

Genetics assignment two

[Science](#), [Biology](#)



Bio 3900 Genetics _____ Hint: Read each question carefully and formulate an analytical and logical response. Answer only what the questions request. Use your time efficiently. Answer the less difficult questions first. Also, if a question appears ambiguous, select and answer an alternative question. You have a choice; therefore, you should not dwell on any question for an extended amount of time. Remember, for true/false statements, you must write the entire word.

1. In a species of tree, four independently assorting genes determine seed color: A, B, C, and D. The recessive alleles of each of these genes (a, b, c and d) produce abnormal enzymes that cannot catalyze a reaction in the biosynthetic pathway for seed pigment. The pathway is shown below:

When both red and blue pigments are present, the seeds are purple. Trees with genotypes Aa Bb cc dd and Aa Bb Cc Dd were crossed.

a. What are the colors of the seeds of each of the parents? You need only write the two colors.

Yellow and purple

b. If the above cross results in 1000 progeny, how many of the progeny are expected to exhibit a yellow color?

250

2. In the Australian Shepherd, Hereditary Cataracts is an autosomal dominant disorder that results in abnormal clouding of the lenses of the eye. In some Aussies, heterozygous for Hereditary Cataracts, the disease is not always expressed. Based on this information, answer the following questions:

a. Provide the terminology that best describes why some Aussies express Hereditary Cataracts and some Aussies do not express the disorder.

Law of Segregation

b. Several alleles are responsible for Hereditary Cataract formation. When present, some alleles result in very rapid cataract growth, whereas; other alleles result in very slow cataract growth. What terminology best describes the behavior of these various alleles?

Law of independent assortment

3. In the oriental fruit fly (*Bactrocera dorsalis*), a number of genes determine eye color. A fly with wild-type eyes (red) is crossed to fly with yellow eyes. All the F1 flies from this cross have wild-type eyes. When the F1 from the cross are interbred (selfed), 450 of the progeny have wild-type eyes, 150 have amethyst eyes (a bright sparkling blue color) and 200 have yellow eyes.

a. What are the genotypes of the P₀, F1 and the F2 generations?

F1 AaBb *AaBb all wild type

F2 red, yellow, yellow

b. Provide a clear and concise explanation that explains the inheritance of eye color in the oriental fruit fly.

The genes exhibit a recessive epistasis thereby masking the expression of color.

4. The Scots Dumpy, a type of chicken from Scotland, can exhibit short-leg length and normal-leg length phenotypes. A breeder crosses two normal-legged Scots Dumpy, and finds that all of the F1 are normal-legged. The breeder repeats the cross and observes the same result. However, when the

same breeder crosses a normal-legged fowl with a short-legged fowl, $\frac{1}{2}$ of the offspring are short-legged and $\frac{1}{2}$ of the offspring are normal-legged.

Finally, following a third cross between two short-legged Scots Dumpy fowl, the breeder observes the following results among 200 offspring counted:

133 short-legged fowl

67 normal-legged fowl

a. What type of inheritance pattern do these data indicate?

Incomplete dominance.

This is disorder has an autosomal dominant inheritance Pattern.

b. What is the genotype of the short-legged chickens?

5. Fruit flies homozygous for the recessive allele, sc^- , have bright red eyes.

Fruit flies homozygous for the recessive allele, br^- , have brownish purple eyes. Fruit flies homozygous recessive for both alleles have white eyes. Fruit flies that possess the sc^+ and br^+ alleles simultaneously have wild-type eyes. The br and sc alleles are independently assorting. Based on this information, determine whether the following statements are true or false.

Please write the word true or the word false.

a. Two genes control eye color in the fruit fly. True

b. A cross between fruit flies heterozygous for the alleles would yield offspring with wild-type eyes. True

c. The initial precursor in a biochemical pathway that explains this data would be a red pigment. False

d. A test cross of a heterozygous fruit fly would yield $\frac{1}{2}$ white eyed offspring. False

6. All cells in the figure below originated from the same individual (a

mammal) during some cell division process.

a. Identify the specific cell division process and the cell division events occurring in each cell. Be concise and label your responses I, II, III and IV.

I. Prophase – the nuclear envelope disappears and the chromosomes condense. The spindle forms as the centrioles move to the opposite direction.

II. Metaphase – the chromosomes attach to the spindle at the cell equator.

III. Anaphase – the centromeres divide and the chromosomes become monads which are pulled to the opposite poles.

IV. Telophase – the cytoplasm divides into two separate cells. The chromosomes re-condense and the spindle vanishes.

b. What is the haploid (n) chromosome number for this mammal?

Haploid number $n = 23$

7. Considering factors that account for the differences in genetic penetrance and expressivity, tell whether the following statements are true or false:

a. Allelic variation can account for difference in penetrance and expressivity of some alleles. True

b. Penetrance and expressivity usually are not affected by environmental factors. False

c. Genes that alter the expression of other genes (e. g. modifier genes) are capable of influencing penetrance and expressivity of a gene and its alleles. True

8. Radishes can be red, purple or white. Radish shape can be long or oval. Several plants with red, long radishes were crossed to plants that produce white oval radishes. All of the F₁ plants produced purple long radishes. When

the F1 were selfed, the following F2 phenotypes were observed:

3/16 red, long

1/16 red, oval

6/16 purple, long

2/16 purple, oval

3/16 white, long

1/16 white, oval

Note: The above data is correct.

Tell whether the following statements are true or false:

- a. 2 genes control root shape in the radish. True
- b. The mode of inheritance of root color in the radish is the result of multi-gene inheritance. True
- c. Both white and purple radishes are true breeding.

9. In the domestic house cat, *Felis catus*, the haploid number of chromosomes is 19. How many sister chromatids are in its:

- a. mitotic metaphase cell? 19
- b. meiotic metaphase I cell? 38
- c. meiotic metaphase II cell? 76

a. How many genotypes are possible from these four alleles?

Four, normal, albino, albino, normal

b. Predict the phenotypes and ratios from a cross $c+cch \times chc$.

The two individuals are albinos in the ratio of 1: 1.

11. In sheep, white fleece (W) is dominant over black (w), and horned (H) is dominant over hornless (h) in males but recessive in females. If A

homozygous horned white ram is bred to a homozygous hornless black ewe:

a. What will be the phenotypes and ratios of the females in the F1 progeny?

White females in the ratio 1: 3

b. What will be the phenotypes and ratios of the males in the following an F1x F1 cross?

Horned white, horned black and hornless white.

12. Assume that long ear lobes in humans are an autosomal dominant trait that exhibits 30% penetrance. A person who is heterozygous for long ear lobes mates with a person who is homozygous for normal ear lobes. Hint: Do not disregard any information given in the scenario above.

a. What is the probability that their first child will have long ear lobes?

The child will have a dominant allele in order to be long ear lobe. The probability of having long ear lobes is 50%.

b. What is the probability that in a family of 4 that 2 will exhibit long ear lobes and 2 will exhibit normal ear lobes?

The probability that in a family of 4 that 2 will exhibit long ear lobes is 50%.