Biology 3 Practice Genetics Problems

In pea plants, the following traits are due to single genes for which there are dominant and recessive alleles. Use this information to help you solve the genetics problems below.

- purple flower color (P) is dominant over white flower color (p)
- yellow peas (Y) are dominant over green peas (y)
- round peas (R) are dominant over wrinkled peas (r)
- tall pea plants (T) are dominant over short pea plants (t)

1. Determine the expected ratios of phenotypes & genotypes from the following crosses:
   - plant with yellow peas (Yy) x plant with green peas (yy)
   - plant with round peas (RR) x plant with round peas (Rr)
   - tall pea plant (TT) x short pea plant (tt)
   - plant with purple flowers (Pp) x plant with purple flowers (Pp)

2. If a white-flowered pea plant and a heterozygous purple-flowered pea plant are crossed, what proportions of phenotypes in the offspring would you predict?

3. Two tall pea plants are crossed and yield the following offspring: 89 tall, 33 short. What must be the genotypes of the parent plants?

4. You want to perform a test cross to determine whether or not a purple-flowered pea plant is true-breeding (homozygous). What kind of pea plant would you cross it with? What would you expect if the purple-flowered plant is true-breeding? What would you expect if the purple-flowered plant is NOT true-breeding?

5. Determine the expected ratios of phenotypes from the following pea plant crosses:
   - tall with purple flowers (Tt Pp) x tall with white flowers (Tt pp)
   - wrinkled yellow peas (rr YY) x round green peas (Rr yy)
   - green peas, white flowers (yy pp) x yellow peas, purple flowers (Yy PP)

6. A true-breeding tall pea plant with white flowers is crossed with a true-breeding short pea plant with purple flowers. What will be the genotype and phenotype of all the offspring? If two offspring are crossed, what ratio of phenotypes will you expect?

7. Two plants with round, green peas yield 62 offspring with round green peas and 19 offspring with wrinkled green peas. What are the genotypes of the parents?
8. You discover a new, mutant pea plant with pink flowers and want more plants like it, so you cross the plant with itself. To your surprise, the offspring include 16 with red flowers, 35 with pink flowers, and 18 with white flowers. What can you conclude about the new mutant allele for flower color? Write out the genotype of the “parents” in this cross and do a Punnett square to see if the outcome above is consistent with your conclusion.

9. A woman with blood type A and a man with blood type B have a child with blood type O. What are the genotypes of each parent and the child? What other blood types are possible for the children of these parents and what is the probability of each?

10. If a man and woman are both blood type AB, what blood types are possible for their children and what is the probability of each?

11. Sally claims that Joe is the father of her child, while Joe insists he is not the father. Sally is blood type O, Joe is blood type AB and the child is blood type O. Could Joe be the father? (qualify your answer)

12. The pedigree below shows the occurrence of cystic fibrosis, an autosomal recessive condition, in 4 generations of this family (individuals with cystic fibrosis are represented by black symbols). Determine the genotypes as best you can for each family member. (use F for the normal allele and f for the recessive mutant allele)