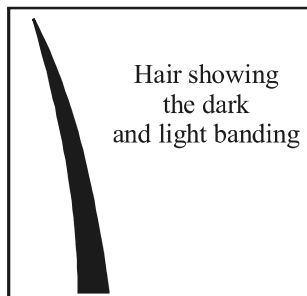


Agouti pattern :

The agouti colour pattern is commonly occurring one (wild type) and is characterized by colour banded hairs in which the part nearest the skin is grey, then a yellow band and finally the distal part is either black or brown. The albino mouse lacks totally in pigments and has white hairs and pink eyes.

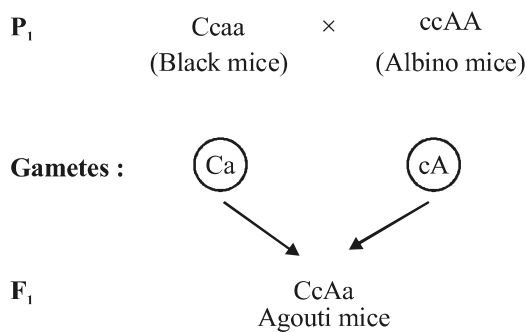
Agouti :



Recessive epistasis :

- 1) The agouti coat colour is controlled by a gene A which is hypostatic to recessive allele c.
- 2) i.e. c is epistatic in recessive state (cc) where it produces albino mouse whether the latter have A or aa genes.
- 3) Thus, cc AA, cc Aa and cc aa genotypes produce albino phenotypes.
- 4) i.e A gene for agouti colour cant express itself in absence of C.
- 5) Further the dominant allele C in the absence of A gives coloured (black) mice, i.e., CC aa and Cc aa genotypes give black coat colours.
- 6) Moreover, in the presence of allele C, the allele A gives rise to agouti coat. Thus, CCAA, CcAA, CcAa and CC Aa genotypes produce agouti coat.
- 7) When black mice (CCaa) are crossed with albino (ccAA), agouti mice (CcAa) appears in F₁ .

Recessive epistasis :



F₂

♂	CA	Ca	cA	ca
♀	CA CCAA (Agouti)	Ca CCAa (Agouti)	cA CcAA (Agouti)	ca CcAa (Agouti)
	Ca CCAa (Agouti)	Ccaa (Black)	CcAa (Agouti)	Ccaa (Black)
	cA CcAA (Agouti)	CcAa (Agouti)	ccAA (Albino)	ccAa (Albino)
	ca CcAa (Agouti)	Ccaa (Black)	CCAa (Albino)	ccaa (Albino)

Summary :

- Agout mice - 9
- Black mice - 3
- Albino - 4
- Phenotypic ration of Recessive epistasis - 9 : 3 : 4

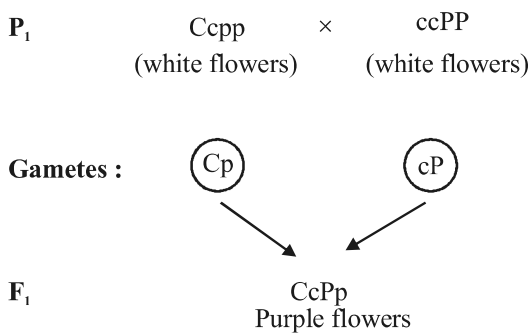
Complimentary

There are a pair of non allelic genes, both of which independently express similar phenotypic trait both the genes interact to produce a completely new trait.

Ration 9 : 7

Complementary genes :

- 1) Two independent pairs of genes, which interact to produce a trait together, but each dominant gene alone does not show its effect are called complimentary genes.
- 2) They are two pairs of non allelic dominant genes which interact to produce only one phenotypic trait but neither of them (if present alone) produces the trait in the absence of another.
- 3) That is for the development of dominant character in question, the presence of both of the genes is necessary.
- 4) Complimentary genes were first studied by bateson and punnet (1906) in case of flower color of sweet pea (*Lathyrus odoratus*).
- 5) Its also an example of recessive epistasis where recessive homozygous alleles of one type suppress the dominant alleles of another type.
- 6) They crossed two white coloured flowers (CCpp, ccPP) of sweet pea and obtained purple CcPp) flowered plants in F₁ generation.
- 7) Clearly both the parents have contributed a gene or factor for the synthesis of this purple color.
- 8) The purple flowered plants of F₁ generation were allowed to self breed.



F₂

♀ ↗	CP	Cp	cP	cp
CP	CCPP (Purple)	CCPp (Purple)	CcPP (Purple)	CcPp (Purple)
Cp	CCPp (Purple)	Ccpp (White)	CcPp (Purple)	Ccpp (White)
cP	CcPP (Purple)	CcPp (Purple)	ccPP (White)	ccPp (White)
cp	CcPp (Purple)	Ccpp (White)	ccPp (White)	ccpp (White)

Summary :

Purple flowers - 9
 White flowers - 7
 Phenotypic ration of Complemeatary genes - 9 : 7

Supplementary genes :

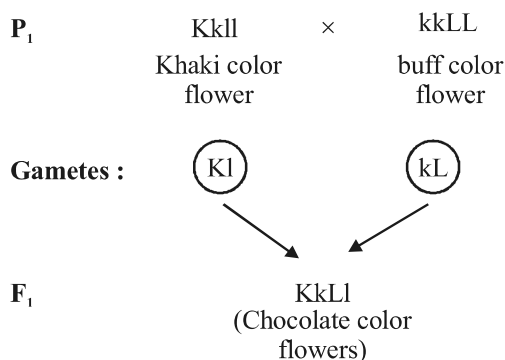
Supplementary genes are a pair of non allelic genes, one of which produces its effect independently in the dominant state while the dominant allele of the second gene is without any independent effect but it is able to modify the effect of the former dominant to produce a new trait.

