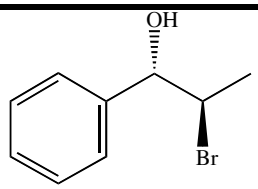
Many of the questions on this exam refer to molecule **A**.



Molecule **A**

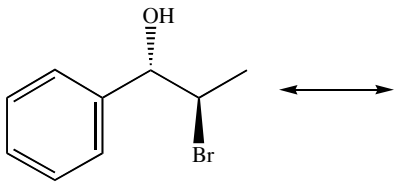
1. (3 points) Name the functional groups in molecule **A**.

2. (4 points) Circle the best response in each case.

   (a) The best estimate for the two Br-C-C bond angles is: 107.0° 109.5° 110.0°

   (b) The bond with the most electron-poor hydrogen is: C-O-H Br-C-H C-C-H

3. (3 points) Draw another important resonance contributor for molecule A. Include all lone pairs and formal charges.



Contributor I Contributor II

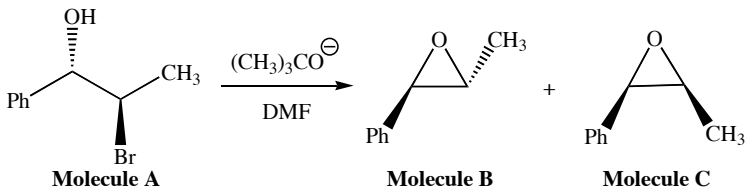
   The most important resonance contributor is (circle one): I II About the same

4. (5 points) Using a Newman projection, draw the most stable conformation of molecule **A** as viewed along the carbon-carbon bond bearing the OH and Br. Put the C-Br in the front.

   Which of these are gauche (circle all that apply): CH_3/H Br/CH_3 Br/OH Ph/CH_3

5. (2 points) If molecule **A** had a fluorine instead of a bromine, the molecule's total torsional strain would be (circle one): Higher Lower About the same

Reaction of molecule **A** with $(CH_3)_3CO^-$ might form molecules **B** and/or **C**.



Molecule A **Molecule B** **Molecule C**

6. (2 points) Draw the enantiomer of molecule **B**.

7. (2 points) Comparing the ring strain of molecule **B** and its enantiomer, which has more ring strain? (Circle one):

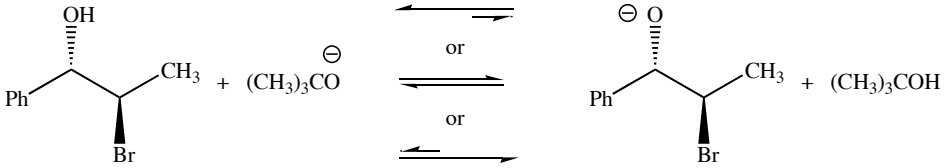
Molecule **B** Enantiomer of **B** Strain is equal

8. (2 points) Draw a diastereomer of molecule **B**.

9. (2 points) Molecule **C** is (circle all that apply):

Chiral Achiral Optically active Optically inactive Meso

10. (2 points) Molecule **A** is a stronger acid than $(CH_3)_3COH$. Circle the appropriate equilibrium arrows.



Molecule A

11. (6 points) Briefly explain how the following factors influence the relative acidities of $(CH_3)_3COH$ and molecule **A**. Use no more than two sentences in each case.

Resonance:

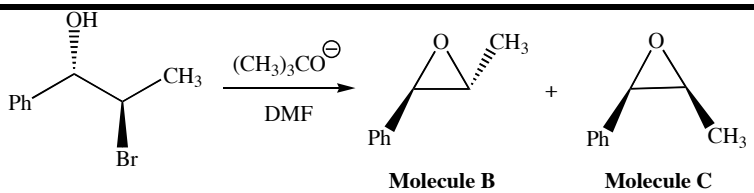
Inductive effect:

12. (2 points) Circle the correct statement concerning the pK_a values of $(CH_3)_3COH$ and $(CH_3)_3CSH$.

$(CH_3)_3COH < (CH_3)_3CSH$ Values about equal $(CH_3)_3COH > (CH_3)_3CSH$

13. (2 points) Finish this sentence in five words or less: The stereochemistry of any S_N2 reaction is a result of...

Questions 14 – 17 refer to this reaction:



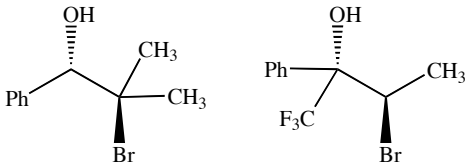
Molecule B **Molecule C**

14. (2 points) Circle the major product of this reaction.

15. (4 points) Write a mechanism to show how the major product is formed.

