

Question Bank

Genetics

1. Name the following :

- (i) The plant used by Mendel for this experiment.
- (ii) The ratio of offsprings in F_2 generation in a dihybrid cross.
- (iii) The fundamental unit of heredity.
- (iv) Term used for departure from a complete similarity between individuals of the same species.
- (v) The scientists who gave the chromosomal theory of inheritance.
- (vi) The number of pair of chromosomes in Man and Drosophila.
- (vii) Another name for Mendelian factors.
- (viii) At which stage of the cell division, chromosomes are the most condensed?
- (ix) The generation produced by crossing two homozygous parents.

Ans. (i) Garden pea plant (ii) 9 : 3 : 3 : 1
(iii) Genes (iv) Variation
(v) Sutton and Boveri (vi) 23; 4
(vii) Genes (viii) Metaphase
(ix) F_1 generation

2. Fill in the blanks.

- (i) A character that is masked is considered_____ while that which is expressed is known as _____.
- (ii) In a monohybrid cross, phenotypic ratio of F₂ generation is _____.
- (iii) Gregor Mendel is called the _____ of Genetics.
- (iv) The somatic cells of females have _____ pair of sex chromosomes.
- (v) _____ is the result of trisomy of the 21st chromosome.
- (vi) A chromosome is mostly made up of _____.
- (vii) _____ results in haploid number of chromosomes in the gametes.
- (viii) Genes are in pairs, known as

Ans. (i) Recessive; dominant

(ii) 3 : 1

(iii) Father

(iv) 1(XX)

(v) Down's syndrome

(vi) DNA

(vii) Meiosis

(viii) Alleles

3. State whether the following statements are true or false. If false, rewrite them by changing the word printed in bold face only.

- (i) A chromosome is mostly made up of **RNA** molecules.
- (ii) The genetic make up of an organism is its **phenotype**.
- (iii) When the alleles are dissimilar, they are said to be **heterozygous**.
- (iv) During **Prophase**, nucleus appears as a network of threads called chromatin.

(v) **Sutton and Boveri** carried out extensive experiments on the garden pea.

(vi) Down's syndrome is caused by the trisomy of the **10th** chromosome.

Ans. (i) False (DNA)

(ii) False (genotype)

(iii) True

(iv) False (interphase)

(v) False (Mendel)

(vi) False (21st)

4. Match the terms in column I with their explanations in column II.

Column I (term)	Column II (Explanation)
A. Genetics	(i) Chromosomes similar in size and shape.
B. Autosomes	(ii) The alternative forms of a gene.
C. Recessive gene	(iii) Study of laws of inheritance of characters.
D. Allele	(iv) A gene that can express only when in a similar pair
E. Homologous chromosomes	(v) Chromosomes other than the pair of sex chromosome.

Ans. (i) A – iii, **B** – v, **C** – iv, **D** – ii

5. Which of the following are homozygous dominant and homozygous recessive for tongue rolling : Rr, rr, RR.

Ans. RR is homozygous dominant for tongue rolling and rr is homozygous recessive for tongue rolling.

6. Define the following terms.

(a) Heterozygous

(b) Homozygous

(c) Pedigree chart.

Ans.(a) Heterozygous — The condition in which a pair of chromosome carries dissimilar alleles for a particular character.

(b) Homozygous — The condition in which a pair of chromosome carries similar alleles of a particular character.

(c) Pedigree chart — It is a family chart which shows the parents and their children along with the hereditary characters.

7. What is the basis of sex in humans?

Ans. The basis of sex in humans is the 46th chromosome. There are 23 pairs of chromosomes in a human body cell. Chromosome pairs numbered 1-22 are similar in males and females. These are termed autosomes. The 23rd pair is different in males and females, and are called the sex chromosomes; which in females consists of two similar chromosomes XX, but in males consists of one X as that of female and another much smaller one called Y chromosome. These X and Y chromosomes form the basis of sex.

8. Define (i) Law of segregation (ii) Homozygous allele (iii) Down's syndrome (iv) Linkage.

Ans. (i) Law of segregation : The contrasting factors separate or segregate during gamete formation and the paired condition is restored during random fertilisation.

(ii) Homozygous allele : In a diploid where both the alleles are identical.

(iii) Down's syndrome : It is caused by the trisomy of the 21st chromosome.

Mostly seen in offsprings of over-aged females, the 21st pair of chromosome does not split equally during oogenesis producing gametes with either $n-1$ and $n+1$ chromosomes, not the normal 'n' number of chromosomes.

