iGenetics A Mendelian Approach 1st Edition Russell Test Bank
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Exam
Name_____

MATCHING. Choose the item in column 2 that best matches each item in column 1.
Please select the best match for each term

1) Haploid
Answer: C

2) Diploid
Answer: E

3) Euploid
Answer: A

4) Polyploid
Answer: D

5) Aneuploid
Answer: B

A) Possessing the correct number of chromosomes

B) Possessing too few or too many copies of a single chromosome

C) One complete set of chromosomes

D) Several complete sets of chromosomes

E) Two complete sets of chromosomes

1) _____
2) _____
3) _____
4) _____
5) _____

Please select the most appropriate match.

6) Monohybrid cross
Answer: C

7) Dihybrid cross
Answer: A

8) *AA* x *aa*
Answer: E

9) 1:2:1:2:4:2:1:2:1
Answer: G

10) *Aa* x *aa*
Answer: B

11) 1:2:1
Answer: D

12) *AaBb* x *AaBb*
Answer: F

A) 9:3:3:1

B) Test cross

C) 3:1

D) monohybrid F_2

E) parental cross

F) dihybrid cross

G) dihybrid F_2

6) _____
7) _____
8) _____
9) _____
10) _____
11) _____
12) _____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

13) In lilies, white flowers (*W*) are dominant to purple flowers (*w*). If two plants that are heterozygous for flower color are mated, the offspring might have which genotype? 13) _____

A) *Ww*
B) *ww*
C) *WW*
D) All of the above
E) None of the above

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Answer: D

14) In a pea plant that is heterozygous for seed color, what proportion of gametes will carry the recessive allele? 14) _____
A) 1/4
B) 3/4
C) 1/2
D) All of the gametes
E) None of the gametes
Answer: C

15) In his experiments, Mendel noted that when two traits are involved in a genetic cross, they are inherited independently of each other. The reason for this is that 15) _____
A) genes on different chromosomes separate during the formation of gametes.
B) genes on the same chromosome separate during the formation of gametes.
C) alleles on the same chromosome separate during the formation of gametes.
D) chromosomes often recombine.
E) alleles on the same gene separate during the formation of gametes.
Answer: A

16) In a test cross between an individual with an unknown genotype that exhibits the dominant phenotype and a known homozygous recessive individual, the progeny showed a 1:1 ratio of dominant to recessive phenotypes. The individual of unknown genotype is therefore _____ for that gene. 16) _____
A) unizygous
B) homogeneous
C) heterozygous
D) hemizygous
E) homozygous
Answer: C

17) The chi-squared statistic can best be described as 17) _____
A) a statistical test that compares observed and expected population means.
B) a statistically significant test.
C) the standardized deviation of observed data from expected data.
D) a statistical test used in genetics.
E) none of the above.
Answer: C

18) In the F_2 generation, how many genotypic classes are possible from a dihybrid cross of two heterozygotes in which the genes involved show complete dominance? 18) _____
A) 3 B) 4 C) 8 D) 9 E) 12
Answer: D

19) In the F_2 generation, how many genotypic classes are possible from a trihybrid cross of two heterozygotes in which the genes involved show complete dominance? 19) _____
A) 2 B) 8 C) 16 D) 27 E) 61
Answer: D

20) If the results of a chi-square test of a given set of data show a *P* value greater than 0.05, then the null hypothesis 20) _____
A) must be rejected.

B) cannot be accepted.
C) cannot be rejected.
D) must be accepted.
E) must be rephrased.
Answer: C

21) A *P* value in statistics is 21) _____
A) the probability of getting the observed data distribution by chance.
B) a measure of the accuracy of a statistical test.
C) arbitrarily set depending on statistical test.
D) a measure of the accuracy of a data set.
E) none of the above.
Answer: A

22) A man whose father expresses a recessive trait marries a woman with a brother expressing the same recessive trait. What is the likelihood that the newlyweds could have a child expressing the trait? 22) _____
A) 1/5 B) 1/2 C) 1/6 D) 1/3 E) 1/4
Answer: C

23) In humans, brown eye color (*B*) is dominant to blue eyes (*b*). A brown-eyed man marries a woman with brown eyes and they have three blue-eyed daughters. What are the genotypes of the man and the woman? 23) _____
A) *BB* and *BB*
B) *Bb* and *Bb*
C) *BB* and *Bb*
D) *bb* and *bb*
E) *Bb* and *bb*
Answer: B

24) The probability that two parents with a family of four will have one girl and three boys is 24) _____
A) 1/2 B) 1/32 C) 1/8 D) 1/16 E) 1/4
Answer: D

25) A couple with three girls is expecting a fourth child. The probability that this child is also a girl is 25) _____
A) 1/4 B) 1/8 C) 1/16 D) 1/2 E) 1/32
Answer: D

