Campbell's Biology, 9e **(Reece et al.)**
Chapter 14 Mendel and the Gene Idea

The questions in Chapter 14 are mostly at the Application/Analysis skill level. The material in the chapter invites students to apply Mendel's laws, and by doing so encourages problem solving. Because of the human-related Concept 14.4, a fair number of Synthesis/Evaluation questions are included as well. Very little of the chapter lends itself to Knowledge/Comprehension questions only. In addition, to help students make maximum use of information presented about one or more specific traits, a greater number of questions than usual is grouped together to explore brief scenarios or figures.

Multiple-Choice Questions

1) What do we mean when we use the terms *monohybrid cross* and *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 dihybrid cross involves organisms that are heterozygous for two characters and a monohybrid cross involves only one.
D) A monohybrid cross is performed for one generation, whereas a dihybrid cross is performed for two generations.
E) A monohybrid cross results in a 9:3:3:1 ratio whereas a dihybrid cross gives a 3:1 ratio.
Answer: C
Topic: Concept 14.1
Skill: Knowledge/Comprehension

2) Why did the F1 offspring of Mendel's classic pea cross always look like one of the two parental varieties?
A) No genes interacted to produce the parental phenotype.
B) Each allele affected phenotypic expression.
C) The traits blended together during fertilization.
D) One phenotype was completely dominant over another.
E) Different genes interacted to produce the parental phenotype.
Answer: D
Topic: Concept 14.1
Skill: Knowledge/Comprehension

3) What was the most significant conclusion that Gregor Mendel drew from his experiments with pea plants?
A) There is considerable genetic variation in garden peas.
B) Traits are inherited in discrete units, and are not the results of "blending."
C) Recessive genes occur more frequently in the F1 generation than do dominant ones.
D) Genes are composed of DNA.
E) An organism that is homozygous for many recessive traits is at a disadvantage.
Answer: B
Topic: Concept 14.1

Skill: Knowledge/Comprehension

4) How many unique gametes could be produced through independent assortment by an individual with the genotype *AaBbCCDdEE*?
A) 4
B) 8
C) 16
D) 32
E) 64
Answer: B
Topic: Concept 14.1
Skill: Application/Analysis

5) The individual with genotype *AaBbCCDdEE* can make many kinds of gametes. Which of the following is the major reason?
A) segregation of maternal and paternal alleles
B) recurrent mutations forming new alleles
C) crossing over during prophase I
D) different possible alignments of chromosomes
E) the tendency for dominant alleles to segregate together
Answer: D
Topic: Concept 14.1
Skill: Knowledge/Comprehension

6) Why did Mendel continue some of his experiments to the F2 or F3 generation?
A) to obtain a larger number of offspring on which to base statistics
B) to observe whether or not a recessive trait would reappear
C) to observe whether or not the dominant trait would reappear
D) to distinguish which alleles were segregating
E) to be able to describe the frequency of recombination
Answer: B
Topic: Concept 14.1
Skill: Synthesis/Evaluation

7) Which of the following differentiates between independent assortment and segregation?
A) The law of independent assortment requires describing two or more genes relative to one another.
B) The law of segregation requires describing two or more genes relative to one another.
C) The law of segregation requires having two or more generations to describe.
D) The law of independent assortment is accounted for by observations of prophase I.
E) The law of segregation is accounted for by anaphase of mitosis.
Answer: A
Topic: Concept 14.1
Skill: Knowledge/Comprehension

8) Two plants are crossed, resulting in offspring with a 3:1 ratio for a particular trait. What does this suggest?
A) that the parents were true-breeding for contrasting traits
B) that the trait shows incomplete dominance
C) that a blending of traits has occurred
D) that the parents were both heterozygous for a single trait
E) that each offspring has the same alleles for each of two traits
Answer: D
Topic: Concept 14.1
Skill: Knowledge/Comprehension

9) 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?
A) *tt*
B) *Hh*
C) *HhTt*
D) *T*
E) *HT*
Answer: E
Topic: Concept 14.1
Skill: Application/Analysis

