# Distillation Separating a Mixture of Liquids   Name _____
The lab is performed by small groups. Group # _____   Section # _____

This procedure is used to
separate volatile substances
from non-volatile (or less
volatile) substances) – or to
separate different liquids from
each other according to their
boiling points. The efficiency
of separation depends on the
difference in the boiling points
and the distance the vapors have
to travel in the neck of the
boiling flask. A longer neck
flask increases the efficiency
of the separation. A simple
set-up such as this will separate
the liquids to a certain extent, but

use a 50 mL grad cylinder to collect the distillate

the **distillate** will still be a mixture, somewhat enriched in the lower-boiling component.
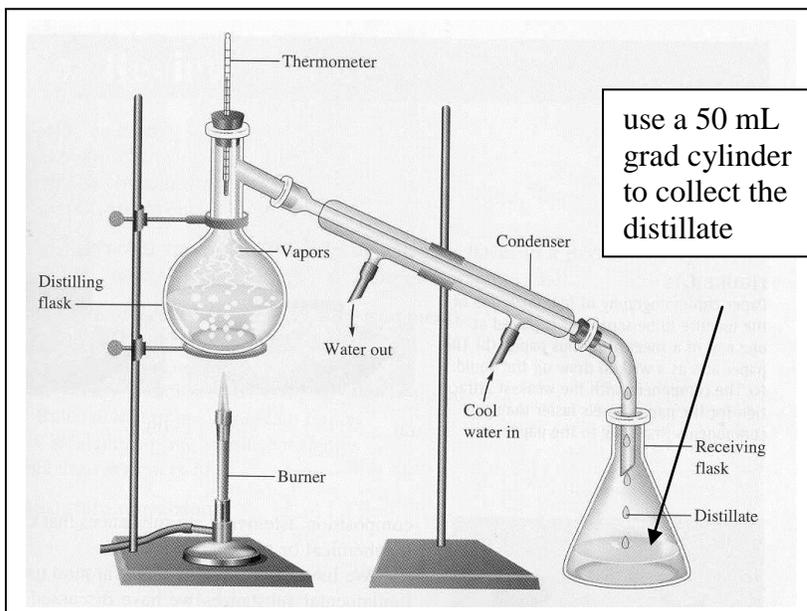
Procedure
   Ethanol and water are the two major volatile components in wine. Pour 250 mL of red wine
into the distillation flask, hook up the glassware making sure the connections are tight, turn on the
cooling water carefully so the water flows slowly. The thermometer should be adjusted to measure
the temperature of the vapors at the point shown in the diagram . Weigh a corked graduated
cylinder. Uncork the cylinder and place it to collect the distillate (instead of the Erlenmeyer
collection flask shown)   Use a heating mantle connected to a power source, instead of a burner.
Set the control to HIGH initially, and reduce the power by about 1/3 when the mixture is
boiling.Measure the temperature of the vapors when the first drops of distillate come out. Measure
the temperature after 5 mL , 10 mL and 15 mL   etc every 5 mL until finally 50.0 mL has been
collected. Cork the grad cylinder , record the volume carefully to 1 decimal place -- at the bottom
of the **meniscus** in the cylinder . Don't exceed 50 mL since there are no marks above 50 on the
cylinder. Carefully sniff the distillate. What do you think ? Good stuff ? Weigh the corked
cylinder with the distillate.

Data
volume of wine used _____   mass of empty grad cylinder & cork _____

T of vapors at first sign of distillate: _____   T at 20.0 mL _____   T at 40.0 mL _____

T of vapors at 5.0 mL of distillate: _____   T at 25.0 mL _____   T at 45.0 mL _____

