

## Genetics test questions

### Multiple Choice

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

- \_\_\_\_ 1. Pea plants were particularly well suited for use in Mendel's breeding experiments for all of the following reasons *except* that
  - a. peas show easily observed variations in a number of characters, such as pea shape and flower color.
  - b. it is possible to completely control matings between different pea plants.
  - c. it is possible to obtain large numbers of progeny from any given cross.
  - d. peas have an unusually long generation time.
  - e. many of the observable characters that vary in pea plants are controlled by single genes.
- \_\_\_\_ 2. A plant with purple flowers is allowed to self-pollinate. Generation after generation, it produces purple flowers. This is an example of
  - a. hybridization.
  - b. incomplete dominance.
  - c. true-breeding.
  - d. the law of segregation.
  - e. polygenetics.
- \_\_\_\_ 3. Which of the following statements about Mendel's breeding experiments is *correct*?
  - a. None of the parental (P) plants were true-breeding.
  - b. All of the F<sub>2</sub> progeny showed a phenotype that was intermediate between the two parental (P) phenotypes.
  - c. Half of the F<sub>1</sub> progeny had the same phenotype as one of the parental (P) plants, and the other half had the same phenotype as the other parent.
  - d. All of the F<sub>1</sub> progeny resembled one of the parental (P) plants, but only some of the F<sub>2</sub> progeny did.
  - e. none of the above
- \_\_\_\_ 4. What is the difference between a monohybrid cross and a dihybrid cross?
  - a. A monohybrid cross involves a single parent, whereas a dihybrid cross involves two parents.
  - b. A monohybrid cross produces a single progeny, whereas a dihybrid cross produces two progeny.
  - c. A monohybrid cross involves organisms that are heterozygous for a single character, whereas a dihybrid cross involves organisms that are heterozygous for two characters.
  - d. A monohybrid cross is performed only once, whereas a dihybrid cross is performed twice.
  - e. A monohybrid cross results in a 9:3:3:1 ratio whereas a dihybrid cross gives a 3:1 ratio.
- \_\_\_\_ 5. A cross between homozygous purple-flowered and homozygous white-flowered pea plants results in offspring with purple flowers. This demonstrates
  - a. the blending model of genetics.
  - b. true-breeding.
  - c. dominance.
  - d. a dihybrid cross.
  - e. the mistakes made by Mendel.

- \_\_\_\_ 6. The F<sub>1</sub> offspring of Mendel's classic pea cross always looked like one of the two parental varieties because
- one allele was completely dominant over another.
  - each allele affected phenotypic expression.
  - the traits blended together during fertilization.
  - no genes interacted to produce the parental phenotype.
  - different genes interacted to produce the parental phenotype.
- \_\_\_\_ 7. What was the most significant conclusion that Gregor Mendel drew from his experiments with pea plants?
- There is considerable genetic variation in garden peas.
  - Traits are inherited in discrete units, and are not the results of "blending."
  - Recessive genes occur more frequently in the F<sub>1</sub> than do dominant ones.
  - Genes are composed of DNA.
  - An organism that is homozygous for many recessive traits is at a disadvantage.
- \_\_\_\_ 8. Which of the following is (are) true for alleles?
- They can be identical or different for any given gene in a somatic cell.
  - They can be dominant or recessive.
  - They can represent alternative forms of a gene.
  - Only A and B are correct.
  - A, B, and C are correct.
- \_\_\_\_ 9. What is genetic cross between an individual showing a dominant phenotype (but of unknown genotype) and a homozygous recessive individual called?
- a self-cross
  - a testcross
  - a hybrid cross
  - an F<sub>1</sub> cross
  - a dihybrid cross
- \_\_\_\_ 10. How many unique gametes could be produced through independent assortment by an individual with the genotype AaBbCCDdEE?
- 4
  - 8
  - 16
  - 32
  - 64
- \_\_\_\_ 11. Two plants are crossed, resulting in offspring with a 3:1 ratio for a particular trait. This suggests
- that the parents were true-breeding for contrasting traits.
  - incomplete dominance.
  - that a blending of traits has occurred.
  - that the parents were both heterozygous.
  - that each offspring has the same alleles.
- \_\_\_\_ 12. Two characters that appear in a 9:3:3:1 ratio in the F<sub>2</sub> generation should have which of the following properties?
- Each of the characters is controlled by a single gene.
  - The genes controlling the characters obey the law of independent assortment.
  - Each of the genes controlling the characters has two alleles.
  - Only A and C are correct.
  - A, B, and C are correct.

- \_\_\_\_ 13. A 9:3:3:1 phenotypic ratio is characteristic of which of the following?
- a monohybrid cross
  - a dihybrid cross
  - a trihybrid cross
  - linked genes
  - both A and D
- \_\_\_\_ 14. A sexually reproducing animal has two unlinked genes, one for head shape (*H*), and one for tail length (*T*). Its genotype is *HhTt*. Which of the following genotypes is possible in a gamete from this organism?
- HT*
  - Hh*
  - HhTt*
  - T*
  - tt*
- \_\_\_\_ 15. It was important that Mendel examined not just the F<sub>1</sub> generation in his breeding experiments, but the F<sub>2</sub> generation as well, because
- he obtained very few F<sub>1</sub> progeny, making statistical analysis difficult.
  - parental traits that were not observed in the F<sub>1</sub> reappeared in the F<sub>2</sub>, suggesting that the traits did not truly disappear in the F<sub>1</sub>.
  - analysis of the F<sub>1</sub> progeny would have allowed him to discover the law of segregation, but not the law of independent assortment.
  - the dominant phenotypes were visible in the F<sub>2</sub> generation, but not in the F<sub>1</sub>.
  - all of the above
- \_\_\_\_ 16. When crossing a homozygous recessive with a heterozygote, what is the chance of getting an offspring with the homozygous recessive phenotype?
- 0%
  - 25%
  - 50%
  - 75%
  - 100%

Use the diagram and description below to answer the following question.