Lablab :



Supplementary genes in lablab :

- 1) Lablab has two genes K and L in the recessive state the second or supplementary gene (l) has no effect on seed coat color.
- 2) Dominant K independently produce khaki color (KKll)
- 3) While its recessive allele gives rise to buff color (kkLL, kkLl) irrespective of the supplementary gene being dominant or recessive.
- 4) In the dominant state the supplementary gene (L) changes the effect of the dominant allele of a pigment forming gene (K) into chocolate color (KkLl).



F₂

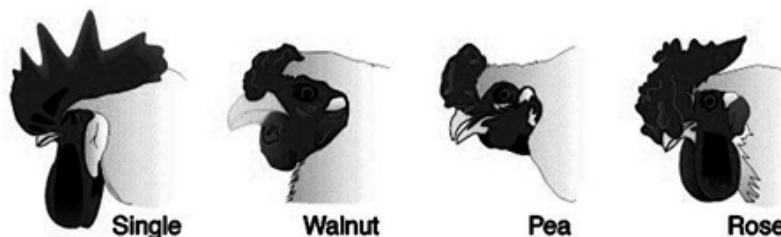
♀ ↗	KL	Kl	kL	kl
KL	KKLL (Chocolate)	KKLl (Chocolate)	KkLL (Chocolate)	KkLl (Chocolate)
Kl	KKLl (Chocolate)	Kkll (Khaki)	KkLl (Chocolate)	Kkll (Khaki)
kL	KkLL (Chocolate)	KkLl (Chocolate)	kkLL (buff)	kkLl (buff)
kl	KkLl (Chocolate)	Kkll (Khaki)	kkLl (buff)	kkll (buff)

Summary :

- Chocolate color flowers - 9
- Khaki color flowers - 3
- Buff color flowers - 4
- Phenotypic ration of Supplementary genes - 9 : 3 : 4

Collaborative genes :

- 1) In the first decade of the twentieth century, British geneticists William Bateson and R.C. Punnett conducted research showing that the shape of the comb in chickens was caused by the interaction between two different genes.
- 2) Bateson and Punnett were aware of the fact that different varieties of chickens possess distinctive combs. For instance, Wyandottes have a “rose” comb, Brahmas have a “pea” comb and Leghorns have a “single” comb.



- 3) When Bateson and Punnett crossed a Wyandotte chicken with a Brahma chicken, all of the F₁ progeny had a new type of comb, which the duo termed a “walnut” comb.
- 4) In this case, neither the rose comb of the Wyandotte nor the pea comb of the Brahma appeared to be dominant, because the F₁ offspring had their own unique phenotype.
- 5) Moreover, when two of these F₁ progeny were crossed with each other, some of the members of the resulting F₂ generation had walnut combs, some had rose combs, some had pea combs and some had a single comb, like that seen in Leghorns.
- 6) Because the four comb shapes appeared in a 9 : 3 : 3 : 1 ratio (i.e., nine walnut chickens per every three rose chickens per every three pea chickens per every one single-comb chicken), it seemed that two different genes must play a role in comb shape.

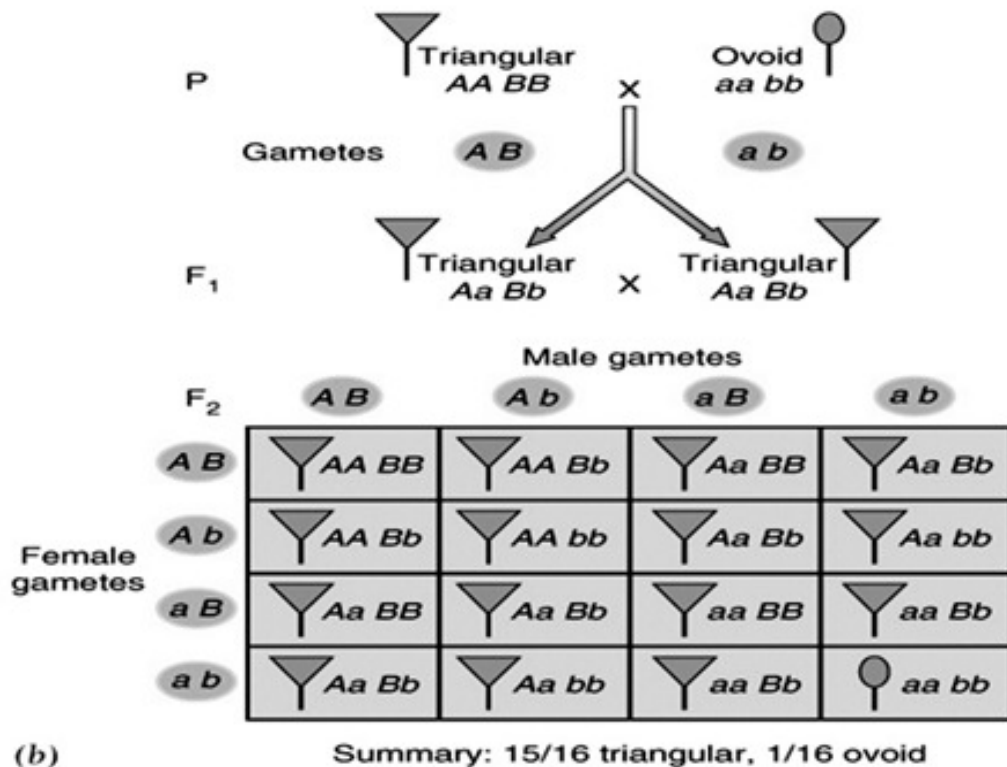
Modifier or collaborative gene :

