AP Biology **Name** _____

Chapter 14 Guided Reading: Mendel and the Gene Idea
10ed

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.

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 how did this approach let Mendel be positive about the exact characteristics of each parent?

3. What is the difference between a *character* and a *trait*? Explain using an example.

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

   P generation

   F_1 generation

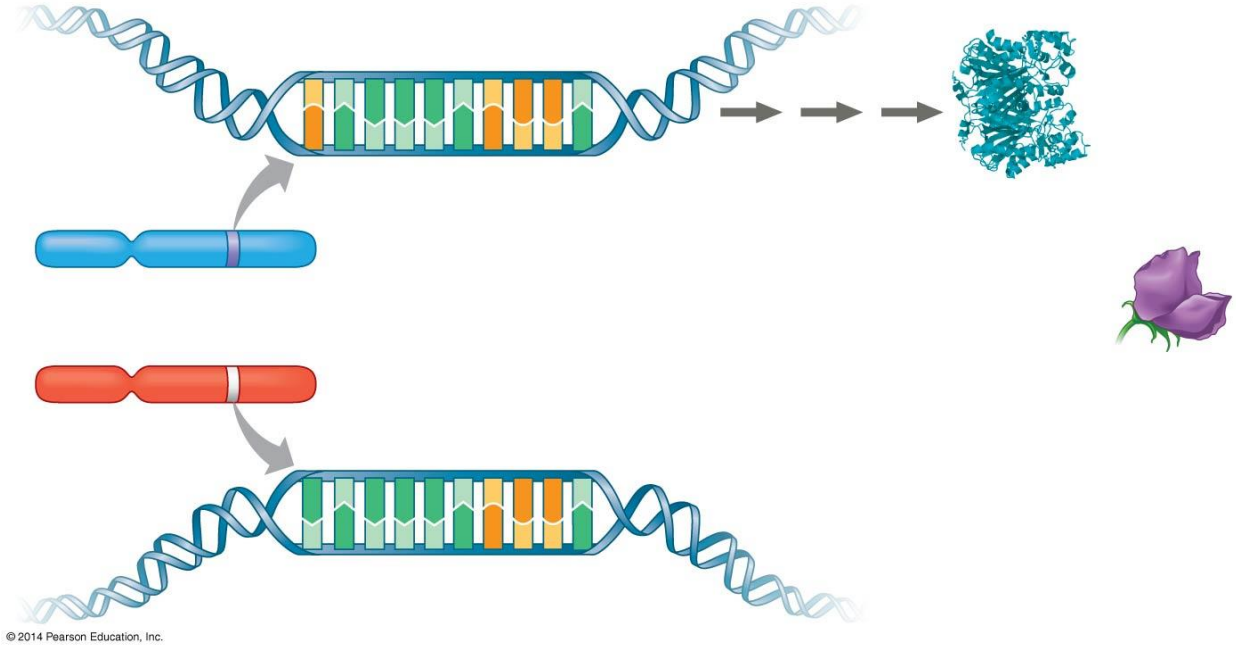
   F_2 generation

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

   b. determined dominant and recessive characteristics

   c. demonstrated the merit of experiments that covered multiple generations

6. Using Fig 14.4, label the *allele for both purple and white flower color*, a *homologous pair*, and the *locus* of the flower color gene. What is the difference between the nucleotide sequences of the purple flower allele compared to the white flower allele? Circle the allele which does not produce a functional gene product.



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 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)	

