

Two genetic loci, *A* and *B*, are independently assorting, and alleles *A* and *B* are dominant over alleles *a* and *b*. Indicate the probabilities of producing the following. (20 points)

- a. An *AB* gamete from an *AaBb* individual?
- c. An *Aabb* progeny from the cross *AaBb* x *AAbb*?
- d. An *A_B_* progeny from the cross *aabb* x *AABB*?
- e. An *aaB_* progeny from the cross *AaBb* x *AaBB*?

You have identified a new chemical that can produce transversion mutations in DNA sequence. If you were to treat the codon *CGG* with this chemical could you produce a missense mutation? Could you produce a nonsense mutation? *Explain.* (15 points)

		Second base					
		U	C	A	G		
U	U	UUU Phe	UCU Ser	UAU Tyr	UGU Cys	U	Third base
	U	UUC Phe	UCC Ser	UAC Tyr	UGC Cys	C	
	U	UUA Leu	UCA Ser	UAA Stop	UGA Stop	A	
	U	UUG Leu	UCG Ser	UAG Stop	UGG Trp	G	
C	C	CUU Leu	CCU Pro	CAU His	CGU Arg	U	Third base
	C	CUC Leu	CCC Pro	CAC His	CGC Arg	C	
	C	CUA Leu	CCA Pro	CAA Gln	CGA Arg	A	
	C	CUG Leu	CCG Pro	CAG Gln	CGG Arg	G	
A	A	AUU Ile	ACU Thr	AAU Asn	AGU Ser	U	Third base
	A	AUC Ile	ACC Thr	AAC Asn	AGC Ser	C	
	A	AUA Ile	ACA Thr	AAA Lys	AGA Arg	A	
	A	AUG Met	ACG Thr	AAG Lys	AGG Arg	G	
G	G	GUU Val	GCU Ala	GAU Asp	GGU Gly	U	Third base
	G	GUC Val	GCC Ala	GAC Asp	GGC Gly	C	
	G	GUA Val	GCA Ala	GAA Glu	GGA Gly	A	
	G	GUG Val	GCG Ala	GAG Glu	GGG Gly	G	

In jimsonweed, two alleles of one gene determine the character difference of purple (P) versus white (W) flowers, and two alleles of a *separate, independent* gene determine the character difference of spiny (Sp) versus smooth (Sm) leaves. The results for three different matings of jimsonweed plants are as follows:

Mating	<i>Parental Phenotypes</i>	P, Sp	W, Sp	P, Sm	W, Sm
1	purple, spiny x purple spiny	94	32	28	11
2	purple, spiny x purple, smooth	40	0	38	0
3	purple, spiny x white, spiny	34	30	0	0

Determine the dominant allele and the genotypes of the parents for each of the crosses (25 points).

In the *X-linked dominantly inherited* fragile-X syndrome, individuals who have no symptoms but carry long repeats that have not expanded across the threshold are said to carry a “premutation” in the fragile-X gene. When a parent has a premutation of a particular size, there is a certain probability that the repeat will expand past the disease threshold and produce Fragile-X syndrome in their child. The likelihood of this expansion occurring is related to the length of the premutation. Use the following information to answer the question:

- A normal father with a normal repeat allele and a mother who is heterozygous for a premutation of 65 *repeats* and a normal repeat allele want to have children.
- They have a 50% chance of having a child carrying a premutation and a 50% chance of having a child with only normal repeat alleles of the gene.
- There is a 17% chance that the mother’s allele will expand past the threshold to produce Fragile-X Syndrome in her child.

Read the following carefully: What is the probability that the couple will have two children who both carry the premutation but with **only one** of the two children developing an expansion to the disease producing mutation? (10 points)