In sexual reproduction, genes are passed from parents to offspring in predictable patterns.

Living things inherit traits in patterns.
Offspring inherit alleles, which are forms of genes, from their parents. Alleles can be dominant or recessive. The alleles you have are your genotype; the observable characteristics that come from your genotype are your phenotype.

Patterns of heredity can be predicted.
Punnett squares show possible outcomes of heredity. Ratios and percentages can be used with Punnett squares to express the probability of particular outcomes.

Meiosis is a special form of cell division.
- At the beginning of meiosis I, the parent cell has two copies of each chromosome pair.
- During meiosis I, the homologs of the chromosome pair separate; there are two cells, each with two copies of one homolog from each pair.
- During meiosis II, the two copies of each homolog separate; each daughter cell has one homolog.

VOCABULARY
- sexual reproduction p. 102
- gene p. 102
- heredity p. 102
- allele p. 103
- phenotype p. 106
- genotype p. 106
- dominant p. 107
- recessive p. 107

VOCABULARY
- Punnett square p. 110
- ratio p. 112
- probability p. 112
- percentage p. 112

VOCABULARY
- gamete p. 118
- egg p. 118
- sperm p. 118
- fertilization p. 118
- meiosis p. 119
11. In guinea pigs, the allele for black fur (B) is dominant, and the allele for brown fur (b) is recessive. If a BB male mates with a Bb female, what percentage of offspring are likely to have black fur?
   a. 100 percent  
   b. 75 percent  
   c. 50 percent  
   d. 25 percent

12. If one parent has two dominant alleles and another parent has two recessive alleles, the offspring will have
   a. the recessive phenotype  
   b. the dominant phenotype  
   c. two dominant alleles  
   d. two recessive alleles

13. Cells that contain half the usual number of chromosomes are
   a. fertilized egg cells  
   b. gametes  
   c. alleles  
   d. diploid cells

14. The process that produces haploid (1n) cells is known as
   a. mitosis  
   b. reproduction  
   c. meiosis  
   d. fertilization

15. What happens when fertilization occurs?
   a. Two 2n cells combine in a new cell.  
   b. Two 1n cells combine into a new cell.  
   c. Two 2n daughter cells are produced.  
   d. Two 1n daughter cells are produced.

16. Which does not occur during meiosis?
   a. Four haploid daughter cells are produced.  
   b. Two diploid daughter cells are produced.  
   c. Only cells that are gametes are produced.  
   d. Daughter cells are produced that contain half the chromosomes of the parent cell.

Short Answer  Write a short answer to each question.

17. In what case would a recessive allele be expressed in the phenotype of an offspring?

18. Describe the purpose of a Punnett square.

19. How does the number of chromosomes in a person's sex cells compare with the number of chromosomes in the body cells?
**Thinking Critically**

20. **INFER** How was Mendel able to infer that each offspring of two parent pea plants had a pair of “factors” for a particular trait?

21. **COMMUNICATE** Briefly describe how heredity works. Use the terms *gene* and *chromosome* in your explanation.

22. **APPLY** Can a dwarf pea plant ever have a dominant allele? Explain.

23. **ANALYZE** How is a Punnett Square used to show both the genotype and phenotype of both parents and offspring?

24. **APPLY** In rabbits, the allele for black fur is dominant over the allele for white fur. Two black rabbits have a litter of eight offspring. Six of the offspring have black hair and two have white hair. What are the genotypes of the parents? Explain.

*Use the Punnett square below to answer the next two questions.*

```
   B   b
b   Bb  bb
   b   Bb  bb
```

25. **CALCULATE** A parent has one dominant allele for black fur (B) and one recessive allele for white fur (b). The other parent has two recessive alleles for white fur. In this cross what is the chance that an offspring will be born with black fur? With white fur?

26. **CALCULATE** What is the percentage chance that an offspring will have the recessive phenotype?

27. **ANALYZE** This diagram shows the process of fertilization. Which of the cells shown are haploid? Explain.

28. **SUMMARIZE** Briefly describe what happens during meiosis I and meiosis II. What is the function of meiosis?

29. **INFER** Look again at the picture on pages 98–99. Now that you have finished the chapter, how would you change or add details to your answer to the question on the photograph?

30. **SYNTHESIZE** Write one or more paragraphs explaining how Mendel’s observations of pea plants contributed to the study of modern genetics. Use these terms in your explanation.

**UNIT PROJECTS**

If you need to create graphs or other visuals for your project, be sure you have grid paper, poster board, markers, or other supplies.
Chapter 4: Patterns of Heredity

Standardized Test Practice

Analyzing data

The chart below shows the phenotypes of pea-plant offspring.

<table>
<thead>
<tr>
<th>Phenotypes of Pea Plants</th>
<th>Number of Offspring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regular (D)</td>
<td>12</td>
</tr>
<tr>
<td>Dwarf (d)</td>
<td>4</td>
</tr>
</tbody>
</table>

1. What percentage of pea plants showed the dominant phenotype?
   a. 100 percent
   b. 75 percent
   c. 50 percent
   d. 25 percent

2. What percentage of pea plants showed the recessive phenotype?
   a. 100 percent
   b. 75 percent
   c. 50 percent
   d. 25 percent

3. What is the genotype of the dwarf pea plants?
   a. DD
   b. Dd
   c. dd
   d. cannot tell

4. What are the possible genotypes of the regular pea plants?
   a. DD and dd
   b. DD and Dd
   c. Dd and dd
   d. cannot tell

5. What are the genotypes of the parents?
   a. Dd and dd
   b. DD and Dd
   c. Dd and Dd
   d. dd and dd

6. Which statement is true, based on the data in the chart?
   a. If both parents were Dd, then none of the offspring would be dwarf.
   b. If both parents were DD, then none of the offspring would be dwarf.
   c. If one parent were Dd and the other were dd, then none of the offspring would be regular.
   d. If one parent were DD and the other parent were dd, then none of the offspring would be regular.

Extended Response

7. Traits for a widow’s peak hairline (W) and curly hair (C) are controlled by dominant alleles. A family of eight has three children with widow’s peaks. All six children have curly hair. Use your knowledge of heredity to write one or two paragraphs explaining the possible genotypes of the parents.

8. A student proposes a hypothesis that traits that are dominant are more common in the general population than traits with recessive alleles. Describe a procedure you might use to test this hypothesis.