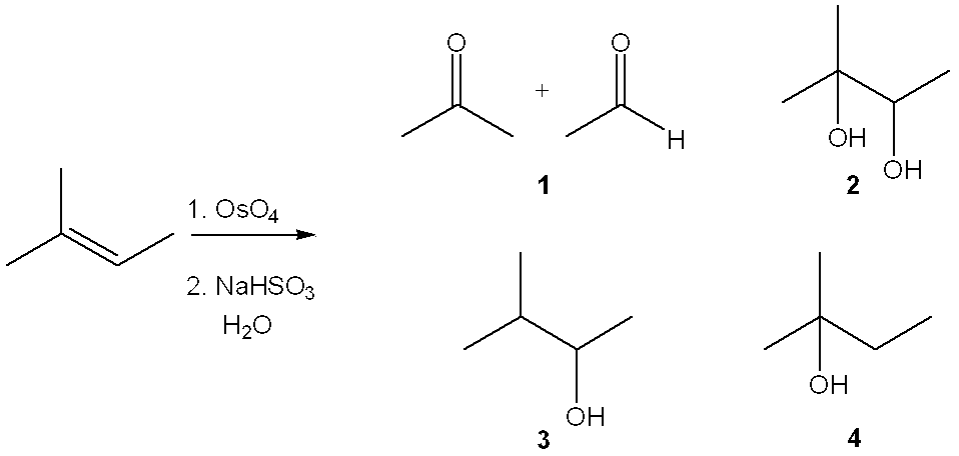


1 **2** **3** **4**

a. **1**
b. **2**
c. **3**
d. **4**

ANS: D

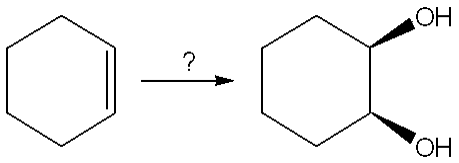
17. What is the major organic product obtained from the following reaction?



a. **1**
b. **2**
c. **3**
d. **4**

ANS: B

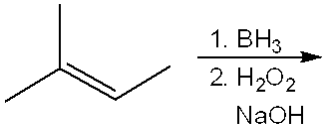
18. What is the best choice of reagent(s) to perform the following transformation?



a. H_2O, H_2SO_4
b. $HgSO_4$; followed by $NaBH_4$
c. BH_3; followed by H_2O_2
d. OsO_4; followed by $NaHSO_3$

ANS: D

19. What is the product of the following reaction?

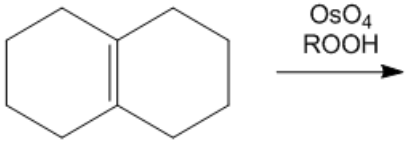


1. (*R*)-3-methyl-2-butanol
2. (*S*)-3-methyl-2-butanol
3. 2-methyl-2-butanol

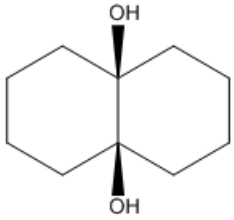
a. only **1**
b. only **2**
c. only **3**
d. only **1** and **2**

ANS: D

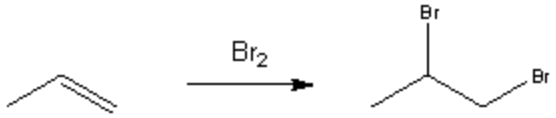
20. What is the product of the following reaction?



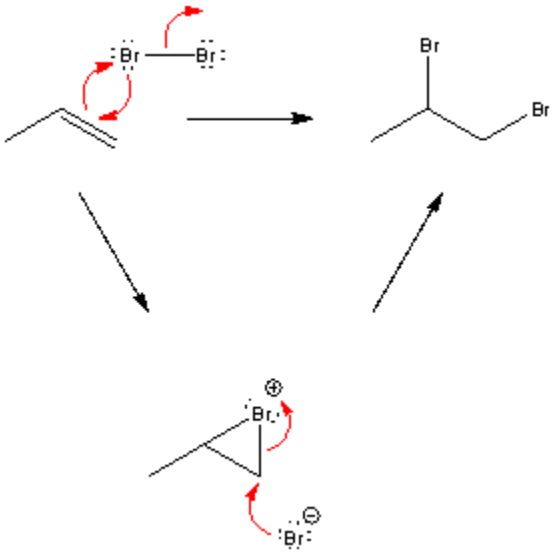
ANS:



