

Using Statistics to Solve Problems

- 1) What fraction of the offspring from parents with identical genotypes of $RrSsTt$ will be $rrsstt$? (Note: use the rules of probability rather than making a gigantic Punnett square) Show or explain your work.
- 2) Suppose two $DdEeFfGgHh$ individuals are mated. What would be the predicted frequency of $ddEEFfggHh$ offspring from such a mating, if the genes are all on different chromosomes? Show or explain your work.

Monohybrid Crosses:

- 3) In peas, tall plant growth is dominant over short. Let the allele for tall be represented by **T** and the allele for short by **t**. What will be the gametes produced by the parents and the height of the offspring be for the following cross? (use a Punnett square) $tt \times Tt$
- 4) In four-o'clock flowers, red flower color, **r**, is incompletely dominant over white, **w**. The heterozygous plants are pink-flowered.
 - a. How would you produce four-o'clock seeds all of which would yield pink-flowered plants?
 - b. Can you generate a true breeding pink plant? Explain.
- 5) Assume white fur is recessive to black fur in mice. Someone has possibly mixed up the labels on the mouse cages containing the black F1 female hybrids and the pure-breeding black females. How would you determine which cage of females was heterozygous?
- 6) In humans, brown eyes are usually dominant over blue eyes. If a brown-eyed man marries a blue-eyed woman and they have ten children, all brown-eyed, can you be certain if the man is homozygous? If the eleventh child has brown eyes, will that prove what the father's genotype is? If the eleventh child has blue eyes, will that prove what the father's genotype is?

Dihybrid Crosses and more:

- 7) In watermelons, the genes for green color and for short shape are dominant over their alleles for striped color and for long shape. Suppose a plant with long striped fruit is crossed with a plant that is heterozygous for both of these characters. Assuming these two genes assort independently, what phenotypes would this cross produce and in what ratios?
- 8) In dogs, dark coat color (**D**) is dominant over albino (**d**), and short hair (**S**) is dominant over long hair (**s**). Assume these effects are caused by two independently assorting genes. Write the genotypes of parents in each of the crosses shown in the table below. Assume the animals are homozygous unless there is evidence that indicates otherwise.

Parental genotypes	Parental phenotypes	Number of Progeny (offspring)			
		Dark, short	Dark, long	Albino, short	Albino, long
	dark, short X dark, short	89	31	29	11
	dark, short X dark, long	18	19	0	0
	dark, short X albino, short	20	0	21	0
	albino, short X albino, short	0	0	28	9
	dark, long X dark, long	0	32	0	10
	dark, short X dark, short	46	16	0	0
	dark, short X dark, long	30	31	9	11

- 9) If the dominant gene **K** is necessary for hearing, and the dominant gene **M** results in deafness no matter what other genes are present, what percentage of offspring produced by the cross $kkMm \times Kkmm$ will be deaf assuming the genes assort independently?

AP Biology

Test Content: DNA Structure & Replication, Protein Synthesis, Genetic Problems (Punnett Squares, Probability)

Test Format (45 total points)

*20 MC Points (25 questions with a curve)

*25 *Short* FRQ Points (Solving Problems with work, explaining answers)

DNA Structure & Replication Study Tips

-**Know the structure of DNA**

-**Know what a nucleotide consists of**

-**Know where the 3' and 5' are on a nucleotide**

-**Recognize key accomplishment on path to understand DNA (scientists, experiments, etc.)**

-**Know steps of DNA replication and enzymes**

Protein Synthesis Practice Problems

-You will answer some multiple choice Qs on this subject (review POGILS, Chapter 12 Reading Qs)

-You will have a Short FRQ problem like #1 and at least one problem that looks like either #2 or #3.

- 1) A double stranded DNA molecule from bacteria with the following sequence produces a polypeptide (protein) that is six amino acids long. The DNA sequence is already grouped into the correct triplets.

3' TAC ATG CTA GAA AAT CCG TGA AAC GAC CAT GTA 5'
ATG TAC GAT CTT TTA GGC ACT TTG CTG GTA CAT

- a) Label the polarity of the bottom strand. (5' and 3' ends)
- b) Using the codon table, find the start and stop codons for this 6 amino acid peptide.(circle and label them)
- c) Write the sequence of this gene's mRNA.
- d) What is the sequence of amino acids in the peptide produced by this gene?
- e) Which amino acid is at the amino terminus of the peptide? _____
- f) Which strand is serving as the template for the mRNA? (top or bottom) _____
- g) Which direction is RNA polymerase moving? (left or right) _____
- h) In which direction does the promoter for this gene lie? (to the right of to the left?) _____
- 2) A biologist inserted a gene from a human liver cell into the chromosome of a bacterium. The bacterium then transcribed this gene into mRNA and translated the mRNA into protein. The protein produced was useless; it contained many more amino acids than the protein made by the eukaryotic cell, and the amino acids were in a different sequence. Explain why.

- 3) DNA replication is said to be semiconservative. Explain why and use a diagram.