1. The polled (hornless) trait in cattle is dominant. The horned trait is recessive. A certain polled bull is mated to three cows. Cow A, which is horned, gives birth to a polled calf. Cow B, also horned, produces a horned calf. Cow C, which is polled, produces a horned calf. What are the genotypes of the four parents?

2. In summer squash, white fruit color is dominant. Yellow is recessive. A squash plant that is homozygous for white is crossed with a homozygous yellow one. Predict the appearance of: (a) the F_1 generation, (b) the F_2, and (c) the offspring of a cross between an F_1 individual and a homozygous white individual.

3. The storage roots of radishes may be long, round or oval. In a series of experiments, crosses between long and oval produced 159 long and 156 oval. Crosses between round and oval produced 199 round and 203 oval. Crosses between long and round produced 576 oval. Crosses between oval and oval produced 121 long, 243 oval and 119 round. Show how root shape is inherited in radishes.

4. What are the possible blood types of children in the following families?

(a) Type A mother, Type A father
(b) Type A mother, Type O father
(c) Type B mother, Type AB father
(d) Type AB mother, Type AB father
(e) Type A mother, Type B father

5. Suppose you examined the cells of a species of plant and found 12 chromosomes: a long straight pair, a short straight pair, a medium-length pair, a long bent pair, a short bent pair, and a medium-length bent pair. You then breed the plants of this species for several generations.

(a) At the end of this time would you expect to find some plants with all the straight chromosomes and none of the bent ones? All of the bent ones and none of the straight ones? Explain.
(b) What proportion of the gametes should have 3 straight chromosomes and 3 bent ones? 4 straight and 2 bent? 6 bent?

6. In garden peas, tall vine is dominant and short vine is recessive. If a homozygous tall plant is crossed with a homozygous short plant, what genotypes are possible in the F_1 generation?

7. A die (singular of dice) has six sides. What is the probability that an even number will come up on one throw of a die?

8. In garden peas, inflated pod is dominant and constricted pod is recessive.

(a) If a plant homozygous for inflated pod is crossed with a plant homozygous for constricted pod, what ratio of phenotypes would you expect to find in the F_2 generation?
(b) What ratio of genotypes would you expect?

9. In guinea pigs, short hair is dominant and long hair is recessive. A short-haired male and a short-haired female produced mostly short-haired offspring, but a few were long-haired. Show how you can determine the genotypes of the parents.

10. In laboratory mice, the normal gray color is dominant over the albino (all-white) color. Starting with purebred albino and purebred gray as parents, what is the ratio of phenotypes in the F_2 generation?

11. A pea plant that was homozygous for axial flowers (the dominant strain) was crossed with a plant that was homozygous for terminal flowers.

(a) What ratio of genotypes would you expect in the F_2 generation?
(b) What ratio of phenotypes would you expect?

12. In the following cases, Z stands for a certain dominant gene and z stands for a certain recessive gene. What ratios of genotypes would you expect from the following crosses:

(a) $ZZ \times zz$,
(b) $Zz \times Zz$,
(c) $Zz \times zz$,
(d) $Zz \times ZZ$?

13. In a certain species of plant, one purebred variety has hairy leaves and another purebred variety has smooth leaves. A cross of the two varieties produces offspring that all have smooth leaves. Predict the ratio of phenotypes in the F_2 generation.

14. In corn, yellow seed color is dominant and white is recessive. A certain ear of corn had a mixture of yellow seeds and white seeds. What color seeds could the parents have grown from?

15. In garden peas, axial flower position is dominant and terminal flower position is recessive; tall vine is dominant and short vine is recessive. A plant known to be purebred for tall vine and axial flowers is crossed with a plant having short vines bearing terminal flowers.

(a) What is the phenotype of the offspring?
(b) What is the genotype of the offspring?
(c) Predict the kinds of offspring (phenotypes) that would appear in the F_2 generation and their ratios.

16. In snapdragons, red flower color (C^R) is codominant with white (C^W), the heterozygotes being pink; the normal (broad) leaves (L^B) are codominant with narrow (grass-like) leaves (L^N), the heterozygotes having leaves of medium breadth. If a red-flowered, broad-leaved plant is crossed with a white-flowered, narrow-leaved one, what will be the phenotypes and their expected ratio in the F_2 generation?

17. In poultry, rose comb is dependent on a dominant factor, *R*, single comb on its recessive allele *r*. A rose-combed male is mated with 2 rose-combed females. Female A produces 4 chicks, all rose-combed. Female B produces 9 chicks, 7 rose-combed and 2 single-combed. What are the genotypes of the 3 parent birds?

18. The Jones family has eight children, all of whom are girls. What is the chance that the next child will be a boy? Explain.

19. A brown mouse is crossed with a heterozygous black mouse. If the mother has a litter of four, what are the chances that all of them will be brown?

20. In man, normal pigmentation is due to a dominant factor *C*, albinism to its recessive allele *c*. A normal man marries an albino woman. Their first child is an albino.

(a) What are the genotypes of these three people?
(b) If they have more children, what would they probably be like?
(c) An albino man marries a normally pigmented woman. They have nine children, all normally pigmented. What are the genotypes of the parents and the children?

21. In dogs, wire hair is due to a dominant factor, smooth hair to its recessive allele. Two wire-haired dogs produce a male puppy which is wire-haired. To what kind of female should he be mated to find out most quickly whether he carries the factor for smooth hair?

22. In guinea pigs, the coat may be rough or smooth. Certain rough-coated guinea pigs, when crossed with smooth-coated ones, produce all rough-coated offspring. Other rough-coated guinea pigs, when crossed with smooth-coated ones, produce equal numbers of rough-coated and smooth-coated offspring. Smooth-coated guinea pigs crossed together always produce smooth-coated offspring. Explain these results. Write the genotypes for all the animals concerned in the crosses.

23. What kinds of gametes would be produced by organisms having the following genotypes:

(a) ***AaBB***, (b) ***aaBB***, (c) ***AAbb***, (d) ***AaBBCc***.

24. In horses, black is due to a dominant gene *B*, chestnut to its recessive allele *b*. The trotting gait is due to a dominant gene *T*, pacing to its recessive allele *t*.

(a) If a homozygous black pacer is mated to a homozygous chestnut trotter, what will be the appearance of the F_1 generation?
(b) If two F_1 individuals were mated, what kinds of offspring could they have, and in what proportions?
(c) If an F_1 male were mated to a homozygous female black pacer, what kinds of offspring could be produced, and in what proportions?

25. In cocker spaniels, black is due to a dominant factor *B*, red to its recessive allele *b*. Solid color is dependent upon a dominant factor *S*, white spotting upon the recessive allele *s*. A red male was mated to a black-and-white female. They had 5 puppies, as follows: 1 black, 1 red, 1 black-and-white, and 2 red-and-white. What were the genotypes of the parents?