- 1) Gene interaction here yields an altogether new phenotype which neither of the genes could produce by itself.
- 2) E.g. Inheritance of comb shape in poultry, controlled by two different pairs of allelic genes.
- 3) There is a gene R for rose comb and gene P for pea comb with their recessive alleles r and p both carrying the characteristic of single comb.
- 4) When both dominant genes R and P combine, they produce a new phenotype (the walnut comb).
- 5) Hence a cross between a homozygous rose comb and a homozygous pea comb individual yields a;1 walnut comb individuals in F₁ generation and 9 walnut, 3 rose, 3 pea and 1 single combed individuals in F₂ generation.
- 6) Homozygous recessive condition gives rise to single comb.

Duplicate genes :

Duplicate dominant genes (15: 1) - If the dominant alleles of both gene loci produce the same phenotype without cumulative effect, the 9 : 3 : 3 : 1 ratio is modified into a 15:1 ratio.

Example - The seed capsules of shepherd’s purse (genus Capsella) occur in two different shape, i.e., triangular and top-shaped. When a plant with triangular seed capsule is crossed with one having top-shaped capsule, in F₁ only triangular, character appears. The F₁ offspring by self crossing produced the F₂ generation with the ‘triangular and top-shaped seed capsules in the ratio of 15 : 1. Two independently segregating dominant genes (A and B) have been found to influence the shape of capsule in the same way. All genotypes having dominant alleles of both of these genes (A and D) would produce plants with triangular-shaped capsules. Only those with the genotype aabb would produce plants with top-shaped capsules.



Phenotypic traits :

- 1) There are two kinds-1. qualitative and quantitative.
Qualitative traits these are the classical mendelian traits, which have two contrasting conditions controlled by a single pair of genes.
- 2) E.g. Smooth and wrinkled pea seeds.
- 3) Tall and dwarf pea plants.
- 4) Black and white guinea pigs.
- 5) A qualitative trait is fully expressed by a single dominant gene.
- 6) The presence of two dominant genes does not modify the phenotype.

- 7) E.g. Bb, BB produce equal black coat color in phenotype.
- 8) The qualitative traits being controlled by a single pair of genes called monogenes are also called monogenic traits.
- 9) The inheritance produces two distinct phenotypes therefore discontinuous variation. eg. Either tallness or dwarfness.

Quantitative inheritance/polygenic inheritance :

- 1) It's a type of inheritance controlled by more than one genes in which the dominant alleles have cumulative effect with each dominant allele expressing a part or unit of the trait, the full trait being shown only when all the dominant alleles are present.
- 2) The genes involved are called polygenes.
- 3) Aka multiple factor inheritance.

Quantitative traits :

- 1) These are the measurable phenotypic trait which do not have two distinct contrasting conditions.
- 2) Instead they show a wide spectrum of phenotypes which imperceptibly blend from one condition to another as continuous variation.
- 3) They are usually controlled by more than one pairs of genes and may be modified by environmental factors.
- 4) Light or dark human skin can become light or dark depending upon exposure to sun.
- 5) The quantitative traits are very common and include certain human characters such as height, weight, skin color hair color, size of some organs, yield of crop plants including size shape and number of seeds.

Lethal gene :

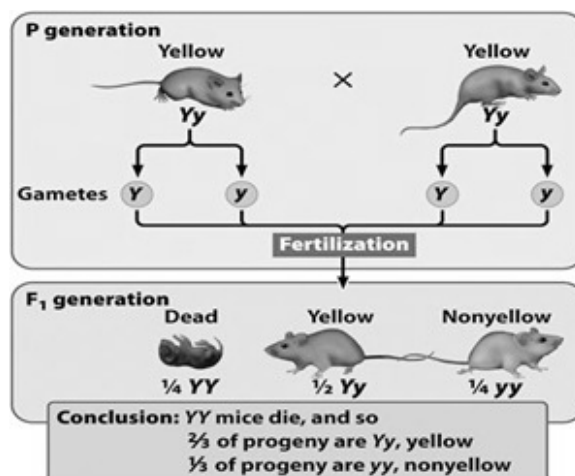
A cross was made between two yellow mice with genotype $Yy \times Yy$ what genetic ratio would we expect to see ?

$Yy \times yy$ should give a ratio of 3 : 1, we have 3 yellow with one yy, 2Yy and one yy

But what is happening is 2 : 1

2 yellow to one gray

In the above cross $1/3^{\text{rd}}$ of mice will never be _____, because they are homozygous for YY allele.



Since the last group is never born they are non-linked in actually determining the phenotype ratio.

Lethal genes : Sometimes alleles occur that, when present in two copies are lethal to individual the affected individual usually dies in embryonic development. Lethal gene ratio - 2 : 1.

Key facts :

Relation among pairs of independent alleles, Gametes, F₂ genotypes and F₂ phenotypes when dominance is present.