10) When crossing an organism that is homozygous recessive for a single trait with a heterozygote, what is the chance of producing an offspring with the homozygous recessive phenotype?
A) 0%
B) 25%
C) 50%
D) 75%
E) 100%
Answer: C
Topic: Concept 14.1
Skill: Application/Analysis

11) Mendel accounted for the observation that traits which had disappeared in the F1 generation reappeared in the F2 generation by proposing that
A) new mutations were frequently generated in the F2 progeny, "reinventing" traits that had been lost in the F1.
B) the mechanism controlling the appearance of traits was different between the F1 and the F2 plants.
C) traits can be dominant or recessive, and the recessive traits were obscured by the dominant ones in the F1.
D) the traits were lost in the F1 due to dominance of the parental traits.
E) members of the F1 generation had only one allele for each trait, but members of the F2 had two alleles for each trait.
Answer: C
Topic: Concept 14.1

Skill: Knowledge/Comprehension

12) The fact that all seven of the pea plant traits studied by Mendel obeyed the principle of independent assortment most probably indicates which of the following?
A) None of the traits obeyed the law of segregation.
B) The diploid number of chromosomes in the pea plants was 7.
C) All of the genes controlling the traits were located on the same chromosome.
D) All of the genes controlling the traits behaved as if they were on different chromosomes.
E) The formation of gametes in plants occurs by mitosis only.
Answer: D
Topic: Concept 14.1
Skill: Synthesis/Evaluation

13) Mendel was able to draw his ideas of segregation and independent assortment because of the influence of which of the following?
A) His reading and discussion of Darwin's *Origin of Species.*
B) The understanding of particulate inheritance he learned from renowned scientists of his time.
C) His discussions of heredity with his colleagues at major universities.
D) His experiments with the breeding of plants such as peas and fuchsia.
E) His reading of the scientific literature current in the field.
Answer: E
Topic: Concept 14.1
Skill: Synthesis/Evaluation

14) Mendel's observation of the segregation of alleles in gamete formation has its basis in which of the following phases of cell division?
A) prophase I of meiosis
B) anaphase II of meiosis
C) metaphase I of meiosis
D) anaphase I of meiosis
E) anaphase of mitosis
Answer: D
Topic: Concept 14.1
Skill: Synthesis/Evaluation

15) Mendel's second law of independent assortment has its basis in which of the following events of meiosis I?
A) synapsis of homologous chromosomes
B) crossing over
C) alignment of tetrads at the equator
D) separation of homologs at anaphase
E) separation of cells at telophase
Answer: C
Topic: Concept 14.1
Skill: Synthesis/Evaluation

16) 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 crosses *BbTt* × *BBtt* will be expected to have black fur and long tails?
A) 1/16
B) 3/16
C) 3/8
D) 1/2
E) 9/16
Answer: D
Topic: Concept 14.2
Skill: Application/Analysis

17) 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?
A) 1
B) 1/2
C) 1/4
D) 1/6
E) 0
Answer: E
Topic: Concept 14.2
Skill: Application/Analysis

18) In the cross *AaBbCc* × *AaBbCc*, what is the probability of producing the genotype *AABBCC*?
A) 1/4
B) 1/8
C) 1/16
D) 1/32
E) 1/64
Answer: E
Topic: Concept 14.2
Skill: Application/Analysis

19) Given the parents *AABBCc* × *AabbCc*, assume simple dominance for each trait and independent assortment. What proportion of the progeny will be expected to phenotypically resemble the first parent?
A) 1/4
B) 1/8
C) 3/4
D) 3/8
E) 1
Answer: C
Topic: Concept 14.2
Skill: Application/Analysis

20) Which of the following is the best statement of the use of the addition rule of probability?
A) the probability that two or more independent events will both occur
B) the probability that two or more independent events will both occur in the offspring of one set of parents
C) the probability that either one of two independent events will occur
D) the probability of producing two or more heterozygous offspring
E) the likelihood that a trait is due to two or more meiotic events
Answer: C
Topic: Concept 14.2
Skill: Knowledge/Comprehension

