Bio-Test

Name:

Period:

Matching (write letter next to number)

_____ 1. the physical location on a chromosome where a gene resides different "versions" of a gene

_____ 2. the trait an organism shows (appearance)

_____ 3. Aa; AA or aa are examples of these

_____ 4. thousands of genes can be found on a single one of these

_____ 5. if both copies of a gene are the same in a diploid individual

_____ 6. the product of an AA x aa cross

_____ 7. a single gene with many effects

_____ 8. heterozygote has a different phenotype than either homozygote

_____ 9. when the genotype of one locus masks expression of trait controlled by another locus

_____ 10. small furry house pets some people like

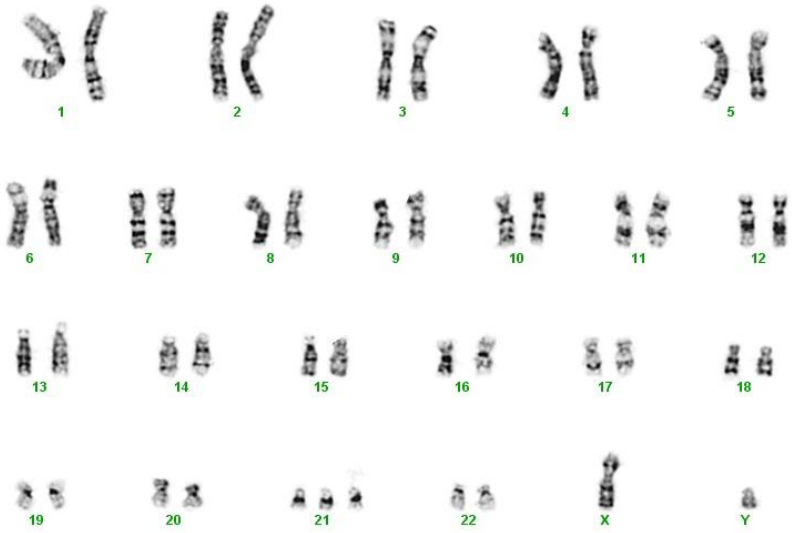
a. cats
b. pleiotropic
c. alleles
d. incomplete dominance
e. homozygous
f. locus
g. heterozygote
h. phenotype
i. genotypes
j. chromosome
k. epistasis

Multiple Choice etc. (1 point each)

1. 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** produced in this organism?
   a. tt
   b. hh
   c. HhTt
   d. Ht
2. The organism from question 1 that is HhTt would be known as a
   a. Dihybrid
   b. Monohybrid
   c. Double Homozygote
   d. P1 generation
3. T/F If a trait is in Hardy-Weinberg equilibrium, there is no net selection on that trait

4. You role a 6-sided die 60 times. After seeing the results, you think the die may be "loaded" to favor certain numbers that seem to come up too often. A good null hypothesis could be:
    a. the die is loaded and this distribution is non random
    b. the distribution is within that reasonably expected for random
    c. the die was made of magnetic material
    d. the die is biased against certain numbers
5. Your statistician says you need a p-value of 0.05 or lower to be significant. The actual p value came out to 0.08 (chi-squared value 9). From these data alone, you can conclude
    a. the die definitely is loaded
    b. the die definitely is **not** loaded
    c. the results could be random
    d. the null hypothesis is proved
6. Note: the next 3 questions all pertain to the same locus for eye surface texture. You take two smooth-eyed flies and breed them. You obtain approximately ¾ smooth-eyed flies and ¼ rough-eyed flies. You can conclude:
    a. smooth is dominant *and* both parents of this cross are heterozygous
    b. smooth is recessive *and* only one of the parents of this cross was heterozygous
    c. smooth is dominant *and* one of parents of this cross was homozygous
    d. smooth is recessive *and* both parents of this cross were heterozygous
7. You start a new experiment with these flies. For this, you cross a rough-eyed fly and a smooth eyed fly. The F1 are **all** smooth-eyed. Using 'S' for the dominant allele and 's' for the recessive, what is the genotype of the smooth-eyed parent?
    a. Ss
    b. SS
    c. ss
    d. cannot determine
8. Finally, you perform a test cross between the F1 (smooth offspring) from question 7 and a rough-eyed fly. Which of the following should be your outcome?
    a. All flies will be smooth eyed, since smooth is dominant
    b. All flies will be rough eyed, since rough is dominant
    c. About ½ of the flies should be smooth eyed and ½ rough eyed
    d. about ¼ of the flies should be rough eyed and ¾ smooth eyed.
9. A gene encodes a protein that makes brown pigment for hair color. A mutant allele encodes a form of the protein that cannot make pigment. This mutant allele is likely to be:
    a. dominant
    b. recessive
    c. linked
    d. lethal
10. A gene is
    a. A unit of inheritance
    b. A sequence of DNA that encodes a protein and its regulatory sequences
    c. Any DNA sequence that results in a measurable phenotype of the organism
    d. All of these are reasonable definitions
11. Which of the following provides an example of epistasis?
    a. Recessive genotypes for either of two genes (aa or bb) results in albino gila monsters.
    b. One allele of a gene is dominant to either of two other alleles of the same gene
    c. Color vision is inherited on the X chromosome of humans
    d. The dominant agouti allele (Aa or AA) results in tabby pattern in cats, unless the homozygous recessive "ee" is present at another locus, in which case the cat is white.
12. We know of a single allele of a specific gene found in almost all blue-eyed people. Scientists cannot find a single gene that is the same in all tall people. From this you can conclude that
    a. height is not an inherited trait
    b. many genes affect height
    c. height is a non-mendelian trait
    d. height is masked by epistasis