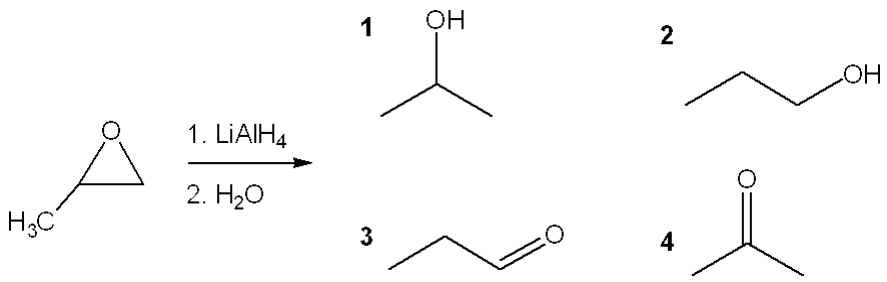
21. Provide a neatly drawn mechanism for the following reaction, including curved arrows to show the movement of pairs of electrons and the structure of reactive intermediates.



ANS:
The reaction proceeds in two steps:
1. Addition of bromine to propene to afford a cyclic bromonium ion
2. Nucleophilic ring-opening addition of bromide anion



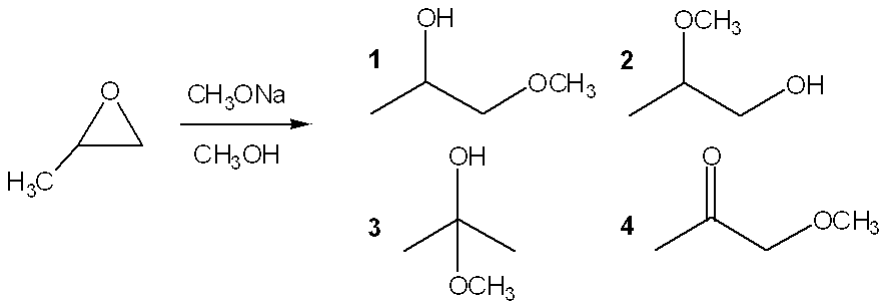
22. What is the major organic product obtained from the following reaction?



a. **1**
b. **2**
c. **3**
d. **4**

ANS: A

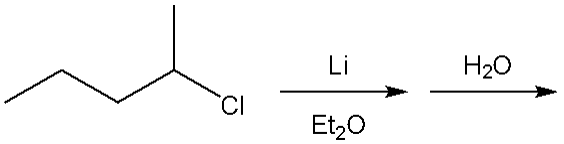
23. What is the major organic product obtained from the following reaction?



a. **1**
b. **2**
c. **3**
d. **4**

ANS: A

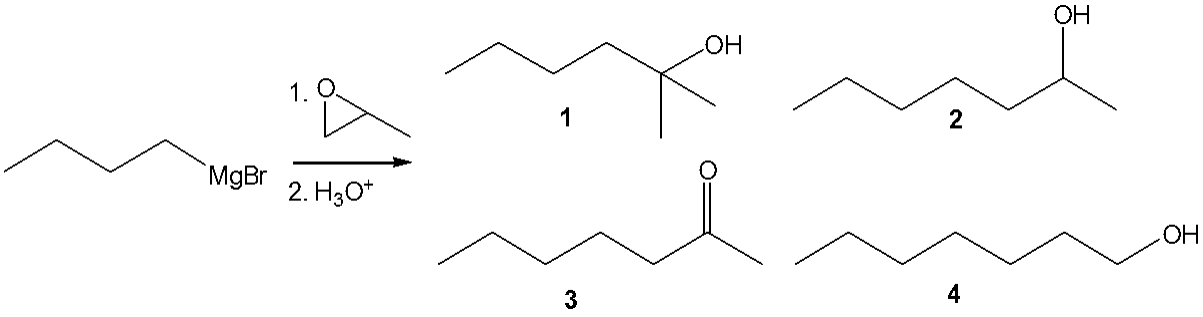
24. What is the major organic product obtained from the following sequence of reactions?



a. 2-pentanol
b. pentane
c. 1-pentene
d. (*E*)-2-pentene

ANS: B

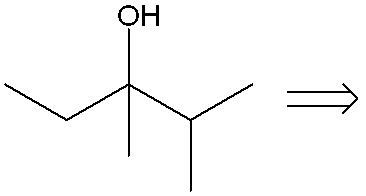
25. What is the major organic product obtained from the following reaction?

