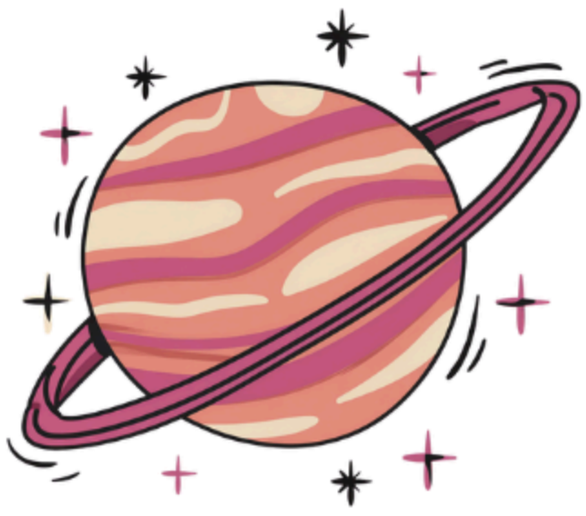

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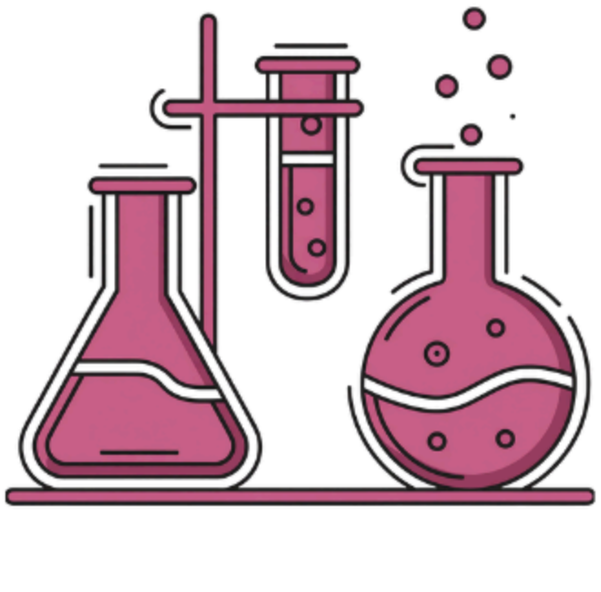
Class - 10th

NCERT Solution

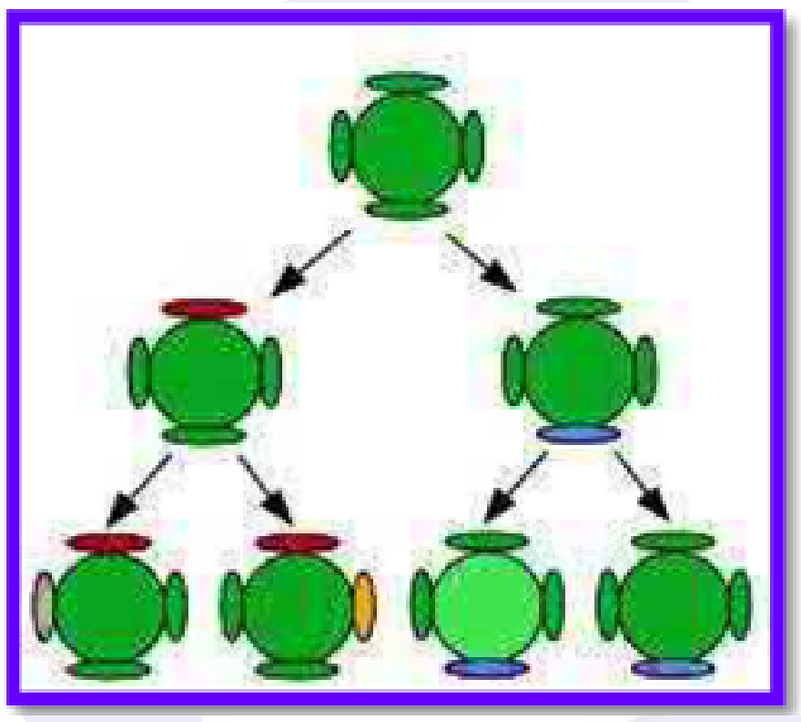
science



HEREDITY CLASS 10 SCIENCE NCERT : DETAILED SOLUTIONS

1. **If a trait A exists in 10% of a population of an asexually reproducing species and trait B exists in 60% of the same population, which trait is likely to have arisen earlier?**

Solution: Trait B is more likely to appear early because it is already prevalent and replicating in a larger portion of the population compared to trait A. This higher existing frequency and replication rate make Trait B more common and more likely to manifest sooner.



