***Genetics, 6e* (Hartwell)**

**Chapter 2 Mendel's Principles of Heredity**

1) Why did Mendel perform reciprocal crosses?

A) To obtain enough plants to perform the experiments that Mendel wanted.

B) To test a hypothesis that stated the ovum carries all the information for progeny.

C) To be able to breed plants year round.

D) To determine whether the inheritance of a trait depends on which parent carries the trait.

2) What is the difference between cross- and self-fertilization?

A) In cross-fertilization the pollen from one plant is used to fertilize the egg of another plant.

B) In cross-fertilization the pollen from one plant is used to fertilize the egg from the same plant.

C) In self-fertilization the pollen from one plant is used to fertilize the egg from another plant.

D) In cross-fertilization insects are used to pollinate the plants, whereas in self-fertilization the investigator pollinates the plants.

3) What is the outcome of crossing two pure-breeding plants with antagonistic traits?

A) Only one of the traits will be seen in the progeny.

B) Both traits will be seen in the progeny.

C) Both traits will be seen in the progeny in a 3:1 ratio.

D) Only one trait will be seen and it will be the trait of the female.

4) According to Mendel's Law of Independent Assortment,

A) alleles of genes on different chromosomes assort randomly into different gametes.

B) alleles of genes assort into gametes grouped according to how they were inherited originally.

C) dominant alleles for one gene must assort into the same gamete as the dominant alleles for another gene.

D) dominant alleles for one gene must assort into the same gamete as the recessive alleles for another gene.

5) An *Ss* × *Ss* mating is performed. If the phenotypic ratio of the progeny is 3 *S*– (– indicates that the other allele is unknown) to 1 *ss*, then

A) the *S* allele is dominant to the *s* allele.

B) neither allele is dominant.

C) the s allele is dominant to the *S* allele.

D) the relationship between the alleles cannot be determined.

6) Which of the following probabilities is correct regarding a mating of an *Ss RR* individual to an individual who is *Ss Rr* ? (A – indicates the the second allele is either dominant or recessive.)

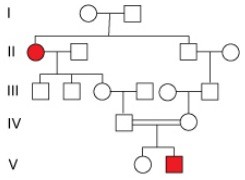
A) *S*– *RR*: 37.5%

B) Homozygous recessive: 10%

C) Heterozygous both alleles: 50%

D) *ss R*– : 15.5%

7)



What does the pattern of inheritance in this pedigree indicate about the disease allele?

A) The disease allele is recessive.

B) The disease allele is dominant.

C) There is no indication that the disease allele is either dominant or recessive.

D) The disease allele is not inherited but arises only by a new mutation in affected individuals.

8) The mutations found in the *CF* gene that result in cystic fibrosis are recessive because

A) the protein produced by the normal allele is sufficient for normal cellular function.

B) the *CF* mutations always result in no protein being produced.

C) *CF* mutations result in a protein that has normal function only if normal CF protein also exists in the cell.

D) dominant alleles that cause a fatal disorder, such as cystic fibrosis, cannot be inherited.

9) The reason that the *HD* allele acts as a dominant allele is that

A) the *HD* mutation results in a protein that can damage nerve cells even in the presence of the normal protein.

B) the normal *HD* allele does not normally produce a protein but the mutant *HD* allele does.

C) the mutant *HD* allele suppresses protein production from the normal *HD* allele.

D) the protein produced from the mutant *HD* allele is nonfunctional.

10) If an individual has 10 gene pairs, how many different gametes can be formed if three of the gene pairs are homozygous and the remaining seven gene pairs are heterozygous?

A) 49

B) 100

C) 128

D) 1024

E) 131,072

11) In some genetically engineered corn plants, a *Bt* gene was added to a chromosome. The *Bt* gene specifies a protein called Bt that is lethal to certain flying insect pests that eat the corn plants. If the corn plant is is heterozygous for the *Bt* gene (one homolog has the introduced *Bt* gene and the other does not), what proportion of the sperm would carry the *Bt* gene? Is the presence of the *Bt* gene (a mutation) dominant or recessive to its absence (the wild type)?

A) all pollen; dominant

B) 1/2; dominant

C) 1/3; recessive

D) 1/4; dominant

E) 1/8; recessive

12) Suppose that in plants, smooth seeds (*S*) is dominant to wrinkled seeds (*s*), and tall plants (*T*) is dominant to short plants (*t*). An F1 plant from a mating between homozygous plants that were tall/smooth and short/wrinkled was crossed to the short/wrinkled parent. What proportion of the progeny is homozygous for short and wrinkled alleles?

A) 1/2

B) 1/4

C) 1/8

D) 1/16

E) 0

13) Sickle cell anemia is a recessive trait in humans. In a cross between a father who has sickle cell anemia and a mother who is heterozygous for the sickle cell allele, what is the probability that all of their first three children will be unaffected?

A) 1/4

B) 1/2

C) none

D) 1/8

E) 1/16

14) In a monohybrid cross *AA* × *aa*, what proportion of homozygotes is expected among the F2 offspring?

A) 1/4

B) 1/2

C) 3/4

D) All are homozygotes.

