

Zoe's Summer of Secrets: Heredity Unlocked

Grade 6

science

summer-vacation

Students will be able to explain how traits are inherited from parents and how genetic variation occurs in offspring.

Name: _____

Date: _____

1. Zoe arrives at her grandma's beach house for summer. She notices her grandma, her mom, and herself all have the same bright green eyes. What is the scientific word for a physical feature passed from parents to offspring?

2. Zoe finds an old photo album — a rare find — in grandma's attic. True or False: Genes are the instructions inside cells that determine which traits an organism inherits.

3. Zoe discovers a unique item: grandma's journal listing family eye colors. Grandma has two copies of the dominant green-eye allele (GG). Grandpa had two copies of the recessive blue-eye allele (gg). What genotype would ALL of their children have? Explain why.

4. Zoe reads that her mom (Gg) married her dad (Gg). Use a Punnett square to find the possible genotypes of their children. List all four boxes and identify which show green eyes.

5. Zoe spots a special object: a tide-pool starfish that can regrow a lost arm. Her cousin asks if this regrown arm trait will appear in the starfish's offspring. What is your hypothesis? Use the words inherited trait and acquired trait in your answer.

6. Zoe uncovers a hidden treasure: a sealed box of grandma's seed packets from rare beach flowers. Grandma crossed a red-flowered plant (RR) with a white-flowered plant (rr). The first generation (F1) all showed pink flowers (Rr) — neither color was fully dominant. What type of inheritance pattern is this? If Zoe crosses two F1 pink plants (Rr × Rr), predict the phenotype ratio of the second generation (F2) and explain what this shows about how alleles interact.

7. Zoe compares two beach lizards. Lizard A has a rare find: a bold striped pattern no other lizard in the group shows. Zoe forms a hypothesis. Explain two different sources of genetic variation that could cause Lizard A's unique pattern. Then describe how this variation could affect the lizard population over many generations if stripes help camouflage the lizard from predators.

8. Zoe's summer mission is complete. She has mapped her family's hidden treasure: a full three-generation trait record. Zoe notices her uncle has a cleft chin, but neither of his parents does. Using what you now know about dominant and recessive alleles, genotypes, and inheritance patterns, write a full scientific explanation for how her uncle could have a trait that neither parent visibly shows. Use the terms carrier, recessive allele, genotype, and phenotype in your answer. Then explain why this discovery matters to scientists who study inherited diseases.

Answer Key: Zoe's Summer of Secrets: Heredity Unlocked

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Before Q6, ask students which traits from Q3 and Q5 they think Zoe would pass to her own children someday — this bridges the Punnett square work directly to the real family data on this worksheet.

- Zoe arrives at her grandma's beach house for summer. She notices her grandma, her mom, and herself all have the same bright green eyes. What is the scientific word for a physical feature passed from parents to offspring?

Answer: Q1: A physical feature passed from parents to offspring is called a TRAIT. Green eye color is an inherited trait. Zoe, her mom, and her grandma share this trait because they received the same genetic information down the family line. Answer = trait.
- Zoe finds an old photo album — a rare find — in grandma's attic. True or False: Genes are the instructions inside cells that determine which traits an organism inherits.

Answer: Q2: Genes are segments of DNA that carry instructions for building traits. These instructions are passed from parent to offspring. The statement is completely accurate. Answer = TRUE.
- Zoe discovers a unique item: grandma's journal listing family eye colors. Grandma has two copies of the dominant green-eye allele (GG). Grandpa had two copies of the recessive blue-eye allele (gg). What genotype would ALL of their children have? Explain why.

Answer: Q3: In a cross between GG and gg, every offspring receives one G allele from grandma and one g allele from grandpa. $GG \times gg \rightarrow$ all offspring are Gg. Because G is dominant, all children would show green eyes. Answer = all children have genotype Gg and show the dominant green-eye trait.
- Zoe reads that her mom (Gg) married her dad (Gg). Use a Punnett square to find the possible genotypes of their children. List all four boxes and identify which show green eyes.

Answer: Q4: Punnett square for $Gg \times Gg$ — top alleles G and g, side alleles G and g. Box 1: GG, Box 2: Gg, Box 3: Gg, Box 4: gg. GG = green eyes (dominant homozygous). Gg = green eyes (dominant allele present). gg = blue eyes (recessive homozygous). Ratio: 3 green-eyed offspring : 1 blue-eyed offspring out of every 4 possible outcomes. Answer = genotypes are GG, Gg, Gg, gg; three out of four possible outcomes show green eyes.
- Zoe spots a special object: a tide-pool starfish that can regrow a lost arm. Her cousin asks if this regrown arm trait will appear in the starfish's offspring. What is your hypothesis? Use the words inherited trait and acquired trait in your answer.

