

MECH 202: Polymers and Composites  
**Experiment Design**  
Project Plan



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**Purpose:**

The objectives of this experiment are:

- Test for the viscosities of PEG at different degrees of polymerization and concentration
- Calculate the viscosity of a PEG monomer

**Experimental Theory:**

Using viscometers which calculates the viscosity of different fluids, calculate the specific viscosity of a grade of PEG at different concentrations. This gives the intrinsic viscosity which when graphed versus molecular weight will give the viscosity of a monomer of PEG. This allows the calculation of the viscosity for the different grades and concentrations of PEG.

To find the viscosity in the viscometers the theory is:

The value of the viscometer is obtained by measuring the time it takes for the steel ball to fall in a solution of known viscosity:

$$K = \frac{\mu}{(\rho_s - \rho_l)t}$$

The solution should have similar physical properties compared to the test fluid. (PEG)

Using the K value and data calculate viscosity for each concentration and grade of PEG.

$$\mu = K (\rho_s - \rho_l) t$$

**List of Materials and Equipment:**

It.#	Vendor Part #	Description	Unit price (\$)	Qty.	Total Price (\$)
1		3 grades of PEG			
2		4 tubes of clear pvc with end caps			
3		4 steel balls			
4		4 threaded end cap and threaded male counterpart			
<b>TOTAL:</b>					

Additionally I need:

- Stop watch
- Deionized water
- Solution with similar properties to PEG

■ PVC cement

**Experiment Set-Up:**

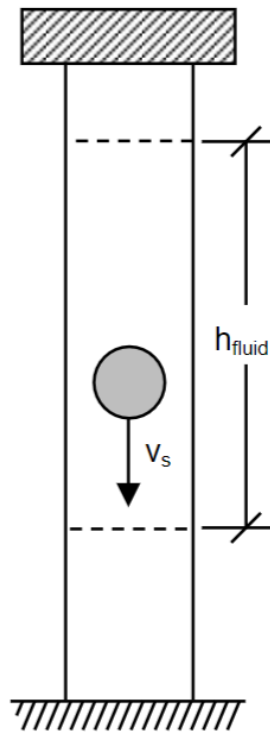


Figure 1. Experiment set-up for measuring viscosity

Figure 1. Experiment set-up for measuring viscosity with a steel ball

**Procedure:**

1. Create 4 viscometers with the exact same dimensions and markers for timing.
2. Fill one viscometer with a liquid that has similar properties to PEG and known viscosity, and known density and calculate the K value for the viscometers.
3. Fill the other 3 viscometers with their solutions at low concentrations and measure the density.
4. Measure the time 6 times for each sample and then increase the concentration of PEG in each and remeasure density.
5. Repeat step 4 4 times.
6. Graph the viscosity versus concentration and then find the intrinsic viscosity for each grade of PEG
7. Graph the intrinsic viscosity vs the molecular weight of the different grades of PEG. Compare the results with known values for PEG.

**Work Breakdown:**

<b><u>Task</u></b>	<b><u>Who</u></b>	<b><u>Deadline</u></b>
Purchase of Material	Jan	Oct. 20
Project Construction	Jan	Oct. 20
Mock Testing	Jan	Oct. 20
Running Lab	Jan	Oct. 26
Preparation of Materials	Jan	Oct. 27
Prep of Presentation Mater.	Jan	Oct. 27
Progress Report	Jan	Oct. 28
Draft of Lab Handout	Jan	Nov. 2
Complete Lab Handout	Jan	Nov. 9
Final Presentation and Demo	Jan	Dec. 4

**References:**

Dr. Saviz, CIVL 130 L01, Viscosity Lab handout F19.doc

Dr. Steimel, MECH 202, Lec\_5\_Viscosity.pdf