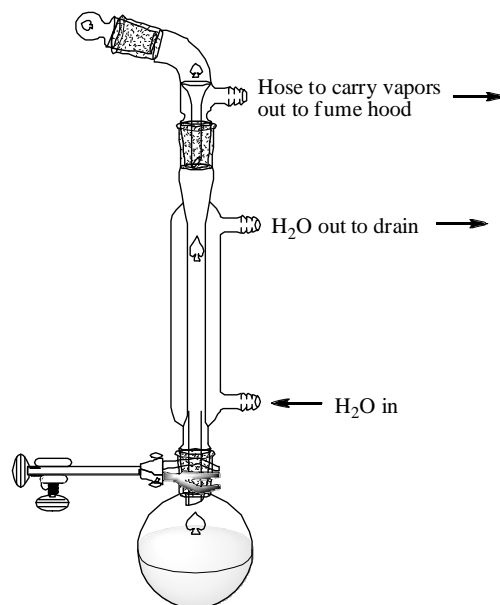


## PL1: Reaction of Butanols with Hydrobromic Acid

Name:

Lab Section (circle one): 2 / 3

**Additional Procedures:** Measuring pipets will be used to deliver sulfuric acid in precise volumes of sulfuric acid (**Op-5**). Heating under reflux (**Op-7**) will be performed with the modified apparatus shown at the right in order to avoid breathing noxious fumes. When purifying the final product by distillation (**Op-27**) use the modified apparatus shown in Figure E9 on page 153 or, if your volume is quite small (1-4 mL) use the microscale “Hickman head” still and a digital thermometer (ask your instructor for the equipment). We will be measuring the IR of each product using neat solution directly on the apparatus with an “ATR accessory” that is not discussed in the textbook. Your instructor will demonstrate its use.



1. In your formal laboratory reports you will use the introduction to help show off your knowledge of the theory behind the methods you've used in that lab exercise. **(a)** Based on the theories you've read about, why do you need to distill the substance prior to measuring its boiling point? **(b)** If your liquid is potentially impure, why is the vapor temperature read at the mid-point in the distillation rather than the beginning or end points?

2. Briefly describe the important differences between internal steam distillation and simple distillation and use that to explain why the vapor temperature during steam distillation will be different than the vapor temperature during simple distillation.

3. Which major peak can be used to determine whether all of the alcohol reactant has been consumed? \_\_\_\_\_  $\text{cm}^{-1}$  Our ATR accessory on the IR spectrometer cuts off at around  $650 \text{ cm}^{-1}$  so it would be difficult to see the C-Br stretching frequency of the product. Look up the IR spectrum (not Raman) of 2-bromobutane on [www.aldrich.com](http://www.aldrich.com) and compare it to the IR spectrum of 2-butanol in your lab. If there were a mixture of 2-bromobutane and 2-butanol—what peak would be easiest to detect the presence of 2-bromobutane ( $4000\text{-}650 \text{ cm}^{-1}$ )?

4. Use the back of this sheet to explain, in your own words, how the microscale boiling point determination works (**Op-31**).