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| PROBLEM #1  Your dog is heterozygous for type A blood. Your dog’s mother is blood type AB. At the pound, the volunteers have 5 possible dogs that could be the father of your dog. Which one matches and how did you come to that conclusion? Justify your answer.  Yellow Dog: ii  Black Dog: IAi  Grey Dog: IBi  Brown Dog: IAIB  White spot Dog: IBIB | PROBLEM #2  In sesame plants, normal leaf is dominant to wrinkled leaf. Determine the possible genotypes of the parents for the following sets of offspring. Which set of parents do you think is most likely for each? Justify your answer.  - Set 1:732 normal leaf: 831 wrinkled leaf  - Set 2: 318 normal leaf: 98 wrinkled leaf |
| PROBLEM #3  Red colored salmon is dominant over brown colored salmon. In a cross between a red salmon and a brown salmon, four of the offspring were red and two were brown. What was the genotype of each parent? Justify your answer. | PROBLEM #4  A dominant gene produces a round shape in peas. The recessive allele produces smooth peas. A farmer only has round peas. He knows that some of them are heterozygous but has no way of knowing it from looking at them. The farmer only wants smooth peas. Describe how he could get 100% smooth peas in his field. Justify your answer. |
| PROBLEM #5  In fruit flies, red eyes are dominant to magenta eyes. Long wings are dominant to short wings. A heterozygous red-eyed, short-winged male is crossed with a magenta-eyed, heterozygous long-winged female. List the phenotypes and genotypes of all the offspring. What percentage of their offspring will have red eyes? Justify your answer. | PROBLEM #6  Minnie’s parents are both 5’ 8”. Minnie is 6’1” and her brother Willie is 5’5”. Explain how this is possible. |
| PROBLEM #7  Explain (or diagram) how Down syndrome occurs in select individuals. | PROBLEM #8  Imagine that one of your parents had Huntington’s disease (dominant disease). What is the probability that you, too, will someday manifest the disease? There is no cure for Huntington’s. Would you want to be tested for the Huntington’s allele? Why or why not? |
| PROBLEM #9  Flower position, stem length, and seed shape were three characters that Mendel studied. Each is controlled by an independently assorting gene and has dominant and recessive expressions as followed:  - Flower position: (A) axial (a) terminal  - Stem length: (T) tall (t) dwarf  - Seed shape: (R) round (r) wrinkled  If a plant that is heterozygous for all three characters is allowed to self-fertilize, what proportion of the offspring would you expect to be as follows?   * homozygous for the three dominant traits * homozygous for the three recessive traits * heterozygous for all three characters * homozygous for axial and tall, heterozygous for seed shape | PROBLEM #10  Karen and Steve each have a sibling with sickle-cell disease. Neither Karen nor Steve nor any of their parents have the disease, and none of them have been tested to see if they have the sickle cell trait. Based on this incomplete information, calculate the probability that if this couple has a child, the child will have sickle-cell disease. |
| PROBLEM #11  Determine the sequence of genes along a chromosome based on the following recombination frequencies:  A-B = 8 map units  A-C = 28 map units  A-D = 25 map units  B-C = 20 map units  B-D = 33 map units | PROBLEM #12  Pseudohypertrophic muscular dystrophy is an inherited disorder that causes gradual deterioration of the muscles. It is seen almost exclusively in boys born to apparently normal parents and usually results in death in the early teens. Is this disorder caused by a dominant or recessive allele? Is its inheritance sex-linked or autosomal? How do you know? Explain why this disorder is almost always seen in boys rather than girls. |
| PROBLEM #13  Horace has type B blood and his wife, Rhonda, has type AB blood. They have three children. Sally has type A blood, Hank has type O blood and Jimmy has type AB blood. Horace suspects that his wife has been unfaithful. Is there any evidence of this? Explain specifically for each child. | PROBLEM #14  Phenylketonuria (PKU) is an inherited disease caused by a recessive allele. If a woman and her husband, who are both carriers, have three children, what is the probability of each of the following?   * all three children are of normal phenotype * one of more of the three children have the disease * all three children have the disease * at least one child is phenotypically normal |
| PROBLEM #15  A man with hemophilia (a recessive, sex-linked condition) has a daughter of normal phenotype. She marries a man who is normal for the trait.   * What is the probability that a daughter of this mating will be a hemophiliac? * That a son will be a hemophiliac? * If the couple has four sons, what is the probability that all four will be born with hemophilia? | PROBLEM #16  A wild-type fruit fly (heterozygous for gray body color and normal wings) is mated with a black fly with vestigial wings. The offspring have the following phenotypic distribution:  Wild type, 778  Black-vestigial 785  Black-normal, 158  Gray-vestigial, 162  - What is the recombination frequency between these genes for body color and wing size? |