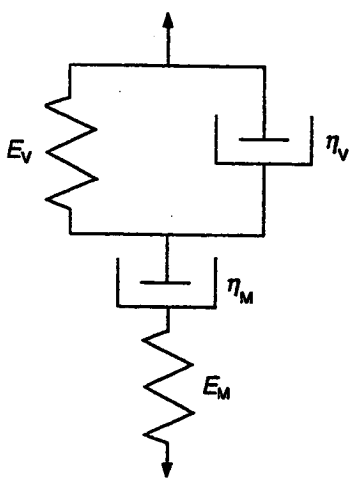
91.

Polymer Science and Engineering

高分子科学概论

1. Define the Flory temperature θ and describe two ways of determining it from thermodynamic considerations. (10%)
2. Contrast the fringed micelle and lamellar models of the structure of crystalline polymers with respect to (a) description and sketch of the basic units, (b) observation basis, (c) interpretation of x-ray evidence, (d) spherulite structure, (e) correlation between density and crystallinity, and (f) changes on cold drawing. (25%)
3. State the equations relating the melt viscosity of a polymer to (a) molecular weight and (b) temperature (5%)
4. Describe briefly (a) creep and (b) stress relaxation. (10%)
5. Predict and explain the effect, if any, of varying molecular weight and degree of short-chain branching on each of the following properties of polyethylene: ultimate tensile strength, stiffness, Tm, sorption of organic liquids. (10%)
6. Given that the molecular weight of a polystyrene(PS) repeating unit is 104 and that the carbon-carbon distance is 1.54Å, calculate the following: (a) The mean-square end-to-end distance for a PS molecule of 1 million molecular weight assuming that the molecular behaves as a freely rotating, freely jointed, volumeless chain. Assume that each link is equivalent to a single repeating unit of PS. (b) The unperturbed root-mean-square end-to-end distance. (10%)
7. Give your best estimate for the weight fraction of plasticizer required to lower the Tg of poly(vinyl chloride) (PVC) to 30℃. Assume that the Tg of PVC is 356 K and that of the plasticizer is 188 K. (10%)
8. Given the four-element model illustrated, derive an analytical solution for the strain behavior and sketch ε (t) versus time under the following stress conditions: ε (strain), σ (stress) (20%)

$t<0$	$\sigma=0$
$0\leqq t<t_1$	$\sigma=\sigma_0$ (creep)
$t_1\leqq t<t_2$	$\sigma=0$ (creep recovery)



$\langle r^2 \rangle = n l^2$