Dihybrid Questions

For each problem draw the Punnett Square if needed, and answer the questions.

1. In certain peas, S is the allele for the dominant spherical shape characteristic; s is the allele for the recessive dented shape characteristic. Y is the allele for the dominant yellow color characteristic; y is the allele for the recessive green color characteristic. For each of the following write the genotype of the individual and list the gametes they can produce.

a) homozygous dominant for both traits

b) homozygous recessive for both traits

c) dented heterozygous yellow

d) heterozygous spherical green

e) heterozygous for both traits

2. In peas round seed is dominant (R) over wrinkled (r) and tall plant (T) is dominant over short plants (t). What will be the genotype and phenotype of the following crosses.

a) RRTT x RRTt b) RRTt x RRTt c) RrTt x RrTt

d) In the cross between a pure bred round seeded tall plant and a wrinkled seeded short plant.

3. In a dihybrid cross, AaBb x AaBb, what fraction of the offspring will be homozygous for both recessive traits?

4. Following a SsYy x SsYy cross, what fraction of the offspring are predicted to have a genotype that is heterozygous for both characteristics?

5. In a dihybrid cross, SsYy x SsYy, what fraction of the offspring will be homozygous for both traits?

6. In peas, a gene for tall plants (T) is dominant over its allele for short plants (t). The gene for smooth peas (S) is dominant over its allele for wrinkled peas (s). Calculate phenotypic ratios for the results of each of the following crosses:

A. TtSs X TtSs B. Ttss X ttss C. ttSs X Ttss D. TTss X ttSS

7. In certain bacteria, an oval shape is dominant over round and thick cell walls are dominant over thin. Cross a heterozygous oval, thick cell walled bacteria with a round, thin cell walled bacteria. Describe the genotype and phenotype of the offspring.

8. Cross a completely heterozygous round/yellow seeded plant with a completely homozygous round/green seeded plant. Also determine the probability of obtaining a round/yellow seeded plant in the offspring.

R = round seeds, r = wrinkled seeds

Y = yellow seeds, y = green seeds

9. In pepper plants, green (G) fruit color is dominant to red (g) and round (R) fruit shape is dominant to square (r) fruit shape. These two genes are located on different chromosomes.

a. What gamete types will be produced by a heterozygous green, round plant?

b. If two such heterozygous plants are crossed, what phenotypes will be seen in the offspring and in what proportions?

10. About 70% of Americans perceive a bitter taste from the chemical phenylthiocarbamide (PTC). The ability to taste this chemical results from a dominant allele (T) and not being able to taste PTC is the result of having two recessive alleles (t). Albinism is also a single locus trait with normal pigment being dominant (A) and the lack of pigment being recessive (a). A normally pigmented woman who cannot taste PTC has a father who is an albino taster. She marries a homozygous , normally pigmented man who is a taster but who has a mother that does not taste PTC.

a) What are the genotypes of the possible children?

b) What percentage of the children will be albinos?

c) What percentage of the children will be non-tasters of PTC?

11. Which of the following genetic crosses would be predicted to give a phenotypic ratio of 9:3:3:1?

A. SSYY x ssyy B. SsYY x SSYy C. SsYy x SsYy D. SSyy x ssYY E. ssYY x ssyy

12. Which of the following genotypes would you not expect to find among the offspring of a SsYy x ssyy test cross:

A. ssyy B. SsYy C. Ssyy D. ssYy E. SsYY

13. In Mendel's experiments, the spherical seed character (SS) is completely dominant over the dented seed character (ss). If the characters for height were incompletely dominant, such that TT are tall, Tt are intermediate and tt are short, what would be the phenotypes resulting from crossing a spherical-seeded, short (SStt) plant to a dented-seeded, tall (ssTT) plant?

14. Two unlinked loci effect mouse hair color. **CC** or **Cc** mice are agouti. "Agouti" refers to a dark brown to black hair that has a lighter tip, either silver, tan, yellow or orange. Many mammals have agouti hair color: rabbits and hares, raccoons, bears, miniature schnauzers. Mice with genotype **cc** are albino because all pigment production and deposition of pigment in hair is blocked. At the second locus, the **B** allele (black agouti coat) is dominant to the **b** allele (brown agouti coat). A mouse with a black agouti coat is mated with an albino mouse of genotype **bbcc**. Half of the offspring are albino, one quarter are black agouti, and one quarter are brown agouti. What is the genotype of the black agouti parent?

15. Two unlinked loci effect mouse hair color. **AA** or **Aa** mice are agouti. Mice with genotype **aa** are albino because all pigment production is blocked, regardless of the phenotype at the second locus. At the second locus, the **B** allele (also coding for agouti coat) is dominant to the **b** allele (black coat) which is dominant to the allele at the first locus. For example A_bb would be black and aa_ _ would be albino and A_ B _ would be agouti. What would be the phenotypic result of a cross between two agouti mice of genotype AaBb?

16. In summer squash, white fruit (W) is dominant over yellow (w); and "disk" fruit shape (D) is dominant over "sphere" shape (d).

A. In a cross between a squash plant homozygous for yellow fruit color and disk fruit shape and one homozygous for white fruit color and sphere fruit shape, what will be the appearance, as to color and shape of fruit, of the F1?