In a particular plant, leaf color is controlled by gene *D*. Plants with the dominant allele *D* have dark green leaves, and plants with the homozygous recessive *dd* genotype have light green leaves. A true-breeding dark-leaved plant is crossed with a light-leaved one, and the F<sub>1</sub> offspring is allowed to self-pollinate. The predicted outcome of this cross is diagrammed in the Punnett square shown below, where 1, 2, 3, and 4 represent the genotypes corresponding to each box within the square.

	<i>D</i>	<i>d</i>
<i>D</i>	1	2
<i>d</i>	3	4

- \_\_\_\_ 17. Which of the boxes marked 1-4 correspond to plants with dark leaves?
- 1 only
  - 1 and 2
  - 2 and 3
  - 4 only
  - 1, 2, and 3
- \_\_\_\_ 18. Which of the boxes correspond to plants with a heterozygous genotype?
- 1
  - 1 and 2
  - 1, 2, and 3
  - 2 and 3
  - 2, 3, and 4
- \_\_\_\_ 19. Which of the plants will be true-breeding?
- 1 and 4
  - 2 and 3
  - 1-4
  - 1 only
  - none
- \_\_\_\_ 20.  $P$  = purple,  $pp$  = white. The offspring of a cross between two heterozygous purple-flowering plants ( $Pp \times Pp$ ) results in
- all purple-flowered plants.
  - purple-flowered plants and white-flowered plants.
  - two types of white-flowered plants:  $PP$  and  $Pp$ .
  - all white-flowered plants.
  - all pink-flowered plants.

- \_\_\_\_\_ 21. Mendel accounted for the observation that traits which had disappeared in the F1 generation reappeared in the F2 generation by proposing that
- new mutations were frequently generated in the F2 progeny, "reinventing" traits that had been lost in the F1.
  - the mechanism controlling the appearance of traits was different between the F1 and the F2 plants.
  - traits can be dominant or recessive, and the recessive traits were obscured by the dominant ones in the F1.
  - the traits were lost in the F1 due to blending of the parental traits.
  - members of the F1 generation had only one allele for each character, but members of the F2 had two alleles for each character.
- \_\_\_\_\_ 22. What are Punnett squares used for?
- predicting the result of genetic crosses between organisms of known genotypes
  - determining the DNA sequence of a given gene
  - identifying the gene locus where allelic variations are possible
  - testing for the presence of the recessive allele
  - more than one of the above
- \_\_\_\_\_ 23. Which of the following is *false*, regarding the law of segregation?
- It states that each of two alleles for a given trait segregate into different gametes.
  - It can be explained by the segregation of homologous chromosomes during meiosis.
  - It can account for the 3:1 ratio seen in the F<sub>2</sub> generation of Mendel's crosses.
  - It can be used to predict the likelihood of transmission of certain genetic diseases within families.
  - It is a method that can be used to determine the number of chromosomes in a plant.
- \_\_\_\_\_ 24. The fact that all seven of the pea plant traits studied by Mendel obeyed the principle of independent assortment means that
- none of the traits obeyed the law of segregation.
  - the diploid number of chromosomes in the pea plants was 7.
  - all of the genes controlling the traits were located on the same chromosome.
  - all of the genes controlling the traits behaved as if they were on different chromosomes.
  - the formation of gametes in plants occurs by mitosis only.
- \_\_\_\_\_ 25. Black fur in mice (*B*) is dominant to brown fur (*b*) Short tails (*T*) are dominant to long tails (*t*). What fraction of the progeny of the cross BbTt × BBtt will have black fur and long tails?
- 1/16
  - 3/16
  - 3/8
  - 1/2
  - 9/16
- \_\_\_\_\_ 26. In certain plants, tall is dominant to short. If a heterozygous plant is crossed with a homozygous tall plant, what is the probability that the offspring will be short?
- 1/2
  - 1/4
  - 0
  - 1
  - 1/6

- \_\_\_\_ 27. A couple has three children, all of whom have brown eyes and blond hair. Both parents are homozygous for brown eyes ( $BB$ ) but one is a blond (rr) and the other is a redhead ( $Rr$ ). What is the probability that their next child will be a brown-eyed redhead?
- 1/16
  - 1/8
  - 1/4
  - 1/2
  - 1
- \_\_\_\_ 28. Two true-breeding stocks of pea plants are crossed. One parent has red, axial flowers and the other has white, terminal flowers; all  $F_1$  individuals have red, axial flowers. If 1,000  $F_2$  offspring resulted from the cross, approximately how many of them would you expect to have red, terminal flowers? (Assume independent assortment).
- 65
  - 190
  - 250
  - 565
  - 750
- \_\_\_\_ 29. In a cross  $AaBbCc \times AaBbCc$ , what is the probability of producing the genotype  $AABBCC$ ?
- 1/4
  - 1/8
  - 1/16
  - 1/32
  - 1/64
- \_\_\_\_ 30. Given the parents  $AABBCC \times AabbCc$ , assume simple dominance and independent assortment. What proportion of the progeny will be expected to phenotypically resemble the first parent?
- 1/4
  - 1/8
  - 3/4
  - 3/8
  - 1
- \_\_\_\_ 31. A 1:2:1 phenotypic ratio in the  $F_2$  generation of a monohybrid cross is a sign of
- complete dominance.
  - multiple alleles.
  - incomplete dominance.
  - polygenic inheritance.
  - pleiotropy.