21) Which of the following calculations require that you utilize the addition rule?
A) Calculate the probability of black offspring from the cross *AaBb* × *AaBb*, when *B* is the symbol for black.
B) Calculate the probability of children with both cystic fibrosis and polydactyly when parents are each heterozygous for both genes.
C) Calculate the probability of each of four children having cystic fibrosis if the parents are both heterozygous.
D) Calculate the probability of a child having either sickle-cell anemia or cystic fibrosis if parents are each heterozygous for both.
E) Calculate the probability of purple flower color in a plot of 50 plants seeded from a self-fertilizing heterozygous parent plant.
Answer: D
Topic: Concept 14.2
Skill: Application/Analysis

22) 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 × white
B) roan × roan
C) white × roan
D) red × roan
E) The answer cannot be determined from the information provided.
Answer: B
Topic: Concept 14.3
Skill: Application/Analysis

23) Which of the following describes the ability of a single gene to have multiple phenotypic effects?
A) incomplete dominance
B) multiple alleles
C) pleiotropy
D) epistasis
Answer: C
Topic: Concept 14.3

Skill: Knowledge/Comprehension

24) Cystic fibrosis affects the lungs, the pancreas, the digestive system, and other organs, resulting in symptoms ranging from breathing difficulties to recurrent infections. Which of the following terms best describes this?
A) incomplete dominance
B) multiple alleles
C) pleiotropy
D) epistasis
E) codominance
Answer: C
Topic: Concept 14.3
Skill: Knowledge/Comprehension

25) Which of the following is an example of polygenic inheritance?
A) pink flowers in snapdragons
B) the ABO blood group in humans
C) Huntington's disease in humans
D) white and purple flower color in peas
E) skin pigmentation in humans
Answer: E
Topic: Concept 14.3
Skill: Knowledge/Comprehension

26) 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 which of the following?
A) the knowledge that multiple alleles are involved
B) the allele for blue hydrangea being completely dominant
C) the alleles being codominant
D) the fact that a mutation has occurred
E) environmental factors such as soil pH
Answer: E
Topic: Concept 14.3
Skill: Knowledge/Comprehension

27) Which of the following provides an example of epistasis?
A) Recessive genotypes for each of two genes (*aabb*) results in an albino corn snake.
B) The allele *b17* produces a dominant phenotype, although *b1* through *b16* do not.
C) In rabbits and many other mammals, one genotype (*cc*) prevents any fur color from developing.
D) In *Drosophila* (fruit flies), white eyes can be due to an X-linked gene or to a combination of other genes.
E) In cacti, there are several genes for the type of spines.
Answer: C
Topic: Concept 14.3
Skill: Application/Analysis

28) Most genes have many more than two alleles. However, which of the following is also true?
A) At least one allele for a gene always produces a dominant phenotype.
B) Most of the alleles will never be found in a live-born organism.
C) All of the alleles but one will produce harmful effects if homozygous.
D) There may still be only two phenotypes for the trait.
E) More than two alleles in a genotype is considered lethal.
Answer: D
Topic: Concept 14.3
Skill: Synthesis/Evaluation

29) How could you best predict the maximum number of alleles for a single gene whose polypeptide product is known?
A) Search the population for all phenotypic variants of this polypeptide.
B) Count the number of amino acids in the polypeptide.
C) Mate all known genotypes and collect all possible offspring different from the parents.
D) Measure the rate of new mutations in the species and estimate the number since it first evolved.
E) Count the number of DNA nucleotides that are in the code for the polypeptides.
Answer: E
Topic: Concept 14.3
Skill: Synthesis/Evaluation

30) An ideal procedure for fetal testing in humans would have which of the following features?
A) the procedure that can be performed at the earliest time in the pregnancy
B) lowest risk procedure that would provide the most reliable information
C) the procedure that can test for the greatest number of traits at once
D) a procedure that provides a three-dimensional image of the fetus
E) a procedure that could test for the carrier status of the fetus
Answer: A
Topic: Concept 14.4
Skill: Synthesis/Evaluation

