Chapter 12 Review

READING TOOLBOX

1. **Punnet Square** Create a Punnet square of a cross between a heterozygous parent and a homozygous parent. Determine the ratio of genotypes and phenotypes.
2. **Concept Map** Make a concept map that describes Mendel's experiments and results. Try to include the following words: *pea plants, alleles, P generation, F_1 generation, F_2 generation, dominant trait, recessive trait, segregation,* and *independent assortment.*

Using Key Terms

Use each of the following terms in a separate sentence.

3. *character*
4. *Punnett square*
5. *codominance*

For each pair of terms, explain how the meanings of the terms differ.

6. *genotype* and *phenotype*
7. *trait* and *allele*
8. *homozygous* and *heterozygous*
9. *incomplete dominance* and *codominance*

Understanding Key Ideas

10. The scientist whose studies formed the basis of modern genetics is
    a. T.A. Knight. **c.** Louis Pasteur.
    b. Gregor Mendel. **d.** Robert Hooke.
11. In Mendel's first experiments with pea plants, the average ratio of contrasting traits in the F_2 generation was
    a. 1:0. **c.** 2:1.
    b. 1:1. **d.** 3:1.
12. Each alternate version of a gene is called a(n)
    a. trait. **c.** genotype.
    b. allele. **d.** phenotype.
13. Some people are born with an extra finger or toe. People who have this trait have inherited either one or two of the same allele. So, the trait is



    a. recessive.
    b. dominant.
    c. phenotypic.
    d. independent.
14. The phenotype of an organism
    a. cannot be seen.
    b. exactly matches its genotype.
    c. is the physical result of its genes.
    d. occurs only in true-breeding organisms.
15. Mendel obtained his P generation by forcing pea plants to
    a. segregate. **c.** cross-pollinate.
    b. self-pollinate. **d.** assort independently.
16. What law states that the inheritance of one trait has no effect on the inheritance of another?
    a. the law of dominance
    b. the law of segregation
    c. the law of universal inheritance
    d. the law of independent assortment
17. Which of the following can help determine if an inherited trait is sex-linked?
    a. a ratio **c.** a pedigree
    b. a testcross **d.** a Punnett square
18. What is the expected phenotypic ratio resulting from a cross of a homozygous dominant parent with a heterozygous parent? Assume complete dominance.
    a. 1:3:1 **c.** 2:1
    b. 1:2:1 **d.** 1:0

Explaining Key Ideas

19. **Summarize** the design of Mendel's plant studies.
20. **State** the law of segregation in your own words.
21. **Describe** the information that a pedigree shows.
22. **Describe** incomplete dominance.

Assignment Guide

Section	Questions
1	2, 3, 7, 10, 11, 15, 19, 31
2	4, 6, 7, 12, 13, 14, 16, 20, 25
3	1, 17, 18, 21, 23, 24, 26, 29, 30, 32
4	9, 22, 27, 28

Review

Reading Toolbox

1.

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

1:1

2. See previous page for answer to concept map.

Using Key Terms

3. A *character* can have several traits.
4. A *Punnett square* looks like a small multiplication table.
5. *Codominance* occurs when two traits are expressed at the same time.
6. *Genotype* is what's in the genes. *Phenotype* is what results from the genes.
7. *Traits* are possible variations of a character. *Alleles* are possible variations of a gene.
8. *Homozygous* is two alleles that are the same. *Heterozygous* is two alleles that are different.
9. *Incomplete dominance* results in blended traits. *Codominance* occurs when two traits are fully expressed at the same time.

Understanding Key Ideas

10. b 11. d 12. b 13. b
14. c 15. b 16. d 17. c
18. d

Explaining Key Ideas

19. Mendel's first experiments used monohybrid crosses and were carried out in three steps. (1) The P generation was bred by self-pollination for many generations to obtain true-breeding phenotypes. (2) The F_1 generation was bred by the cross-pollination of two different P parents. (3) The F_2 generation was bred by the self-pollination of F_1.
20. The law of segregation means that chromosome pairs separate when gametes are formed, so each gamete gets one allele for each gene.
21. A pedigree shows the appearance or absence of a trait through several generations of related individuals.
22. Incomplete dominance occurs when the heterozygous phenotype is intermediate between (or a combination of) the homozygous phenotypes.