*Refer to the result below to answer the following questions.*

A tall plant is crossed with a short plant, and the progeny are all intermediate in size between the two parental plants.

- \_\_\_\_ 32. This could be an example of
- incomplete dominance.
  - polygenic inheritance.
  - complete dominance.
  - A and B
  - B and C

- \_\_\_\_ 33. If the intermediate  $F_1$  progeny were allowed to self-pollinate, and the  $F_2$  progeny were also intermediate in size, but following a normal distribution, this would suggest  
a. incomplete dominance.  
b. polygenic inheritance.  
c. complete dominance.  
d. a strong environmental influence.  
e. codominance.
- \_\_\_\_ 34. If the intermediate  $F_1$  progeny were allowed to self-pollinate, and 25% of the  $F_2$  progeny were tall, 50% were intermediate in size, and 25% were short, this would suggest  
a. incomplete dominance.  
b. polygenic inheritance.  
c. complete dominance.  
d. pleiotropy.  
e. multifactorial inheritance.
- \_\_\_\_ 35. In snapdragons, heterozygotes have pink flowers, whereas homozygotes have red or white flowers. When plants with red flowers are crossed with plants with white flowers, what proportion of the offspring will have pink flowers?  
a. 0%  
b. 25%  
c. 50%  
d. 75%  
e. 100%
- \_\_\_\_ 36. Tallness ( $T$ ) is dominant to dwarfness ( $t$ ), while red ( $R$ ) flower color is dominant to white ( $r$ ). The heterozygous condition results in pink ( $Rr$ ) flower color. A dwarf, red snapdragon is crossed with a plant homozygous for tallness and white flowers. What are the genotype and phenotype of the  $F_1$  individuals?  
a.  $ttRr$ -dwarf and pink  
b.  $ttrr$ -dwarf and white  
c.  $TtRr$ -tall and red  
d.  $TtRr$ -tall and pink  
e.  $TTRR$ -tall and red
- \_\_\_\_ 37. Skin color in a fish is inherited via a single gene with four different alleles. How many different types of gametes would be possible in this system?  
a. 1  
b. 2  
c. 4  
d. 8  
e. 16
- \_\_\_\_ 38. In cattle, roan coat color (mixed red and white hairs) occurs in the heterozygous ( $Rr$ ) offspring of red ( $RR$ ) and white ( $rr$ ) homozygotes. Which of the following crosses would produce offspring in the ratio of 1 red:2 roan:1 white?  
a. red  $\times$  white  
b. roan  $\times$  roan  
c. white  $\times$  roan  
d. red  $\times$  roan  
e. The answer cannot be determined from the information provided.

- \_\_\_\_ 39. The relationship between genes *S* and *N* is an example of  
a. incomplete dominance.  
b. epistasis.  
c. complete dominance.  
d. pleiotropy.  
e. codominance.
- \_\_\_\_ 40. A cross between a true-breeding sharp-spined cactus and a spineless cactus would produce  
a. all sharp-spined progeny.  
b. 50% sharp-spined, 50% dull-spined progeny.  
c. 25% sharp-spined, 50% dull-spined, 25% spineless progeny  
d. all spineless progeny  
e. It is impossible to determine the phenotypes of the progeny.
- \_\_\_\_ 41. If doubly heterozygous *SsNn* cactuses were allowed to self-pollinate, the F<sub>2</sub> would segregate in which of the following ratios?  
a. 3 sharp-spined : 1 spineless  
b. 1 sharp-spined : 2 dull-spined : 1 spineless  
c. 1 sharp spined : 1 dull-spined : 1 spineless  
d. 1 sharp-spined : 1 dull-spined  
e. 9 sharp-spined : 3 dull-spined : 4 spineless

*Use the information below to answer the following questions.*

Feather color in budgies is determined by two different genes Y and B. YYBB, YyBB, or YYBb is green; yyBB or yyBb is blue; YYbb or Yybb is yellow; and yybb is white.

- \_\_\_\_ 42. A blue budgie is crossed with a white budgie. Which of the following results is *not possible*?  
a. green offspring  
b. yellow offspring  
c. blue offspring  
d. A and B  
e. A, B, and C
- \_\_\_\_ 43. Two blue budgies were crossed. Over the years, they produced 22 offspring, 5 of which were white. What are the most likely genotypes for the two blue budgies?  
a. yyBB and yyBB  
b. yyBB and yyBb  
c. yyBb and yyBb  
d. yyBB and yybb  
e. yyBb and yybb

- \_\_\_\_ 44. Three babies were mixed up in a hospital. After consideration of the data below, which of the following represent the correct baby and parent combinations?

Couple #	I	II	III
Blood Groups	A and A	A and B	B and O
Baby #	1	2	3
Blood Groups	B	O	AB

- a. I-3, II-1, III-2
- b. I-1, II-3, III-2
- c. I-2, II-3, III-1
- d. I-2, II-1, III-3
- e. I-3, II-2, III-1

Use the following information to answer the questions below.

A woman who has blood type A, has a daughter who is type O positive and a son who is type B negative. Rh positive is a simple dominant trait over Rh negative.