31) A scientist discovers a DNA-based test for one allele of a particular gene. This and only this allele, if homozygous, produces an effect that results in death at or about the time of birth. Of the following, which is the best use of this discovery?
A) Screen all newborns of an at-risk population.
B) Design a test for identifying heterozygous carriers of the allele.
C) Introduce a normal allele into deficient newborns.
D) Follow the segregation of the allele during meiosis.
E) Test school-age children for the disorder.
Answer: B
Topic: Concept 14.4
Skill: Synthesis/Evaluation

32) An obstetrician knows that one of her patients is a pregnant woman whose fetus is at risk for a serious disorder that is detectable biochemically in fetal cells. The obstetrician would most reasonably offer which of the following procedures to her patient?
A) CVS
B) ultrasound imaging
C) amniocentesis
D) blood transfusion
E) X-ray
Answer: C
Topic: Concept 14.4
Skill: Synthesis/Evaluation

33) The frequency of heterozygosity for the sickle-cell anemia allele is unusually high, presumably because this reduces the frequency of malaria. Such a relationship is related to which of the following?
A) Mendel's law of independent assortment
B) Mendel's law of segregation
C) Darwin's explanation of natural selection
D) Darwin's observations of competition
E) the malarial parasite changing the allele
Answer: C
Topic: Concept 14.4
Skill: Synthesis/Evaluation

34) Phenylketonuria (PKU) is a recessive human disorder in which an individual cannot appropriately metabolize a particular amino acid. The amino acid is not otherwise produced by humans. Therefore, the most efficient and effective treatment is which of the following?
A) Feed them the substrate that can be metabolized into this amino acid.
B) Transfuse the patients with blood from unaffected donors.
C) Regulate the diet of the affected persons to severely limit the uptake of the amino acid.
D) Feed the patients the missing enzymes in a regular cycle, such as twice per week.
E) Feed the patients an excess of the missing product.
Answer: C
Topic: Concept 14.4
Skill: Synthesis/Evaluation

35) Hutchinson-Gilford progeria is an exceedingly rare human genetic disorder in which there is very early senility and death, usually from coronary artery disease, at an average age of approximately 13. Patients, who look very old even as children, do not live to reproduce. Which of the following represents the most likely assumption?
A) All cases must occur in relatives; therefore, there must be only one mutant allele.
B) Successive generations of a family will continue to have more and more cases over time.
C) The disorder may be due to mutation in a single protein-coding gene.
D) Each patient will have had at least one affected family member in a previous generation.
E) The disease is autosomal dominant.
Answer: C

Topic: Concept 14.4
Skill: Synthesis/Evaluation

36) One of two major forms of a human condition called neurofibromatosis (NF 1) is inherited as a dominant gene, although it may range from mildly to very severely expressed. If a young child is the first in her family to be diagnosed, which of the following is the best explanation?
A) The mother carries the gene but does not express it at all.
B) One of the parents has very mild expression of the gene.
C) The condition skipped a generation in the family.
D) The child has a different allele of the gene than the parents.
Answer: B
Topic: Concept 14.4
Skill: Synthesis/Evaluation

Art Questions

Use Figure 14.1 and the following description to answer the questions below.

In a particular plant, leaf color is controlled by gene locus *D*. Plants with at least one 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 F1 offspring is allowed to self-pollinate. The predicted outcome of the F2 is diagrammed in the Punnett square shown in Figure 14.1, where 1, 2, 3, and 4 represent the genotypes corresponding to each box within the square.

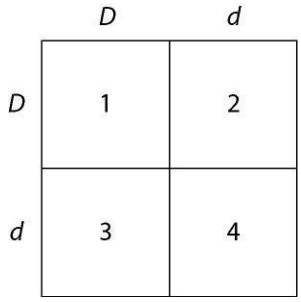

Figure 14.1

37) Which of the boxes marked 1-4 correspond to plants with dark leaves?
A) 1 only
B) 1 and 2
C) 2 and 3
D) 4 only
E) 1, 2, and 3
Answer: E
Topic: Concept 14.1
Skill: Application/Analysis

