

1. (25 points) Pluronic L64 is a triblock copolymer made of PEO-PPO-PEO. The formula for PEO is  $(-\text{CH}_2\text{OCH}_2-)_n$ , and for PPO is  $(-\text{OCH}(\text{CH}_3)\text{CH}_2-)_m$ . (Note that we have ignored the difference of the end unit of a polymer.) The subscript number is the number of the repeating unit for the unimer. We can assume that the mass density for both PEO and PPO are 1 g/ml.
  - 1.1) (5 points) Estimate the average scattering length density of PEO segment.
  - 1.2) (5 points) Estimate the average scattering length density of PPO segment.
  - 1.3) (5 points) Estimate the average scattering length density of the whole L64 polymer.
  - 1.4) (5 points) If we can deuterate the PEO to have d-PEO with the formula  $(-\text{CD}_2\text{OCD}_2-)_n$ , the density of d-PEO is about 1.09 g/ml. (It is heavier than PEO as D is heavier than H.) Please estimate the average scattering length density of d-PEO.
  - 1.5) (5 points) With the deuterated PEO and protonated PPO section, please estimate the average scattering length density of this partially deuterated L64 polymer. You can assume that the mass density of the partially deuterated L64 is around 1.03 g/ml.