- \_\_\_\_ 45. Which of the following is a possible genotype for the son?
- a. *IBIB*
  - b. *IBIA*
  - c. *ii*
  - d. *IBi*
  - e. *IAIA*
- \_\_\_\_ 46. Which of the following is a possible genotype for the mother?
- a. *IAIA*
  - b. *IBIB*
  - c. *ii*
  - d. *IAi*
  - e. *IAIB*
- \_\_\_\_ 47. Which of the following is a possible phenotype for the father?
- a. A
  - b. O
  - c. B
  - d. AB
  - e. impossible to determine
- \_\_\_\_ 48. Which of the following is the probable genotype for the mother?
- a. *I<sup>A</sup>I<sup>A</sup>RR*
  - b. *I<sup>A</sup>I<sup>A</sup>Rr*
  - c. *I<sup>A</sup>irr*
  - d. *I<sup>A</sup>iRr*
  - e. *I<sup>A</sup>iRR*

- \_\_\_\_ 49. Which of the following is a possible phenotype of the father?  
a. A negative  
b. O negative  
c. B positive  
d. A positive  
e. O positive
- \_\_\_\_ 50. What is the chromosomal system for determining sex in mammals?  
a. A  
b. B  
c. C  
d. D  
e. E
- \_\_\_\_ 51. What is the chromosomal system for sex determination in grasshoppers and certain other insects?  
a. A  
b. B  
c. C  
d. D  
e. E
- \_\_\_\_ 52. What is the chromosomal system for sex determination in birds?  
a. A  
b. B  
c. C  
d. D  
e. E
- \_\_\_\_ 53. What is the chromosomal system of sex determination in most species of ants and bees?  
a. A  
b. B  
c. C  
d. D  
e. E

*Use the terms listed below to answer the following questions. Each term may be used once, more than once, or not at all.*

- A. incomplete dominance
- B. multiple alleles
- C. pleiotropy
- D. epistasis

- \_\_\_\_ 54. the ability of a single gene to have multiple phenotypic effects  
a. A  
b. B  
c. C  
d. D

- \_\_\_\_ 55. the ABO blood group system  
a. A  
b. B  
c. C  
d. D
- \_\_\_\_ 56. the phenotype of the heterozygote differs from the phenotypes of both homozygotes  
a. A  
b. B  
c. C  
d. D
- \_\_\_\_ 57. cystic fibrosis affects the lungs, the pancreas, the digestive system, and other organs, resulting in symptoms ranging from breathing difficulties to recurrent infections  
a. A  
b. B  
c. C  
d. D
- \_\_\_\_ 58. Which of the following is an example of polygenic inheritance?  
a. pink flowers in snapdragons  
b. the ABO blood groups in humans  
c. Huntington's disease in humans  
d. white and purple flower color in peas  
e. skin pigmentation in humans
- \_\_\_\_ 59. Hydrangea plants of the same genotype are planted in a large flower garden. Some of the plants produce blue flowers and others pink flowers. This can be best explained by  
a. environmental factors such as soil pH.  
b. the allele for blue hydrangea being completely dominant.  
c. the alleles being codominant.  
d. the fact that a mutation has occurred.  
e. acknowledging that multiple alleles are involved.

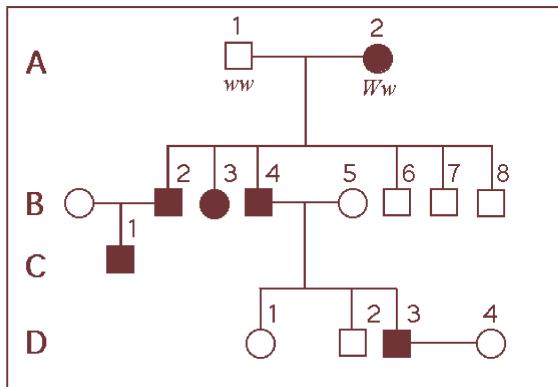
*Use the information below to answer the following questions.*

A woman and her spouse both show the normal phenotype for pigmentation, but both had one parent who was an albino. Albinism is an autosomal recessive trait.

- \_\_\_\_ 60. What is the probability that their first child will be an albino?  
a. 0  
b. 1/4  
c. 1/2  
d. 3/4  
e. 1
- \_\_\_\_ 61. If their first two children have normal pigmentation, what is the probability that their third child will be an albino?  
a. 0  
b. 1/4  
c. 1/2  
d. 3/4  
e. 1

- \_\_\_\_ 62. Huntington's disease is caused by a dominant allele. If one of your parents has the disease, what is the probability that you, too, will have the disease?
- 1
  - $\frac{3}{4}$
  - $\frac{1}{2}$
  - $\frac{1}{4}$
  - 0
- \_\_\_\_ 63. A woman has six sons. The chance that her next child will be a daughter is
- 1.
  - 0.
  - $\frac{1}{2}$ .
  - $\frac{1}{6}$ .
  - $\frac{5}{6}$ .

The pedigree chart below is for a family, some of whose members exhibit the recessive trait, wooly hair. Affected individuals are indicated by an open square or circle. Use the chart to answer the following questions.