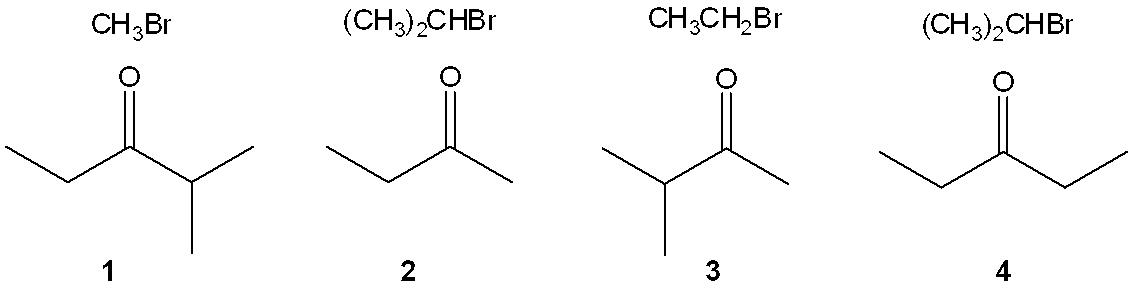


a. **1**
b. **2**
c. **3**
d. **4**

ANS: B

26. Which combination(s) of alkyl bromide and carbonyl compound can be used to prepare the following product by addition of the Grignard reagent derived from the alkyl bromide to the carbonyl compound?

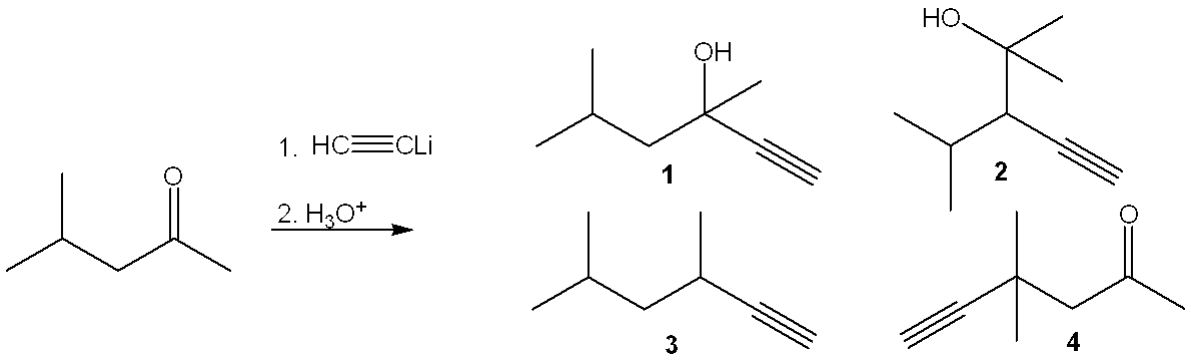




a. only **1** and **2**
b. only **3** and **4**
c. only **2** and **3**
d. only **1**, **2** and **3**

ANS: D

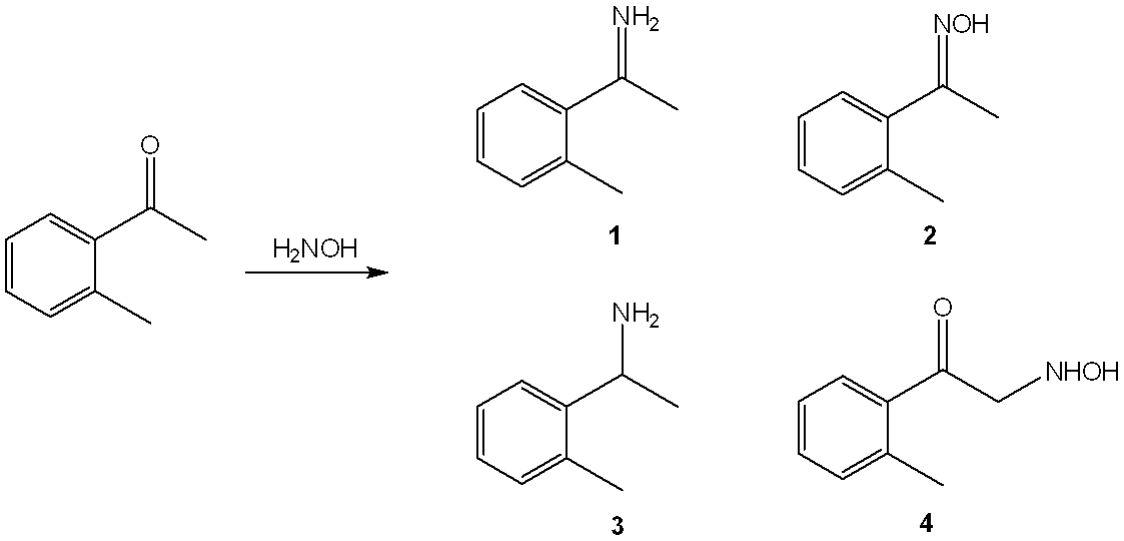
27. What is the major organic product obtained from the following reaction?



