Quiz Lab 14 Torque Rheometer

1) The Couette rheometer used with PDMS measured the viscosity and we could manually observe the viscosity at different shear rates. The Torque rheometer measures the viscosity as a function of the frequency of oscillation in a cone and plate geometry. What is the difference between these two instruments?
2) Rather than reporting the viscosity the torque rheometer usually reports the loss and storage shear modulus, G" and G'. How are these parameters realated to the viscosity?
3) Is there a loss and storage viscosity? How would these be calculated?
4) The torque rheometer can measure the first normal stress difference. Explain what the normal stress difference is and how it can be measured.
5) What is the second normal stress difference and how could it be measured?
6) If the G' and G" curves cross what does this indicate about the frequency where the two are equal?
7) Loss and storage modulus are often plotted in a log log plot against frequency. This indicates power law behavior. List the power-laws that might be expected in the dynamic spectrum for a typical polymer sample.
8) The storage modulus should always increase with frequency since the material becomes stiffer at higher frequencies. At some point in frequency the storage modulus can reach a plateau called the plateau modulus. What is the plateau modulus and how can you calculate the entanglement molecular weight from this value?
9) The loss modulus can show peaks. Explain to what a peak in the storage modulus corresponds.
10) What is a Cole-Cole plot and what can it measure in a polymer sample.
11) Sketch the storage and loss modulus for a Hookean elastic, a Newtonian fluid, a viscoelastic material with a T_g.
12) If an elastomer is mixed with a ceramic filler what type of response from question 11 would you expect?