- \_\_\_\_ 64. What is the genotype of individual B-5?
- WW
  - Ww
  - ww
  - WW or ww
  - ww or Ww
- \_\_\_\_ 65. What is the likelihood that the progeny of D-3 and D-4 will have wooly hair?
- 0%
  - 25%
  - 50%
  - 75%
  - 100%
- \_\_\_\_ 66. What is the probability that individual C-1 is Ww?
- $\frac{3}{4}$
  - $\frac{1}{4}$
  - $\frac{2}{4}$
  - $\frac{2}{3}$
  - 1

- \_\_\_\_ 67. People with sickle-cell trait  
a. are heterozygous for the sickle-cell allele.  
b. are usually healthy.  
c. have increased resistance to malaria.  
d. produce normal and abnormal hemoglobin.  
e. all of the above
- \_\_\_\_ 68. When a disease is said to have a multifactorial basis, it means that  
a. many factors, both genetic and environmental, contribute to the disease.  
b. it is caused by a gene with a large number of alleles.  
c. it affects a large number of people.  
d. it has many different symptoms.  
e. it tends to skip a generation.
- \_\_\_\_ 69. Which of the following terms is *least* related to the others?  
a. pedigree  
b. karyotype  
c. amniocentesis  
d. chorionic villus sampling  
e. epistasis

*Use the answers below to answer the following questions. Each answer may be used once, more than once, or not at all.*

- A. Huntington's disease
- B. Tay-Sachs disease
- C. phenylketonuria
- D. cystic fibrosis
- E. sickle-cell disease

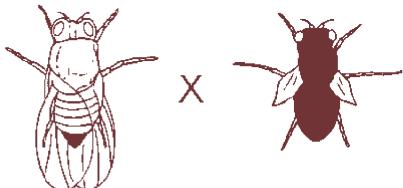
- \_\_\_\_ 70. Substitution of the "wrong" amino acid in the hemoglobin protein results in this disorder.  
a. A  
b. B  
c. C  
d. D  
e. E
- \_\_\_\_ 71. Individuals with this disorder are unable to metabolize certain lipids, affecting proper brain development. Affected individuals die in early childhood.  
a. A  
b. B  
c. C  
d. D  
e. E
- \_\_\_\_ 72. This is caused by a dominant single gene defect and generally does not appear until the individual is 35-45 years of age.  
a. A  
b. B  
c. C  
d. D  
e. E

- \_\_\_\_ 73. Effects of this recessive disorder can be completely overcome by regulating the diet of the affected individual.
- A
  - B
  - C
  - D
  - E
- \_\_\_\_ 74. This results from a defect in membrane proteins that normally function in chloride ion transport.
- A
  - B
  - C
  - D
  - E
- \_\_\_\_ 75. Which of the following techniques involves the preparation of a karyotype?
- amniocentesis
  - chorionic villus sampling
  - fetoscopy
  - A and B only
  - A, B, and C
- \_\_\_\_ 76. Chromosomes and genes share all of the following characteristics *except* that
- they are both present in pairs in all diploid cells.
  - they both undergo segregation during meiosis.
  - their copy numbers in the cell decrease after meiosis, and increase during fertilization.
  - they are both copied during the S phase of the cell cycle.
  - they both pair up with their homologues during prophase of mitosis.
- \_\_\_\_ 77. The improvement of microscopy techniques in the late 1800s set the stage for the emergence of modern genetics because
- it revealed new and unanticipated features of Mendel's pea plant varieties.
  - it allowed biologists to study meiosis and mitosis, revealing the parallels between the behaviors of genes and chromosomes.
  - it allowed scientists to see the DNA present within chromosomes.
  - it led to the discovery of mitochondria.
  - All of the above are true.
- \_\_\_\_ 78. When Thomas Hunt Morgan crossed his red-eyed F<sub>1</sub> generation flies to each other, the F<sub>2</sub> generation included both red- and white-eyed flies. Remarkably, all the white-eyed flies were male. What was the explanation for this result?
- The involved gene was on the X chromosome.
  - The involved gene was on the Y chromosome.
  - The involved gene was on an autosome.
  - Other male-specific factors influence eye color in flies.
  - Other female-specific factors influence eye color in flies.

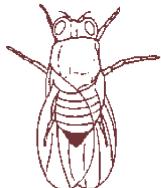
- \_\_\_\_ 79. Which of the following statements is (are) true?
- The closer two genes are on a chromosome, the higher the probability that a crossover will occur between them.
  - The observed frequency of recombination of two genes that are far apart from each other has a maximum value of 50%.
  - Two of the traits that Mendel studied—seed color and flower color—are linked on the same chromosome.
  - Only B and C are correct.
  - A, B, and C are correct.
- \_\_\_\_ 80. How would one explain a testcross involving F<sub>1</sub> dihybrid flies in which more parental-type offspring than recombinant-type offspring are produced?
- The two genes are linked.
  - The two genes are unlinked.
  - Recombination did not occur in the cell during meiosis.
  - The testcross was improperly performed.
  - Both of the characters are controlled by more than one gene.
- \_\_\_\_ 81. New combinations of linked genes are due to which of the following?
- nondisjunction
  - crossing over
  - independent assortment
  - mixing of sperm and egg
  - both A and C
- \_\_\_\_ 82. What does a frequency of recombination of 50% indicate?
- The two genes likely are located on different chromosomes.
  - All of the offspring have combinations of traits that match one of the two parents.
  - The genes are located on sex chromosomes.
  - Abnormal meiosis has occurred.
  - Independent assortment is hindered.

The following questions refer to the data and figures below.

CROSS I. Purebred lines of wild-type fruit flies (gray body and normal wings) are mated to flies with black bodies and vestigial wings.



F1 offspring all have a normal phenotype.



CROSS II. F1 flies are crossed with flies recessive for both traits (a testcross).

Resulting Offspring	Normal	Percentage
Gray body; normal wings	575	25.1
Black body; vestigial wings	571	24.9
Black body; normal wings	577	25.2
Gray body; vestigial wings	568	24.8

KEY:

- A. CROSS I results give evidence supporting the statement.
- B. CROSS I results give evidence against the statement.
- C. CROSS II results give evidence supporting the statement.
- D. CROSS II results give evidence against the statement.
- E. Neither CROSS I nor CROSS II results support the statement.