Number of Heterozygous Pairs	Number of Kinds of Gametes	Number of F ₂ Genotypes	Number of F ₂ Phenotypes
1	2	3	2
2	4	9	4
3	8	27	8
4	16	81	16
10	1024	59059	1024
n	2 ⁿ	3 ⁿ	2 ⁿ

Formula for number of genotypes in case of multiple allelism is $\frac{n}{2}(n+1) = n$ Alleles.

If a cross is made between two yeasts having genotype Aa Bb Cc, then the probability of getting genotype aa bb cc will be 1/64 because if we consider individuals the probabilities of occurring of aa, bb and cc is $\frac{1}{4}$ therefore $\frac{1}{(4)^3} = \frac{1}{64}$. Three genotypes are produced by two alleles.

EXERCISE – 1

1. The diploid chromosome number in *Pisum sativum* is
 - (a) 8
 - (b) 10
 - (c) 7
 - (d) 14
2. The ability of a gene to produce multiple phenotypic effect is called
 - (a) polyploidy
 - (b) pleiotropy
 - (c) epistasis
 - (d) phenotypic variation
3. Which of the following is more likely to be heterozygous?
 - (a) Pure lines
 - (b) Self-pollinated crops
 - (c) Autopolyploids
 - (d) Cross-pollinated crops
4. Gene recombinations are due to
 - (a) mutation
 - (b) independent assortment
 - (c) linkage
 - (d) modifier genes
5. An individual, which is always true breeding is
 - (a) dominant
 - (b) recessive
 - (c) hybrid
 - (d) none of these
6. Pure line is connected with the development of
 - (a) complete homozygosity
 - (b) complete heterozygosity
 - (c) homozygosity and self assortment
 - (d) heterozygosity and linkage
7. In case of incomplete dominance, F_2 generation has
 - (a) genotypic ratio equal to phenotypic ratio
 - (b) genotypic ratio is 3 : 1
 - (c) phenotypic ratio is 3 : 1
 - (d) none of the above
8. When two hybrids are crossed, the percentage of recessive is
 - (a) 25 %
 - (b) 100 %
 - (c) 50 %
 - (d) 75 %
9. Assume that in mice, B = black fur, b = brown fur. If a heterozygous black mouse mates with a homozygous brown mouse, what per cent of their offspring will have black fur ?
 - (a) 25 %
 - (b) 50 %
 - (c) 75 %
 - (d) 100 %
10. What is the major value in using a Punnett square ?
 - (a) show all gametic combinations
 - (b) show genotypic ratios
 - (c) show all phenotypic ratios
 - (d) all of the above
11. A codominance cross between a homozygous red and a homozygous white snapdragons produces plants with
 - (a) 50 % red and 50 % white flowers
 - (b) red flowers
 - (c) pink flowers
 - (d) sterile flowers
12. Why was Mendel fairly certain that he had a pure-bred variety when he collected seeds from a pea plant ?
 - (a) the flower is self-pollinating in these plants
 - (b) peas bear a large number of 'offspring'
 - (c) because the varieties are so distinctive
 - (d) he maintained extremely accurate records
13. Mendel was the first biologist.
 - (a) to study the mechanics of inheritance
 - (b) to discover that chromosomes are responsible for inheritance
 - (c) to use statistical methods in analysing his results
 - (d) all of the above
14. Mendel's law of segregation states that
 - (a) the two factors for the same trait separate in the production of gametes
 - (b) the two different traits will be inherited independently of each other
 - (c) the gametes are produced by meiosis
 - (d) all of the above
15. One reason for Mendel's success was that he
 - (a) repeated his experiments many times
 - (b) used carefully controlled experiments
 - (c) used plants with easily observable traits
 - (d) all of the above
16. Mendel developed his basic principles of heredity by
 - (a) microscopic study of chromosomes and genes
 - (b) mathematical analysis of the offspring of pea plants
 - (c) breeding experiments with *Drosophila*
 - (d) ultracentrifugation studies of cell organelles

