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1. A recently graduated Biological Engineer was just hired at a big Biotechnology company. The first task she was assigned was to work on increasing the half-life of a newly developed therapeutic antibody in the body. She knows that this can be achieved by binding polyethylene glycol (PEG, OH-(-CH_2CH_2O-)$_n$-H) to the protein, since this decreases clearance in the body, without significantly affecting protein activity. The problem is that it is really hard to control the size of the polymer chain and she doesn't have too much experience with chemical synthesis of polymers, so she goes and measures the radius of gyration (R_g) of the synthesized PEG by laser light scattering and finds that R_g = 5nm. The characteristic ratio (C_N) of PEG is 4 in water, and the bond length is 0.3 nm.

   a) Calculate the average number of rods (N_K), number of monomers (N) and molecular weight of the PEG synthesized. (Usually, the size of PEG bound to therapeutic proteins ranges from 5 to 30 kDa)

   b) Polystyrene (-(-$CHC_6H_5CH_2$-)-$_n$) has a characteristic ratio of 9.6 in water, and a bond length of .15 nm. Calculate N_K, N and molecular weight for this polymer if its radius of gyration is 5 nm. Would you bind this to a drug? Why?