- \_\_\_\_ 83. Vestigial wings are a recessive trait.  
a. A  
b. B  
c. C  
d. D  
e. E
- \_\_\_\_ 84. The genes for body color and wing shape are linked.  
a. A  
b. B  
c. C  
d. D  
e. E

- \_\_\_\_ 85. An F<sub>1</sub> cross should produce flies that will fall into a Mendelian 9:3:3:1 ratio.
- A
  - B
  - C
  - D
  - E
- \_\_\_\_ 86. There are 25 centimorgans (map units) between the genes for body color and wing shape.
- A
  - B
  - C
  - D
  - E
- \_\_\_\_ 87. A 0.1% frequency of recombination is observed
- only in sex chromosomes.
  - only on genetic maps of viral chromosomes.
  - on unlinked chromosomes.
  - in any two genes on different chromosomes.
  - in genes located very close to one another on the same chromosome.
- \_\_\_\_ 88. The following is a map of four genes on a chromosome:



Between which two genes would you expect the highest frequency of recombination?

- A and W
  - W and E
  - E and G
  - A and E
  - A and G
- \_\_\_\_ 89. The reason that linked genes are inherited together is that
- they are located on the same chromosome.
  - the number of genes in a cell is greater than the number of chromosomes.
  - chromosomes are unbreakable.
  - alleles are paired.
  - genes align that way during metaphase I.
- \_\_\_\_ 90. What is the mechanism for the production of genetic recombinants?
- X inactivation
  - methylation of cytosine
  - crossing over and independent assortment
  - nondisjunction
  - deletions and duplications during meiosis

- \_\_\_\_ 91. There is good evidence for linkage when
- two genes occur together in the same gamete.
  - a gene is associated with a specific phenotype.
  - two genes work together to control a specific characteristic.
  - genes do not segregate independently during meiosis.
  - two characteristics are caused by a single gene.

Refer to the figure below to answer the following questions.

	<i>b</i>	0		<i>b</i> = black body
	<i>cn</i>	9	0	<i>cn</i> = cinnabar eyes
<i>Gene</i>	<i>rb</i>	3.5	6.5	<i>rb</i> = reduced bristles
	<i>vg</i>	19	9.0	<i>vg</i> = vestigial wings
	<i>b</i>	cn	<i>rb</i>	<i>vg</i>

The numbers in the boxes are the recombination frequencies in between the genes (in percent).

- \_\_\_\_ 92. In a series of mapping experiments, the recombination frequencies for four different linked genes of *Drosophila* were determined as shown in the figure. What is the order of these genes on a chromosome map?
- rb-cn-vg-b*
  - vg-b-rb-cn*
  - cn-rb-b-vg*
  - b-rb-cn-vg*
  - vg-cn-b-rb*
- \_\_\_\_ 93. Which of the following two genes are closest on a genetic map of *Drosophila*?
- b* and *vg*
  - vg* and *cn*
  - rb* and *cn*
  - cn* and *b*
  - b* and *rb*

X, Y, and Z are three genes in *Drosophila*. The recombination frequencies for two of the three genes are shown below.

Gene Pair	Recombination Frequency
X-Y	50%
X-Z	25%
Y-Z	?

- \_\_\_\_\_ 94. Genes X and Y could be
- located on different chromosomes.
  - located very near to each other on the same chromosome.
  - located far from each other on the same chromosome.
  - both A and B
  - both A and C
- \_\_\_\_\_ 95. If the recombination frequency for Y and Z was found to be 50%, this would mean that
- genes X and Y are on the same chromosome.
  - genes X and Y are on different chromosomes.
  - genes Y and Z are on different chromosomes.
  - both A and C.
  - both B and C
- \_\_\_\_\_ 96. Which of the following is true regarding linkage maps? They
- always have a total of 100 map units.
  - can be used to pinpoint the precise physical position of a gene on a chromosome.
  - are a genetic map based on recombination frequencies.
  - require preparation of karyotypes.
  - reflect the frequency of crossing over between X and Y chromosomes.
- \_\_\_\_\_ 97. The frequency of crossing over between any two linked genes is
- higher if they are recessive.
  - different between males and females.
  - determined by their relative dominance.
  - the same as if they were not linked.
  - proportional to the distance between them.
- \_\_\_\_\_ 98. Sturtevant provided genetic evidence for the existence of four pairs of chromosomes in *Drosophila* by showing that
- there are four major functional classes of genes in *Drosophila*.
  - Drosophila* genes cluster into four distinct groups of linked genes.
  - the overall number of genes in *Drosophila* is a multiple of four.
  - the entire *Drosophila* genome has approximately 400 map units.
  - Drosophila* genes have, on average, four different alleles.
- \_\_\_\_\_ 99. Map units on a linkage map cannot be relied upon to calculate physical distances on a chromosome because
- the frequency of crossing over varies along the length of the chromosome.
  - the relationship between recombination frequency and map units is different in every individual.
  - physical distances between genes change during the course of the cell cycle.
  - the gene order on the chromosomes is slightly different in every individual.
  - all of the above

