**Name Period**

**Chapter 14: Mendel and the Gene Idea**

If you have completed a first-year high school biology course, some of this chapter will serve as a review for the basic concepts of Mendelian genetics. For other students, this may be your first exposure to genetics. In either case, this is a chapter that should be carefully mastered. Spending some time with this chapter, especially working genetics problems, will give you a solid foundation for the extensive genetics unit in the chapters to come.

***Overview***:

1. In the 1800s the most widely favored explanation of genetics was “blending.” Explain the concept of blending, and then describe how Mendel’s “particulate” (gene) hypothesis was different.

***Concept 14.1 Mendel used the scientific approach to identify two laws of inheritance***

2. One of the keys to success for Mendel was his selection of pea plants. Explain how using pea plants allowed Mendel to control mating; that is, why were pea plants so well suited to Mendel’s experiments?

4. Define the following terms. Then, consider your own family. Which generation would your mother’s grandparents be? Your mother? You?

**P generation**:

**F1 generation**:

**F2 generation**:

5. Explain how Mendel’s simple cross of purple and white flowers did the following:

1. refuted blending:
2. determined dominant and recessive characteristics:
3. demonstrated the merit of experiments that covered multiple generations:

7. In sexually reproducing organisms, why are there exactly two chromosomes in each homologous pair?

8. Mendel’s model consists of four concepts. Describe each concept in the appropriate space below.

Indicate which of the concepts can be observed during meiosis by placing an asterisk by the concept.

|  |  |
| --- | --- |
| Mendel’s Four Concepts | Description of Concept |
| First concept |  |
| Second concept |  |

|  |  |
| --- | --- |
| Third concept |  |
| Fourth concept  (*law of segregation*) |  |

10. In pea plants, *T* is the allele for tall plants, while *t* is the allele for dwarf plants. If you have a tall plant, demonstrate with a *testcross* how it could be determined if the plant is homozygous tall or heterozygous tall. Show the punnet square for each of the two possibilities.

11. Explain the difference between a *monohybrid* cross and a *dihybrid* cross.

12. As you start to work word problems in genetics, two things are critical: the parent’s genotype must be correct, and the gametes must be formed correctly. Using Figure 14.8 as your guide, explain how the gametes are derived for the following cross. (You should have four different gametes).

*YyRr* ×*YyRr*

13. Complete the cross given in question 12 by placing the gametes in a *Punnett square*. Then provide the phenotypic ratio of the offspring.

14. Explain Mendel’s *law of independent assortment*.

***Concept 14.2 The laws of probability govern Mendelian inheritance***

15. An event that is certain to occur has a probability of ­­­\_\_\_\_\_\_ while an event that is certain not to occur has a probability of \_\_\_\_\_\_\_

16. In probability, what is an *independent event*?

17. State the *multiplication rule* and give an original example.

18. State the *addition rule* and give an original example.

19. What is the probability that a couple will have a girl, a boy, a girl, and a boy in this specific order?

***Concept 14.3 Inheritance patterns are often more complex than those predicted by simple Mendelian genetics***

20. Explain how *incomplete dominance* is different from *complete dominance*, and give an example of incomplete dominance.

21. Compare and contrast *codominance* with *incomplete dominance*.

22. Dominant alleles are not necessarily more common than recessive alleles in the gene pool.

Explain why this is true.

23. Explain what is meant when a gene is said to have *multiple alleles*. Blood groups are an excellent human example of this.

24. Blood groups are so important medically that you should be able to solve genetics problems based on blood types. The first step in accomplishing that is to understand the genotypes of each blood type. Before working any problems, complete this ABO blood type chart.

|  |  |
| --- | --- |
| Genotype | Phenotype (blood group) |
| IAIA or IA*i* | A |

|  |  |
| --- | --- |
| IBIB or IB*i* | B |
| IAIB | AB |
| *ii* | O |

25. Question 2 in the *Concept Check 14.3* is a blood type problem. Complete it here, and show your work.

26. What is *pleiotropy*? Explain why this is important in diseases like cystic fibrosis and sickle-cell disease.

27. Explain *epistasis*.

28. Explain why the dihybrid cross detailed in Figure 14.12 in your text has four yellow Labrador retrievers instead of the three that would have been predicted by Mendel’s work.

29. Why is height a good example of *polygenic inheritance*?

30. *Quantitative variation* usually indicates \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ inheritance.

31. Using the terms *norm of reaction* and *multifactorial*, explain the potential influence of the environment on phenotypic expression.

***Concept 14.4 Many human traits follow Mendelian patterns of inheritance***

34. Describe what you think is medically important to know about the behavior of recessive alleles.

35. You are expected to have a general knowledge of the pattern of inheritance and the common symptoms of a number of genetic disorders. Provide this information for the disorders listed below.

a. cystic fibrosis:

b. sickle-cell disease:

c. achondroplasia:

1. Huntington’s disease:

37. Explain the strengths and weaknesses of both amniocentesis and CVS

38. What are the symptoms of *phenylketonuria (PKU*)? How is newborn screening used to identify children with this disorder?