a. **1**
b. **2**
c. **3**
d. **4**

ANS: A

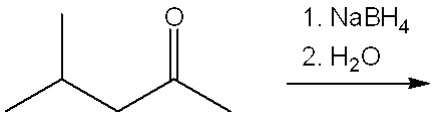
28. What is the major organic product obtained from the following reaction?



a. **1**
b. **2**
c. **3**
d. **4**

ANS: B

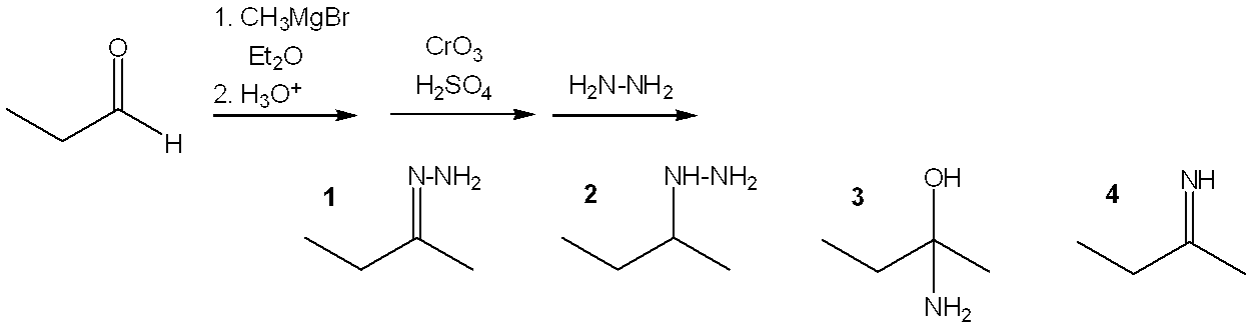
29. What is the major organic product obtained from the following reaction?



a. 2-methypentane
b. 4-methyl-2-pentanol
c. 4-methyl-1-pentene
d. (*E*) 4-methyl-2-pentene

ANS: B

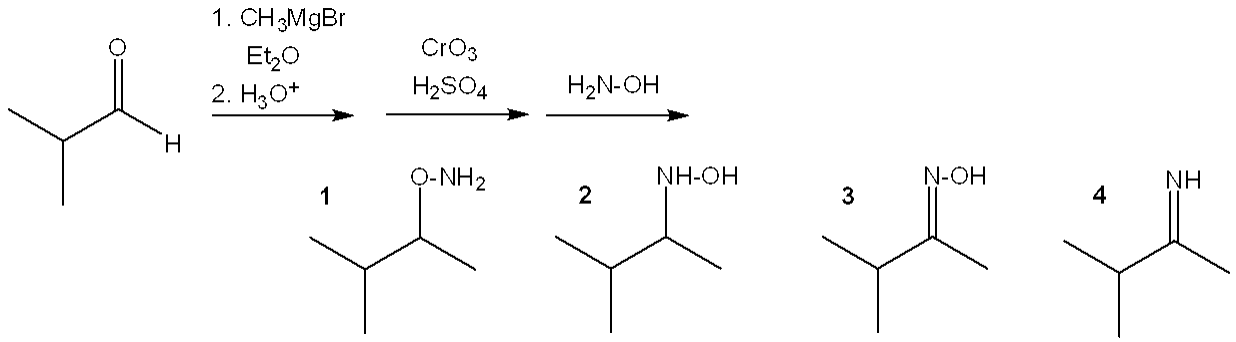
30. What is the major organic product obtained from the following sequence of reactions?



a. **1**
b. **2**
c. **3**
d. **4**

ANS: A

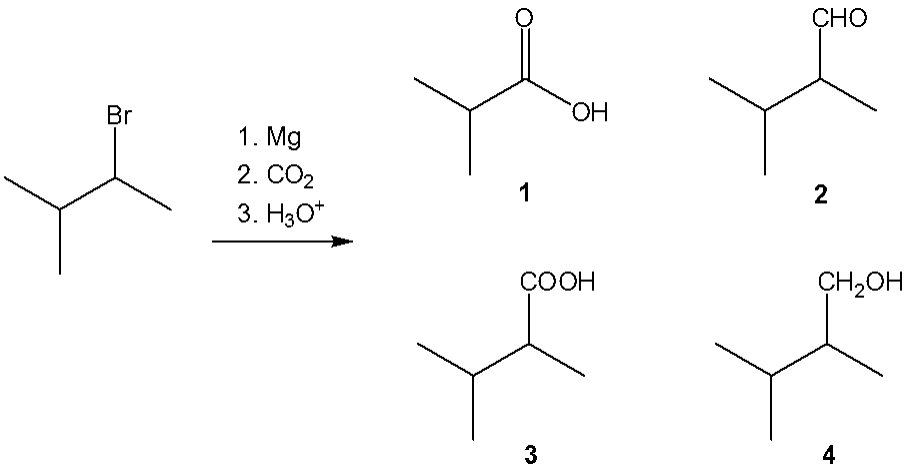
31. What is the major organic product obtained from the following sequence of reactions?