38) Which of the boxes correspond to plants with a heterozygous genotype?
A) 1
B) 1 and 2
C) 1, 2, and 3

D) 2 and 3
E) 2, 3, and 4
Answer: D
Topic: Concept 14.1
Skill: Application/Analysis

39) Which of the plants will be true-breeding?
A) 1 and 4 only
B) 2 and 3 only
C) 1, 2, 3, and 4
D) 1 only
E) 1 and 2 only
Answer: A
Topic: Concept 14.1
Skill: Application/Analysis

The following questions refer to the pedigree chart in Figure 14.2 for a family, some of whose members exhibit the dominant trait, *W*. Affected individuals are indicated by a dark square or circle.

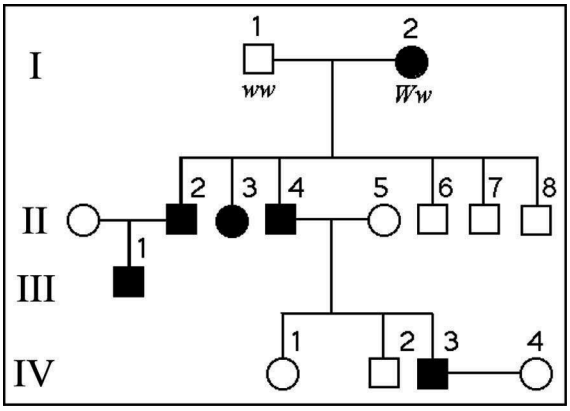

Figure 14.2

40) What is the genotype of individual II-5?
A) *WW*
B) *Ww*
C) *ww*
D) *WW* or *ww*
E) *ww* or *Ww*
Answer: C
Topic: Concept 14.4
Skill: Application/Analysis

41) What is the likelihood that the progeny of IV-3 and IV-4 will have the trait?
A) 0%
B) 25%
C) 50%

D) 75%
E) 100%
Answer: C
Topic: Concept 14.4
Skill: Application/Analysis

42) What is the probability that individual III-1 is *Ww*?
A) 3/4
B) 1/4
C) 2/4
D) 2/3
E) 1
Answer: E
Topic: Concept 14.4
Skill: Application/Analysis

Use the following pedigree (Figure 14.3) for a family in which dark-shaded symbols represent individuals with one of the two major types of colon cancer. Numbers under the symbols are the individual's age at the time of diagnosis.

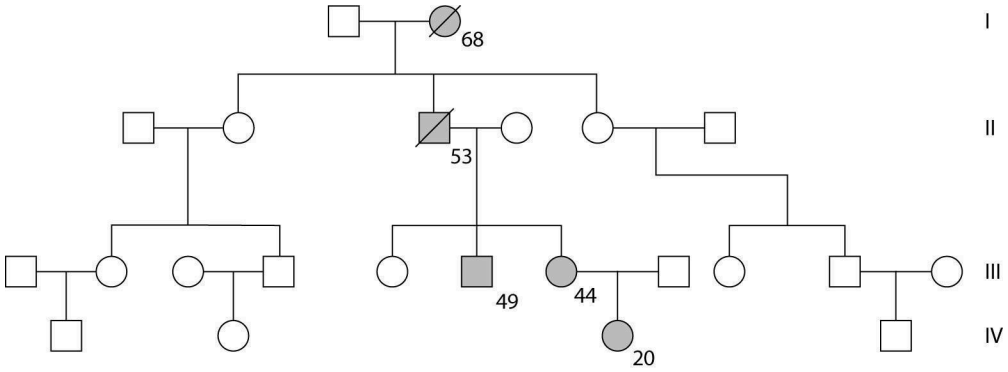

Figure 14.3

43) What is the genotype of the deceased individual in generation II?
A) homozygous for a gene for colon cancer
B) homozygous for both cancer alleles from his mother
C) heterozygous for a gene for colon cancer
D) affected by the same colon cancer environmental factor as his mother
E) carrier of all of the several known genes for colon cancer
Answer: C
Topic: Concept 14.4
Skill: Application/Analysis