E) None are homozygotes.

15) In a dihybrid cross *AA bb* × *aa BB*, what proportion of the F2 offspring is expected to be homozygous for at least one gene?

A) 1/4

B) 1/2

C) 3/4

D) All are homozygotes.

E) None are homozygotes.

16) In the testcross *Aa Bb* × *aa bb*, what proportion of individuals are expected to be homozygous for both genes in the F1 generation?

A) 1/4

B) 1/2

C) 3/4

D) All are homozygotes.

E) None are homozygotes.

17) Among the dihybrid crosses below, which will produce a 1:1 phenotypic ratio?

A) *AA BB* × *aa bb*

B) *Aa Bb* × *Aa Bb*

C) *Aa Bb* × *aa bb*

D) *Aa BB* × *aa BB*

E) *AA bb* × *aa BB*

18) Assume that in guinea pigs, dark brown fur (*B*) is dominant to black fur (*b*). If you mate a homozygous black guinea pig with a heterozygous brown guinea pig, what proportion of the progeny will be black?

A) none

B) 1/4

C) 1/2

D) 3/4

E) all

19) Assume that in guinea pigs, dark brown fur (*B*) is dominant to black fur (*b*). If you mate a black guinea pig with a homozygous brown guinea pig, what proportion of the progeny will be homozygous?

A) none

B) 1/4

C) 1/2

D) 3/4

E) all

20) An allele that expresses its phenotype even when heterozygous with a recessive allele is termed

A) recessive.

B) recombinant.

C) dominant.

D) parental.

E) independent.

21) The diploid cell formed by the fertilization of the egg by the sperm during sexual reproduction is a

A) reciprocal.

B) zygote.

C) dihybrid.

D) gamete.

E) monohybrid.

22) The alleles present in an individual make up the individual's

A) recombinant types.

B) recessiveness.

C) dominance.

D) phenotype.

E) genotype.

23) The first offspring from the parents are called

A) P.

B) F1.

C) F2.

D) a testcross.

E) P2.

24) What type of cross is performed to determine the genotype of an individual?

A) A testcross

B) A dihybrid cross

C) A monohybrid cross

D) A  genotyping cross

E) A controlled cross

25) If the parents of a family already have two boys, what is the probability that the next two offspring will both be girls?

A) 1

B) 1/2

C) 1/3

D) 1/4

E) 1/8

26) Suppose that in plants, smooth seeds (*S*) is dominant to wrinkled seeds (*s*) and tall plants (*T*) is dominant to short plants (*t*). An F1 tall plant with smooth seeds was crossed to a parent plant that was short and wrinkled. What proportion of the progeny is expected to be heterozygous for tall and smooth?

A) 1/2

B) 1/4

C) 1/8

D) 1/16

E) 0

27) A rare recessive trait in a pedigree is indicated by which pattern of inheritance?

A) vertical

B) horizontal

C) diagonal

D) both vertical and horizontal

E) pure-breeding

28) The dominant Huntington disease allele causes severe neural/brain damage at approximately age 40. A female whose mother has Huntington disease marries a male whose parents are normal. It is not known if the female has the disease. Keeping in mind that the disease allele is rare in the population, what is the probability that their firstborn will inherit the gene that causes Huntington disease?

A) 25%

B) 50%

C) 75%

D) 100%

E) 0%

29) In a monohybrid cross *AA* × *aa*, what proportion of heterozygotes is expected among the F2 offspring?

A) 1/4

B) 1/2

C) 3/4

D) All are heterozygotes.

E) None are heterozygotes.

30) In a dihybrid cross *AA BB* × *aa bb*, what proportion of heterozygotes for both gene pairs is expected among the F2 offspring?

A) 1/4

B) 1/2

C) 3/4

D) All are heterozygotes.

E) None are heterozygotes.

31) In the dihybrid cross *Aa Bb* × *aa bb*, what proportion of heterozygotes for both gene pairs is expected among the F1 offspring?

A) 1/4

B) 1/2

C) 3/4

D) All are heterozygotes.

E) None are heterozygotes.

32) Among the dihybrid crosses below, which will produce offspring with a 1:1:1:1 genotypic ratio?

A) *AA BB* × *aa bb*

B) *Aa Bb* × *Aa Bb*

C) *Aa Bb* × *aa bb*

D) *Aa BB* × *aa BB*

E) *AA bb* × *aa BB*

33) What is the term for crosses between parents that differ in only one trait?

A) Testcrosses

B) Cross fertilize

C) Monohybrid crosses

D) Dihybrid crosses

E) Reciprocal crosses

34) An alternative form of a single gene is known as

A) a parental.

B) a dihybrid.

C) a reciprocal.

D) an allele.

E) a recessive.

35) A phenotype reflecting a new combination of genes occurring during gamete formation is called

A) a recombinant type.

B) an independent assortment.

C) heterozygous.

D) homozygous.

E) a multihybrid cross.

For each of the following pedigree symbols, select the correct meaning.

