Dihybrid and Epistasis Practice Exam and Homework

1. There is an individual with a genotype of *CCDd*. How many genotypically different gametes based on these two pairs of alleles could be produced?
   a. 1
   b. 2
   c. 3
   d. 4
   e. 6

2. Aberdeen Angus cattle are black (*BB*) and polled (no horns) (*PP*). Red shorthorn cattle are red with horns (*bb pp*). Black (*B*) and polled (*P*) are dominant. What will be the F_2 ratios of a cross between these two types of cattle?

   a. 9 black polled: 3 black horned: 3 red polled: 1 red horned
   b. 9 black polled: 3 black horned: 3 red horned: 1 red polled
   c. 9 black polled: 3 red polled: 3 red horned: 1 black horned
   d. 9 red horned: 3 black horned: 3 red polled: 1 black polled

The next three questions refer to the diagram below. Dihybrid crosses were made with Black (B) dominant to white (b), and straight hair (S) dominant to curly hair (s).

	BS	*Bs*	*bS*	*bs*
BS	Q	U	Y	H
Bs	R	V	Z	J
bS	S	W	F	K
bs	T	X	G	L

3. What is the genotype for organisms of type "J"?

   a. *Bb ss*
   b. *bb ss*
   c. *BB ss*
   d. *bb SS*
   e. *bB Ss*

4. What is the probability of obtaining progeny with the genotype of *Bbss* in a cross between organisms of type H and type T?

   a. 1/16
   b. 2/16
   c. 3/16
   d. 4/16

e. 1/2

5. What is the probability of producing a black, straight haired progeny in a cross of type Z organisms with type L?

   a. 0
   b. 1/4
   c. 3/16
   d. 1/2
   e. 9/16

6. When homozygous black, solid-hoofed male pigs were mated to females from a pure breed of red, cloven-hoofed pigs and the F_1 progeny were backcrossed to the female breed, the results were 8 black, solid-hoofed, 11 black, cloven-hoofed, 14 red, cloven-hoofed and 10 red, solid-hoofed piglets. What is the genetic basis of the two pairs of alleles?
   a. Black is dominant to red; solid hoof is dominant to cloven.
   b. Red is dominant to black; cloven is dominant to solid.
   c. Black is dominant to red; cloven is dominant to solid.
   d. Red is dominant to black; solid is dominant to cloven.

7. In snapdragons, red flower color, *R*, is incompletely dominant to white, *r*, with *Rr* being pink. Broad leaf, *B*, is incompletely dominant over narrow, *b*, with *Bb* intermediate in leaf breadth. A red flowered, broad leafed plant is crossed with a pink flowered intermediate leafed one. Which progeny could not occur in this cross?

   a. Red flowered, broad leafed
   b. Pink flowered, intermediate leafed
   c. Red flowered, narrow leafed
   d. Pink flowered, broad leafed

8. When there are four heterozygous independent pairs of alleles, what is the possible number of genotypic classes in an F_2?

   a. 4
   b. 8
   c. 16
   d. 64
   e. 81

9. In chickens the genotype *rr pp* produces single combs; *R_ P_*, walnut comb; *rr P_*, pea comb; and, *R_ pp*, rose comb. If *rr PP* (pea) are crossed to *RR pp* (rose). What would be the progeny's comb type?

   a. Rose
   b. Single

c. Walnut
d. Pea
e. More than one of the above is true.

10. In chickens, individuals have un-feathered shanks when they are homozygous for recessive genes at two loci; the presence of a single dominant gene at either locus causes feathers. What is the feathered to un-feathered ratio in their offspring if chickens heterozygous at both loci are crossed?

    a. 9:7
    b. 12:4
    c. 13:3
    d. 15:1

11. In mice, the allele *A*, causes agouti banding of hairs, and is dominant to the allele *a*, so that *aa* mice are solid black. The allele, *C*, causes color and is dominant to *c*, and *cc* mice are albinos. When a mouse is *cc*, its color cannot be shown. Heterozygous *Cc Aa* mice are crossed to *cc aa* mice. What will the phenotypic ratios be in the progeny?

    a. 2 agouti: 1 black: 1 albino
    b. 1 agouti: 2 black: 1 albino
    c. 1 agouti: 1 black: 2 albino
    d. 1 agouti: 1 albino
    e. None above are correct.

