Practice Test 06 — Answer Key

Module 10: Inheritance

Part A: Multiple Choice

1. **B** — An allele is one of two or more alternate forms of a gene (e.g., T for tall, t for short).
2. **B** — Genotype is the genetic makeup (e.g., Tt); phenotype is the observable trait (e.g., tall).
3. **B** — Two identical alleles (BB or bb) = homozygous.
4. **C** — Two different alleles (Bb) = heterozygous.
5. **C** — Gregor Mendel studied inheritance using pea plants (Pisum sativum).
6. **A** — Aa × Aa → 1 AA : 2 Aa : 1 aa. Only 1/4 (aa) shows the recessive phenotype.
7. **C** — Tt × tt → 50% Tt (tall) : 50% tt (short). So 50% will be short.
8. **B** — BB × bb → all offspring are Bb (heterozygous, showing the dominant phenotype).
9. **B** — A test cross (crossing with a homozygous recessive) reveals whether the dominant individual is BB or Bb based on the offspring.
10. **B** — The Law of Segregation: during gamete formation, the two alleles for each gene separate, so each gamete carries only one allele.
11. **C** — When the heterozygote shows a blended (intermediate) phenotype, it is incomplete dominance.
12. **B** — RW × RW → 1 RR (Red) : 2 RW (Pink) : 1 WW (White). This is the hallmark 1:2:1 ratio of incomplete dominance.
13. **B** — Blood type AB is codominance: both the A and B antigens are fully expressed on the red blood cell surface.
14. **C** — Height, skin color, and eye color are polygenic traits — influenced by multiple genes, producing continuous variation.
15. **B** — Genes on the X chromosome produce sex-linked (X-linked) traits.
16. **B** — Males have only one X chromosome (XY), so a single recessive allele on the X is expressed because there is no second X to mask it.

17. **C** — A pedigree is a family chart used to trace how a trait is inherited across generations.
18. **C** — X^C X^c × X^C Y → Sons: 50% X^C Y (normal), 50% X^c Y (color blind). So 50% of sons will be color blind.

Part B: Fill in the Blank

1. **Dominant**; **Recessive**
2. **Phenotype**; **Genotype**
3. **Dihybrid** cross
4. **Sex** chromosomes; **XX**; **XY**
5. **Affected female**; **Affected male**

Part C: Short Answer

1. **Punnett Square: Aa × Aa**

	A	**a**
A	AA	Aa
a	Aa	aa

   - **Genotypic ratio:** 1 AA : 2 Aa : 1 aa
   - **Phenotypic ratio:** 3 dominant : 1 recessive

2. **Incomplete Dominance vs. Codominance:**

   - **Incomplete dominance:** The heterozygous phenotype is a blend of the two homozygous phenotypes. Example: Red × White snapdragons → Pink offspring. Neither allele completely dominates.
   - **Codominance:** Both alleles are fully and simultaneously expressed in the heterozygote. Example: Blood type AB (I^A I^B) — both A and B antigens appear on the red blood cell surface.
   - Key difference: Incomplete dominance blends the two phenotypes into one intermediate; codominance shows both phenotypes side by side.

3. **Color Blindness Cross: X^c Y × X^C X^c**

	X^C	**X^c**
X^c	X^C X^c (carrier daughter)	X^c X^c (color blind daughter)
Y	X^C Y (normal son)	X^c Y (color blind son)

   - Probability of daughters being color blind: **50%** (1 out of 2 daughters)
   - Probability of sons being color blind: **50%** (1 out of 2 sons)

4. **Definitions:**

   - **Allele:** An alternate form of a gene found at the same position on a chromosome (e.g., T for tall, t for short).
   - **Genotype:** The genetic makeup of an organism — the specific combination of alleles it carries (e.g., Tt, AA, aa).
   - **Phenotype:** The observable physical traits of an organism that result from its genotype (e.g., tall, short, brown eyes).
   - **Dominant:** The allele that is expressed when at least one copy is present; it masks the recessive allele in the heterozygote (e.g., T in Tt).
   - **Recessive:** The allele that is only expressed when two copies are present (homozygous recessive); it is masked by the dominant allele in the heterozygote (e.g., t in Tt → the organism appears tall, not short).