- \_\_\_\_ 100. A map of a chromosome that includes the positions of genes relative to visible chromosomal features, such as stained bands, is called a
- linkage map.
  - physical map.
  - recombination map.
  - cytogenetic map.
  - banded map.
- \_\_\_\_ 101. Males are more often affected by sex-linked traits than females because
- males are hemizygous for the X chromosome.
  - male hormones such as testosterone often exacerbate the effects of mutations on the X chromosome.
  - female hormones such as estrogen often compensate for the effects of mutations on the X.
  - X chromosomes in males generally have more mutations than X chromosomes in females.
  - mutations on the Y chromosome often exacerbate the effects of X-linked mutations.
- \_\_\_\_ 102. SRY is
- a gene present on the Y chromosome that triggers male development.
  - a gene present on the X chromosome that triggers female development.
  - an autosomal gene that is required for the expression of genes on the Y chromosome.
  - an autosomal gene that is required for the expression of genes on the X chromosome.
  - required for development, and males or females lacking the gene do not survive past early childhood.
- \_\_\_\_ 103. In cats, black fur color is caused by an *X-linked* allele; the other allele at this locus causes orange color. The heterozygote is tortoiseshell. What kinds of offspring would you expect from the cross of a black female and an orange male?
- tortoiseshell female; tortoiseshell male
  - black female; orange male
  - orange female; orange male
  - tortoiseshell female; black male
  - orange female; black male
- \_\_\_\_ 104. Red-green color blindness is a sex-linked recessive trait in humans. Two people with normal color vision have a color-blind son. What are the genotypes of the parents?
- $XcXc$  and  $XcY$
  - $XcXc$  and  $XY$
  - $XCXC$  and  $XcY$
  - $XCXC$  and  $XY$
  - $XCXc$  and  $XY$
- \_\_\_\_ 105. In the following list, which term is *least* related to the others?
- Duchenne muscular dystrophy
  - autosome
  - sex-linked genes
  - color blindness
  - hemophilia

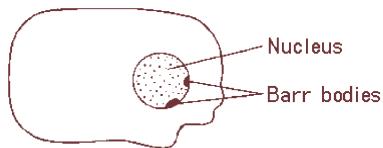
- \_\_\_\_ 106. Cinnabar eyes is a sex-linked recessive characteristic in fruit flies. If a female having cinnabar eyes is crossed with a wild-type male, what percentage of the F1 males will have cinnabar eyes?
- 0%
  - 25%
  - 50%
  - 75%
  - 100%
- \_\_\_\_ 107. Most calico cats are female because
- a male inherits only one of the two X-linked genes controlling hair color.
  - the males die during embryonic development.
  - the Y chromosome has a gene blocking orange coloration.
  - only females can have Barr bodies.
  - multiple crossovers on the Y chromosome prevent orange pigment production.
- \_\_\_\_ 108. A recessive allele on the X chromosome is responsible for red-green color blindness in humans. A woman with normal vision whose father is color-blind marries a color-blind male. What is the probability that a son of this couple will be color-blind?
- 0
  - 1/4
  - 1/2
  - 3/4
  - 1
- \_\_\_\_ 109. In birds, sex is determined by a ZW chromosome scheme. Males are ZZ and females are ZW. A lethal recessive allele that causes death of the embryo is sometimes present on the Z chromosome in pigeons. What would be the sex ratio in the offspring of a cross between a male that is heterozygous for the lethal allele and a normal female?
- 2:1 male to female
  - 1:2 male to female
  - 1:1 male to female
  - 4:3 male to female
  - 3:1 male to female
- \_\_\_\_ 110. A man who carries an X-linked allele will pass it on to
- all of his daughters.
  - half of his daughters.
  - all of his sons.
  - half of his sons.
  - all of his children.

Refer to the information below to answer the following questions.

An achondroplastic male dwarf with normal vision marries a color-blind woman of normal height. The man's father was six-feet tall, and both the woman's parents were of average height. Achondroplastic dwarfism is autosomal dominant, and red-green color blindness is X-linked recessive.

- \_\_\_\_ 111. How many of their daughters might be expected to be color-blind dwarfs?
- all
  - none
  - half
  - one out of four
  - three out of four
- \_\_\_\_ 112. How many of their sons would be color-blind and of normal height?
- all
  - none
  - half
  - one out of four
  - three out of four
- \_\_\_\_ 113. They have a daughter who is a dwarf with normal color vision. What is the probability that she is heterozygous for both genes?
- 0
  - 0.25
  - 0.50
  - 0.75
  - 1.00
- \_\_\_\_ 114. Male calico cats could be the result of
- sex-linked inheritance.
  - nondisjunction, leading to the male calico having two X chromosomes.
  - incomplete dominance of multiple alleles.
  - recessive alleles retaining their fundamental natures even when expressed.
  - a reciprocal translocation.
- \_\_\_\_ 115. A Barr body is normally found in the nucleus of which kind of human cell?
- unfertilized egg cells only
  - sperm cells only
  - somatic cells of a female only
  - somatic cells of a male only
  - both male and female somatic cells
- \_\_\_\_ 116. Which of these syndromes afflicts mostly males?
- Turner syndrome
  - Down syndrome
  - Duchenne muscular dystrophy
  - cri du chat syndrome*
  - chronic myelogenous leukemia