36)



A) Unaffected male

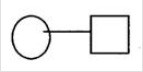
B) Unaffected female

C) Mating

D) Affected male

E) Affected female

37)



A) Unaffected male

B) Unaffected female

C) Mating

D) Affected male

E) Affected female

38)



A) Unaffected male

B) Unaffected female

C) Mating

D) Affected male

E) Affected female

39)



A) Unaffected male

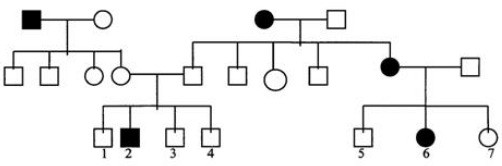
B) Unaffected female

C) Mating

D) Affected male

E) Affected female

Below is a pedigree for a common human trait (not a disease) controlled by a single gene. Shaded symbols are for individuals exhibiting the trait.



40) Identify the mode of inheritance of the trait.

A) Dominant

B) Recessive

C) Either dominant or recessive

D) Cannot be determined

41) If individuals 4 and 7 have a child, what is the probability that the child will exhibit the trait?

A) 1/4

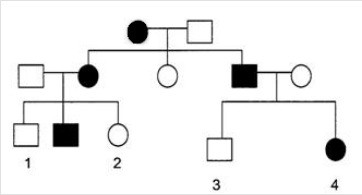
B) 1/2

C) 1/6

D) 2/3

E) 0

Below is a pedigree of a human genetic disease in which solid color indicates affected individuals. Assume that the disease is caused by a gene that can have the alleles *A* or *a*.



42) Based on this pedigree, what is the most likely mode of inheritance?

A) Dominant

B) Recessive

C) Either dominant or recessive

D) Cannot be determined

43) What is/are the possible genotype(s) of person 1?

A) *AA*

B) *Aa*

C) Either *AA* or *Aa*

D) *aa*

E) Cannot be determined

44) What is/are the possible genotype(s) of person 2?

A) *AA*

B) *Aa*

C) Either *AA* or *Aa*

D) *aa*

E) Cannot be determined

45) What is/are the possible genotype(s) of person 3?

A) *AA*

B) *Aa*

C) Either *AA* or *Aa*

D) *aa*

E) Cannot be determined

46) What is/are the possible genotype(s) of person 4?

A) *AA*

B) *Aa*

C) Either *AA* or *Aa*

D) *aa*

E) Cannot be determined

47) If individuals 1 and 4 have a child together, what is the probability that the child will exhibit the disease?

A) 0%

B) 25%

C) 50%

D) 75%

E) 100%

48) If individuals 2 and 3 have a child together, what is the probability that the child will exhibit the disease?

A) 0%

B) 25%

C) 50%

D) 75%

E) 100%

In corn, having ligules (*L*) is dominant to liguleless (*l*), and green leaves (*G*) is dominant to white leaves (*g*).

49) If a testcross is performed with a dihybrid plant with ligules and green leaves, what proportion of the progeny would be green and liguleless?

A) 1/16

B) 1/8

C) 1/4

D) 1/2

E) Cannot be determined

50) If a pure-breeding liguleless plant with green leaves is crossed to pure-breeding plant with ligules and white leaves, predict the proportion of F2 progeny with the genotype *Ll gg*.

A) 1/16

B) 1/8

C) 1/4

D) 1/2

E) Cannot be determined

51) If a pure-breeding plant that is liguleless and has green leaves is crossed to a pure-breeding plant with white leaves and ligules, predict the genotypes and phenotypes of the F1.

A) *LL GG*, green and ligules

B) *Ll GG*, green and ligules

C) *Ll Gg*, green and ligules

D) *ll gg*, white and liguleless

E) *Ll gg*, green and liguleless

52) How was the approach taken by Mendel similar to the approaches taken by modern scientific inquiry?

A) Mendel repeated his experiments.

B) Mendel examined both continuous and discrete traits.

C) Mendel used the same technical methods that are used today.

D) Mendel's experiments challenged no hypotheses that were favored at the time.

53) Pea shape is controlled by a gene that specifies an enzyme known as Sbe1 (for Starch-branching enzyme 1). A recessive allele of *Sbe1* likely encodes

A) an Sbe1 enzyme with reduced function.

B) an Sbe1 enzyme with a new function.

C) a different type of enzyme.

D) an Sbe1 enzyme with enhanced catalytic activity.

54) An allele of the pea color gene specifies the enzyme Sgr, which normally functions in a pathway to break down chlorophyll during pea maturation, resulting in yellow mature peas. A second allele of the *Sgr* gene produces no enzyme and is the \_\_\_\_\_\_\_\_ allele.

A) dominant

B) recessive

C) wild-type

D) functioning

55) Mendel's law of independent assortment dictates than an *Aa Bb* dihybrid would make equal numbers of four gamete types. What are these four gamete types?

A) *A; a; B; b*

B) *AA; BB; aa; bb*

C) *A B; A b; a B; a b*

D) *AA BB; AA bb; Aa Bb; aa BB*

56) According to Mendel's law of equal segregation, an *Aa* monohybrid makes two types of gametes with equal frequency. These two gamete types are:

A) *AA* and *aa*

B) *A* and *a*

C) *Aa* and *aa*

D) *AA* and *Aa*