Ethers and Epoxides

Draw structures corresponding to each of the following IUPAC names.

1. tetrahydrofuran

2. 12-crown-4

4. allyl benzyl ether

5. diethyl ether
6. Write the complete stepwise mechanism for the reaction. Show all intermediate structures and all electron flow with arrows.

7. What is the name of this reaction procedure

8. Mechanistically, the reaction outlined above is:
   a. an E1 process
   b. an S_N1 process
   c. an E2 process
   d. an S_N2 process

9. Alternatively, cyclopentyl methyl ether may be synthesized from cyclopentene. Outline a synthesis of cyclopentyl methyl ether from cyclopentene.
10. Diphenyl ether is inert to cleavage by HI or HBr. Explain.

![Diphenyl Ether Reaction](image)

11. Write the complete stepwise mechanism for the reaction below. Show all electron flow with arrows and draw all intermediate structures.

![Cyclohexene Reaction](image)
Consider the data below to answer the following questions.

Acetals are a special class of ethers which have two ether linkages at a single carbon. Tetrahydropyranyl ethers are acetics that are easily cleaved with mild aqueous acids at room temperature to yield alcohols.

12. Draw the mechanism for this transformation showing the electron flow using curved arrows.

13. This ether cleavage occurs so easily under such mild conditions because the carbocation intermediate in step two is very stable. Explain why this carbocation is stabilized.
When 1,2-epoxypropane is treated with sodium ethoxide in ethanol 1-epoxy-2-propanol is the major product while only a trace amount of 2-ethoxy-1-propanol is produced. Show the mechanisms and explain these results.
Consider the data below to answer the following questions.

Epoxides are synthesized industrially in one step by silver oxide air oxidation of ethylene and on a laboratory scale in one step by treating an alkene with $m$-chloroperoxybenzoic acid. An alternative two step process converts alkenes to halohydrins, which are converted by treatment with base to epoxides.

15. Show the mechanism with electron flow arrows for each step in the above transformation.

16. The synthesis of epoxides by base treatment of halohydrins is an example of an intramolecular:
   a. $S_N 1$ reaction
   b. hydrolysis reaction
   c. dehydration reaction
   d. Williamson ether synthesis
Propose structure(s) for the starting material(s), reagent(s), or major organic product(s) of the following reactions or sequences of reactions. Show all relevant stereochemistry.

17. \[ \text{Propose structure(s).} \]

2. \[ \text{Propose structure(s).} \]

3. \[ \text{Propose structure(s).} \]

4. \[ \text{Propose structure(s).} \]

5. \[ \text{Propose structure(s).} \]
18. Choose the best reagent for carrying out the following reactions from the list below. Place the letter of the reagent(s) in the box over the reaction arrow. Only one letter per box.

A. NaH, then CH$_3$I  
B. NaOCH$_3$, CH$_3$OH  
C. $m$-ClC$_6$H$_4$CO$_2$H  
D. CH$_3$MgBr in ether, then H$_3$O$^+$  
E. warm H$_2$SO$_4$/H$_2$O  
F. Hg(O$_2$CCF$_3$)$_2$, CH$_3$OH  
G. H$_2$/Pd  
H. PCC, CH$_3$Cl$_2$  
I. Cl$_2$, H$_2$O  
J. LiAlH$_4$ in ether, then H$_3$O$^+$