13. The very rare disease Cerebral dysgenesis–neuropathy–ichthyosis–palmoplantar-keratoderma syndrome is due to a single mutation in the gene for the protein snap29, which is involved in vesicle fusion/secretion. As the name implies, the mutation has dramatic effects in brain/nervous system, epithelium and other systems of the body. This would be a good example of
    a. pleiotropy
    b. epistasis
    c. co-dominance
    d. a multi-gene trait
14. Consider the following karyotype. This is an example of:



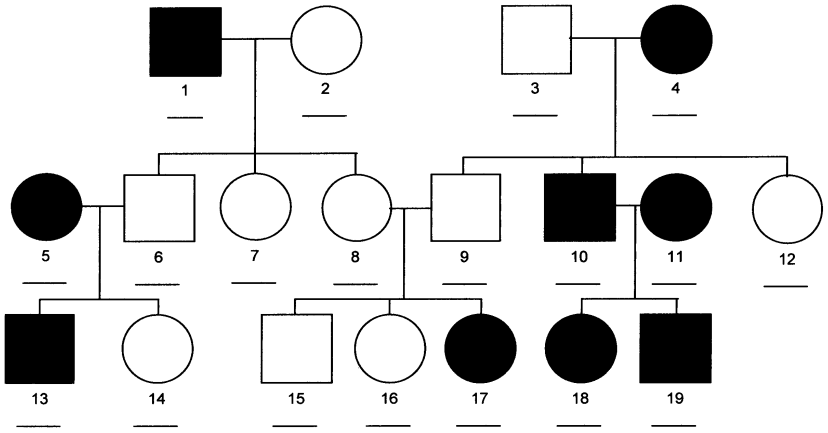
    a. a normal female
    b. a male with a trisomy
    c. a normal male
    d. a female with a monosomy
15. In the "Spooky Fish" episode of Southpark, Stan obtains a pet fish that kills several people and threatens Stan. Why is the fish so dangerous and evil?
    a. It is the product of genetic engineering crossing a goldfish with a shark
    b. It came from an evil parallel universe through a portal at "Indian Burial Ground Pet Store."
    c. Cartman has trained the fish to kill members of Stan's family
    d. It is part of an evil animal cult that lives in the forrest and is plotting to overthrow humans

Free response

16. (6 points…don't fill the page) In the pedigree below, filled shapes are individuals that have a particular trait and non-filled shapes are not affected.
    a. (2) What is the mode of inheritance (dominant/recessive Sex-link or autosomal) of the gene indicated in this pedigree?

    b. (2) Cite evidence for your conclusion.

    c. (2) What are the genotypes of individuals 5 and 6 (just use "A" and "a" as needed)?



You become a cat breeder after college and develop a line of fluorescent cats. The table shows some results of your breeding. You have blue fluorescent cats and green Fluorescent cats that are true-breeding (Homozygous) as shown in first two crosses. When you cross them (cross 3 and 4) ALL of the females (and only the females) are Cyan fluorescent ("CF," Cyan is a blue-green color).

