**Chapter 7 - Inheritance**

**All Lectures Uploaded on YouTube:**

[**https://tinyurl.com/fkm10-biology**](https://tinyurl.com/fkm10-biology)



**MCQS**

1. C
2. B
3. B
4. C
5. C
6. A
7. B
8. A
9. B
10. B
11. A
12. B
13. B
14. B
15. C

# **Short Answer Questions**

**1. Why do chromosomes need to compact into thick chromatids during cell division?** Chromosomes compact into thick chromatids to prevent tangling and breakage during cell division. This ensures that DNA is evenly distributed to daughter cells.

**2. How does the structure of telomeres help protect genetic information during cell division?** Telomeres act as protective caps at chromosome ends, preventing loss of essential genes. They stop DNA from fraying and sticking to other chromosomes.

**3. How do Mendel’s experiments with pea plants support the idea of dominant and recessive traits?** Mendel observed that some traits appeared in F1 generation while others were hidden but reappeared in F2. This showed the presence of dominant and recessive alleles.

**4. Why did Mendel use true-breeding plants in his experiments?** True-breeding plants consistently produce offspring with the same traits, making it easier to study inheritance patterns without unexpected variation.

**5. How can two parents with free earlobes have a child with attached earlobes?** If both parents are heterozygous (Ee), their child has a 25% chance of inheriting “ee,” resulting in attached earlobes.

**6. How does the law of segregation ensure genetic diversity of offspring?** During gamete formation, allele pairs separate so each gamete carries only one allele. Random fertilization then creates new allele combinations.

**7. Why did Mendel’s dihybrid cross results differ from his monohybrid cross results?** In a dihybrid cross, two traits were studied simultaneously, showing independent assortment. This produced a 9:3:3:1 ratio instead of the 3:1 ratio of monohybrid crosses.

**8. In pea plants, round seed (R) is dominant over wrinkled seed (r). If Rr × rr, what are the genotypic and phenotypic ratios?** Genotypes = 50% Rr, 50% rr.  
 Phenotypes = 50% round, 50% wrinkled.

**9. If TT × tt, what will be the genotype and phenotype of F1? What about F2?** F1: All Tt (tall).  
 F2 (Tt × Tt): Genotype ratio = 1 TT : 2 Tt : 1 tt, Phenotype ratio = 3 tall : 1 short.

**10. In humans, free earlobes (E) are dominant over attached earlobes (e). A person with free earlobes has a child with attached earlobes. What are the genotypes of the parents?** The child must be “ee.” One parent is heterozygous (Ee), the other is homozygous recessive (ee).

**11. Two pea plants, YYRR × yyrr. What are the genotypic and phenotypic ratios in F2 if F1 self-fertilizes?** F1: All YyRr (yellow round).  
 F2: Genotype ratio complex, Phenotype ratio = 9 yellow round : 3 yellow wrinkled : 3 green round : 1 green wrinkled. (9:3:3:1)

**12. In a dihybrid cross (RrYy × RrYy), probability of RRYY in F2?** Probability = 1/16, since both traits must be homozygous dominant together.

# **Extensive Answer Questions**

**1. Describe the different parts of a chromosome, including chromatids, centromeres, and telomeres.** A chromosome is made of two sister chromatids, which are identical copies joined at the centromere. The centromere is essential for spindle fiber attachment during cell division. Telomeres are protective caps at the chromosome ends, preventing genetic information loss and maintaining stability. Together, these parts ensure chromosomes replicate and divide accurately.

**2. Explain how DNA is organised within the chromosome, including the role of histone proteins and nucleosomes.** DNA is wrapped around histone proteins, forming bead-like structures called nucleosomes. These nucleosomes coil further to form chromatin fibers, which condense into chromosomes during division. Histones help package DNA efficiently while regulating gene expression. This organisation allows long DNA molecules to fit into the nucleus while remaining accessible for replication and transcription.

**3. Describe Mendel’s procedure of crossing a true-breeding round-seeded pea plant with a wrinkled-seeded plant. Also draw the diagram of the cross.** Mendel crossed pure round (RR) with pure wrinkled (rr). All F1 offspring were round (Rr), showing dominance of round seeds. When F1 (Rr) plants self-pollinated, the F2 generation showed a ratio of 3 round : 1 wrinkled. This experiment demonstrated the principle of dominance and segregation

**4. Explain the results of the F1 and F2 generations in monohybrid cross and describe Mendel’s conclusions.** In a monohybrid cross (e.g., RR × rr), the F1 offspring were all heterozygous (Rr) and showed only the dominant trait. In the F2 generation, crossing Rr × Rr gave a 3:1 phenotypic ratio and 1:2:1 genotypic ratio. Mendel concluded that traits are controlled by discrete factors (genes), with one allele dominant and the other recessive, and alleles segregate during gamete formation.

**5. Define genotype and phenotype, providing examples to illustrate how different genotypes can lead to different phenotypes.** Genotype refers to the genetic makeup (e.g., EE, Ee, or ee), while phenotype is the observable trait (e.g., free or attached earlobes). A homozygous dominant (EE) and heterozygous (Ee) both produce the free earlobe phenotype, while homozygous recessive (ee) produces attached earlobes. This shows how different genetic combinations can result in the same or different physical appearances.

**6. Explain what a test cross is and how it can be used to determine whether an organism displaying a dominant trait is homozygous or heterozygous.** A test cross involves crossing an individual with a dominant phenotype (e.g., round seeds) with a homozygous recessive individual (e.g., wrinkled seeds). If all offspring show the dominant trait, the parent is homozygous dominant. If offspring are 50% dominant and 50% recessive, the parent is heterozygous. This method helps reveal hidden alleles and confirm genotype.



