CHAPTER – 2

HUMAN CHROMOSOMES

P. 23 Check Your Progress 1

A. Fill in the blanks.

1. 44, 2
2. nucleosome

B. State whether true or false. Rewrite the false statements correctly.

1. False.

   DNA is the segment of chromatid that carries heredity information.

2. True

P. 24 Exercises

I. Multiple-Choice Questions

A. Choose the most appropriate answer.

1. a **2.** c **3.** b **4.** c

5. b **6.** c **7.** c

II. Assertion–Reason Type Questions

A. 1. b **2.** b **3.** a **4.** b

III. Very Short Answer Type Questions

A. Name the following.

1. Chromosome
2. Sex chromosomes
3. Chromatin
4. Hydrogen bond
5. A pentose sugar, a phosphate group and a nitrogenous base
6. Allele
7. Nucleotides

B. Fill in the blanks.

1. gene
2. Centromere
3. Chromatin
4. nucleosome

IV. Short Answer Type Questions.

A. Answer these questions.

1. Chromosome can be defined as a strand of DNA molecule associated with proteins. Chromosomes are the hereditary vehicles found in the nucleus of a cell. Chromosomes contain genes which are carriers of heredity.
2. Gene is the basic unit of heredity. It is located on a chromosome.
3. Chromosomes are referred to as hereditary vehicles as the characteristics travel from parents to offsprings in the form of genes situated on the chromosome.
4. A gene (segment of DNA) codes for the synthesis of a specific protein which controls the expression of a particular characteristic in an individual. Thus, gene is the basis of heredity found on a chromosome. Genes are composed of DNA.
5. Human skin cell is diploid (2n) in nature whereas ovum is haploid (n). Therefore, human skin cell has 46 (23 pairs) chromosomes and ovum has 23 chromosomes.
6. Adenine, Guanine, Cytosine and Thymine

V. Long Answer Type Questions

A. Answer these questions.

1. The heterogametic sex is the one in which the sex chromosomes differ. In human males, one sex chromosome is smaller than the other. The larger one is known as X chromosome and the smaller one is known as Y chromosome. During gamete formation they produce two types of gametes, 50% with X chromosome and 50% with Y chromosome. Thus, the human males are described as heterogametic.
2. Adenine, Guanine, Cytosine and Thymine
3. Each chromosome consists of two chromatids joined at some point along the length. At the point of joining, a constriction is formed called the centromere. Centromere is the point on the chromosome where the spindle fibres are attached. If the centromere is at the middle position, the chromosome is metacentric. If the centromere is towards one end (away from the centre), the chromosome is acrocentric. If the centromere is at an extreme end, the chromosome is telocentric.
4. A nucleosome is a section of DNA that is wrapped around a core of proteins. Inside the nucleus, DNA forms a complex with

proteins called chromatin, which allows the DNA to be condensed into a smaller volume. When the chromatin is extended and viewed under a microscope, the structure resembles beads on a string. Each of these tiny beads is called a nucleosome. The nucleosome is the fundamental subunit of chromatin. Each nucleosome is composed of a little less than two turns of DNA wrapped around a set of eight proteins called histones, which are known as a histone octamer. Each histone octamer is composed of two copies each of the histone proteins H2A, H2B, H3, and H4. The chain of nucleosomes is then compacted further and forms a highly organized complex of DNA and protein called a chromosome.

5. DNA–histone complex is called chromatin. DNA forms about 40% and histones (proteins) form about 60% of the overall part of chromosome. DNA has negative charge while histones are positively charged basic protein molecules which are bound to it. This DNA–histone complex is called chromatin.

Difference between chromosome and chromatin.

Chromatin	Chromosome
Thin, long, uncoiled structure	Thick, compact, ribbon-like structure
Composed of nucleosomes	Composed of chromatin fibres
It is unpaired.	It is paired.
It is undercondensed part of nucleoprotein.	It is condensed part of nucleoprotein.
It is observable in the interphase nucleus.	It is observable in the M-phase or nuclear division.

VI. Structured/Application/Skill Type Questions

A. Given below is a figure of certain structure found in human cells.

1. Chromosome

2. **i.** Centromere. It is the point on the chromosome, where spindle fibres are attached during cell division.

3. **ii.** Chromatids