12. A particular cross gives in the F_2 a 9:3:4 phenotypic ratio. What is the expected phenotypic ratio when the F_1 is crossed with the double recessive?

    a. 1:1:1:1
    b. 1:1:2
    c. 1:3
    d. 2:2
    e. None above are correct.

13. In humans, there is a dominant allele that causes vitiligo, where small-unpigmented spots appear on the body. Also, there is a recessive allele for another gene that causes albinism, which causes the entire body to be unpigmented. Vitiligo cannot be seen in albinos. A man with vitiligo had an albino mother and normal father.

    If the man has a child by a phenotypically normal-skinned woman who had an albino father, what is the probability of having a phenotypically normal child?

    a. 0
    b. 1/8
    c. 2/8
    d. 3/8
    d. 4/8

e. None above are correct.

14. In the tomato, cut leaf, *C*, is dominant to potato leaf, *c*; and, purple stem, *A*, is dominant to green stem, *a*. Potato purple plants are crossed with cut, green plants and the progeny ratios were: 70 cut, purple; 91 potato, purple; 86 cut, green; 77 potato, green. What are the probable genotypes of the parents?

a. *cc Aa* x *Cc aa*
b. *cc AA* x *Cc aa*
c. *cc AA* x *CC aa*
d. *cc Aa* x *CC aa*
e. None above are correct.

15. Brachyphalangy is lethal when homozygous and is dominant in humans. Heterozygotes have characteristically short fingers.
Ability to roll the tongue is dominant to non-rolling.
Two short-fingered persons, one not able to roll his tongue and the other heterozygous for both these alleles, marry. What phenotypic ratios are expected in their **living** progeny?

	Normal fingered, tongue roller	Normal fingered, non-roller	Short fingered, tongue roller	Short fingered, non-roller
a.	2	1	2	1
b.	1	2	1	2
c.	2	2	1	1
d.	1	1	2	2

e. None above are true.

16. A parakeet with green plumage is crossed to a white parakeet. The progeny are all green. Crossing these progeny together gave the following offspring: 3 white, 8 blue, 29 green, and 9 yellow. Propose a genetic hypothesis to explain the results (an expected ratio).

17. In the parakeet problem given above, propose a biochemical basis for the various colors.

18. In oats, there are two pairs of alleles that interact to determine seed hull color. A cross between two homozygous varieties of oats, one with white-hulled seeds and one with black-hulled seeds, produced an F_1 with black hulled seeds. The cross F_1 x F_1 produced in the F_2 the following proportions: 12/16 black: 3/16 gray: 1/16 white. If F_1's were crossed to the white parental variety, what phenotypes and proportions would be expected among the progeny?

19. In humans there are three alleles at the *ABO* locus causing blood types A, B, AB, O. How many genotypic and phenotypic combinations are possible in the offspring of a brown-eyed, red-haired, taster man with AB blood group (*Bb rr Tt AB*) married to a blue-eyed, non-red haired, taster with type A blood (*bb Rr Tt AO*) woman?

20. One set of coat color alleles in guinea pigs is multiple allelic. When homozygous the phenotypes are: *CC*, black; $c^k c^k$, sepia; $c^d c^d$, cream; $c^a c^a$, albino. The observed dominance relationships are: *C* is dominant to all other alleles, c^k is dominant to c^d and c^a, c^d is dominant to c^a. What phenotypic ratios are expected when Cc^k males are mated with $c^d c^a$ females; or when $c^k c^a$ (sepia) mate with $c^d c^a$ (cream)?