

Science Olympiad Heredity

Multiple Choice

Identify the letter of the choice that best completes the statement or answers the question.

1. A Punnett square shows you all the ways in which ____ can combine.
 - a. alleles
 - b. eggs
 - c. sperm
 - d. colors
2. Blood type in humans is controlled by ____ alleles.
 - a. one
 - b. two
 - c. three
 - d. four
3. Mendel called plants that received different alleles for a trait from each parent ____.
 - a. hybrids
 - b. dominant
 - c. genotypes
 - d. phenotypes
4. Which of these is a recessive genetic disorder?
 - a. Down syndrome
 - b. type AB blood
 - c. type O blood
 - d. cystic fibrosis
5. In a Punnett square, a capital letter stands for a ____ allele.
 - a. recessive
 - b. dominant
 - c. homozygous
 - d. heterozygous
6. Of the following, which is NOT a human blood phenotype?
 - a. O
 - b. AB
 - c. B
 - d. C
7. Of the following, which represents a homozygous recessive genotype?
 - a. TT
 - b. Tt
 - c. tt
 - d. TTT
8. Factors that control traits are called
 - a. genes.
 - b. purebreds.
 - c. recessives.
 - d. parents.
9. What does the notation TT mean to geneticists?
 - a. two dominant alleles
 - b. heterozygous alleles
 - c. at least one dominant allele
 - d. one dominant and one recessive allele
10. What does the notation Tt mean to geneticists?
 - a. two dominant alleles

- b. two recessive alleles
 - c. homozygous alleles
 - d. one dominant allele and one recessive allele
11. What does a Punnett square show?
- a. all the possible outcomes of a genetic cross
 - b. only the dominant alleles in a genetic cross
 - c. only the recessive alleles in a genetic cross
 - d. all of Mendel's discoveries about genetic crosses
12. If a homozygous black guinea pig (BB) is crossed with a homozygous white guinea pig (bb), what is the probability that an offspring will have black fur?
- a. 25 percent
 - b. 50 percent
 - c. 75 percent
 - d. 100 percent
13. An organism's physical appearance is its
- a. genotype.
 - b. phenotype.
 - c. codominance.
 - d. heterozygous.

Matching

Match each term with the correct description below.

- | | |
|-----------------|--------------------------|
| a. pedigree | e. probability |
| b. heterozygous | f. incomplete dominance |
| c. genotype | g. multiple alleles |
| d. phenotype | h. polygenic inheritance |
14. organisms with two different alleles for a trait
15. when an intermediate form is expressed in offspring
16. when more than two alleles control a trait
17. physical appearance of an organism
18. helps determine the chance that something will occur
19. when a group of gene pairs act together
20. genetic makeup of an organism
21. tool for tracing a trait through a family

Match each term with the correct description below.

- a. Punnett square
- b. homozygous
- c. heredity
- d. dominant factor
- e. recessive factor
- f. alleles
- g. genetics

- 22. a genetics tool that uses letters to represent dominant and recessive alleles
- 23. a factor that seems to disappear
- 24. when there are two alleles that are exactly the same
- 25. a factor that covers up another factor
- 26. the different forms a gene has for a trait
- 27. passing on of traits from parents to offspring
- 28. study of heredity

Short Answer

- 29. A family has four children, two girls and two boys. One girl and one boy are color-blind. Are their parents color-blind?
- 30. Offspring with homozygous alleles received how many alleles from each parent?
- 31. What possible genotypes will the offspring have if the parents' blood types are O and AB?

Use the diagram to answer each question.

Punnett Squares

		<i>F</i> ₁ generation				<i>F</i> ₂ generation		
		<i>W</i>	<i>W</i>			<i>W</i>	<i>w</i>	
<i>w</i>	<i>Ww</i>	<i>Ww</i>					<i>WW</i>	<i>Ww</i>
<i>w</i>	<i>Ww</i>	<i>Ww</i>					<i>Ww</i>	<i>ww</i>

W = white flowers

w = purple flowers

32. Which trait—white flowers or purple flowers—is controlled by a dominant allele? Which is controlled by a recessive allele? How do you know?
33. In which generation are the parents purebred? In which generation are they hybrids?
34. In the *F*₁ generation, what is the genotype of the offspring? What is their phenotype?
35. In the *F*₂ generation, what percent of the offspring have purple flowers? What is the genotype of the purple-flowered offspring?
36. In the *F*₂ generation, what percent of the offspring have white flowers? What are the genotypes of the white-flowered offspring?
37. Suppose one of the parents of the *F*₂ generation had been *ww* instead of *Ww*. What percent of the offspring would have purple flowers? What percent would have white flowers?