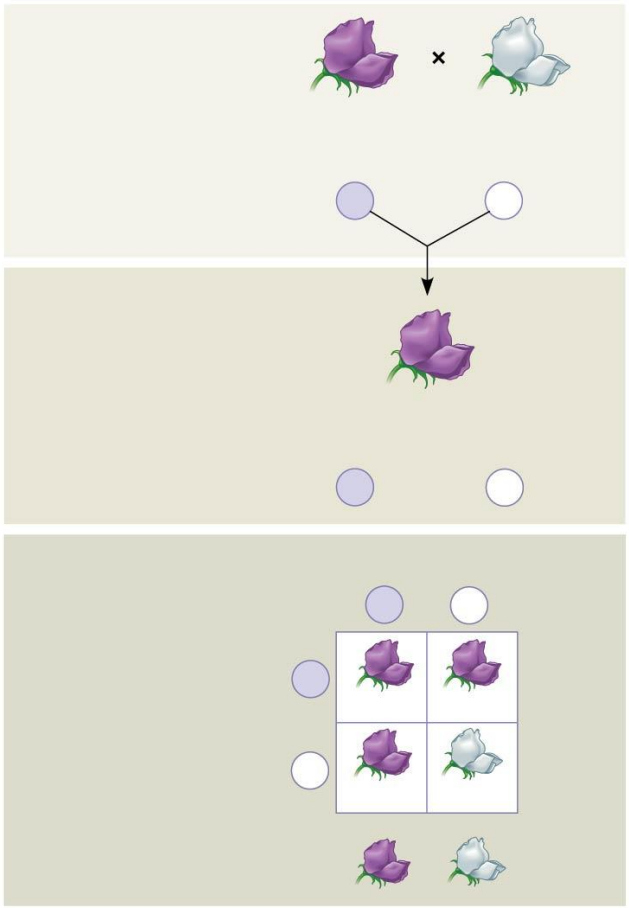
9. Using Fig. 14.5 in your text as your guide, provide the missing notations for the figures below (P, F_1, F_2). Also indicate the alleles for each individual as well as the gametes it produces and complete the Punnett square.

a. What is the F_2 phenotypic ratio? _____, genotypic ratio?

_____.

b. Which generation is completely heterozygous? _____

c. Which generation has both heterozygous and homozygous offspring? _____



10. In pea plants, *T* is the allele for tall plants and *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. (Use Punnett squares)

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 parents 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 X *YyRr*

13. Complete the cross given in question 12 by placing the gametes for each parent below, along the top and sides of the table. Fill in the possible combinations in the *Punnett square*. Finally, provide the phenotypic ratio of the offspring.

Phenotypes/ Phenotypic Ratio:

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

15. An event that is certain to occur has a probability of _____,and 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?

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	Red Blood Cell Appearance	Phenotype (blood group)

25. Question 2 in *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.

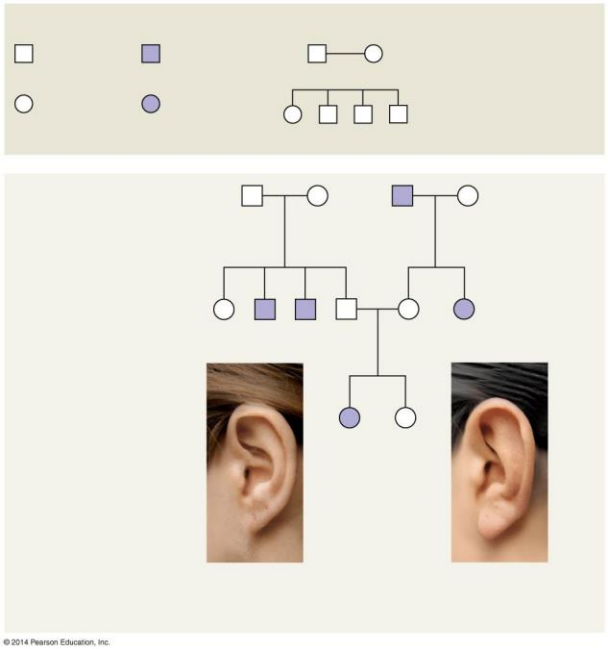
27. Explain *epistasis.*

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. *Quantitative variation* usually indicated *polygenic inheritance.* What is a good example of this?

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

31. Pedigree analysis is often used to determine the mode of inheritance (dominant or recessive, for example). Be sure to read the “Tips for Pedigree Analysis” in Figure 14.15 in your text; then complete the unlabeled pedigree by indicating the genotypes for all involved. The thought processes necessary to answer questions 33 and 34 are similar to those required for many of the questions on the AP exam. What is the mode of inheritance for this pedigree? Justify your response by citing evidence from the pedigree.



