

1) A heterozygous (A/a) plant is selfed. Under complete dominance, the expected progeny phenotype ratio is:

- a) 1:1      b) 1:2:1      c) 3:1      d) 9:3:3:1      e) 1:1:1:1

2) If a plant of genotype A/a; B/b; D/d; E/e; f/f is selfed and the genes assort independently, how many different genotypes will be found among the progeny?

- a) 4      b) 16      c) 24      d) 64      e) 128

3) Groggins are creatures from the planet Zabar. As a xenogeneticist you are interested in determining the inheritance of two traits in this species, using two stocks that are homozygous for different alleles affecting antennae color (pink or red) and tail barbs (barbed or smooth). You make the crosses diagrammed below.

Cross A

P<sub>0</sub> red, barbed M x pink, smooth F

Cross B

pink, smooth M x red, barbed F

F<sub>1</sub> red, smooth males and females

red, smooth males; pink smooth females

The trait of pink antenna is best described as:

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

4) A couple without an ancestral history of Tay-Sachs disease (an autosomal recessive) have two normal children and an infant affected with Tay-Sachs. The sister of the husband wants to marry the brother of the wife; in such a marriage, what would be the probability of their first child having Tay-Sachs? Assume that all the adults are phenotypically normal.

- a) 1/2      b) 1/4      c) 1/8      d) 1/16      e) 0

5) Which of the following is the correct order of increasing levels of chromosome packing (smallest to largest)?

- a) nucleosomes-loops-solenoids-supercoils
- b) solenoids-nucleosomes-loops-supercoils
- c) solenoids-nucleosomes-supercoils-loops
- d) nucleosomes-solenoids-loops-supercoils
- e) solenoids-loops-nucleosomes-supercoils

6) Which of the following is not a chromosomal landmark?

- a) centromere location
- b) histone location
- c) telomeres
- d) constitutive heterochromatin
- e) location of the nucleolar organizer

7) In a moth in which  $2n = 56$ , what is the total number of chromatids present during Prophase I of meiosis?

- a) 14      b) 28      c) 56      d) 112      e) 224

8) The frizzle fowl gets its name from the unusual way that its feathers curl up. Unfortunately, frizzle fowl do not breed true; when two frizzles are mated, they always produce 50% frizzles, 25% normal, and 25% with peculiar woolly feathers that soon fall out, leaving the birds naked. If you wanted to mass produce frizzle fowl for sale, which type would be best to use as a breeding pair?

- a) frizzle male x frizzle female
- b) normal male x frizzle female
- c) normal male x normal female
- d) frizzle male x woolly female
- e) normal male x woolly female

9) A  $gal^-$  mutant

- a) cannot grow without galactose
- b) is resistant to galactose
- c) can utilize galactose as a carbon source
- d) cannot utilize galactose as a carbon source
- e) can make its own galactose

10) From one  $F^+$  strain the following three Hfr strains were derived, each shown with the first three markers (in order third, second, first) transferred during an Hfr x  $F^-$  cross:

Hfr 1 . . . D A F  $\rightarrow$

Hfr 2 . . . E B F  $\rightarrow$

Hfr 3 . . . E C D  $\rightarrow$

The order of the genes on the bacterial chromosomal circle must be which of the following? (A is shown at both ends to represent circularity)

- a) A D C E B F A
- b) A B C D F E A
- c) A C D F E B A
- d) A E F B C D A
- e) A F B D E C A

11) A female armadillo heterozygous for the traits of hairy snout (h), red eyes (r), and warty paws (W) is test-crossed to a male that is homozygous recessive for all three traits. The distribution of test cross progeny is: 74 + + +; 70 h r W; 44 h + +; 50 + r W; 4 + + W; 2 h r +; 368 h + W; 388 + r +; and is similar in both sexes. Which of the following shows how you would calculate the RF value for h and r?