17. Mendel developed the basic principles of heredity by
 (a) examining chromosomes with microscope
 (b) analysing large numbers of offsprings
 (c) using X-rays to induce mutations
 (d) observing crossing over during meiosis
18. Pea plants heterozygous for both height and colour of seed coat (TtYy) were crossed with pea plants that were homozygous recessive for both traits (ttyy). The offsprings from this cross included tall plants with green seeds, tall plants with yellow seeds, short plants with green seeds and short plants with yellow seeds. This cross best illustrates
 (a) gene mutation
 (b) independent assortment of chromosomes
 (c) environmental influence on heredity
 (d) intermediate inheritance
19. In squirrels, the gene for grey fur (G) is dominant over the gene for black fur (g). If 50 % of a large litter of squirrels are grey, the parental cross that produced this litter was most likely
 (a) $GG \times Gg$ (b) $Gg \times gg$
 (c) $GG \times GG$ (d) $gg \times gg$
20. In a certain variety of chicken, the genes for black feather colour and the genes for white feather colour are codominant. This variety of chicken will most likely have
 (a) three possible phenotypes for feather colour
 (b) only two genotypes for feather colour
 (c) white feather colour only
 (d) black feather colour only
21. How many genetically different kinds of gametes will an individual with genotype AAbb produce ?
 (a) one (b) two
 (b) three (d) four
22. A fruitfly has two genes for eye colour, but each of its sperm cells has only one. This illustrates
 (a) independent assortment
 (b) linked genes
 (c) pleiotropy
 (d) segregation
23. Mendel made some crosses where he looked two characteristics at once round yellow peas crossed with wrinkled green peas, for example. He did this because he wanted to find out
 (a) how new characteristics originated
 (b) whether different characteristics were inherited together or separately
 (c) how plants and animals adapt to their environments
 (d) whether the characteristics influence each other whether the colour affects degree of roundness, for example
24. Carriers of a genetic disorder
 (a) are indicated by solid symbols on a family pedigree
 (b) are involved in consanguineous matings
 (c) will produce children with the disease
 (d) are heterozygotes for the gene that can cause the disorder
25. Human skin colour is controlled by several gene pairs. Let us assume here that there are just three gene pairs on different chromosomes and that for each pair there are two alleles and incompletely dominant one that codes for melanin deposition and an incompletely recessive one that codes for no melanin deposition. If a very dark-skinned person mates with a very light-skinned person, what is the chance that their offsprings will have very dark skin ?
 (a) zero (b) 1/4
 (c) 5/8 (d) 9/64
26. A woman without dimples mates with a man who has dimples and who is known to be heterozygous for the trait. What is the chance of their first child will have dimples ?
 (a) one in four (b) one in two
 (c) three out of four (d) it is certain
27. A test cross distinguishes between
 (a) two homozygous forms
 (b) a homozygous dominant and a heterozygous form
 (c) two heterozygous forms
 (d) a homozygous recessive and a heterozygous form
28. When a pure strain of tall plants (T/T) with round peas (R/R) is crossed with a pure strain of short plants (t/t) with wrinkled peas (r/r), a F_1 generation is produced. When these F_1 plants self-pollinate, how many phenotypes (with regard to plant height and pea shape) are produced in the F_2 generation ?
 (a) 4 (b) 6
 (c) 9 (d) 16

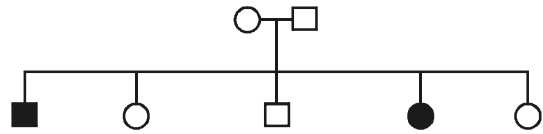
29. When a pure strain of tall plants (T/T) with round peas (R/R) is crossed with a pure strain of short plants (t/t) with wrinkled peas (r/r), a F_1 generation is produced. The alleles for short and wrinkled are recessive to those for tall and round, respectively. When these F_1 plants self-pollinate, what proportion of the F_2 generation is short with wrinkled peas ?
- (a) zero (b) 1/16
(c) 1/2 (d) 9/16
30. How many different kinds of gametes can an organism of genotypes A/a; B/B; C/c produce ?
- (a) 3 (b) 4
(c) 9 (d) 16
31. When a particular characteristic of an individual e.g., petal colour, shows variation among the offspring produced after the individual is selfed, it is said to be
- (a) pure-breeding (b) true-breeding
(c) homozygous (d) heterozygous
32. Genes A and B are necessary for normal hearing. A deaf man marries a deaf woman and all their children have normal hearing. The genotype of the parents
- (a) AAbb and AAbb (b) Aabb and aaBb
(c) AAbb and aaBB (d) aaBB and aaBb
33. Choose the best explanation for the mechanism of inheritance, keeping in mind Mendel's laws of segregation and independent assortment.
- (a) a characteristic is inherited 'in combination' with others
(b) the presence of one characteristic (e.g., colour) modifies the inheritance of the other (e.g., shape)
(c) a characteristic (say shape) is inherited independent of the influence of others (e.g., colour)
(d) rare combinations of characters are always due to mutations, which are inherited by the progeny
34. The interaction not included under Bateson's factor hypothesis is
- (a) complementary genes
(b) epistasis
(c) blending
(d) supplementary genes
35. What will be the result of a cross between TtGG and ttGG?
- (a) One TtGG and one ttGG
(b) Three TtGg and one ttgg
(c) Two TtGg, one TTGG and one ttGG
(d) Nine TtGG, three TTGG, three TtGg and one ttgg
36. Genes P and Q are necessary for normal hearing. A deaf man marries a deaf woman and all their children had normal hearing. The genotype of the parents are
- (a) ppqq × ppQq (b) PPqq × PPqq
(c) ppQQ × ppQq (d) PPqq × ppQQ
37. Mendel crossed plants with red and white flowers. In the F_1 only red flowered plants were found. Two F_1 plants were crossed and in F_2 generation 2950 red and 1050 white flowered plants were obtained. It is reasonable, he conclude that
- (a) mutation had occurred
(b) the genes for white flower is incompletely dominant
(c) the probability of white flowered plants is 1/4
(d) no reason can be attributed
38. Blue eye colour in human is recessive to brown eye colour. The expected children of a marriage between blue eyed woman and brown eyed male, who had a blue eyed mother are likely to be
- (a) all blue-eyed
(b) three blue-eyed one brown-eyed
(c) all brown-eyed
(d) one blue-eyed and one brown-eyed
39. Which one of the following individuals can produce sixteen different gametes ?
- (a) Aa, Bb, Cc, Dd
(b) Aa, Bb, cc, DD, Ee, Ff
(c) Aa, Bb, Cc, dd, EE, FF
(d) Aa, Bb, Cc, DD, Ee, Ff
40. The probability of getting abc phenotype from a cross Aa Bb Cc × aa Bb cc is
- (a) 1/2 (b) 1/4
(c) 1/8 (d) 1/16
41. Resistance to a fungus in pea plants is conferred by gene 'H' which is completely recessive to its allele 'h' for susceptibility. If a resistant female plant is crossed with a homozygous susceptible male, what would be order of genotype in pistillate parent, staminate parent, male gametes and egg ?
- (a) Hh, HH, H, h (b) hh, Hh, h, h
(c) hh, HH, H, h (d) Hb, HH, h, H
42. The mating of a red fruit bearing tomato plant with yellow fruit bearing plants yielded 173 plants. Out of these, 84 bore yellow fruits. The genotypes of the parents are most likely
- (a) RR, rr (b) RR, Rr
(c) Rr, rr (d) rr, rr