44) In each generation of this family after generation I, the age at diagnosis is significantly lower than would be found in nonfamilial (sporadic) cases of this cancer (~ 63 years). What is the most likely reason?
A) Members of this family know to be checked for colon cancer early in life.
B) Hereditary (or familial) cases of this cancer typically occur at earlier ages than do nonfamilial forms.
C) This is pure chance; it would not be expected if you were to look at a different family.
D) This cancer requires mutations in more than this one gene.
E) Affected members of this family are born with colon cancer, and it can be detected whenever they are first tested.
Answer: B

Topic: Concept 14.4
Skill: Synthesis/Evaluation

45) From this pedigree, how does this trait seem to be inherited?
A) from mothers
B) as an autosomal recessive
C) as a result of epistasis
D) as an autosomal dominant
E) as an incomplete dominant
Answer: D
Topic: Concept 14.4
Skill: Application/Analysis

46) The affected woman in generation IV is thinking about her future and asks her oncologist (cancer specialist) whether she can know whether any or all of her children will have a high risk of the same cancer. The doctor would be expected to advise which of the following?
I. genetic counseling
II. prenatal diagnosis when/if she becomes pregnant
III. testing to see whether she has the allele
IV. testing to see whether her future spouse or partner has the allele
A) I only
B) II only
C) I and II only
D) I, II, and III only
E) III and IV only
Answer: C
Topic: Concept 14.4
Skill: Synthesis/Evaluation

Scenario Questions

Use the following information to answer the questions below.

Two true-breeding stocks of pea plants are crossed. One parent has red, axial flowers and the other has white, terminal flowers; all F1 individuals have red, axial flowers. The genes for flower color and location assort independently.

47) If 1,000 F2 offspring resulted from the cross, approximately how many of them would you expect to have red, terminal flowers?
A) 65
B) 190
C) 250
D) 565
E) 750
Answer: B
Topic: Concept 14.2
Skill: Application/Analysis

48) Among the F2 offspring, what is the probability of plants with white axial flowers?
A) 9/16
B) 1/16
C) 3/16
D) 1/8
E) 1/4
Answer: C
Topic: Concept 14.2
Skill: Application/Analysis

Use the following information to answer the questions below.

Labrador retrievers are black, brown, or yellow. In a cross of a black female with a brown male, results can be either all black puppies, 1/2 black to 1/2 brown puppies, or 3/4 black to 1/4 yellow puppies.

49) These results indicate which of the following?
A) Brown is dominant to black.
B) Black is dominant to brown and to yellow.
C) Yellow is dominant to black.
D) There is incomplete dominance.
E) Epistasis is involved.
Answer: E
Topic: Concept 14.2
Skill: Application/Analysis

50) How many genes must be responsible for these coat colors in Labrador retrievers?
A) 1
B) 2
C) 3
D) 4
E) 5
Answer: B
Topic: Concept 14.2
Skill: Application/Analysis

51) In one type cross of black × black, the results were as follows:
9/16 black
4/16 yellow
3/16 brown
The genotype *aabb* must result in which of the following?
A) black
B) brown
C) yellow
D) a lethal result
E) white

Answer: C
Topic: Concept 14.2
Skill: Application/Analysis

Use the following information to answer the questions below.

Radish flowers may be red, purple, or white. A cross between a red-flowered plant and a white-flowered plant yields all-purple offspring. The part of the radish we eat may be oval or long, with long being the dominant characteristic.

52) If true-breeding red long radishes are crossed with true-breeding white oval radishes, the F1 will be expected to be which of the following?
A) red and long
B) red and oval
C) white and long
D) purple and long
E) purple and oval
Answer: D
Topic: Concept 14.2
Skill: Application/Analysis

53) In the F2 generation of the above cross, which of the following phenotypic ratios would be expected?
A) 9:3:3:1
B) 9:4:3
C) 1:1:1:1
D) 1:1:1:1:1:1
E) 6:3:3:2:1:1
Answer: E
Topic: Concept 14.2
Skill: Application/Analysis

54) The flower color trait in radishes is an example of which of the following?
A) a multiple allelic system
B) sex linkage
C) codominance
D) incomplete dominance
E) epistasis
Answer: D
Topic: Concept 14.3
Skill: Application/Analysis

Use the following information to answer the questions below.

