1) In chicken, the normal condition of legs/feet is dominant over the creeping condition. Heterozygous of this condition are creepers. When two heterozygotes were crossed, the expected ratio of 3:1 was not obtained in the breeding. Using genetic symbols, to illustrate the above situation. Explain this condition.
2) In maize, the amount of chlorophyll is controlled by a certain allele where green-leaved maize plants are dominant over white-leaved maize plants. In a cross, two plants were crossed, all $F_1$ offsprings were green-leaved. When the $F_1$ offspring were selfed, the expected, $F_2$ phenotype ratio was not obtained instead 2:1 is obtained. Use genetic symbols to illustrate this situation
3) In snapdragon; three different plants are observed; green plants, golden/Auria plants, and white plants. When two Auria/golden plants are crossed, a ratio of 2:1 was obtained instead of the expected monohybrid ratio of 3:1. Use genetic symbols to carry out a cross. Explain your results.
4) In Drosophila, the gene for eye colour is sex-linked, and red-eye colour/wild type is dominant over white/mutant eye colour. Another gene for wings length is such that, long wings are dominant over vestigial wings, but not sex-linked. A cross between heterozygotes long-winged and carrier for the red eye was mated with another male with mutant eyes but also heterozygous for long wings.
   **a.** Work out the phenotypes and genotypes of the offsprings
   **b.** Work out the proportions of mutant eye males
5) In sweet pea, the genes for flower colour and the shape of the pollen grain display a unique kind of linkage. When a cross was made between blue flower and long pollen grain on red flower and round pollen grain, all the $F_1$ had blue flower and long pollen grain. However, self-breeding of the $F_1$ progeny gave unique combines with some plants having blue flowers and round pollen grains, while others had red flowers and long pollen grains.
   **a.** Carry out the genetic cross using suitable symbols to show the genotypes of the $F_2$ generations.
   **b.** When a test cross was done between blue long (BbLl) and a double recessive (bbll), the following results
6) The dominant alleles for awn character in rice plants exhibit a duplicate interaction/epistasis, the development of awn in rice is controlled by two dominant duplicate alleles A and B, such that, the presence of these two alleles can produce awn. The

awnless condition develops when both of these alleles are homozygous recessive (aabb). A cross was carried out between awned and awnless strains and all the $F_1$ were awed plants. Inter-breeding of the $F_1$, produced both awn and awnless plants in the ratio not conforming to a dihybrid cross. Use genetic symbols to carry out this cross. Explain the $F_2$ ratio obtain.

7) In rice, the gene for the expression of anthocyanin pigment exhibits a unique interaction. The green colour of plants is controlled by a certain gene (L) which is dominant over the second gene controlling purple plant colour (P). When a cross was made between a green plant (LLpp) and another purple plant (iiPP), all the offsprings were green. Inter-breeding of $F_1$ plants produced green and purple plants in a ratio that does not agree with the expected dihybrid ratio. Use genetic symbols to show the genotypes and phenotypes of the $F_1$ and $F_2$ offsprings including the phenotypic ratio.
8) The genes for tail length and scale colour in some species of newts display linkage. The gene for tail length has two alleles, where the normal tail trait is dominant over the short tail length, while the gene for scale colour likewise has two alleles, and the dominant allele produces white scales, while the recessive allele produces green scales, carryout a crossing, using suitable symbols to determine;
   **a.** The genotypes and the phenotypic ratio of the $F_2$ offspring
   **b.** The genotypes and the phenotypic ratio of a cross between a heterozygote with normal tail length and green scales, and one with a short tail and white scales
9) The colour of feathers in pigeons is controlled by two genes; one produces pigmented feathers, and the other gene controls the deposition of pigment on the feathers. The two genes are located on different loci on the homologous chromosome and interact together in a certain way. The normal condition produces grey feathers, while the presence of the allele for the deposition of pigment on the feathers in the dominant state, produces white feathers, regardless of the allele. Carry out a cross using suitable genetic symbols, to determine the genotype of the ratio of the offsprings in the $F_2$ generation.
10) In humans, the gene for green and red colour blindness is sex-linked, while the gene for blood groups is controlled by several genes/alleles. A woman heterozygous for blood group A and carries for colour blindness got married to a man carrying two different alleles for blood group B, through having a normal eye.