26) Net or overall probabilities are obtained by multiplying separate independent probabilities. This is formally known as 26) _____
A) the probability rule.
B) the product rule.
C) the chi-square test.
D) the sign test.
E) the sum rule.
Answer: B

27) Which of the following is true concerning the inheritance of a dominant trait? 27) _____
A) The trait is observed in every generation.
B) Every affected person must have at least one affected parent.
C) An affected heterozygote will transmit the allele to half of his or her offspring on average.
D) All of the above

E) None of the above
Answer: D

28) Which of the following is a useful characteristic for a candidate for Mendelian studies? 28) _____
A) Slow growing, late to reproduce, and producing many offspring
B) Fast growing, late to reproduce, and producing few offspring
C) Slow growing, early to reproduce, and producing few offspring.
D) Fast growing, early to reproduce, and producing many offspring
E) Fast growing and nonreproductive
Answer: D

29) In his monohybrid crosses for seed color in peas, Mendel reported 6,022 yellow seeds and 2,001 green seeds. How many of each color class were expected? 29) _____
A) All should be yellow
B) 2,006 yellow and 6,017 green
C) All should be green
D) 4,011 green and 4,011 yellow
E) 6,017 yellow and 2,006 green
Answer: E

30) Mendel's monohybrid crosses for round vs. wrinkled peas yielded 7,324 F_2 offspring from crosses of 253 plants, as reported in a famous 1867 letter to the botanist Carl N$\ddot{a}$geli. How many of these were expected to be wrinkled□the recessive trait? 30) _____
A) 0 B) 7,324 C) 1,831 D) 5,493 E) 3,662
Answer: C

TRUE/FALSE. Write 'T' if the statement is true and 'F' if the statement is false.

31) A test cross with a heterozygous dominant individual will yield only heterozygous dominant offspring. 31) _____
Answer: True False

32) Two individuals can be phenotypically identical yet have different genotypes for a given trait. 32) _____
Answer: True False

33) The genotypic F_2 ratio expected in a dihybrid cross is 9:3:3:1. 33) _____
Answer: True False

34) The phenotype determines the genotype. 34) _____
Answer: True False

35) True-breeding individuals are produced by repeated backcrossing. 35) _____
Answer: True False

36) Mendel was the first to describe dominant, recessive, and codominant traits. 36) _____
Answer: True False

37) Mendel's work immediately revolutionized the study of inheritance. 37) _____
Answer: True False

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

38) Mendel was the first scientist to deduce the idea of diploidy□that is, that organisms like pea plants and humans possess two complete sets of genetic material. Summarize Me l's observations nde and reasoning

that led him to this conclusion. 38) ___ ___ ___ ___ _

Answer: The $F_1$and F_2 phenotypic ratios that Mendel observed in different crosses led him to conjecture that each parent contributes one version of a "unit factor" for each trait during reproduction. Each individual thus possesses two such factors (diploidy), and it is combinations of unit factors that constitute the genotype.

39) Mendel selected seven traits to analyze in his famous pea plant crosses, and all of these traits yielded expected 3:1 phenotypic F_2 ratios in monohybrid crosses. He was fortunate in his selection of these traits. How so? What problem might he have encountered that may have yielded confusing ratios? 39) _____

Answer: By chance, some of the traits he selected might not have been assorting independently, owing to linkage (occurring on the same chromosome).

40) Mendel's insights started with his approach of analyzing discrete traits, leading to the idea of "particulate" rather than "blending" inheritance. Yet this was an uncommon way to view the inheritance of traits, as many found it counterintuitive or contrary to experience. How so? 40) _____

Answer: Experience with breeding pets or livestock, or even having children, suggests that parental traits seem to blend together in the offspring. This is because most traits that breeders considered are complex, polygenic traits. By focusing on simple discrete traits, Mendel was able to show that his "unit factors" simply combined and recombined in pairs each generation and were not blended away.

41) What are the steps involved in setting up a dihybrid F_3 cross? 41) _____

Answer: True-breeding parentals doubly homozygous for different alleles for each of two traits are crossed, yielding F_1s that are heterozygous for both traits. Two of these are then crossed to yield F_2s. Two of these, when crossed, will yield the F_3 generation.

42) A monohybrid cross is made for flower color, where purple is dominant to white. Fifteen hundred F_2 offspring are analyzed. How many white flowers are expected? 42) _____

Answer: One-quarter of the offspring should be homozygous recessive, thus: (0.25) x 1,500 = 375 white flowers.

