Polymers.

Example Sheet 1 (E1)

Molecular Mass Distributions Problems.

1 Express $\overline{M}_w$, the weight average molecular mass in terms of m and a) x_m the number fraction of the polymer and b) w_m, the weight fraction.
Express your results for both discrete and continuous distributions of molecular mass.

2. Monodisperse polystyrene samples. A and B.

Blend made up from,

1 kg A, mm = 10,000 kg/kmol

1 kg B, mm = 100,000 kg/kmol

What is $\overline{M}_n$, $\overline{M}_w$, $\overline{DP}_n$ and $\overline{DP}_w$ of blend. (hint, there are a number of ways to skin a cat but you might like to work from a knowledge of the weight fraction of each molecular mass component.)

Ans. 1.82 10^4 kg/kmol, 5.5 10^4 kg/kmol, 175, 529.

3. Monodisperse polypropylene samples A, B and C.

A, 10,000 kg/kmol

B, 40,000 kg/kmol

C, 70,000 kg/kmol

What is the 1st, 2nd, 3rd and 1.5 moment of blend, made from

(1) Equal weight fractions

(2) Equal number fractions.

ans 1) 2.16 10^4, 4 10^4, 5.5 10^4, 3 10^4 kg/kmol
2) 4 10^4, 5.5 10^4 , 6.18 10^4, 4.87 10^4 kg/kmol

4. Show that for a 'most probable' molecular mass distribution

$$\frac{\overline{M}_w}{\overline{M}_n} = 2$$

and determine $\overline{M}_3/\overline{M}_w$.

(Use equation for most probable distribution given in Lectures).

If you can do these four questions you probably have a good understanding of handling moments of molecular masses (or particle sizes, or residence time distributions!).

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