

020529 Quiz 10 Properties

- 1)
 - a) **Sketch** the behavior of the coefficient of first normal stress difference, viscosity and the recoverable shear strain as a function of rate of strain.
 - b) **How** is the recoverable shear compliance related to the recoverable shear strain?
 - c) **How** are the low shear rate behaviors of the viscosity, coefficient of first normal stress difference and recoverable shear compliance related?
 - d) For a Lodge liquid **how are** the time dependent shear stress and first normal stress difference related to the time dependent modulus for a variable rate of strain and for a constant rate of strain?
 - e) **How are** the zero shear rate viscosity and coefficient of the first normal stress difference related to the time dependent modulus?

- 2)
 - a) For the dumb bell model **write an expression** for the velocity of one of the ends of the dumb bell relative to the other end (Langevin equation) when it is subjected to random Brownian motion.
 - b) **Sketch** the prediction of this model, position versus time.

- 3)
 - a) **Give** an expression for the particle velocity in the Rouse model similar to that given for the dumb bell model (leave out the Brownian term).
 - b) **Write** the wave solution to this equation in 1-d for a polymer chain of infinite molecular weight.
 - c) **Give** an expression for the relaxation time for the Rouse model with a chain of infinite molecular weight.