    Using suitable genetic symbols, workout;
    **a.** The phenotypes and genotypes of their children

**b.** The possibility of the couple producing a colour blind daughter. Explain your findings

11) In Drosophila, the gene for eye colour is sex-linked and red-eye colour/wild type is dominant over white/mutant eye colour. Another gene on a different chromosome is dominant in population over short-winged flies in a breeding experiment, a male heterozygote for long wings and mutant eyes were allowed to mate with a female with long wings, through heterozygous and carries for mutant eyes.
    **a.** Using suitable genetic symbols, work out the phenotype ratio and genotype of the offsprings.
    **b.** What is the proportion of mutant-eyed males into offspring progeny? Explain your results.
12) In cattle, the hornless/polled condition is dominant over the horned condition. Another gene controls the pattern of fur colour such that the allele for white for is Co-dominant while the $F_1$ allele is for red fur. Mating of a homozygous hornless white bull with a homozygous horned red cow was carried out and in the $F_1$ offsprings; all the calves were roan and hornless. When two offsprings from the $F_1$ progeny were mated, the expected hybrid ratio was not obtained. Using suitable genetic symbols, carry out the cross to determine the $F_1$ and $F_2$ genotypes and phenotypic ratios. Explain the results concerning mendelian laws.

    dominant gene in another locus of the same chromosome;

13) In dogs, the coat colour of the fur is controlled by two genes that interact together uniquely, one gene on a certain locus of the homologous chromosome, controls the population of pigmented fur, while the second gene that regulates the deposition of fur is on a different locus of the homologous chromosome. The presence of at least one dominant allele for the deposition of pigment produces black fur and the absence of either of the two dominant alleles produces brown fur. Using genetic symbols, work out the phenotypes and phenotypic ratio of the mendelian principles
14) In pigs of Duroc – jersey type, coat colour is controlled by two pairs of genes which uniquely supplement each other, Sandy coat colour is produced by one of the dominant alleles and a second non-allele gene. When neither of the dominant alleles is present, the pigs are white, but when both allele and non – allelic genes are present together, they produced red fur in the dominant state. If S is an allele for the allelic gene that produces Sandy fur and R represents the non-allelic gene that produces Sandy coat, carry out a cross

between two sandy pigs of the genotypes. SSRR and SSrr, to determine the genotypes and phenotypes of the $F_1$ and $F_2$ offsprings.

15) In wheat, the gene for colour of kernels is dominant over white kernels. A cross between two pure breeding red kernel wheat plants and pure breeding white kernel wheat plants produced $F_1$ plants all with brown kernels. Using suitable genetic symbols, determine the genotypes and phenotypes of the offsprings in $F_2$. Explain your results.

16) In onion, the production of red coloured pigment is controlled `by a certain gene which results in the formation of pigment on bulbs. Red coloured bulbs are dominant over the white bulbs. The gene for white colour, when in dominant state prevents the formation of red colour on bulbs, such that when absent in the dominant state, the recessive bulbs are yellow in colour

   **a.** Using genetic symbols, carry out a crossing to determine the genotypes of the $F_1$ and $F_2$ offsprings.

   **b.** Explain your results

17) In chicken, the inheritance of colour of feathers involves interaction between two loci. The allele for white feathers is dominant to the allele for coloured feathers. A cross between two pure bleeds of white feathers gave an $F_1$ progeny with all brick having white feathers. When the $F_1$ progeny was, however, allowed to self-bred, the $F_2$ birds showed some unique phenotypes with some birds having white feathers, as a few had coloured feathers. Using suitable symbols; show the interaction and display the $F_1$ progeny

18) In Drosophila, the gene for colour of the eyes is sex-linked. Another gene controls the length of the wings and body colour, such that long-winged flies and grey bodies are dominant in the fly population to the genes for short wings and black colour of the body. Breeding was done between two pure lines of red eyes with long wings and a grey body male and vestigial winged black-bodied female with mutant eyes. All the $F_1$ offsprings were grey-bodied, long-winged, and had red eyes. When the $F_1$ offsprings were allowed to breed, different phenotypes were seen in the $F_2$ generation. Using suitable genetic symbols, show the phenotypes and genotypes of $F_1$ and $F_2$ offsprings.

19) A sex-linked gene controls fur colour in cats ginger-coloured fur is controlled by an allele G and black coloured fur is controlled by the following g. some cats exclusively females are described as tortoiseshell because of having ginger and black patches of fur.

a) Using suitable genetic symbols, work out the genotypes and phenotypic ratio expected in the offspring of the cross between a male cat with genotype $X^gY$ and a tortoiseshell female.

and black female whose genotype was $X^g X^g dd$ to produce male kittens of the two different colours.

b) The effect of G and g alleles is modified by another gene that is not sex-linked but has two alleles. The allele d changes ginger colour to cream and black into grey. The dominant allele D does not modify the effect of G or g. Using suitable genetic symbols, work out the genotype and the ratio of phenotypes expected in the offsprings of the cross between a cream-coloured male cat