Genetics Practice Problems

Try the online gentics practice problems at:

- http://biology.clc.uc.edu/courses/bio105/geneprob.htm
- http://www.biology.arizona.edu/mendelian_genetics/mendelian_genetics.html
- http://www.k-state.edu/biology/pob/genetics/intro.htm

Basic conventions

1. For each genotype below, indicate whether it is heterozygous (He) or homozygous (Ho)

AA __Ho_	Ee __He__	Ii __He___	Mm _He____
Bb __He___	ff __Ho__	Jj __He___	nn __Ho___
Cc __He___	Gg __He__	kk __Ho___	oo __Ho___
DD __Ho___	HH __Ho__	LL __Ho___	Pp __He___

2. What is the difference between a gene that is *dominant* and a gene that is *frequent in a population?*

A *dominant* allele is one whose expression in an individual can be detected even if only one copy is inherited (that is, both AA and Aa individuals will show the trait). An allele that is *frequent* in a population is one that is common. *Dominance* has to do with gene expression, not how common a gene is.

3. For each of the genotypes below determine what phenotypes would be possible.

Purple flowers are dominant to white flowers.	Bobtails in cats are recessive.
PP: purple_____	TT ___normal_____
Pp_purple_____	Tt __normal_____
pp_white_____	tt___bobtail_____

Monohybrid crosses

1. Cystic fibrosis is a genetic disorder caused by a single gene that coded for a protein in the cell membranes of the lung cells and cells lining the intestines. If a person inherits two defective copies of the gene, they show CF symptoms. If a person inherits only one defective copy and one "good" copy of the gene, they make enough of the functional CF protein that they show few or no symptoms. This is why the CF gene is considered "recessive." For each of the cases below, use Punnet squares to determine the chances of the children of the given sets of parents of inheriting two defective copies of the gene, and therefore having CF. Use CF for the "good" (dominant) allele and cf for the "broken" (recessive) allele.

Dad: CF CF
Mom: cf cf

Results: All children will be CF cf (heterozygous)

Dad: CF cf
Mom: cf cf

Results: 50% chance of having a CF cf (normal, carrier child, and 50% chance of having a cf cf (cystic fibrosis) child.

Dad: CF CF
Mom: CF cf

Note that this problem has been corrected. "Mom" is now heterozygous.
Results: All children will have a normal phenotype (50% CF CF, 50% CF cf).

Dad: CF cf
Mom: CF cf

Note that this problem has been corrected. "Mom" is now heterozygous. Results: 75% chance of a child with normal phenotype (CF CF or CF cf), 25% chance of a child who has cystic fibrosis.

2. Gregor Mendel developed the first models of heredity after he studied inheritance of traits in pea plants. Mendel selected certain traits, such as flower color, plant height, pea color, pea shape, and others. Beginning with purebreeding straits of peas for each trait, he crossed various forms of the traits (white flowers with purple, wrinkled peas with smooth, etc.), examined the traits in the offspring, then crossed the offspring generation and counted how many of the next generation showed the various traits. After nine years of careful gathering, recording, and analyzing data, Mendel described his laws of heredity. He was the first to use the terms "dominant" and "recessive" in describing how traits are inherited and expressed. The following questions relate to peas and their traits.

a. A TT (tall) plant is crossed with a tt (short plant). What percentage of the offspring will be tall?

100% will be tall (genotype: Tt)

b. A Tt plant is crossed with a Tt plant. What percentage of the offspring will be short?

25% of the offspring will be short (tt)

c. A heterozygous round seeded plant (Rr) is crossed with a homozygous round seeded plant (RR). What percentage of the offspring will be homozygous (RR)?

50% will be RR

d. A homozygous round seeded plant is crossed with a homozygous wrinkled seeded plant.

What are the genotypes of the parents?

_____Rr_____ x _____Rr_____

What percentage of the offspring will also be homozygous? 50% will be Rr

e. In pea plants purple flowers are dominant to white flowers. If two white flowered plants are cross, what percentage of their offspring will be white flowered? All will be white (pp)

f. A white flowered plant is crossed with a plant that is heterozygous for the trait. What percentage of the offspring will have purple flowers? 50% will be purple (with a heterozygous genotype, Pp)

g. Two plants, both heterozygous for the gene that controls flower color are crossed.

What percentage of their offspring will have purple flowers? 75% (PP and Pp)

What percentage will have white flowers? 25% pp

3. Guinea pigs were a popular model for observing genetics in early gentic studies (as were fruit flies). Try these problems involving Guinea pig genetics.

a. In guinea pigs, the allele for short hair is dominant. So let's use S for long and s for short.

What genotype would a heterozygous short haired guinea pig have? ___Ss____
What genotype would a purebreeding short haired guinea pig have? ___SS____
What genotype would a long haired guinea pig have? ____ss____

b. Show the cross for a pure breeding short haired guinea pig and a long haired guinea pig. What percentage of the offspring will have short hair?

SS x ss

The resulting Punnet square will show 100% short-haired offspring, and all will be Ss.