a. **1**
b. **2**
c. **3**
d. **4**

ANS: C

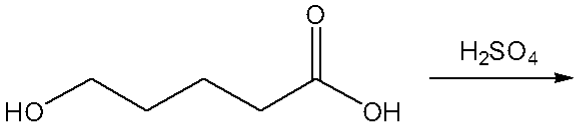
32. What is the major organic product obtained from the following reaction?

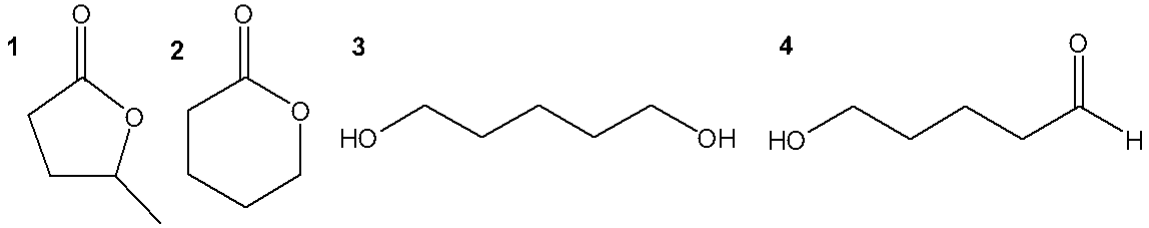


a. **1**
b. **2**
c. **3**
d. **4**

ANS: C

33. What is the major organic product obtained from the following reaction?

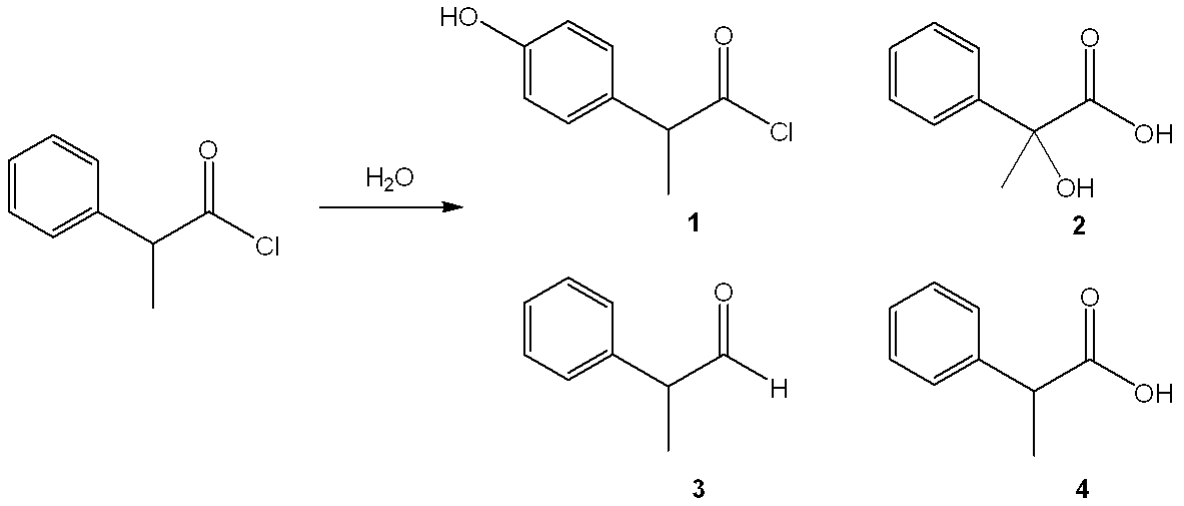




a. **1**
b. **2**
c. **3**
d. **4**

ANS: B

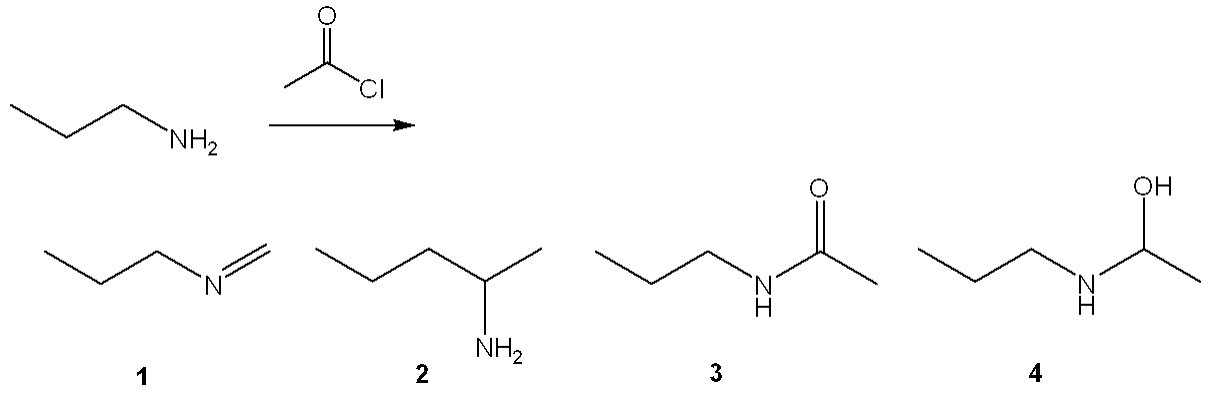
34. What is the major organic product obtained from the following reaction?