43. Three yellow round pea seeds labelled A, B, C were taken and grown into plants. The plants were crossed to a plant grown from a green wrinkled pea. 100 seeds issuing from each cross were sorted into phenotypic classes as follows
- I.A : 100 yellow round
 II.B : 51 yellow round, 49 green round
 III.C : 24 yellow round, 26 yellow wrinkled, 25 green round
 IV : Green wrinkled

The genotype of plant C would be

- (a) YYRR (b) YyRR
 (c) YyRR (d) YYRr
44. If dwarf pea plant was treated with gibberellic acid, it grew as tall as the pure tall plant then the phenotypic ratio of F_2 is likely to be
- (a) all dwarf
 (b) all tall
 (c) 50% tall, 50% dwarf
 (d) 75% tall, 25% dwarf
45. Why were pea plants more suitable than dogs for Mendel's experiment?
- (a) There were no pedigree records of dogs
 (b) Pea plants can be self-fertilised
 (c) All pea plants have 2n number of chromosomes
 (d) Dogs have different colour
46. In rice plant, the presence of gene P causes its leaves to be coloured deep purple. But if the gene I is present then the purple colour is inhibited and the leaf becomes normally green. What is the ratio in F_2 generation of green and purple plants?
- (a) 9 : 7 (b) 9 : 6 : 1
 (c) 12 : 3 : 1 (d) 13 : 3
47. Mating between black rats of identical genotype produced offspring-14 creamy, 47 black and 19 albino. What epistatic ratio is expected and what type of epistasis is operative?
- (a) 1 : 2 : 1, incomplete dominance
 (b) 9 : 3 : 4, recessive epistasis
 (c) 12 : 3 : 1, dominant epistasis
 (d) None of the above
48. The minimum progeny population size allowing for random union of all kinds of gametes from Aa Bb Cc parents is
- (a) 9 (b) 27
 (c) 64 (d) more than 100
49. Which phase of meiosis is most directly related to the law of independent assortment?
- (a) Anaphase-II (b) Prophase-II
 (c) Metaphase-I (d) Metaphase-II

50. Given below is a pedigree chart of a family with five children. It shows the inheritance of attached ear lobes as opposed to the free ones. The squares represent the male individuals and circles the female individuals, which one of the following conclusions drawn is correct?



Free Ear-lobes ○ □ Attached Ear-lobes ● ■

- (a) The parents are homozygous recessive
 (b) The trait is Y-linked
 (c) The parents are homozygous dominant
 (d) The parents are heterozygous
51. Normal maize has starchy seeds which remain smooth when dry. A mutant form has sugary seeds, which go crinkled when dry. When a mutant was crossed with a normal plant, an F_1 was produced which has smooth seeds. What would be the relative ratios of the different seed types, if the F_1 was allowed to self?
- (a) 1 smooth : 3 sugary
 (b) 3 smooth : 1 sugary
 (c) 1 smooth : 1 sugary
 (d) All sugary
52. Genes
- (a) are the unit of inheritance
 (b) contain the information that is required to express a particular trait in an organism
 (c) both a and b
 (d) were the unit of recombination
53. Law of Mendel which is not completely applicable is
- (a) codominance
 (b) law of segregation
 (c) law of independent assortment
 (d) law of dominance
54. When two odd characters are present in a gene, this is known as
- (a) bigamous (b) heterogamous
 (c) polymorphic (d) heteromorphic
55. The term 'genotype' was coined by
- (a) H J Muller (b) T Boveri
 (c) W S Sutton (d) W L Johanssen

