1) Flory defined the persistence length, using the equation $a = l/(1-\alpha)$.
   **Explain** each of the terms in this equation.
   **Define** the persistence length using a sketch of a polymer coil.
   **Explain** how the persistence length could be measured.
   **What** is a typical value for a bond length and the persistence length in a polymer.

2) How does the overlap concentration, $c^*$, depend on molecular weight, $N$?

3) Calculate the dependence of the concentration blob size $\xi_p$ on concentration, $c$, given that:
   $$\xi_p = R_{F0} \left(\frac{c}{c^*}\right)^P$$
   where $P$ is a power you need to determine, and $R_{F0}$ is the coil size in the dilute regime for a very good solvent. (Hint: You need to know the $N$ dependence of $\xi_p$ to do this calculation.)
Answers: 020417 Quiz 4 Properties

1) \( l' \) is an arbitrary step size that could be a chemical bond length. \( \alpha = \cos(\theta') \), where \( \theta' \) is the average angle between two steps. The average dot product between unit vectors associated with \( l' \) steps is a decaying function of the distance between the steps. The function has a value of 1 at zero step length and a value of 0 for infinite step length. The persistence length is similar to the standard deviation of this orientation distribution function and it occurs when the average cosine is equal to 1/e. The chain direction is, on average, random beyond this size. The persistence length is measured in a neutron scattering experiment as the transition point between the coil scaling and persistence scaling. For PE the bond length is about 1.5 Å and the persistence length is about 5.8 Å.

2) \( c^* = \frac{N}{R_F^3} = N^{1-3/df} = N^{-4/5} \)

3) \( \xi_p \) doesn't depend on molecular weight, while \( c^* \) has the dependence in 2) and \( R_{F0} \) goes as \( N^{3/5} \). \( N^0 = N^{3/5}(N^{4/5})^P \), so P must equal -3/4.