Parents	Offspring
1 ♂Green Fluorescent (GF) x ♀ GF	all GF
2 ♂Blue Fluorescent (BF) x ♀ BF	all BF
3 ♂GF (from cross 1) x ♀ BF (from cross 2)	⚷ all BF; ♀ all CF
4 ♂BF (from cross 2) x ♀ GF (from cross 1)	⚷ all GF; ♀ all CF
5 ♂BF (offspring of cross 3) x ♀ CF	¼ BF ⚷ ; ¼ GF ⚷ ; ¼ CF ♀ ; ¼ BF ♀

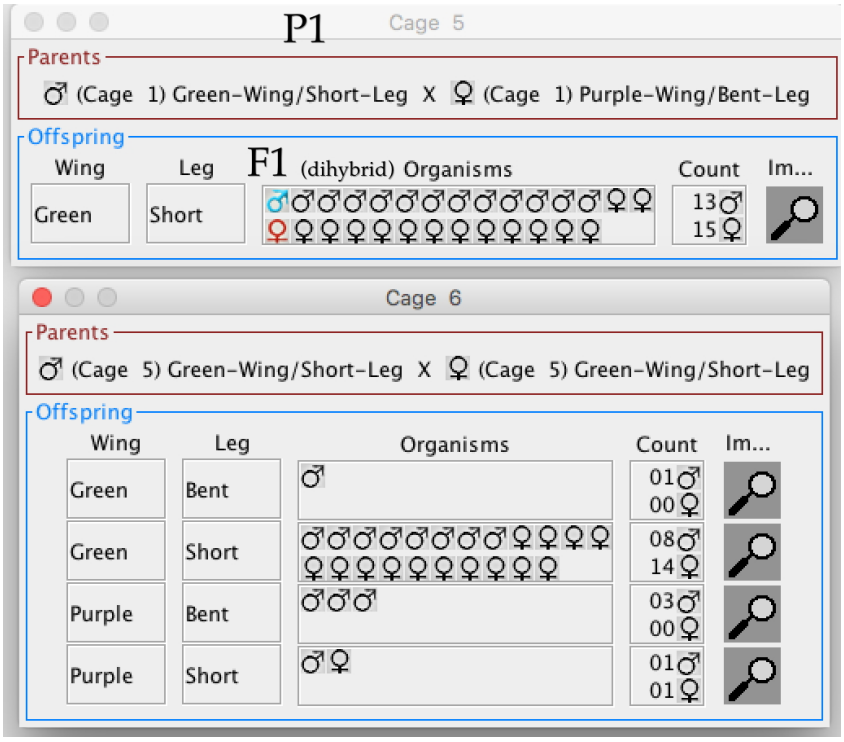
17. (2)What is the mode of inheritance (e.g. "autosomal dominant" or similar terms) of your fluorescence genes? Cite evidence for your conclusion.

18. (2) Why are there no cyan-fluorescent males?

19. (4) Draw a Punnet square for cross 5

20. (6) California King Snakes can be "banded" or "striped." Banded is due to a recessive allele and is common all over California whereas striped is dominant and limited to some specific regions (including parts of San Diego county). In East county, near the Safari Park, you find a population of King snakes where 60% show the dominant striped phenotype. Determine the frequency of the dominant allele (p), the frequency of the recessive allele (q) and what proportion of the population is heterozygous.

21. (10pt) Below is a set of data from VGL2. The "P1" generation (parents of cage 5) are both homozygous for the traits they carry. The F1 "dihybrid" are their offspring. Cage 6 contains the offspring of a dihybrid cross.



a. (3) Which two alleles are dominant? Cite the evidence for your conclusion.

b. (1) Based on inspection of data from cage 6, do you hypothesize that the genes are linked? Cite the evidence from the cross that led to your hypothesis.

c. (6) Perform a chi-square test on cage 6. What can you say about the likelihood that the genes are linked? Assume your statistician says a p-value of 0.05 is sufficient to be significant—also, equations on the next page and you may use that page to answer this if you need more room.

Standard Error

$$SE_{\bar{x}} = \frac{s}{\sqrt{n}}$$

Mean

$$\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i$$

Standard Deviation

$$s = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n-1}}$$

Chi-Square

$$\chi^2 = \sum \frac{(o-e)^2}{e}$$

Chi-Square Table

	Degrees of Freedom							
p	1	2	3	4	5	6	7	8
0.05	3.84	5.99	7.82	9.49	11.07	12.59	14.07	15.51
0.01	6.64	9.32	11.34	13.28	15.09	16.81	18.48	20.09

Hardy Weinberg Equations

$p^2 + 2pq + q^2 = 1$

$p + q = 1$

p = frequency of the dominant allele in a population

q = frequency of the recessive allele in a population