

Rules of Molecular Structure Calculation

1- Number of Nucleotides DNA = Molecular Weight / 618

عدد النيوكليوتيدات = الوزن الجزيئي / 618

2- Length of DNA = Number of Nucleotides X 3.4

طول الـ DNA = عدد النيوكليوتيدات * 3.4

3- Volume of DNA = length X 3.14 X $(10 \times 10^{-8})^2$

حجم الـ DNA = طول الـ DNA * 3.14 * $(10 \times 10^{-8})^2$

4- Number of DNA turns = Number of Nucleotides / 10

عدد لفات الـ DNA = عدد النيوكليوتيدات / 10

5- Number of Amino Acids = Molecular Weight of Protein / 120

عدد الاحماض الامينية = الوزن الجزيئي للبروتين / 120

6- Number of Ribonucleotide = Number of Amino acids X 3

عدد الرايبونيوكلوتيدات = عدد الاحماض الامينية * 3

7- Molecular Weight of mRNA = Number of Ribonucleotides X 320

الوزن الجزيئي للـ mRNA = عدد الرايبونيوكلوتيدات * 320

Calculation of molecular structure of DNA:

Ex. (1): Calculate the **length, volume** and **number of turns** of double helix DNA molecule, if the M.Wt of this DNA molecule is 3×10^7 dalton.

Solution:

No. of nucleotides pairs = $3 \times 10^7 / 618 = 48544$ bp

Length of DNA strands

$$= 48544 \times 0.34 = 16.5049 \text{ A}$$

$$16.5049 / 10^{-8} = 16.5 \times 10^{-4} \text{ cm}$$

The Shape of DNA molecule is cylindrical, so

The length of cylinder (DNA) = $16.5 \times 10^{-4} \text{ cm}$

the diameter is 20A ($20 \times 10^{-8} \text{ cm}$)

$$\begin{aligned} \text{The Volume of cylinder} &= 3.14 \times r^2 \times \text{length} \\ &= 3.14 \times (10 \times 10^{-8} \text{ cm})^2 \times 16.5 \times 10^{-4} = 5.18 \times 10^{-17} \text{ cm}^3 \end{aligned}$$

$$\text{No. of turns} = 48544 \text{ bp} / 10 \text{ bp turn} = 4854.4 \text{ turn}$$

Ex. (2): Calculate the M.wt of mRNA that coded to protein if the M.wt of this protein is equal to 75000 dalton ?

Solution:

$$\text{No. of amino acids} = 75000 / 120 = 625 \text{ amino acids}$$

$$\text{No. ribonucleotides of mRNA} = 3 \times 625 = 1875 \text{ ribnucleotides}$$

$$\text{M. wt of mRNA} = 1875 \times 320 = 6 \times 10^5 \text{ dalton}$$