a. **1**
b. **2**
c. **3**
d. **4**

ANS: D

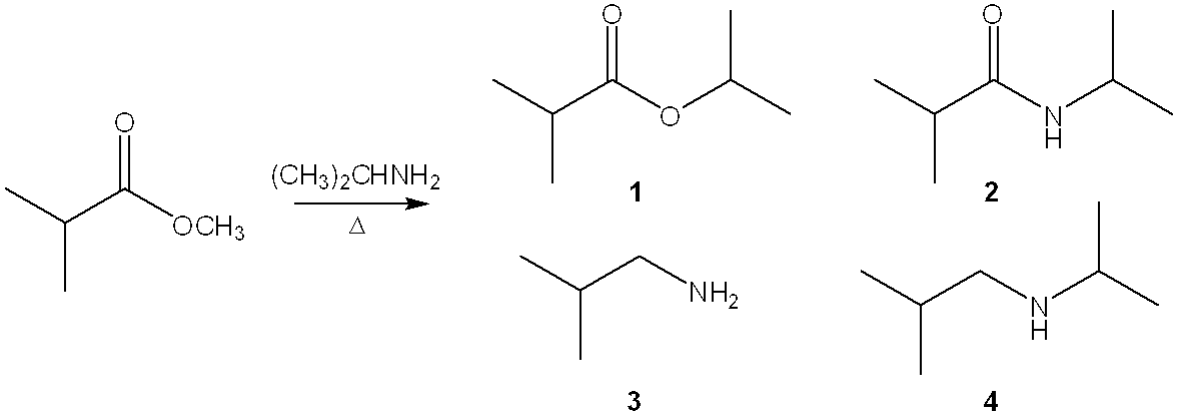
35. What is the major organic product obtained from the following reaction?



a. **1**
b. **2**
c. **3**
d. **4**

ANS: C

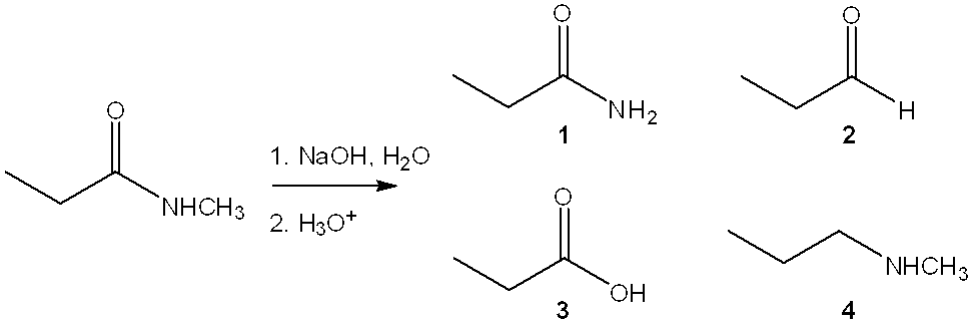
36. What is the major organic product obtained from the following reaction?



a. **1**
b. **2**
c. **3**
d. **4**

ANS: B

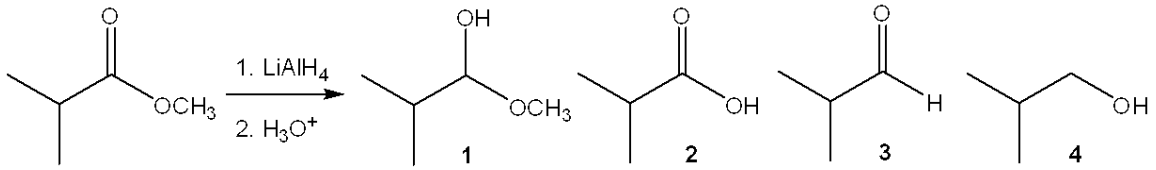
37. What is the major organic product obtained from the following reaction?