2. **How does the creation of variations in a species promote survival?**

Solution:
Genetic variations help species adapt more effectively to changes in their environment. These variations are crucial for evolution because they influence how allele frequencies shift through natural selection. By enabling species to better adjust to new conditions, genetic variations play a key role in determining whether a species will continue to thrive or face extinction.

3. **How do Mendel's experiments show that traits may be dominant or recessive?**

Solution:
Mendel demonstrated that traits can be either dominant or recessive through his experiments with pea plants, focusing on a mono-hybrid cross. He crossed tall (TT) pea plants with dwarf (tt) pea plants. The resulting F1 generation plants were all tall, indicating that the tall trait was dominant. When Mendel self-pollinated these F1 plants, the F2 generation showed a ratio where 1/4 of the plants were dwarf. This result led Mendel to conclude that the F1 tall plants were not true-breeding but carried both tall and dwarf traits. The dominance of the tall trait over the dwarf trait reinforced the idea that traits can be categorized as dominant or recessive.

4. **How do Mendel’s experiments show that traits are inherited independently?**

Solution:
Mendel's dihybrid cross experiment revealed that traits are inherited independently of one another. He used two traits: seed shape and seed color. In his experiment, yellow (YY) color was dominant over green (yy), and round (RR) shape was dominant over the wrinkled (rr). When crossing plants with dominant traits (RRYY) with those having non-dominant traits (rryy), the F2 generation exhibited a phenotypic ratio of 9:3:3:1. This ratio included 9 plants with round yellow seeds (RRYY), 3 with round green seeds (RRyy), 3 with wrinkled yellow seeds (rrYY), and 1 with wrinkled green seeds (rryy). Mendel observed that the round yellow and wrinkled green plants were parental combinations, while the round green and wrinkled yellow plants were new combinations. The results showed that each trait pair segregates independently, and each type of gamete (RY, Ry, rY, and ry) appeared with equal frequency, supporting the principle of independent assortment.

5. **A man with blood group A marries a woman with blood group O, and their daughter has blood group O. Is this information enough to tell you which of the traits – blood group A or O – is dominant? Why or why not?**

Solution:
Based on the information provided, we can determine the dominance relationships between blood types:
Blood Type A vs. Blood Type O:
Blood Type A is dominant.
Blood Type O is recessive.
Possible Genotypes:
For Blood Type A : The genotype can be either AA (homozygous) or AO (heterozygous).
For Blood Type O : The genotype must be OO (homozygous recessive).
Parental Genotypes:
Father's Blood Type : Could be either AA or AO .
Mother's Blood Type : Could be either OA or OO .
Implications for Offspring:
If the father is AA and the mother is OO , all offspring will have the genotype AO , resulting in Blood Type A.
If the father is AO and the mother is OO , there is a 50% chance for each offspring to have Blood Type A (genotype AO) and a 50% chance to have Blood Type O (genotype OO).

6. **How is the sex of the child determined in human beings?**
Solution:

In humans, the determination of a child's sex is indeed influenced by the chromosomes contributed by both parents, but it's crucial to understand the roles of the X and Y chromosomes in this process:

Chromosomal Combinations:

Males have one X and one Y chromosome (XY).

Females have two X chromosomes (XX).

Sex Determination:

When a male's X chromosome combines with a female's X chromosome (XX), the combination results in XX, which means the child will be female (a girl).

When a male's Y chromosome combines with a female's X chromosome (XX), the combination results in XY, which means the child will be male (a boy).