B. What will be the appearance, as to color and shape of fruit of the cross WwDd x WWdd.

17. In guinea pigs, rough coat (R) is dominant over smooth coat (r); and black coat (B) is dominant over white (b). Cross a homozygous rough, black animal with a smooth, white one.

A. What will be the appearance of the F1?

B. What will be the appearance of the F2?

18. In humans, assume that brown eyes (B) are dominant to blue (b); and right-handedness (R) to left-handedness (r). A right-handed, blue-eyed man whose father was left-handed marries a left-handed, brown-eyed woman from a family in which all the members have been brown-eyed for several generations. What offspring may be expected from this marriage as to the two traits mentioned?

19. A brown-eyed, right-handed man marries a blue-eyed, right-handed woman. Their first child is blue-eyed and left-handed. If other children are born to this couple, what will probably be their appearance as to these two traits?

20. A right-handed, blue-eyed man marries a right-handed, brown-eyed woman. They have two children, one left-handed and brown-eyed and the other right-handed and blue-eyed. By a later marriage with another woman who is also right-handed and brown-eyed, this man has nine children, all of whom are right-handed and brown-eyed. What are the genotypes of this man and his two wives?

21. In guinea pigs, black coat color is dominant over white, short hair is dominant over long, and rough coat is dominant over smooth. Cross a guinea pigs that is heterozygous for all three traits with a white, heterozygous short-haired, smooth coat guinea pig.

Dihybrid Answers

1. a) SSYY Gametes: SY
b) ssyy Gametes sy
c) ssYy Gametes: sY,sy
d) Ssyy Gametes Sy,sy
e) SsYy Gametes SY,Sy,sY,sy

2.

a) geno: 1 RRTT: 1 RRTt phono: all tall and round
b) geno: 1 RRTT :2 RRTt : 1 RRtt Pheno: 3 round tall: 1 round short
c) geno: 1 RRTT:2RRTt:1RRtt:2RrTT:4RrTt:1rrTT:2Rrtt:2rrTt:1rrtt
pheno: 9 round and tall:3 round and short: 3 wrinkled and tall: 1 wrinkled and short
d) geno: all RrTt pheno: all round and tall

3. 1/16

1/4 of the gametes of each parent will be ab. The fraction of the offspring homozygous for both recessive traits will be 1/4 times 1/4, or 1/16.

4. 4/16

Four out of 16 possible combinations of alleles yield the SsYy genotype. They are:

SY and sy
sY and Sy
Sy and sY
sy and SY

5. 1/4

There are four different genotypes that are homozygous for both traits. These are SSYY, SSyy, ssYY, and ssyy

6. A. TtSs X TtSs
9/16 tall smooth; 3/16 tall wrinkled; 3/16 short smooth; 1/16 short wrinkled
B. Ttss X ttss
1/2 tall wrinkled; 1/2 short wrinkled
C. ttSs X Ttss
1/4 tall smooth; 1/4 short smooth; 1/4 tall wrinkled; 1/4 short wrinkled
D. TTss X ttSS
all tall smooth (TtSs)

7. 1 OoTt:1 Oott:1 ooTt;1 oott
1 oval thick:1 oval thin:1 round thick:1 round thin

8.1RRYy:1RRyy:1RrYy:1Rryy
2 round yellow:2 round green

9. a. the green round plant will produce GR, Gr, gR, and gr gametes in equal proportion since the genes are unlinked
b. this will give 9/16 green round, 3/16 green square, 3/16 red round, and 1/16 red square

10. a) 1 AATt: 1 AAtt: 1 AaTt: 1 Aatt
b) Zero
c) 1/2

11. C. SsYy x SsYy

12. E. SsYY

Offspring could not be homozygous for the dominant yellow seed color (YY), because one recessive y allele must be inhereited from the ssyy parent.

13. All the progeny would be spherical-seeded and intermediate height.

14. BbCc

This is the only possibility for this combination of offspring.

15. 9 agouti: 3 black: 4 albino

This is a variant of the normal 9:3:3:1 ratio for a normal dihybrid cross.

16. A. Parents = wwDD x WWdd
F1 = WwDd white disk
B. Parents = WwDd x WWdd
1/2 white disk and 1/2 white sphere

17. A. Parents = RRBB x rrbb
F1 = RrBb (rough black)
B. This is a dihybrid F2 cross and you should expect 9/16 rough black, 3/16 rough white, 3/16 smooth black, 1/16 smooth white.

18. man = Rrbb inherited an allele for left handedness from his father
father = rr
woman = rrBB (probably no blue alleles in this family but can't be sure)
Parents = Rrbb x rrBB
Children = 1/2 right handed brown eyed; 1/2 left handed brown eyed

19. Man is RrBb
Woman is Rrbb
First child is rrbb. Knowing this you know that each parent must have at least one r and one b.
3/8 brown right; 3/8 blue right, 1/8 brown left; 1/8 blue left

20. Man = Rrbb must have allele for left (child 1)
First Wife = RrBb must have allele for left (child 1) and for blue (child 2)
Child 1 = rrBb must have blue allele from father
Child 2 = R?bb
Second Wife = RRBB she is probably homozygous since all nine children are right and brown. Can't be positive.
Nine Children = R?Bb must get blue allele from father

21. BSR 3 BSr 3 BsR 1 Bsr 1 bSR 3 bSr 3 bsR 1 bsr 1