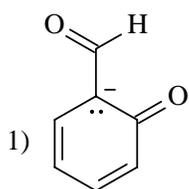
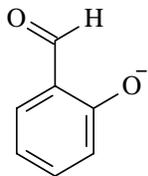
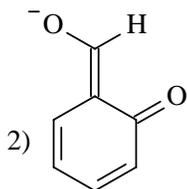


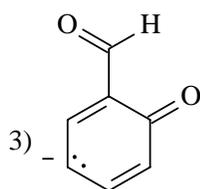
1. Which one of the following is not a resonance form of the phenolate ion shown below?



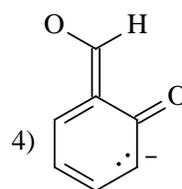
1) 1



2) 2

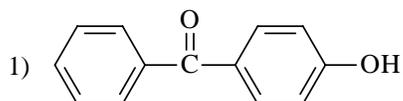
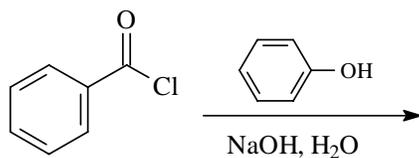


3) 3

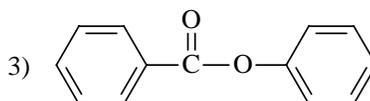


4) 4

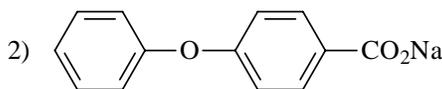
2. What is the product of the following reaction?



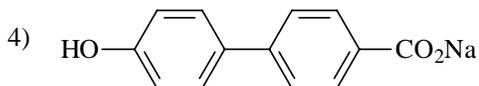
1) 1



3) 3

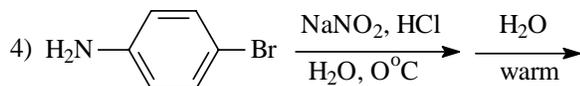
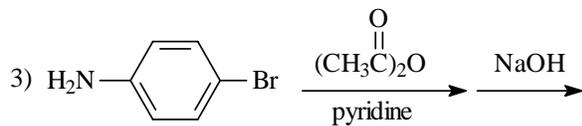
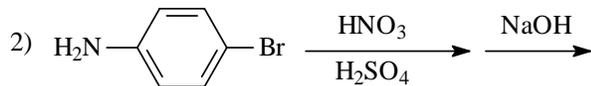
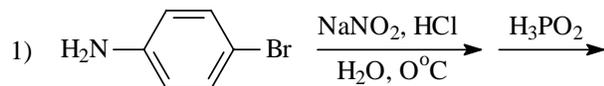


2) 2



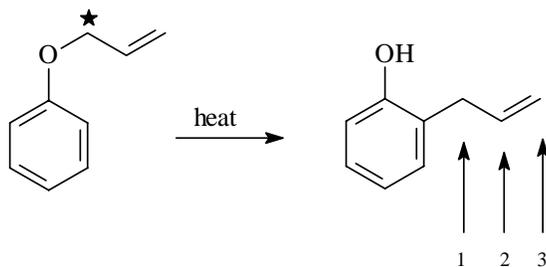
4) 4

3. Which reaction sequence below converts *para*-bromoaniline into *para*-bromophenol?



- 1) 1 2) 2 3) 3 4) 4

4. Indicate where the isotopically labelled carbon atom (*) is located in the product.



- 1) #1
2) #2
3) #3
4) equally distributed between #1 and #2
5. Arrange the following in order of decreasing acidity.

- A. benzoic acid ($C_6H_5CO_2H$)
B. benzyl alcohol ($C_6H_5CH_2OH$)
C. phenol (C_6H_5OH)

- 1) C>A>B
2) C>B>A
3) A>B>C
4) A>C>B

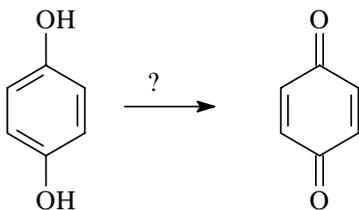
6. Which compound in each of the pairs of compounds shown below is the stronger acid?

A. phenol and B. cyclohexanol

C. phenol and D. *p*-nitrophenol

- 1) A and C 2) A and D 3) B and C 4) B and D

7. Identify the reagent(s) needed to carry out the following conversion.

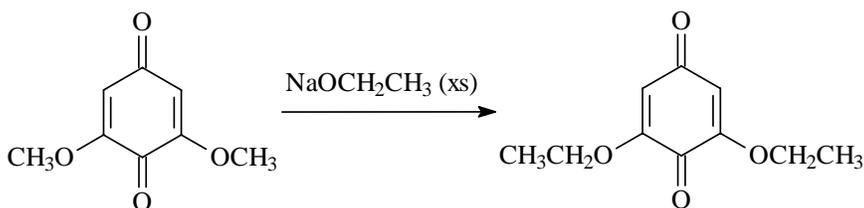


- 1) Na metal 2) LiAlH₄
3) Na₂Cr₂O₇, H₂SO₄/H₂O 4) NaOH

8. Which one of the following reacts with aqueous HCl to give phenol?

- 1) C₆H₅CN 2) CH₃CO₂C₆H₅ 3) C₆H₅CH=O 4) C₆H₅NHNH₂

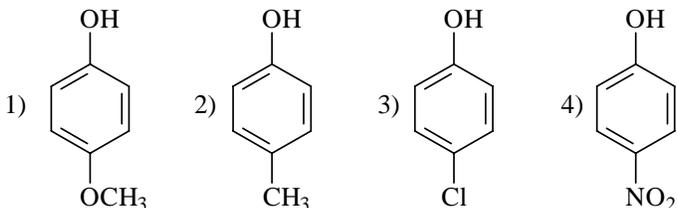
9. Propose a mechanism for the reaction shown below.



10. Which one of the following ethers is the most unreactive to cleavage with HBr?

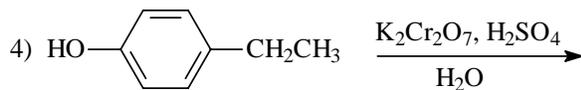
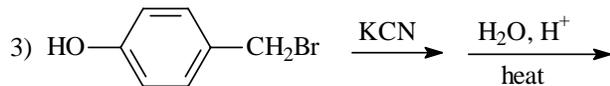
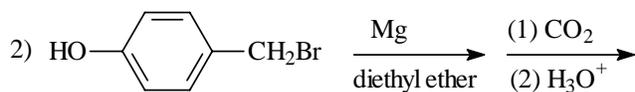
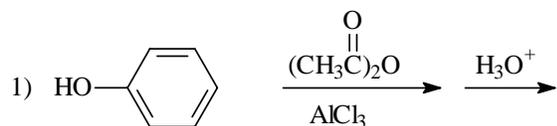
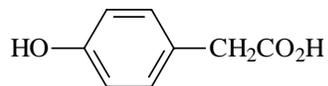
- 1) C₆H₅OCH₂C₆H₅ 2) C₆H₅OC₆H₅
3) H₂C=CHCH₂OCH₂CH=CH₂ 4) (CH₃)₃COC(CH₃)₃

11. Which one of the following phenols is most acidic?



- 1) 1 2) 2 3) 3 4) 4

12. Which of the following methods works best to synthesize the compound shown below?



1) 1

2) 2

3) 3

4) 4