T at 10.0 mL _____   T at 30.0 mL _____   T at 50.0 mL _____

T at 15.0 mL _____   T at 35.0 mL _____

Mass of cylinder with distillate. _____

Calculate the mass of the distillate in the cylinder _____
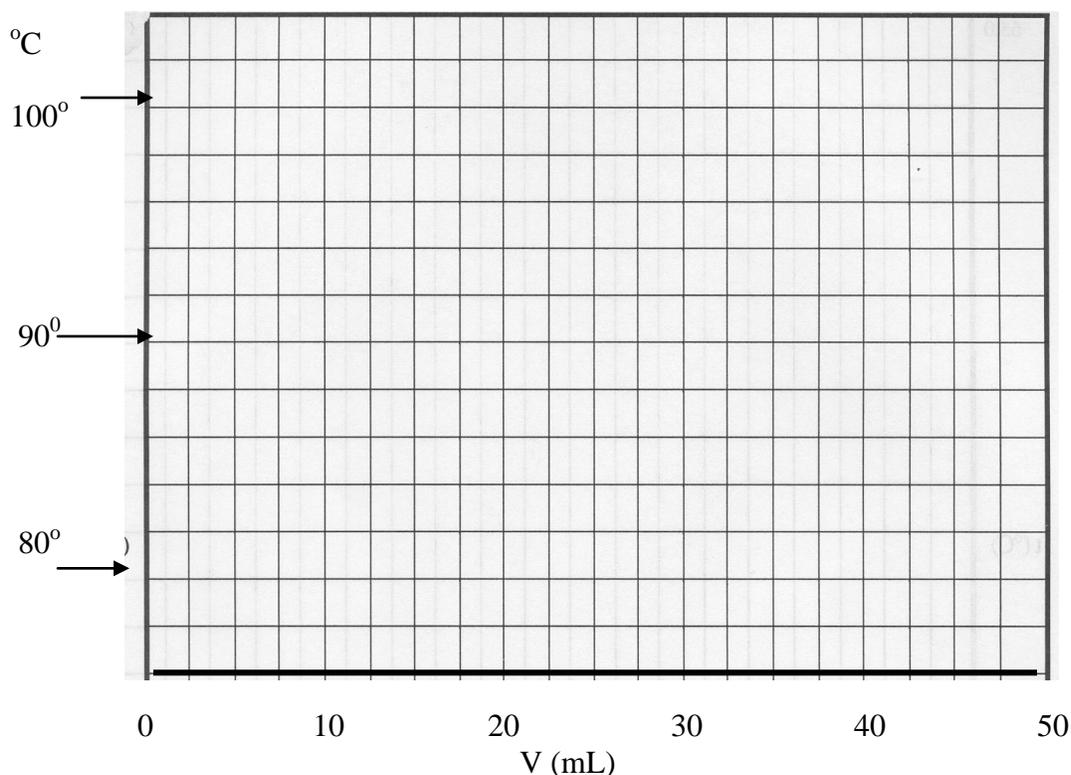
Calculate the density (g/mL) of the liquid in the cylinder.
        mass of distillate / 50.0 mL   d = _____ g/mL

Data Analysis.

Make a graph, plotting the temperature and volume data (T on the y axis, volume
0 – 50 mL on   the x axis)

°C

100°

90⁰

80°

0   10   20   30   40   50

V (mL)

Questions

1. Look at the graph of temperature vs volume. Assuming the T of pure boiling
   water is 100°C , Do you think all of the ethanol had boiled out, when 50 mL was
   collected. ? If so - at what point do you think all the ethanol had boiled out ?

2. The boiling point of pure ethanol is 78°C . At the first sign of condensing vapors
   (when maybe just one drop of distillate has been collected) - do you think you
    have pure ethanol ? _____ Why or why not ?

3. Graphing Use a fine graph paper (10 sq/inch or 10/cm) to plot the densities of aqueous ethanol solutions at $20°$ C (y axis) vs the % composition (x axis).

% ethanol	d	% ethanol	d	% ethanol	d	% ethanol	d
0	0.998	30	.954	55	.902	80	.843
5	.989	35	.945	60	.891	85	.830
10	.982	40	.935	65	.879	90	.818
15	.975	45	.924	70	.867	95	.803
20	.968	50	.913	75	.855	100	.789
25	.963						

4. Is the graph linear ? _____ Why can't you use a computer program to find a slope and equation of the line ?

5. You have calculated the density of the distillate. Plot the density of the distillate on the graph, and read the % of ethanol/ water in the distillate on the x axis

   _____ % ethanol

6. <u>Assuming</u> all the ethanol did boil out by the time 50 mL had been collected, now you can calculate the % of ethanol in the original wine sample. Since only 50 of the of the 250 mL of original liquid was distilled. , the percent of the ethanol in the wine = % in the distillate x 50/250

   = _____ %

7. Compare the % of ethanol you calculated above, with the actual % of ethanol in the wine as per the bottle label (or given by the instructor).

   Wine brand. read the label   % ethanol by volume in wine: _____ %

   Find the % error in the result.
   <u>exp. value - true value</u>   x 100 =   % error
         true value

   _____% error