56. Mendel's law is still true because it takes place in
 (a) sexually reproducing plants
 (b) asexually reproducing plants
 (c) both a and b
 (d) apomictic reproducing plants
57. In wheat, when a green plant was self-fertilized, the progeny had 209 green seedlings and 14 white seedlings. The above result indicates that the parents were
 (a) heterozygous for two duplicate alleles
 (b) true-breeding
 (c) heterozygous for one allele
 (d) none of the above
58. First child of a normal pigmented couple is albino. The possibility of a second child being an albino is
 (a) 25 % (b) 50 %
 (c) 75 % (d) 100 %
59. All allelomorphic pair implies
 (a) a pair of contrasting characters
 (b) a pair of non-contrasting characters
 (c) any two characters
 (d) sex-linked characters
60. Hybrids are generally superior to parents due to
 (a) heterosis
 (b) homozygosity
 (c) heterozygosity
 (d) parents are generally weak
61. Mendel's law of independent assortment can be demonstrated by
 (a) test-cross (b) back-cross
 (c) monohybrid cross (d) dihybrid cross
62. A couple with curly hair husband and straight hair wife have all their children curly hair because
 (a) both are heterozygous
 (b) husband is homozygous and wife is heterozygous
 (c) husband is heterozygous while wife homozygous
 (d) both are homozygous
63. Allelism refers to
 (a) genic interactions controlling a character
 (b) multiple genes controlling a character
 (c) expression of many characters by a single gene
 (d) alternative forms of a gene at a given locus
64. In Mendelian dihybrid cross when heterozygous Round Yellow are self crossed, Round Green offsprings are represented by the genotype
 (a) RrYy, RrYY and RRYy
 (b) Rryy, RRyy and rryy
 (c) rrYy and rYY
 (d) Rryy and RRYy
65. Select the correct statement from the ones given below with respect to dihybrid cross.
 (a) tightly linked genes on the same chromosome show higher recombinations
 (b) genes far apart on the same chromosome show very few recombinations
 (c) genes loosely linked on the same chromosome show similar recombinations as the tightly linked ones
 (d) tightly linked genes on the same chromosome show very few recombinations
66. How many different types of gametes can be formed by F_1 progeny, resulting from the following cross $AABBCC \times aabbcc$?
 (a) 3 (b) 8
 (c) 27 (d) 64
67. Which of the following animal is mostly used in genetics experiments ?
 (a) Butterfly (b) Fruitfly
 (c) Housefly (d) Dragonfly
68. In sex linkage, the speciality is
 (a) atavism
 (b) reversion
 (c) gene flow
 (d) criss-cross inheritance
69. Hybrid breakdown refers to the condition when offsprings are physiologically inferior to the following generation ?
 (a) F_1 (b) F_2
 (c) P_1 (d) All of these
70. The phenotypic ratio obtained in quantitative inheritance of a dihybrid cross is
 (a) 1 : 2 : 1
 (b) 1 : 4 : 6 : 4 : 1
 (c) 1 : 6 : 15 : 20 : 15 : 6 : 1
 (d) 9 : 3 : 3 : 1

71. In a certain plant red colour flower (R) is dominant over white colour flower (r), when heterozygous Rr plant is crossed 64 offsprings are obtained. The number of white offspring are
(a) 64 (b) zero
(c) 16 (d) 32
72. Mendelian recombination is due to
(a) linkage
(b) independent assortment of genes
(c) mutation
(d) dominant characters
73. In pigs, white coat (W) is dominant to black (w). Two white pigs are breed to produce nine white and two black pigs. What are the genotype of the parents ?
(a) WW × WW (b) WW × Ww
(c) Ww × Ww (d) ww × ww
74. A condition where a certain gene is present in only a single copy in a diploid cell is called
(a) heterozygous (b) monogamous
(c) homozygous (d) hemizygous
75. Genes when present in homozygous condition results in non-viable progeny, the factor responsible for such conditions are
(a) polygenes (b) linked genes
(c) lethal genes (d) epistatic genes
76. The process that involves intergenic suppression or the masking effect, which one gene locus has upon the expression of another is called
(a) epistasis
(b) dominance
(c) incomplete dominance
(d) recessive
77. Which of the following Mendel's law has not been proved to be true in all the cases ?
(a) law of segregation
(b) law of independent assortment
(c) law of dominance
(d) none of these
78. There is resemblance between parents and offspring but not the exact likeness. This is because of
(a) variations produced by crossing over at the time of gamete formation
(b) variations produced by chance distribution of chromosomes to the two poles of meiosis I
(c) both the above a and b points
(d) none of the above points
79. In a cross between a pure tall pea plant with green pod and a pure short plant with yellow pod, how many short plants you would expect in F₂ generation ?
(a) 4 (b) 9
(c) 3 (d) 1
80. Genotype of individual is
(a) genetic constitution (b) genetic set up
(c) both of these (d) none of these
81. If a dihybrid for character is crossed to a homozygous recessive individual for the same character, the phenotypic ratio of the progeny would be
(a) 1 : 1 : 1 : 1 (b) 1 : 2 : 1
(c) 3 : 1 (d) 13 : 3
82. If the genotype of an individual is AA Bb CC, it is a
(a) trihybrid (b) monohybrid
(c) dihybrid (d) none of the above
83. In the F₂ generation, genotypic and phenotypic ratios are identical in case of
(a) mendelian monohybrids
(b) mendelian dihybrids
(c) incomplete dominance
(d) none of the above
84. The frequency of a mutant gene in a population is expected to increase if the gene is
(a) dominant (b) recessive
(c) favourably selected (d) sex linked
85. From a cross AAbb × aaBB, following genotypic ratio will be obtained in F₁ generation
(a) 1 Aa BB : 3 aa BB
(b) 3 Aa BB : 1 aa BB
(c) All AAbb : No aa BB
(d) All AaBB
86. Mendel's work was republished in Flora in the year
(a) 1884 (b) 1901
(c) 1906 (d) 1894