43) Speculate on the molecular basis for dominance and recessiveness, using flower color as an example, where red is dominant over white. 43) _____

Answer: If the trait is controlled by a gene responsible for synthesizing red pigment, the recessive allele could be a dysfunctional mutant. Red pigment would be made as long as there was at least one functional copy of the gene present□this is the essence of dominance, where the presence of a single allele is sufficient to mask the recessive allele.

44) You observe an individual of your favorite study organism expressing the dominant phenotype for a certain trait. How would you go about determining if the individual was homozygous dominant or heterozygous for that trait? 44) _____

Answer: Perform a test cross with a recessive homozygous individual: If $Aa \times aa \rightarrow$ offspring are *Aa:aa* in a 1:1 ratio, and if $AA \times aa \rightarrow$ all offspring are *Aa* heterozygotes.

45) An albino man and a nonalbino woman have several children, one of whom is albino. (a) What can you conclude about the genotype of the mother? (b) What is the probability that the nonalbino children are heterozygous? 45) _____

Answer: (a) The mother must be heterozygous (a carrier) in order to have even one albino offspring. (b) With parents of genotype *Aa* × *aa*, any nonalbino offspring must be heterozygous, so the probability is 100 percent.

46) A nonalbino man and a nonalbino woman have several children, one of whom is albino. (a) What can you conclude about the genotype of the mother? (b) What is the probability that the nonalbino children are heterozygous? 46) _____

Answer: (a) Both parents must be heterozygous (a carrier) in order to have an albino offspring. (b) With parents of genotype *Aa* × *Aa*, the nonalbino offspring genotypes possible are *AA*, *Aa*, and *aA*. Two of these three are carriers, so there is a 2/3 (66 percent) chance that a nonalbino child is a carrier.

47) A dihybrid cross yields 200 F_2 offspring. How many are expected to resemble the homozygous recessive parental? 47) _____

Answer: In a dihybrid cross, 1/16 of the offspring are expected to be homozygous recessive. Thus, 1/16 × 200 = 12.5 offspring.

48) A monohybrid (1-gene) cross yields 4 genotypic classes, and a dihybrid (2-gene) cross yields 16. How many classes are expected from a tetrahybrid (4-gene) cross? 48) _____

Answer: Following the simple relationship $4^1 = 4$ and $4^2 = 16$, $4^4 = 256$ expected genotypic classes.

49) Explain why heterozygotes are expected to be produced twice as frequently as either homozygote in a monohybrid F_1 cross. 49) _____

Answer: Combinatorials. Each individual offspring genotype has an equal likelihood of occurring (=1/4), but since there are two ways to make heterozygotes (*Aa* and *aA*), together they occur with a 1/4 + 1/4 = 1/2 frequency, twice that of either homozygote, which occur at a frequency of 1/4 each.

50) State the key difference between Mendel's principle of segregation and independent assortment. 50) _____

Answer: Segregation refers to separation of alleles into gametes, while independent assortment refers to random combinations of such alleles from different genes occurring in gametes.

1) C
2) E
3) A
4) D
5) B
6) C
7) A
8) E
9) G
10) B
11) D
12) F
13) D
14) C
15) A
16) C
17) C
18) D
19) D
20) C
21) A
22) C
23) B
24) D
25) D
26) B
27) D
28) D
29) E
30) C
31) FALSE
32) TRUE
33) FALSE
34) FALSE
35) TRUE
36) FALSE
37) FALSE
38) The $F_1$and F_2 phenotypic ratios that Mendel observed in different crosses led him to conjecture that each parent contributes one version of a "unit factor" for each trait during reproduction. Each individual thus possesses two such factors (diploidy), and it is combinations of unit factors that constitute the genotype.
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44) Perform a test cross with a recessive homozygous individual: If *Aa* × *aa* → offspring are *Aa*:*aa* in a 1:1 ratio, and if *AA* × *aa* → all offspring are *Aa* heterozygotes.

45) (a) The mother must be heterozygous (a carrier) in order to have even one albino offspring. (b) With parents of genotype *Aa* × *aa*, any nonalbino offspring must be heterozygous, so the probability is 100 percent.

46) (a) Both parents must be heterozygous (a carrier) in order to have an albino offspring. (b) With parents of genotype *Aa* × *Aa*, the nonalbino offspring genotypes possible are *AA*, *Aa*, and *aA*. Two of these three are carriers, so there is a 2/3 (66 percent) chance that a nonalbino child is a carrier.

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49) Combinatorials. Each individual offspring genotype has an equal likelihood of occurring (=1/4), but since there are two ways to make heterozygotes (*Aa* and *aA*), together they occur with a 1/4 + 1/4 = 1/2 frequency, twice that of either homozygote, which occur at a frequency of 1/4 each.

50) Segregation refers to separation of alleles into gametes, while independent assortment refers to random combinations of such alleles from different genes occurring in gametes.

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