- a)  $RF = (74 + 70 + 44 + 50 + 4 + 2)/1000$
- b)  $RF = (74 + 70 + 44 + 50 + 4 + 2 + 4 + 2)/1000$
- c)  $RF = (74 + 70 + 4 + 2)/1000$
- d)  $RF = (44 + 50 + 2 + 4)/1000$
- e)  $RF = (74 + 70 + 44 + 50)/1000$

12) A female armadillo heterozygous for the traits of hairy snout (h), red eyes (r), and warty paws (W) is test-crossed. The genotype of the male in the testcross is best described as:

- a) H/H; R/R; w/w
- b) +/+; +/+; +/+
- c) H/H; R/R; W/W
- d) h/h; r/r; W/W
- e) h/h; r/r; +/+

13) Four of the following events are part of both meiosis and mitosis, but only one is exclusively meiotic. Which one?

- a) chromatid formation
- b) spindle formation
- c) chromosome condensation
- d) chromosome movement to the poles
- e) chromosome pairing

14) The pedigree below is for a rare hereditary disease of the kidneys in humans. Which of the following modes of inheritance is most likely?

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

15) Estimates of genetic distance are:

- a) reliable if loci are on the same chromosome
- b) reliable if loci are on the same arm of the same chromosome
- c) reliable if the loci are no further than 50 map units apart
- d) reliable only if a mapping function has been used
- e) none of the above

16) The tomato autosomal genes leafy (*ly*) and bushy (*bu*) are 24 cM apart. An female of genotype *ly + / + bu* is testcrossed to a male of genotype *ly bu / ly bu*. The proportion of progeny that have a wild type phenotype will be:

- a) 0.12
- b) 0.24
- c) 0.38
- d) 0.48
- e) 0.76

17) For the chromosome interval marked by two microsatellite loci, a LOD score of four

- a) indicates that one or more candidate genes are located in the region
- b) indicates that at least four independent pedigrees were used in the analysis
- c) indicates a likelihood ratio of 4.0
- d) indicates a likelihood ratio of 4000
- e) none of the above

18) When a chi-square test is significant,

- a) the hypothesis is rejected
- b) the p-value is less than 0.5
- c) the genes are linked
- d) there are insufficient degrees of freedom
- e) you must redo the experiment

19) In Jimsonweed, flower color may be either purple or white, and seed pods may be either spiny or smooth. You make a number of crosses among plants of unknown genotype (collected from the wild) and obtain the following results:

Parents male x females	Offspring	
	Males	Females
1. purple spiny x purple, spiny	purple, spiny	purple, spiny
2. purple, spiny x purple, smooth	$\frac{1}{2}$ purple, spiny $\frac{1}{2}$ purple smooth	$\frac{1}{2}$ purple spiny $\frac{1}{2}$ purple smooth
3. purple, smooth x white, smooth	purple, smooth	$\frac{1}{2}$ purple, spiny $\frac{1}{2}$ purple, smooth
4. purple, spiny x white, spiny	$\frac{1}{2}$ purple, spiny $\frac{1}{2}$ white, spiny	$\frac{1}{2}$ purple spiny $\frac{1}{2}$ white spiny
5. purple, smooth x purple, smooth	$\frac{3}{4}$ purple smooth $\frac{1}{4}$ white smooth	$\frac{3}{4}$ purple smooth $\frac{1}{4}$ white, smooth
6. white, smooth x white, spiny	$\frac{1}{2}$ white, spiny $\frac{1}{2}$ white, smooth	$\frac{1}{2}$ white, spiny $\frac{1}{2}$ white, smooth

Which of the following best describes the phenotype of spiny seed pods?

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

20) Phenotypes caused by mutations in mitochondrial genes:

- a) have an inheritance pattern consistent with sex-linked dominant traits
- b) have an inheritance pattern consistent with autosomal dominant traits
- c) have an inheritance pattern consistent with sex-linked recessive traits
- d) have an inheritance pattern consistent with autosomal recessive traits
- \*e) have an inheritance pattern consistent with uniparental transmission