Answer: Q5: An inherited trait is coded in an organism's DNA and passed to offspring. An acquired trait is gained during an organism's lifetime and is NOT written into DNA. The starfish's ability to regrow an arm is a built-in inherited trait. However, the specific regrown arm itself is an acquired characteristic of that individual. Hypothesis: the regrown arm will NOT appear in offspring because acquired traits are not encoded in genes and therefore cannot be inherited. Answer = the regrown arm is an acquired trait and will not pass to offspring; the regeneration ability itself is inherited.
- Zoe uncovers a hidden treasure: a sealed box of grandma's seed packets from rare beach flowers. Grandma crossed a red-flowered plant (RR) with a white-flowered plant (rr). The first generation (F1) all showed pink flowers (Rr) — neither color was fully dominant. What type of inheritance pattern is this? If Zoe crosses two

F1 pink plants ($Rr \times Rr$), predict the phenotype ratio of the second generation (F2) and explain what this shows about how alleles interact.

Answer: Q6: When neither allele is fully dominant and the offspring show a blended phenotype, this is called incomplete dominance. F1 cross: $RR \times rr \rightarrow$ all Rr (pink). F2 Punnett square: $Rr \times Rr \rightarrow$ RR (red), Rr (pink), Rr (pink), rr (white). Phenotype ratio = 1 red : 2 pink : 1 white. This shows that in incomplete dominance both alleles are expressed partially, producing a phenotype between the two parent phenotypes. Neither allele completely masks the other. Answer = incomplete dominance; F2 ratio is 1 red : 2 pink : 1 white, showing that allele interaction can blend traits rather than one masking the other.

7. Zoe compares two beach lizards. Lizard A has a rare find: a bold striped pattern no other lizard in the group shows. Zoe forms a hypothesis. Explain two different sources of genetic variation that could cause Lizard A's unique pattern. Then describe how this variation could affect the lizard population over many generations if stripes help camouflage the lizard from predators.

Answer: Q7: Source 1 — Mutation: a random change in DNA can create a new allele that codes for the striped pattern. This change may have occurred in a parent's reproductive cells and been passed to Lizard A. Source 2 — Sexual reproduction and recombination: when two parents reproduce, alleles from both parents combine in new ways. A combination of alleles from both parents could produce a pattern not seen in either parent alone. Long-term population effect: if stripes camouflage the lizard and help it survive predators, striped lizards survive longer and reproduce more. Over many generations, natural selection favors the stripe allele. The frequency of the stripe allele increases in the population. This is how inherited variation drives evolutionary change. Answer = mutation and recombination are two sources of variation; if stripes aid survival, natural selection increases the stripe allele's frequency across generations.

8. Zoe's summer mission is complete. She has mapped her family's hidden treasure: a full three-generation trait record. Zoe notices her uncle has a cleft chin, but neither of his parents does. Using what you now know about dominant and recessive alleles, genotypes, and inheritance patterns, write a full scientific explanation for how her uncle could have a trait that neither parent visibly shows. Use the terms carrier, recessive allele, genotype, and phenotype in your answer. Then explain why this discovery matters to scientists who study inherited diseases.

Answer: Q8: A recessive allele can be carried in an organism's genotype without appearing in its phenotype. If both of Zoe's uncle's parents are carriers — meaning each parent has genotype Cc (one dominant allele C , one recessive allele c) — their phenotype shows the dominant trait (no visible cleft chin) because C masks c . However, when two carriers reproduce, there is a 1-in-4 chance an offspring inherits cc — one recessive allele from each parent. An offspring with genotype cc has a phenotype that expresses the recessive trait, in this case the cleft chin. The parents are called carriers because they carry the recessive allele without showing it. Punnett square: $Cc \times Cc \rightarrow CC$ (no cleft), Cc (carrier, no cleft), Cc (carrier, no cleft), cc (cleft chin expressed). This matters to scientists studying inherited diseases because many serious genetic conditions — such as cystic fibrosis or sickle cell disease — follow this same recessive pattern. Two healthy carrier parents can have an affected child. Understanding carrier genotypes allows scientists to predict disease risk in families, develop genetic screening tools, and work toward treatments that target the specific allele responsible. Zoe's three-generation map is exactly the kind of family pedigree scientists use to trace how hidden alleles travel through a family over time. Answer = both parents are carriers (Cc); each passed a recessive allele (c) to the uncle, giving him genotype cc and expressing the recessive phenotype; this models how inherited diseases can skip generations and why carrier screening matters in medicine.