

QUESTION:

How to calculate the molecular mass and length of a segment of B-DNA specifying a 40-kD protein?

SOLUTION:

Average molecular weight of amino acid = 105.2 dalton

Assume that the 40 kDa protein is composed of 380 amino acids ($40000 \text{ Da} / 105.2 \text{ Da} = 380$).

1 amino acid = 3 nucleotides

Number of nucleotides = $380 \times 3 = 1140 \text{ nt}$

Average molecular weight per nucleotide = 499.5 Da

Molecular mass of B-DNA is $5.69 \times 10^5 \text{ Da}$

In the B-form of DNA, the helix makes a turn every 3.4 nm, and the distance between two neighboring base pairs is 0.34 nm. Hence, there are about 10 pairs per turn.

The contour length of B-DNA = $1140 \text{ nt} / 10 \text{ nt} \times 3.4 \text{ nm} = 387.6 \text{ nm}$ (or 3876 \AA).