32. In the pedigree you just completed, explain why you know the genotype of one female in the third generation, but are unsure of the other.

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

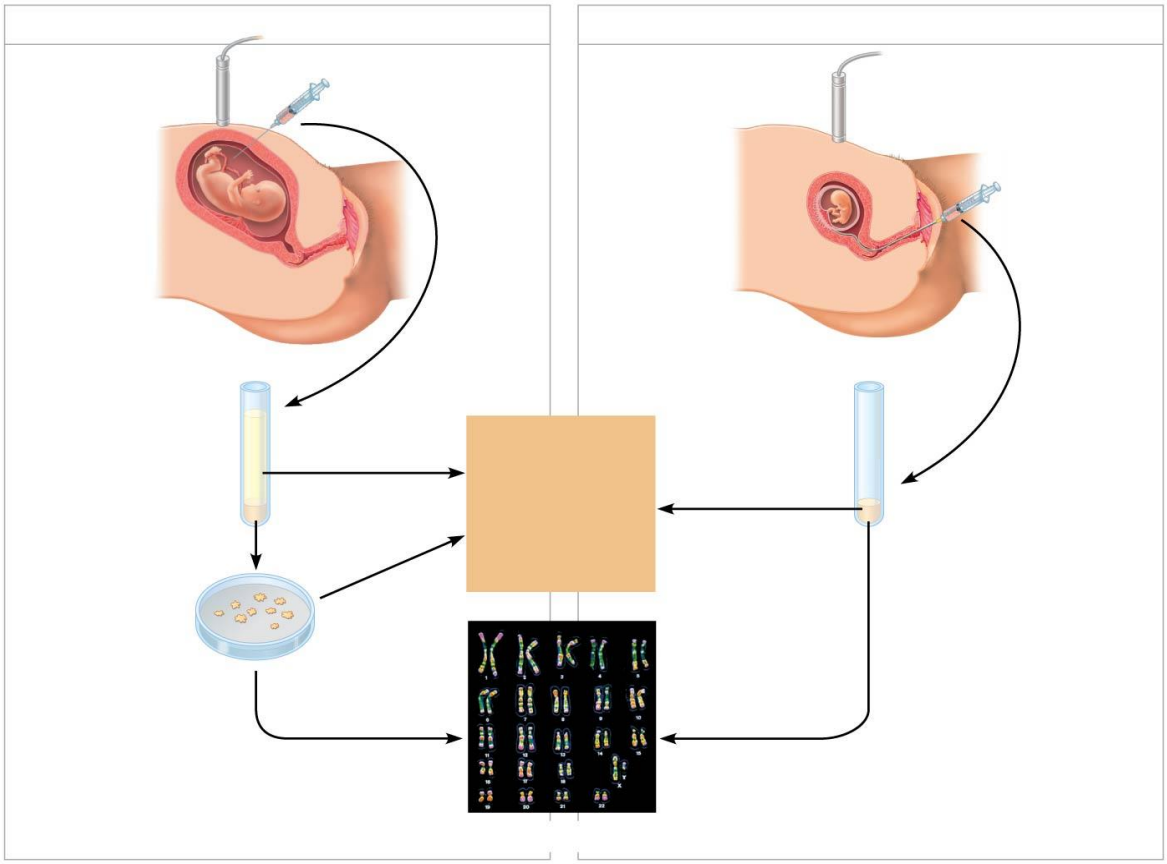
34. You are expected to have a general knowledge of the pattern of inheritance and the common symptoms of a number of genetic disorders. Provide this information for the disorders in the following list.
    a. Cystic fibrosis

    b. Sickle-cell disease

    c. Achondroplasia

    d. Huntington's disease

35. *Amniocentesis* and *chronic villus sampling* (CVS) are the two most widely used methods for testing fetus for genetic disorders. Use the following unlabeled diagram to explain the three main steps in amniocentesis and the two main steps of CVS.



36. What are the strengths and weaknesses of each fetal test?

37. Just a few years ago, biologist and medical personnel were surprised to learn that fetal cells can escape and enter the mother's blood. How can these cells be used in fetal testing?

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