a. **1**
b. **2**
c. **3**
d. **4**

ANS: C

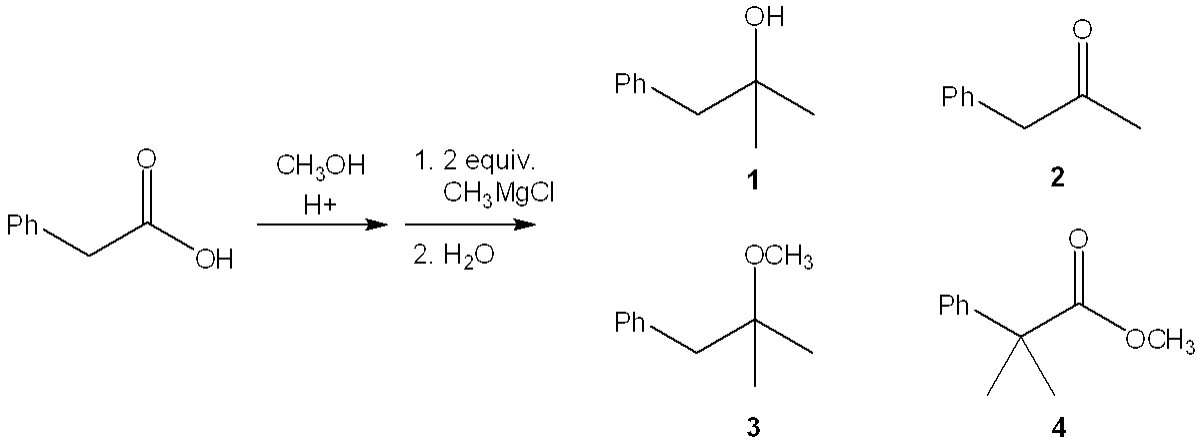
38. What is the major organic product obtained from the following reaction?



a. **1**
b. **2**
c. **3**
d. **4**

ANS: D

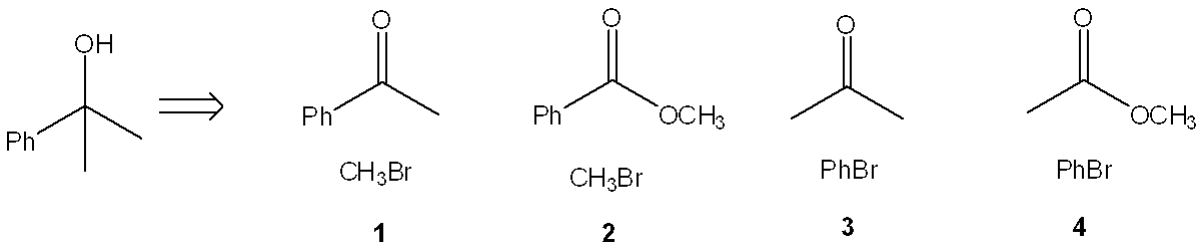
39. What is the major organic product of the following sequence of reactions?



a. **1**
b. **2**
c. **3**
d. **4**

ANS: A

40. Which combination(s) of organic bromide and carbonyl compound can be used to prepare the following product by reaction of the Grignard reagent derived from the alkyl bromide with the carbonyl compound?



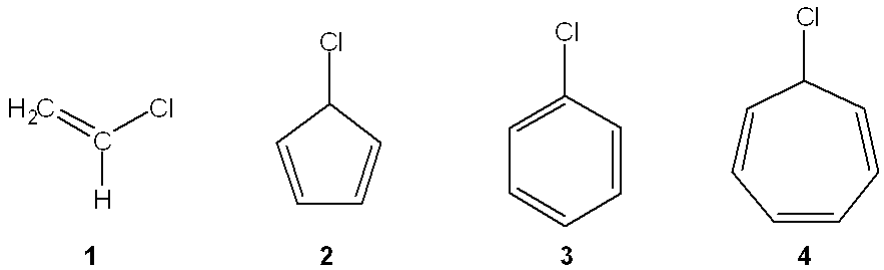
a. only **1**
b. only **1** and **2**
c. only **1**, **2** and **3**
d. **1**, **2**, **3** and **4**