Science Olympiad Heredity Answer Section

MULTIPLE CHOICE

- | | | | |
|---------------------|---------|--------------|-----------------------------|
| 1. ANS: A | DIF: B | OBJ: 3/1 | STO: 1SC-E2 PO1 |
| 2. ANS: C | DIF: B | OBJ: 6/2 | |
| 3. ANS: A | DIF: B | OBJ: 2/1 | STO: 2SC-E6 PO2, 2SC-E6 PO4 |
| 4. ANS: D | DIF: B | OBJ: 7/2 | STO: 4SC-E6 PO2, 4SC-E6 PO3 |
| 5. ANS: B | DIF: B | OBJ: 3/1 | STO: 1SC-E2 PO1 |
| 6. ANS: D | DIF: B | OBJ: 6/2 | |
| 7. ANS: C | DIF: B | OBJ: 3/1 | STO: 1SC-E2 PO1 |
| 8. ANS: A | DIF: L1 | REF: p. C-79 | OBJ: C.3.1.2 |
| 9. ANS: A | DIF: L1 | REF: p. C-80 | OBJ: C.3.1.2 |
| STO: GR8.S4.C2.PO.3 | | | |
| 10. ANS: D | DIF: L3 | REF: p. C-80 | OBJ: C.3.1.2 |
| STO: GR8.S4.C2.PO.3 | | | |
| 11. ANS: A | DIF: L2 | REF: p. C-86 | OBJ: C.3.2.1 |
| 12. ANS: D | DIF: L2 | REF: p. C-87 | OBJ: C.3.2.1 |
| 13. ANS: B | DIF: L1 | REF: p. C-88 | OBJ: C.3.2.2 |
| STO: GR8.S4.C2.PO.3 | | | |

MATCHING

- | | | | |
|---|--------|----------|-----------------------------|
| 14. ANS: B | DIF: B | OBJ: 5/2 | |
| 15. ANS: F | DIF: B | OBJ: 6/2 | |
| 16. ANS: G | DIF: B | OBJ: 4/1 | |
| 17. ANS: D | DIF: B | OBJ: 4/1 | |
| 18. ANS: E | DIF: B | OBJ: 3/1 | STO: 1SC-E2 PO1 |
| 19. ANS: H | DIF: B | OBJ: 8/2 | |
| 20. ANS: C | DIF: B | OBJ: 6/2 | |
| 21. ANS: A | DIF: B | OBJ: 4/1 | |
| 22. ANS: A | DIF: B | OBJ: 3/1 | STO: 1SC-E2 PO1 |
| 23. ANS: E | DIF: B | OBJ: 1/1 | |
| STO: 1SC-E2 PO2, 1SC-E2 PO3, 4SC-E6 PO1, 4SC-E6 PO2, 4SC-E6 PO3 | | | |
| 24. ANS: B | DIF: B | OBJ: 2/1 | STO: 2SC-E6 PO2, 2SC-E6 PO4 |
| 25. ANS: D | DIF: B | OBJ: 2/1 | STO: 2SC-E6 PO2, 2SC-E6 PO4 |
| 26. ANS: F | DIF: B | OBJ: 1/1 | |
| STO: 1SC-E2 PO2, 1SC-E2 PO3, 4SC-E6 PO1, 4SC-E6 PO2, 4SC-E6 PO3 | | | |
| 27. ANS: C | DIF: B | OBJ: 4/1 | |
| 28. ANS: G | DIF: B | OBJ: 1/1 | |
| STO: 1SC-E2 PO2, 1SC-E2 PO3, 4SC-E6 PO1, 4SC-E6 PO2, 4SC-E6 PO3 | | | |

SHORT ANSWER

29. ANS:
The father is color-blind; the mother is a carrier.

DIF: A OBJ: 8/2

30. ANS:
one

DIF: B OBJ: 3/1 STO: 1SC-E2 PO1

31. ANS:
AO or BO

DIF: A OBJ: 6/2

32. ANS:
White flowers are controlled by a dominant allele. Purple flowers are controlled by a recessive allele. Dominant alleles are represented by capital letters, and recessive alleles are represented by the lowercase versions of the same letters.

DIF: L2 REF: p. C-80 OBJ: C.3.1.2

33. ANS:
The parents in the F_1 generation are purebred. The parents in the F_2 generation are hybrids.

DIF: L3 REF: p. C-77, p. C-80 OBJ: C.3.1.2

34. ANS:
The genotype is Ww . The phenotype is white flowers.

DIF: L2 REF: p. C-88 OBJ: C.3.2.2

35. ANS:
In the F_2 generation, 25% of the offspring have purple flowers. Their genotype is ww .

DIF: L3 REF: p. C-87 OBJ: C.3.2.1

36. ANS:
In the F_2 generation, 75% of the offspring have white flowers. Their genotypes are WW and Ww .

DIF: L3 REF: p. C-87 OBJ: C.3.2.1

37. ANS:
If one of the parents had been ww , 50% of the offspring would have purple flowers and 50% would have white flowers.

DIF: L3 REF: p. C-87 OBJ: C.3.2.1