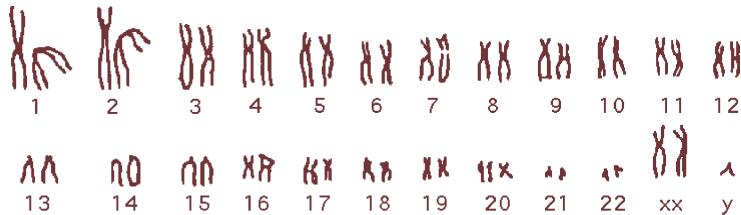
- \_\_\_\_ 117. If a human interphase nucleus of a person contains three Barr bodies, it can be assumed that the person
- has hemophilia.
  - is a male.
  - has four X chromosomes.
  - has Turner syndrome.
  - has Down syndrome.
- \_\_\_\_ 118. If nondisjunction occurs in meiosis II during gametogenesis, what will be the result at the completion of meiosis?
- All the gametes will be diploid.
  - Two gametes will be  $n + 1$ , and two will be  $n - 1$ .
  - One gamete will be  $n + 1$ , one will be  $n - 1$ , and two will be  $n$ .
  - There will be three extra gametes.
  - Two of the four gametes will be haploid, and two will be diploid.
- \_\_\_\_ 119. The figure below represents the stained nucleus from a cheek epithelial cell of an individual whose genotype would probably be



- XX.
  - XY.
  - XYY.
  - XXX.
  - XXY.
- \_\_\_\_ 120. If a pair of homologous chromosomes fails to separate during anaphase of meiosis I, what will be the chromosome number of the four resulting gametes with respect to the normal haploid number ( $n$ )?
- $n + 1; n + 1; n - 1; n - 1$
  - $n + 1; n - 1; n; n$
  - $n + 1; n - 1; n - 1; n - 1$
  - $n + 1; n + 1; n; n$
  - $n - 1; n - 1; n; n$
- \_\_\_\_ 121. A cell that has  $2n + 1$  chromosomes is
- trisomic.
  - monosomic.
  - aneuploid.
  - polyploid.
  - both A and C
- \_\_\_\_ 122. If a chromosome lacks certain genes, what has most likely occurred?
- disjunction
  - an inversion
  - a deletion
  - a translocation
  - a nonduplication

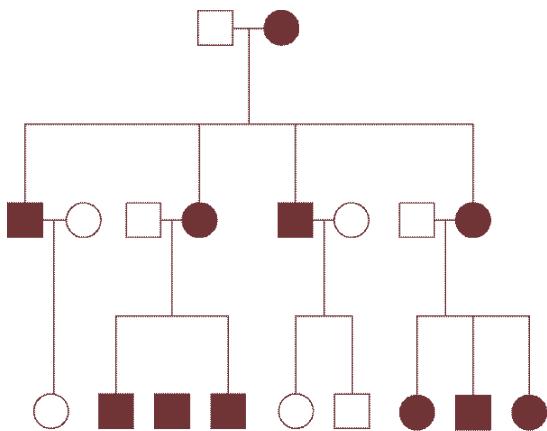
- \_\_\_\_ 123. One possible result of chromosomal breakage is for a fragment to join a nonhomologous chromosome. This is called a (an)
- deletion.
  - disjunction.
  - inversion.
  - translocation.
  - duplication.
- \_\_\_\_ 124. In the following list, which term is *least* related to the others?
- trisomic
  - monosomic
  - aneuploid
  - triploid
  - nondisjunction
- \_\_\_\_ 125. A nonreciprocal crossover causes which of the following products?
- deletion
  - duplication
  - nondisjunction
  - A and B
  - B and C
- \_\_\_\_ 126. One possible result of chromosomal breakage can be that a fragment reattaches to the original chromosome in a reverse orientation. This is called
- disjunction.
  - translocation.
  - deletion.
  - inversion.
  - aneuploidy.
- \_\_\_\_ 127. A human individual is phenotypically female, but her interphase somatic nuclei do not show the presence of Barr bodies. Which of the following statements concerning her is probably *true*?
- She has Klinefelter syndrome.
  - She has an extra X chromosome.
  - She has Turner syndrome.
  - She has the normal number of sex chromosomes.
  - She has two Y chromosomes.

\_\_\_\_ 128. The karyotype shown below is associated with which of the following genetic disorders?



- a. Turner syndrome
  - b. Down syndrome
  - c. Klinefelter syndrome
  - d. hemophilia
  - e. male-pattern baldness
- \_\_\_\_ 129. In humans, male-pattern baldness is controlled by a gene that occurs in two allelic forms. Allele *Hn* determines nonbaldness, and allele *Hb* determines pattern baldness. In males, because of the presence of testosterone, allele *Hb* is dominant over *Hn*. If a man and woman both with genotype *HnHb* have a son, what is the chance that he will eventually be bald?
- a. 0%
  - b. 25%
  - c. 33%
  - d. 50%
  - e. 75%
- \_\_\_\_ 130. Of the following human trisomies, the one that generally has the most severe impact on the health of the individual is
- a. trisomy 21.
  - b. Klinefelter syndrome (XXY).
  - c. trisomy X.
  - d. XYY.
  - e. All of the above have equal impact.
- \_\_\_\_ 131. What do all human males inherit from their mother?
- a. mitochondrial DNA
  - b. an X chromosome
  - c. the SRY gene
  - d. A and B only
  - e. A, B, and C
- \_\_\_\_ 132. Which of the following statements is *true regarding genomic imprinting*?
- a. It explains cases in which the gender of the parent from whom an allele is inherited affects the expression of that allele.
  - b. It is greatest in females because of the larger maternal contribution of cytoplasm.
  - c. It may explain the transmission of Duchenne muscular dystrophy.
  - d. It involves an irreversible alteration in the DNA sequence of imprinted genes.
  - e. All of the above are correct.

133. The pedigree in the figure below shows the transmission of a trait in a particular family. Based on this pattern of transmission, the trait is most likely



- a. mitochondrial.
- b. autosomal recessive.
- c. sex-linked dominant.
- d. sex-linked recessive.
- e. autosomal dominant.