

- 1) Which of the following phenotypic ratios is not consistent with single gene inheritance?  
 a) 3:1      b) 2:1:1      c) 2:1      d) 1:1      e) 9:7
- 2) The allelic series for an autosomal gene affecting fruit color in squash is:  $c^R = c^Y > c^W > c^G > c^B$ , where  $c^R$  is red,  $c^Y$  is yellow,  $c^W$  is white,  $c^G$  is green and  $c^B$  is blue. If you cross individuals of the genotype:  $c^R c^Y$  and  $c^W c^G$ , what phenotypic distribution do you expect in the offspring?  
 a) 2 red: 2 yellow  
 b) 2 red: 1 yellow: 1 orange  
 c) 1 red: 2 orange: 1 yellow  
 d) 2 red: 1 yellow: 1 white  
 e) none of the above
- 3) In a marriage between a man who is phenotype A and a woman who is phenotype B at the ABO locus, what types of children are possible? (Assume no epistasis)  
 a) only A      b) only B      c) A, B or AB      d) A, B, AB or O      e) A, AB or O
- 4) You have two homozygous strains of iris, one with maroon flowers and one with yellow flowers. You make the crosses diagramed below (reciprocal crosses give the same results). If you cross a white flowered individual from the  $F_1$  to a purple flowered individual from the  $F_2$ , what is the expected proportion of yellow flowered offspring?  
 a) 1/2      b) 9/16      c) 1/4      d) 3/16      e) there's not enough data to tell
- 5) In Siamese cats, the feet, ears, nose and tip of the tail have dark fur, while the rest of the body is light colored. This is an example of:  
 a) variable penetrance  
 b) multiple alleles  
 c) random shutdown of one X-chromosome (Barr body)  
 d) variable expressivity  
 e) a gene interaction
- 6) You cross lines of mice homozygous for black fur and white fur. The  $F_1$  progeny have reddish fur. If you cross  $F_1$  males and females, what will be the most common phenotype in the  $F_2$ ?  
 a) black fur  
 b) white fur  
 c) reddish fur  
 d) there's not enough information to tell  
 e) none of the above
- 7) The C locus affects kernel color in corn ( $C/-$  plants are purple,  $c/c$  plants are white). You make the following cross to investigate the genetics of transposable elements. Which of the following statements will be true regarding the offspring of this cross?  
 a) 50% of the offspring will have purple spots in a white background; the other 50% will have white spots in a purple background  
 b) some of the offspring with the genotype  $C/c Ds^+/Ds Ac^+/Ac^+$  may be entirely white due to a  $Ds$  sequence jumping into the C allele, and interrupting its expression  
 c) offspring that are homozygous for  $Ac^+$  will be uniformly purple, whereas heterozygous offspring ( $Ac^+/Ac$ ) may exhibit white spots in a purple background  
 d) because all offspring will be heterozygous for  $Ds^+/Ds$ , all will express some white spots in a purple background  
 e) because all offspring will be heterozygous  $C/c$ , all will be purple

8) Which of the following will not reduce the deleterious effects of a transposable element on its host?

- a) transposition only in the germline
- b) preferential insertion into intergenic regions
- c) preferential insertion into the distal tip of the chromosome
- d) preferential insertion into heterochromatin
- e) splicing out of transcript

9) Which of the following is part of the transposable element life cycle?

- a) horizontal transfer to another species
- b) rapid increase in copy number
- c) gradual loss of functional elements through mutation
- d) gradual reduction in transposition rate
- e) all of the above

10) Two pure lines of tomatoes show different recombination frequencies in the region Cfp2 to Lf on chromosome 5. Strain A has an RF value of 0.03, while strain B has an RF value of 0.19. The two lines are crossed, and the F<sub>1</sub> hybrids display reduced fertility. What is the best explanation for the in RF values between the strains?

- a) deletion in strain A
- b) duplication in strain B
- c) inversion in strain B
- d) inversion in strain A
- e) translocation in strain A

11) Four strains of *Drosophila* were constructed in which one autosome contained the recessive mutant alleles of the four genes rolled eyes, thick legs, straw bristles and apterous wings (i.e., wingless), and the homologous autosome contained one of four different deletions (deletions 1-4). The phenotypes of the flies were as follows: Based on the pattern of pseudodominance, the gene order must be:

- a) rolled--thick--straw--apterous
- b) thick--straw--rolled--apterous
- c) thick--straw--apterous--rolled
- d) straw--rolled--apterous--thick
- e) rolled--apterous--thick--straw

12) Crossover in a region with a duplication:

- a) is reduced because of imprecise pairing
- b) can lead to further duplications
- c) is likely to be non-reciprocal
- d) all of the above
- e) none of the above

13) Aneuploids result from nondisjunction during:

- a) metaphase of mitosis
- b) metaphase I of meiosis
- c) anaphase I of meiosis
- d) prophase I of meiosis
- e) telophase II of meiosis

14) An allotetraploid plant carries four copies of a gene that affects flower color. Plants which carry three or four R alleles are red, those with one or two R alleles are pink, and white plants must carry only r alleles. You make a cross between two individuals of genotype R/R/r/r. What phenotypic ratio do you expect in the progeny?

- a) 1 red: 2 pink: 1 white
- b) 1 red: 4 pink: 1 white
- c) 9 red: 6 pink: 1 white
- d) 9 red: 26 pink: 1 white
- e) none of the above

15) A triploid plant with 5 chromosomes in each set ( $3n = 15$ ) is discovered. If aneuploid pollen is inviable, what is the probability of a meiosis in which all univalents pass to the same pole?

- a) one-half
- b) one-fifth
- c) one-tenth
- d) one-fifteenth
- e) one-sixteenth

16) You census a population of fire ants for genetic variation at the phosphoglucomutase-3 locus which has two codominant alleles,  $A_1$  and  $A_2$ . You find the following number of each genotype: 416  $A_1A_1$ , 726  $A_1A_2$ , and 102  $A_2A_2$ . If the population is in Hardy Weinberg Equilibrium, the genotype frequencies should be:

- a)  $A_1A_1 = 0.334$ ,  $A_1A_2 = 0.584$ ,  $A_2A_2 = 0.082$
- b)  $A_1A_1 = 0.112$ ,  $A_1A_2 = 0.341$ ,  $A_2A_2 = 0.007$
- c)  $A_1A_1 = 0.578$ ,  $A_1A_2 = 0.764$ ,  $A_2A_2 = 0.286$
- d)  $A_1A_1 = 0.392$ ,  $A_1A_2 = 0.468$ ,  $A_2A_2 = 0.140$
- e) none of the above

17) Which of the following evolutionary forces does not increase population genetic variation?

- a) recombination
- b) mutation
- c) directional selection
- d) gene flow
- e) disassortative mating

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- a) 0.626
- b) 0.334
- c) 0.584
- d) 0.645
- e) none of the above

19) Three genes that increase height in snouters above the base height of 24 cm have been identified. Each gene has two alleles; one (+) increases height by 3 cm, the other (-) increases height by 1 cm. If these alleles are additive, and all alleles are equally common in the population, which is in Hardy-Weinberg Equilibrium, what will be the height of the most common genotype? (Assume that environmental variance = 0.)

- a) 24 cm
- b) 30 cm
- c) 36 cm
- d) 48 cm
- e) none of the above

20) Heritability can be defined as:

- a) the proportion of a trait that is genetic
- b) the number of genes affecting a quantitative character
- c) the proportion of phenotypic variance that is due to genetic variance
- d) all of the above
- e) none of the above