87. Gene which have similar phenotypic effect when present separately but interact to produce a new phenotype when present together are known as
 (a) supplementary genes
 (b) complementary genes
 (c) epistatic genes
 (d) inhibitory genes
88. A test cross
 (a) is commonly used to investigate the genotype of the diploid individual
 (b) involves mating one genotype to another homozygous for all dominant genes under consideration
 (c) involves mating one genotype to another homozygous for recessive alleles of all genes under consideration
 (d) both a and c
89. Mendel studied seven contrasting characters for his breeding experiments; which of the following character he did not study ?
 (a) plant height (b) pod colour
 (c) pod shape (d) leaf shape
90. Allele is called
 (a) a pair of chromosome
 (b) a pair of contrasting character
 (c) a pair of sex chromosome
 (d) none of these
91. In wheat, when a green plant was self fertilized, the progeny had 20 green seedlings and 14 white seedlings. The above result indicated that the parents were
 (a) true breeding
 (b) homozygous for one allele
 (c) heterozygous for one allele
 (d) heterozygous for two duplicate alleles
92. An organism with two copies of the same allele is\
 (a) homozygous for that trait
 (b) homologous for the allele
 (c) heterozygous for the trait
 (d) heterozygous for the allele
93. The branch genetics started in
 (a) 1857 (b) 1866
 (c) 1900 (d) 1905
94. Rediscovery of Mendel's work was made in
 (a) 1866 (b) 1900
 (c) 1898 (d) None of these
95. The condition in which only one allele of a pair is present is called
 (a) homozygous
 (b) hemizygous
 (c) heterozygous
 (d) incomplete dominance
96. Bar eye character in *Drosophila* is due to
 (a) deficiency (b) duplication
 (c) translocation (d) polyploidy
97. Presence of chromosome number, which is different from the multiple of basic chromosome no is called ?
 (a) hyperploidy (b) heteroploidy
 (c) aneuploidy (d) euploidy
98. 'Triticale' is derived from cross between ?
 (a) wheat and aegilops
 (b) wheat and rice
 (c) wheat and maize
 (d) wheat and rye
99. In common hexaploid bread wheat, the three diploid genomes are
 (a) A, B and C (b) A, C and D
 (c) B, C and D (d) A, B and D
100. The marriage between blood relations and cousins should be prohibited because
 (a) it reduces the reproductivity
 (b) it will not prove successful
 (c) it increases the probability of increasing the transmission of defective germplasm
 (d) none of the above
101. Which is back cross in a monohybrid cross ?
 (a) 9 : 3 : 3 : 1 (b) 1 : 1
 (c) 1 : 2 : 1 (d) 3 : 1
102. 12 : 3 : 1, F_2 ratio is obtained in interaction of ____ factors
 (a) complementary (b) supplementary
 (c) epistatic (d) inhibitory
103. Pseudodominance is
 (a) there is incomplete dominance
 (b) dominance of recessive alleles in a single generation
 (c) deficiency in which recessive allele will behave like a dominant allele
 (d) there is no such phenomenon

104. Gene interaction in which either of dominant gene is enough to give rise to same phenotypic effect is
- complementary gene
 - duplicate gene
 - epistatic gene
 - supplementary
105. Which of the following conditions represents a case of co-dominant genes ?
- a gene expression itself, suppressing the phenotypic effect of its alleles
 - genes that are similar in phenotypic effect when present separately, but when together interact to produce a different trait
 - alleles, both of which interact to produce a trait, which may or may not resemble either of the parental types
 - alleles, each of which produces an independent effect in a heterozygous condition
106. Which of the following diseases is governed by pleiotropic genes
- sickle cell anaemia
 - haemophilia
 - colour blindness
 - none of these
107. Epistasis implies
- one pair of genes can completely mask the expression of another pair of genes
 - one pair of genes independently controls a particular phenotype
 - one pair of genes enhances the phenotype expression of another pair of genes
 - many genes collectively control a particular phenotype
108. Polymorphic variations are due to
- more than one gene
 - one or two genes
 - both of these
 - nonr of these
109. What is the phenotypic ratio of the progeny obtained by self fertilization of a codominant dihybrid individual ?
- 3 : 1
 - 1 : 2 : 1
 - 9 : 3 : 3 : 1
 - 1 : 2 : 1 : 2 : 4 : 2 : 1 : 2 : 1
110. If in a filial generation 9 : 3 : 3 : 1 ratio is replaced by 9 : 7 ratio, it is due to
- complementary gene
 - epistatic gene
 - supplementary gene
 - hypostatic gene

ANSWER KEY**EXERCISE – 1**

1. (d)	2. (b)	3. (d)	4. (b)	5. (b)	6. (a)	7. (a)	8. (a)	9. (b)	10. (d)
11. (c)	12. (a)	13. (c)	14. (a)	15. (a)	16. (c)	17. (b)	18. (b)	19. (b)	20. (a)
21. (a)	22. (d)	23. (b)	24. (d)	25. (a)	26. (b)	27. (b)	28. (a)	29. (b)	30. (b)
31. (d)	32. (c)	33. (c)	34. (c)	35. (a)	36. (d)	37. (c)	38. (d)	39. (b)	40. (d)
41. (c)	42. (c)	43. (b)	44. (d)	45. (b)	46. (d)	47. (b)	48. (c)	49. (c)	50. (d)
51. (b)	52. (c)	53. (c)	54. (b)	55. (d)	56. (a)	57. (a)	58. (a)	59. (a)	60. (a)
61. (b)	62. (d)	63. (d)	64. (d)	65. (d)	66. (b)	67. (b)	68. (d)	69. (a)	70. (b)
71. (c)	72. (b)	73. (c)	74. (a)	75. (c)	76. (a)	77. (b)	78. (c)	79. (a)	80. (c)
81. (a)	82. (a)	83. (c)	84. (a)	85. (d)	86. (b)	87. (b)	88. (d)	89. (d)	90. (b)
91. (d)	92. (a)	93. (c)	94. (b)	95. (b)	96. (b)	97. (c)	98. (d)	99. (d)	100. (c)
101. (b)	102. (c)	103. (c)	104. (b)	105. (d)	106. (a)	107. (a)	108. (a)	109. (d)	110. (a)

Dream on !!