Drosophila (fruit flies) usually have long wings (+) but mutations in two different genes can result in bent wings (*bt*) or vestigial wings (*vg*).

55) If a homozygous bent wing fly is mated with a homozygous vestigial wing fly, which of the following offspring would you expect?
A) all *+bt +vg* heterozygotes
B) 1/2 bent and 1/2 vestigial flies
C) all homozygous + flies
D) 3/4 bent to 1/4 vestigial ratio
E) 1/2 bent and vestigial to 1/2 normal
Answer: A
Topic: Concept 14.2
Skill: Application/Analysis

56) If flies that are heterozygous for both the bent wing gene and the vestigial wing gene are mated, what is the probability of offspring with bent wings only?
A) 1/8
B) 3/8
C) 1/4
D) 9/16
E) 3/16
Answer: E
Topic: Concept 14.2
Skill: Application/Analysis

Use the following information to answer the questions below.

Tallness (*T*) in snapdragons is dominant to dwarfness (*t*), while red (*R*) flower color is dominant to white (*r*). The heterozygous condition results in pink (*Rr*) flower color.

57) A dwarf, red snapdragon is crossed with a plant homozygous for tallness and white flowers. What are the genotype and phenotype of the F1 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
Answer: D
Topic: Concept 14.3
Skill: Application/Analysis

58) If snapdragons are heterozygous for height as well as for flower color, a mating between them will result in what ratio?
A) 9:3:3:1
B) 6:3:3:2:1:1
C) 1:2:1
D) 27:9:9:9:3:3:3:1
E) 9:4:3
Answer: B
Topic: Concept 14.3
Skill: Application/Analysis

Use the following information to answer the questions below.

Skin color in a certain species of fish is inherited via a single gene with four different alleles.

59) How many different types of gametes would be possible in this system?
A) 1
B) 2
C) 4
D) 8
E) 16
Answer: C
Topic: Concept 14.3
Skill: Knowledge/Comprehension

60) One fish of this type has alleles 1 and 3 (*S*1*S*3) and its mate has alleles 2 and 4 (*S*2*S*4). If each allele confers a unit of color darkness such that *S*1 has one unit, *S*2 has two units, and so on, then what proportion of their offspring would be expected to have five units of color?
A) 1/4
B) 1/5
C) 1/8
D) 1/2
E) 0
Answer: D
Topic: Concept 14.3
Skill: Application/Analysis

Refer to the following information to answer the questions below.

Gene *S* controls the sharpness of spines in a type of cactus. Cactuses with the dominant allele, *S*, have sharp spines, whereas homozygous recessive *ss* cactuses have dull spines. At the same time, a second gene, *N*, determines whether or not cactuses have spines. Homozygous recessive *nn* cactuses have no spines at all.

61) The relationship between genes *S* and *N* is an example of
A) incomplete dominance.
B) epistasis.
C) complete dominance.
D) pleiotropy.
E) codominance.
Answer: B
Topic: Concept 14.3
Skill: Knowledge/Comprehension

62) 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.
Answer: A
Topic: Concept 14.3
Skill: Application/Analysis

63) If doubly heterozygous *SsNn* cactuses were allowed to self-pollinate, the F2 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
Answer: E
Topic: Concept 14.3
Skill: Application/Analysis

Use the information given here to answer the following questions.

Feather color in budgies is determined by two different genes, *Y* and *B*, one for pigment on the outside and one for the inside of the feather. *YYBB*, *YyBB*, or *YYBb* is green; *yyBB* or *yyBb* is blue; *YYbb* or *Yybb* is yellow; and *yybb* is white.

64) A blue budgie is crossed with a white budgie. Which of the following results is *not* possible?
A) green offspring only
B) yellow offspring only
C) blue offspring only
D) green and yellow offspring
E) a 9:3:3:1 ratio
Answer: D
Topic: Concept 14.3
Skill: Application/Analysis

65) 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*
Answer: C
Topic: Concept 14.3
Skill: Application/Analysis

Use the following information to answer the questions below.

