Birla Institute of Technology & Science, Pilani (Raj.)
BIO F111 GENERAL BIOLOGY
Worksheet for Chapter 9 (*Patterns of Inheritance*)

A. Choose the best matching phrase in the right column for each of the terms in the left column:

a. Pedigree	1. having two identical alleles of a given gene
b. Alleles	2. the allele expressed in the phenotype of the heterozygote
c. Independent assortment	3. alternative forms of a gene
d. Gametes	4. a chart showing inheritance of a trait across many generations
e. Gene	5. a cross between individuals both heterozygous for two genes
f. Segregation	6. alleles of one gene separate into gametes randomly with respect to alleles of other genes
g. Heterozygote	7. reproductive cells containing only one copy of each gene
h. Dominant	8. the allele that does not contribute to the phenotype of the heterozygote
i. F_1	9. the cross of an individual of ambiguous genotype with a homozygous recessive individual
j. Test cross	10. an individual with two different alleles of a gene
k. Genotype	11. the heritable entity that determines a characteristic.
l. Recessive	12. the alleles an individual has.
m. Dihybrid cross	13. the separation of the two alleles of a gene into different gametes
n. Homozygote	14. offspring of the P generation

B. 1. There are 4 alleles possible for a given gene. At a single locus for this gene, how many of these alleles could: (i) A mammal have? (ii) A human ovum have? Justify your answer in each case.

2. What is the maximum number of types of gametes formed by individuals with these genotypes?
a. AABBCC b. AaBBCC c. AaBBCc d. AaBbCc

C. 1. When 2 black mice are crossed, ten black and three white mice result. Write down:
a. the dominant allele b. the recessive allele c. the genotypes of the parents

2. Galactosemia is a recessive human disease that is treatable by restricting lactose and glucose in the diet. A couple is heterozygous for the galactosemia gene.
a. If the couple has four children, what is the probability that none of the four will have galactosemia?
b. If the couple has four children, what is the probability that at least one of the children will have galactosemia?
c. If the couple has four children, what is the probability that the first two will have galactosemia and the second two will not?
d. If the couple has four children with galactosemia, what is the probability that their next child will have galactosemia?
e. The woman is pregnant with twins. If she has fraternal (non-identical) twins, what is the probability that both of the twins will be girls who have galactosemia?
f. If the twins are identical, what is the probability that both will be girls and have galactosemia?

D. 1. A dominant allele ***W*** confers black fur on guinea pig. A guinea pig that is homozygous recessive ***ww*** has white fur. Fred would like to know whether his pet black furred guinea pig is homozygous. How might he determine his pet's genotype?

2. Incomplete dominance is seen in the inheritance of a disease called hypercholesterolemia. Normal individuals are homozygous dominant (C^HC^H). Heterozygotes (C^HC^h) have blood cholesterol levels about twice what is normal. The disease is even more severe in homozygous individuals (C^hC^h), who have dangerously high levels of cholesterol in blood and are prone to heart attacks early in their lives.

Suppose Mark and Lisa are both heterozygous for this characteristic, and both have elevated levels of blood cholesterol. Their daughter Katerina has a cholesterol level that is extremely high (six times normal); she is homozygous.

a. What is the probability of Mark and Lisa having their next two children normal? Show how you arrived at this answer, indicating the genotypes clearly.

b. Now suppose that the disease gene follows simple Mendelian dominance pattern (rather than incomplete dominance), with Mark and Lisa both being normal but Katerina being diseased. What is the probability of their next healthy child being a carrier? Justify your answer.

3. Alleles of the gene that determines seed coat patterns in lentils can be organized in a dominance series: marbled > spotted = dotted (codominant alleles) > clear. A lentil plant homozygous for the marbled seed coat pattern allele was crossed to one homozygous for the spotted pattern allele. In another cross, a homozygous dotted lentil plant was crossed to one homozygous for clear. An F1 plant from the first cross was then mated to an F1 plant from the second cross.

a. What phenotypes in what proportions are expected from this mating?

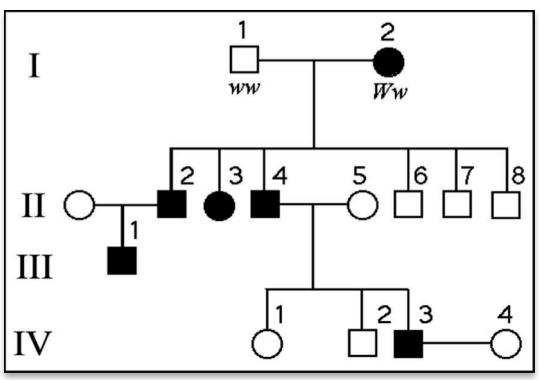
b. What are the expected phenotypes of the F1 plants from the two original parental crosses?

E. 1. Work out a typical dihybrid cross between a pea plant with round and yellow seeds, and one with wrinkled and green seeds.

2. In tomatoes, red fruit is dominant to yellow fruit and purple stems are dominant to green stems. The progeny from one mating consisted of 305 red fruit, purple stem plants; 328 red fruit, green stem plants; 110 yellow fruit, purple stem plants; and 97 yellow fruit, green stem plants. What was the genotype of the parents in this cross? Give appropriate justification.

3. In rabbits, the homozygous ***CC*** is normal, ***Cc*** results in deformed legs, and ***cc*** results in very short legs. The genotype ***BB*** produces black fur, ***Bb*** brown fur, and ***bb*** white fur. If a cross is made between brown rabbits with deformed legs and white rabbits with deformed legs, what percentage of the offspring would be expected to have deformed legs and white fur?

4. The following questions are in connection with the pedigree chart shown below for a family, some of whose members exhibit the dominant trait, ***W***. Affected individuals are indicated by a dark square or circle.



a. What is the genotype of individual II-5? Explain briefly.

b. What is the likelihood that the progeny of IV-3 and IV-4 will have the trait? Show how you arrived at the answer.