7. **A Mendelian experiment consisted of breeding tall pea plants bearing violet flowers with short pea plants bearing white flowers. The progeny all bore violet flowers, but almost half of them were short. This suggests that the genetic makeup of the tall parent can be depicted as**

(a) TTWW

(b) TTww

(c) TtWW

(d) TtWw

Solution: Correct answer – (c) In this scenario, the tall parent plant is likely heterozygous for both traits, with a genetic makeup of TtWW. Since half of the progeny are short, it indicates that the tall parent plant must also carry the gene for shortness (t), as the presence of short offspring implies that the parent was not pure-breeding for height. The fact that all progenies have violet flowers suggests that violet is dominant over white. Therefore, the tall parent plant must carry the dominant violet flower genes (WW) to produce progenies with violet flowers. This information helps to conclude that the tall parent plant is TtWW, where "T" represents the dominant tall allele, "t" represents the recessive short allele, "W" represents the dominant violet flower allele, and "w" represents the recessive white flower allele.

8. **A study found that children with light-coloured eyes are likely to have parents with light-coloured eyes. On this basis, can we say anything about whether the light eye colour trait is dominant or recessive? Why or why not?**

Solution: To determine whether a trait is dominant or recessive, it is essential to study its inheritance patterns over at least three generations. This approach allows for observing how the trait behaves when crossed with different genotypes and tracking its expression in offspring. Without this generational information, it is challenging to conclusively identify if the trait is dominant or recessive.

The inheritance pattern can reveal whether a trait consistently appears in offspring regardless of the parent's genetic makeup (indicating dominance) or only when both parents carry the trait (indicating recessiveness). Thus, a thorough analysis over multiple generations is crucial for accurate classification.

9. **Outline a project that aims to find the dominant coat colour in dogs.**

Solution:

Dogs have a variety of genes that govern coat colour. There are at least eleven identified gene series (A, B, C, D, E, F, G, M, P, S, T) that influence coat colour in dog. A dog inherits one gene from each of its parents. The dominant gene gets expressed in the phenotype. For example, in the B series, a dog can be genetically black or brown. Let us assume that one parent is homozygous black (BB), while the other parent is homozygous brown (bb

	BB	
	B	B
bb		
	b	Bb	Bb
	b	Bb	Bb

In this case, all the offspring will be heterozygous (Bb). Since black (B) is dominant, all the offspring will be black. However, they will have both B and b alleles. If such heterozygous pups are crossed, they will produce 25% homozygous black (BB), 50% heterozygous black (Bb), and 25% homozygous brown (bb) offspring.

	B	b
B	BB	Bb
b	Bb	Bb

10. **Explain the importance of fossils in deciding evolutionary relationships.**

Solution:

Fossils provide valuable evidence about several aspects of ancient life:
(a) Organisms and Their Paleobiology: Fossils help scientists understand what ancient organisms looked like, how they lived, and their environments. This includes their physical structures, adaptations, and how they fit into their ecosystems.
(b) Behavior of Organisms: Fossils can also offer clues about the behavior of ancient species. For example, a site with over 10,000 skeletons of Hadrosaurus suggests that these dinosaurs lived in herds, providing insights into their social behavior and lifestyle.
(c) Evolutionary History: Fossils are crucial for understanding the evolutionary history of organisms. Discoveries such as Pakicetus, a goat-sized land-dwelling mammal that is an ancestor of modern whales, illustrate how species have evolved from one form to another.

11. **How is the equal genetic contribution of male and female parents ensured in the progeny?**

Solution:

Equal genetic contribution from both male and female parents is ensured through the inheritance of chromosomes during reproduction. Humans have 23 pairs of chromosomes, where 22 pairs are autosomes and the remaining pair consists of sex chromosomes, X and Y. Females have two X chromosomes (XX), while males have one X and one Y chromosome (XY). During fertilization, the male gamete (sperm) and the female gamete (egg) fuse to form a diploid zygote. This zygote receives genetic material equally from both parents: the male contributes 22 autosomes plus either an X or Y chromosome, while the female contributes 22 autosomes plus an X chromosome. This ensures a balanced genetic inheritance and determines the sex of the offspring

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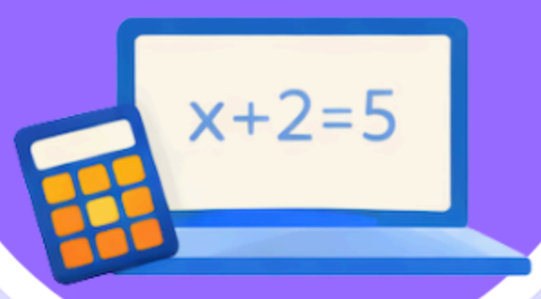

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