23. Note: Accept alleles in any order such as *Rr* or *rR*.

	RY	*Ry*	*rY*	*ry*
RY	*RRYY*	*RRYy*	*RrYY*	*RrYy*
Ry	*RRyY*	*RRyy*	*RryY*	*Rryy*
rY	*rRYY*	*rRYy*	*rrYY*	*rrYy*
ry	*rRyY*	*rRyy*	*rryY*	*rryy*

24. b

Critical Thinking

25. Inheritance involves probability. One can only see patterns by analyzing many sample events and large amounts of data.

26. The statement is true. Sample explanation: Even if a person somehow had all three alleles of the ABO blood-group gene (which is not likely), the alleles I^A and I^B code for surface molecules, while *i* codes for no molecule, so a person with all three alleles would still be type AB and not type ABO.

27. Accept all reasonable answers. Human behavior is influenced partly by the complex interactions of genes, and by environmental factors. Human behavior is not completely understood.

28. The woman could be a carrier of the recessive cystic fibrosis allele.

Writing for Science

29. Student summaries should indicate that the high incidence of Hopi albinism is probably due to the size of the population. Once a few children with albinism are born in a small population, the albinism allele is more likely to be passed on and occur in homozygous form in successive generations.

Methods of Science

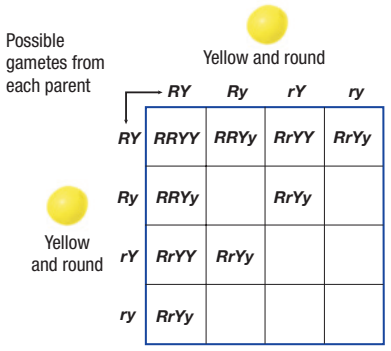
30. Student designs will vary but should be similar to Mendel's dihybrid cross experiments. If the two characters show fully independent assortment, then they are not linked.

Alternative Assessment

31. Student speeches should be realistic and written in a formal style. Consider providing time for interested students to deliver their speeches.

Using Science Graphics

Use the diagram of a dihybrid cross Punnett square to answer the following question(s).



23. Copy the Punnett square onto a separate piece of paper. Then, fill in the missing possible genotypes of offspring.

24. When homologous chromosomes are separated during meiosis, only chance determines which of the pair is passed into any given gamete. This finding is known as the
- **a.** law of chance.
- **b.** law of segregation.
- **c.** law of universal inheritance.
- **d.** law of independent assortment.

Critical Thinking

25. Evaluating Methods Mendel based his conclusion about inheritance patterns on experiments involving large numbers of plants. Why is it important to study many individuals when studying patterns of inheritance?

26. Justifying Conclusions A classmate states that a person cannot have type ABO blood. Is this statement true? Explain your answer.

27. Forming Reasoned Opinions Do you think that human behavior is determined by genes? Explain your answer.

28. Justifying Conclusions A 20-year-old man who has cystic fibrosis has a sister who is planning to have a child. The man encourages his sister to see a genetic counselor. Why do you think the man gave his sister this advice?

Writing for Science

29. Summarizing The Hopi, a Native American people, have an unusually high ratio of persons who have the albinism trait. Research current hypotheses explaining why albinism is more common in people of Hopi ancestry than in other populations. Write a short summary of your findings.

Methods of Science

30. Designing an Experiment In tomato plants, tallness is dominant over dwarfness, and hairy stems are dominant over hairless stems. You can buy true-breeding (homozygous) plants that are tall and have hairy stems or that are dwarf and have hairless stems. Design an experiment to determine whether the genes for height and hairiness of the stem are closely linked on chromosomes.

Alternative Assessment

31. Speech Imagine that you have just been awarded the Nobel Prize in medicine for your research in human genetics and heredity. Write and perform an acceptance speech describing how Gregor Mendel influenced your work.

Math Skills

32. Probability The mathematics of independent assortment applies to any set of independent events, such as the numbers drawn in a lottery. For example, suppose 10 balls are marked from 0 to 9 and placed in a jar. If the balls are mixed thoroughly and one is taken out, the chances are 1 in 10 that a particular number will be drawn. If two jars are used, the chances of the same number being drawn from both jars is

$$\frac{1}{10} \times \frac{1}{10} = \frac{1}{100}$$

or 1 in 100. Suppose you enter a lottery that uses four jars that each contain 10 numbered balls. A number is drawn from each jar in sequence to make a four-digit number. If you choose the number 9,999, what is the chance that your number will be drawn?

Math Skills

32. The chance for the number 9 to be drawn from a jar is $\frac{1}{10}$. The chance that a nine will be drawn from each of the four jars is $(\frac{1}{10} \times \frac{1}{10} \times \frac{1}{10} \times \frac{1}{10}) = \frac{1}{10{,}000}$.