A woman who has blood type A positive has a daughter who is type O positive and a son who is type B negative. Rh positive is a trait that shows simple dominance over Rh negative and is designated by the alleles *R* and *r*, respectively. A third gene for the MN blood group has codominant alleles *M* and *N*.

66) Which of the following is a possible partial genotype for the son?
A) *IBIB*
B) *IBIA*
C) *ii*
D) *IBi*
E) *IAIA*
Answer: D
Topic: Concept 14.3
Skill: Application/Analysis

67) Which of the following is a possible genotype for the mother?
A) *IAIA*
B) *IBIB*
C) *ii*
D) *IAi*
E) *IAIB*
Answer: D
Topic: Concept 14.3
Skill: Application/Analysis

68) Which of the following is a possible phenotype for the father?
A) A negative
B) O negative
C) B positive
D) AB negative
E) impossible to determine
Answer: C
Topic: Concept 14.3
Skill: Application/Analysis

69) If both children are of blood type M, which of the following is possible?
A) Each parent is either M or MN.
B) Each parent must be type M.
C) Both children are heterozygous for this gene.
D) Neither parent can have the *N* allele.
E) The MN blood group is recessive to the ABO blood group.
Answer: A
Topic: Concept 14.3
Skill: Application/Analysis

Refer to the following information to answer the questions below.

Humanoids on the newly explored planet Brin (in a hypothetical galaxy in ~50 years from the present) have a gene structure similar to our own, but many very different plants and animals.

70) One species of a small birdlike animal has an extremely variable tail length, which is a highly polymorphic trait. Geneticists have come to realize that there are eight separate genes for tail length per haploid genome, with each gene having two alleles. One allele for each gene (*a*, *b*, and so on) increases the length by 1 cm, whereas the other allele (*a*2, *b*2, and so on) increases it by 0.5 cm. One bird was analyzed and found to have the following genotype:
*a*1*a*1*b*2*b*2*c*1*c*2*d*1*d*2*e*2*e*2*f*1*f*2*g*1*g*1*h*1*h*2
What is the length of its tail?
A) 6 cm
B) 8 cm
C) 12 cm
D) 24 cm
E) 36 cm
Answer: C
Topic: Concept 14.3
Skill: Application/Analysis

71) One species of green plant, with frondlike leaves, a spine-coated stem, and purple cup-shaped flowers, is found to be self-pollinating. Which of the following is true of this species?
A) The species must be haploid.
B) Its reproduction is asexual.
C) All members of the species have the same genotype.
D) Some of the seeds would have true-breeding traits.
E) All of its dominant traits are most frequent.
Answer: D
Topic: Concept 14.3
Skill: Synthesis/Evaluation

72) If the environmental parameters, such as temperature, humidity, atmosphere, sunlight, and so on, are mostly Earthlike, which of the following do you expect of its types of leaves, stems, and flowers?
A) The genes for them would have originated on Earth.
B) Genes for these traits would have a common ancestor with those from Earth.
C) Such plants could be safely eaten by humans.
D) Genotypes for these traits would be identical to Earth plants with the same traits.
E) Phenotypes would be selected for or against by these environmental factors.
Answer: E
Topic: Concept 14.3
Skill: Synthesis/Evaluation

73) Marfan syndrome in humans is caused by an abnormality of the connective tissue protein fibrillin. Patients are usually very tall and thin, with long spindly fingers, curvature of the spine, sometimes weakened arterial walls, and sometimes ocular problems, such as lens dislocation. Which of the following would you conclude about Marfan syndrome from this information?
A) It is recessive.
B) It is dominant.
C) It has a late age of onset (> 60).
D) It is pleiotropic.
E) It is epistatic.
Answer: D
Topic: Concept 14.4
Skill: Knowledge/Comprehension

End-of-Chapter Questions

Chapter 14 of the textbook contains no multiple-choice end-of-chapter "Test Your Understanding" questions.