16. (2 points) Write the rate expression for this reaction. Assume the proton transfer step is not rate determining.

17. (8 points) Consider these molecules, the circle the best answer in each case.



Molecule **D** Molecule **E**

(a) When the reaction solvent is changed from DMF to CH_3OH, the reaction rate:

Increases Decreases Does not change significantly

(b) When the Br of molecule **A** is changed to Cl, the reaction rate:

Increases Decreases Does not change significantly

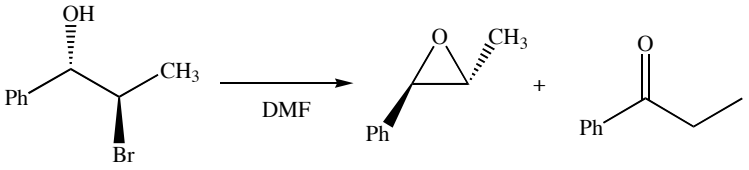
(c) When molecule **A** is changed to molecule **D**, the reaction rate:

Increases Decreases Does not change significantly

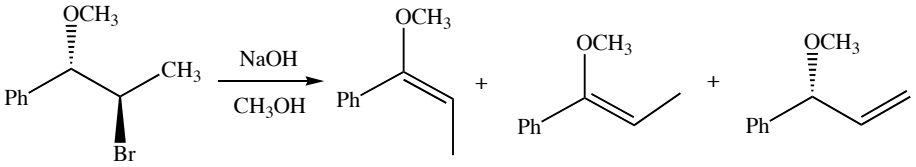
(d) When molecule **A** is changed to molecule **E**, the reaction rate: (circle one):

Increases Decreases Does not change significantly

18. (10 points) Write an S_N1 mechanism that accounts for the reactions products shown.



Questions 19 - 23 refer to this reaction:

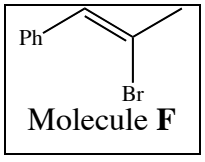


19. (2 points) Circle the major product.

20. (2 points) The mechanism for the major product is (circle one): E1 E2

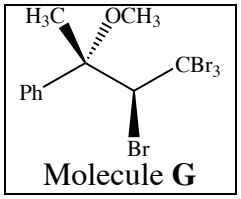
21. (2 points) Write the mechanism for the formation of the major product.

22. (2 points) Finish this sentence in 20 words or less: Molecule **F** is not formed in this reaction because...

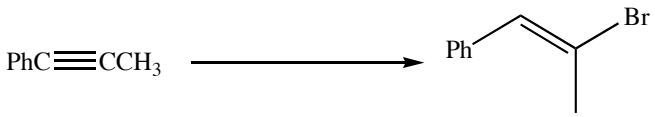


23. (2 points) When molecule **A** is changed to molecule **G**, the rate of the elimination reaction is (circle one):

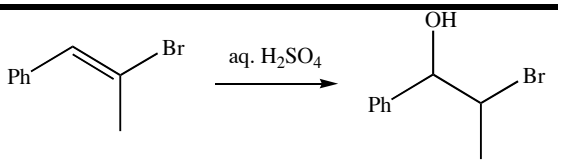
Increased Decreased Does not change significantly.



24. (2 points) Write the missing reagents above and/or below the reaction arrow.



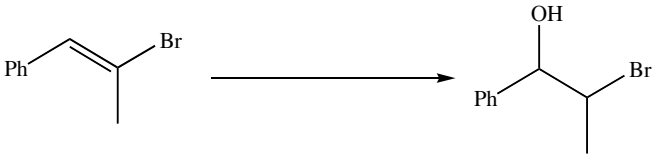
Questions 25 - 27 refer to this reaction:



25. (11 points) Write the mechanism. Label the rate-determining step as "rds."

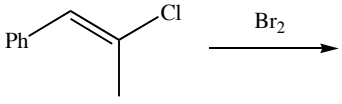
26. (1 point) Does this reaction obey Markovnikov's Rule? Yes No Can't determine

27. (2 points) Other than aqueous acid, give another set of reagents to carry out this same reaction.

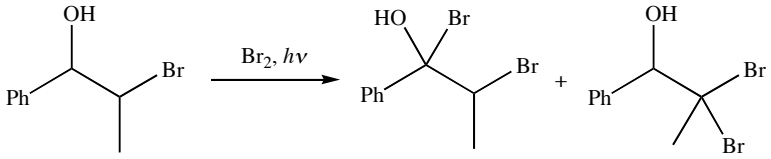


---

28. (3 points) Write the major organic product(s) of this reaction.



29. Consider this reaction:



(a) (1 point) Circle the major product.

(b) (7 points) Provide the best mechanism for the formation of the major product.