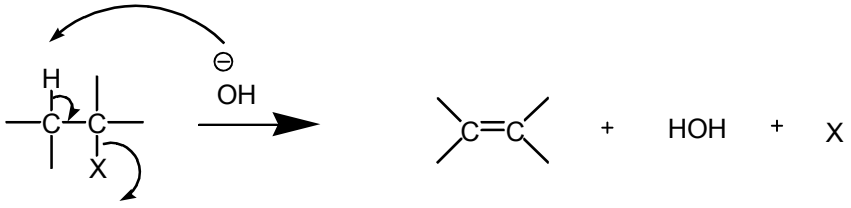
CHEM 253 Winter 2003

Experiment #3 Dehydrohalogenation of 1-chloro-2-methylbutane

Background: A haloalkane can be dehydrohalogenated (lose HX) when allowed to react with a very strong base (KOH) resulting in the formation of an alkene.

The mechanism is thought to be E2:



Recall the Universal Gas Law: PV = nRT. The moles (mmol) of gas produced can be calculated by measuring the volume of water displaced.

Physical Properties:

	M.W.	density	amnt. used	mmoles	B.P.
$C_5H_{11}Cl$	106.60	0.886	481.3 µL		100°@750mm
C_5H_{10}	70.14	0.650			31°C
Ethanolic KOH			3.0 mL		

Initial Calculations:

Apparatus:

Procedure:
Using a very large beaker, fill 1/3 with water. Fill (at least) 2 large test tubes with water; place a glass plate over the open end, and invert into the beaker such that no air is allowed to enter the test tube. Heat this water to 35-40^{o} using a hot plate. (You'll need to put your hand into it, so don't get it too hot!)
Attach a rubber hose to the thermometer adapter by using a short piece of glass tubing. You will need to place the O-ring on the tubing in order for the connection to be tight. BE CAREFUL!!!! If provided, secure the rubber tubing to the glass tubing with copper wire. Place a pipette bulb over the nipple of the thermometer adapter and wire this closed also.
Using the pipette provided, add 3.0 mL of an ethanolic potassium hydroxide solution to a 5-mL conical vial containing a triangular spinbar. Avoid getting any of the base on the ground-glass joint. Put a thin layer of stopcock grease on the ground-glass joint of the thermometer adapter. Add 481.3 μL of 1-chloro-2-methylbutane to the vial and attach the thermometer adapter to the vial and place this assembly in an aluminum heating block. Clamp the apparatus securely.
While stirring, slowly increase the temperature of the heating source (second hot plate) until gas begins to evolve from the rubber hose. Immediately place the end of the rubber hose into the mouth of an inverted test tube in order to trap the gas being produced. (BE CAREFUL. Remember that the water in the beaker is warm.) Continue heating the reaction mixture at this temperature until gas evolution ceases. (Change test tubes if needed before all the water has been displaced.) Carefully remove the hose from the test tube and remove the heat source from the vial.
Slide the glass plate over the end of the tube and remove it from the beaker. Measure the amount of water remaining in the tube and compare it to the total amount that the tube should hold, i.e. SUBTRACT. This should provide you with the volume of gas produced. Using the barometric pressure reading for the room and converting temperature to Kelvin (+ 273), calculate the number of moles/millimoles of gas produced. R = 0.0821 mL atm/mmol K. [You may ignore the vapor pressure of water.]

**Disclaimer: If you fail to see any gas produced, at least you will have seen <u>how</u> one would collect a gaseous sample.

In your lab report, show the calculations for the PV = nRT problem and for the percent yield of the alkene product.