ANS: C

41. Which of the following compounds is antiaromatic?
a. ethane
b. cyclobutadiene
c. benzene
d. cyclooctatetraene

ANS: B

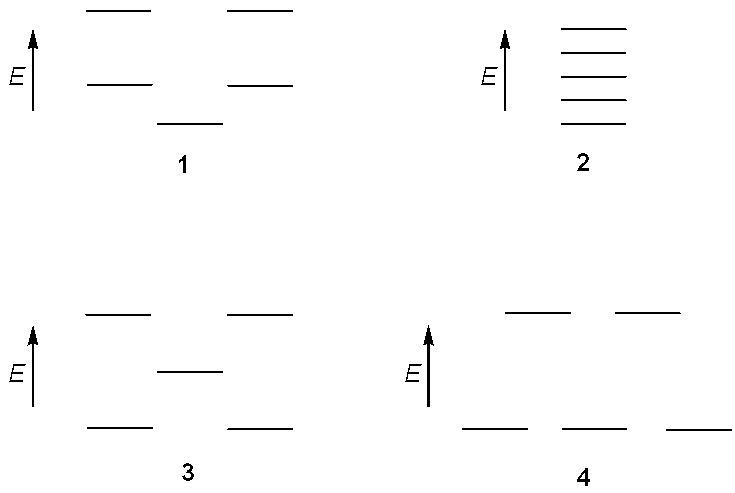
42. Which of the following compounds undergoes heterolytic carbon-halogen bond cleavage to form a stable organic cation?



a. **1**
b. **2**
c. **3**
d. **4**

ANS: D

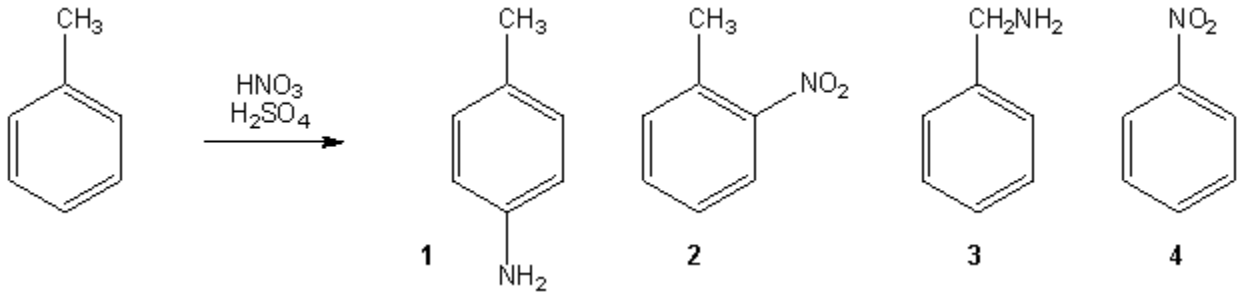
43. Which of the following represents the energy levels of the molecular orbitals of cyclopentadienyl anion?



a. **1**
b. **2**
c. **3**
d. **4**

ANS: A

44. What is the major organic product obtained from the following reaction?



a. **1**
b. **2**
c. **3**
d. **4**

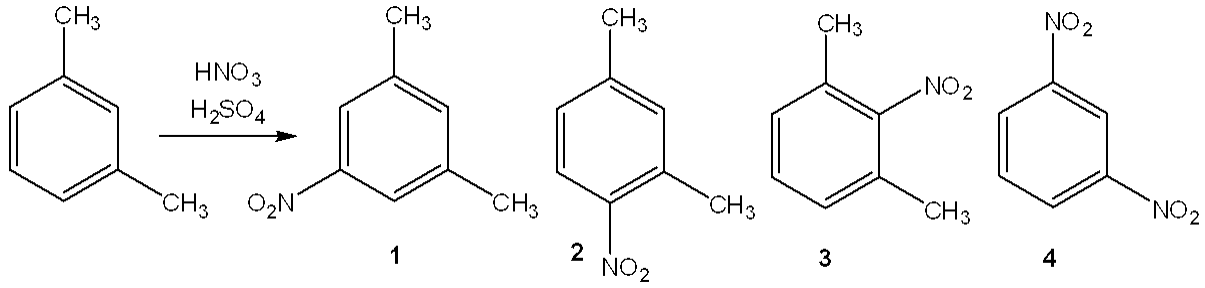
ANS: B

45. Which of the following undergoes the most rapid sulfonation upon treatment with fuming sulfuric acid?

a. benzene
b. benzoic acid
c. benzonitrile
d. nitrobenzene

ANS: A

46. What is the major organic product obtained from the following reaction?



a. **1**
b. **2**
c. **3**
d. **4**

ANS: B