

**FLUIDS LAB 1**  
**FALL 2003**

**VISCOSITY**

**Objectives of the Experiment:**

- To determine the kinematic viscosity of four grades of motor oil at various temperatures using a Saybolt Viscometer.
- To learn more about viscosity, how it varies relative to temperature, and to demonstrate one method of how it is measured.

**Procedure:**

1. Measure and record the weight of an empty Saybolt standard flask.
2. Identify and record the grade of the four oil samples.
3. Pour each oil sample in the proper container of the Saybolt Viscometer (each container should be labeled). There are four metal containers in the viscometer and they are surrounded by an oil bath that needs to be kept at a constant temperature. An electric heater embedded in the bath is used to adjust the temperature to the desired level.
4. Measure and record the temperature of the oil bath in the viscometer using a bulb thermometer.
5. The measurement of the oil's viscosity is determined by the time required to collect 60 ml of a sample when it is drained through an orifice at the bottom of the container. It is necessary to use a suitable stopwatch to time the process.
6. Place an empty flask under the container directly below the draining orifice. Carefully, remove the cork stopper at the bottom of the container and simultaneously start timing the draining process. Collect the fluid in the flask and stop the timer at the moment the fluid reaches the 60 ml graduation. The units of elapsed time are referred to as Saybolt Universal Seconds or SUS.
7. Determine the net mass of the fluid samples by weighing the 60 ml volume in the flask.
8. Calculate the density of the samples from these measurements. Make sure that the units are consistent.
9. Repeat the same process for all the samples provided.
10. The time in SUS is directly proportional to the absolute viscosity of the fluid and inversely proportional to its density. This time can be converted to stokes or centistokes units by using standard tables of conversion or through a simple conversion equation.
11. Repeat the steps for different temperatures.

**Questions:**

1. Determine the kinematic viscosity, dynamic viscosity and density of all the samples in the proper units. Record these values in tabulated form.
2. Compare these values to the published values in product literature.
3. Use all the information you have from this experiment to develop separate computer generated graphs of the variation of kinematic viscosity, dynamic viscosity and density of the sample fluid as a function of temperature. These graphs should be presented with a line that best fits the experimental points statistically.

**Note:**

The Standard Test Method for Saybolt Viscosity (ASTM D 88) is no longer supported by the ASTM. This method however does provide an adequate means of comparing the viscosities of different fluids.