These upon fertilisation by a normal spermatozoa produce a zygote with three 21st chromosomes. Zygotes with less than normal number of chromosomes fail to develop which causes severe abnormalities and causes Down's syndrome, characterised by mental retardation, reduced resistance to diseases, congenital heart abnormalities, a short stocky body, thick neck and the characteristic fold of skin over the inner corner of the eye.

(iv) Linkage : The tendency of genes to stay together in hereditary transmission is called linkage. Such groups of genes form a linkage group. The occurrence of a linkage group is due to the fact that there are far more hereditary characters in an individual than there are chromosomes in it.

9. Why did Mendel select garden pea for his experiments on genetics?

Ans. Mendel selected the garden pea for his experiments in genetics because :

- (i)** The plant has many varieties, showing a number of contrasting features.
- (ii)** The plants are easy to cultivate.
- (iii)** The plant is normally self-pollinating, so he could obtain pure strains.
- (iv)** Artificial cross-pollination resulted in fertile hybrids.

10. Name any two genetic diseases in human.

Ans. Haemophilia and sickle cell anaemia are two genetic diseases of human.

11. Among lion, tiger and domestic cat, all the three have the same number of 38 chromosomes, yet they have different appearance. How do you account for such difference?

Ans. Though the number of chromosomes is same in the three cases, but the genes present on the chromosomes are different in three different animals accounts for such differences.

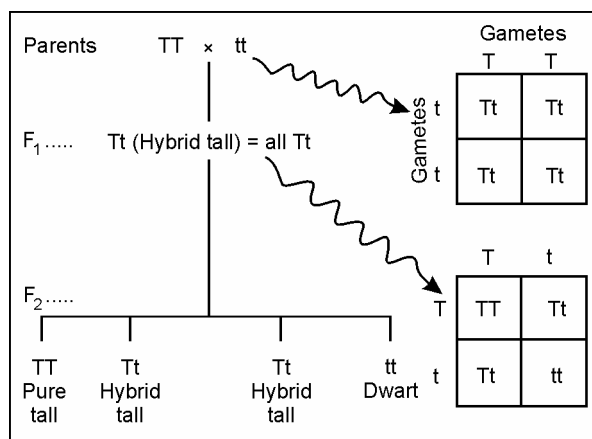
12. Differentiate between character and trait.

Ans. Any heritable feature is a character and the alternative terms of a character are called traits.

13. Make a square for finding out the proportion of different genotypes in the progeny of a genetic cross. For example,

(i) A cross between pure tall (TT) pea-plants with pure dwarf (tt) plants.

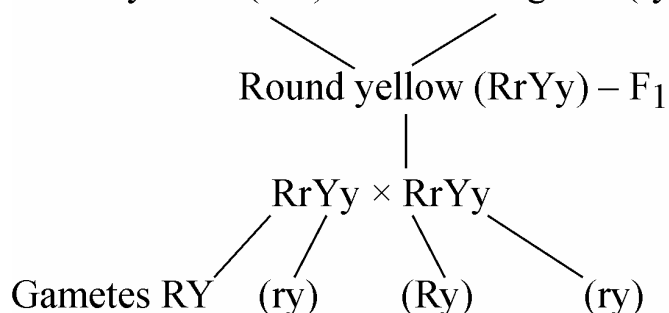
Ans.



14. Explain with example, Mendel's third law of inheritance.

Ans. According to the third law of inheritance, **the principle of independent assortment**, during the inheritance of more than one pair of contrasting characters, brought together in an offspring, the inheritance of each factor is independent of the other. For example, if a pea plant homozygous for yellow seed colour, round seed coat (dominant) is crossed with a pea plant, homozygous for green seed colour, and wrinkled seed coat, all the F_1 offsprings have yellow and round seeds, obviously showing only dominant characters. However, on self-pollinating, the offsprings of F_1 , four different types of seeds are produced as F_2 .

Round yellow (RY) $\times$ Wrinkled green (ry)



Thus, it is concluded that rounded form does not always remain with yellow, but it can combine with green as well. Also, wrinkled form can also pair with yellow.

Self-breeding of F_1	RY	Ry	rY	ry
RY	RRYY	RRYy	RrYY	RrYy
Ry	RRYy	RRyy	RrYy	Rryy
rY	RrYY	RrYy	rrYY	rrYy
ry	RrYy	Rryy	rrYy	rryy

Round yellow $\rightarrow$ RRYY, RRYy, RrYY, RrYy, RRYy,
RrYy, RrYY, RrYy, RrYy.

Round green $\rightarrow$ RRyy, Rryy, Rryy.

Wrinkled yellow $\rightarrow$ rrYY, rrYy, rrYy.

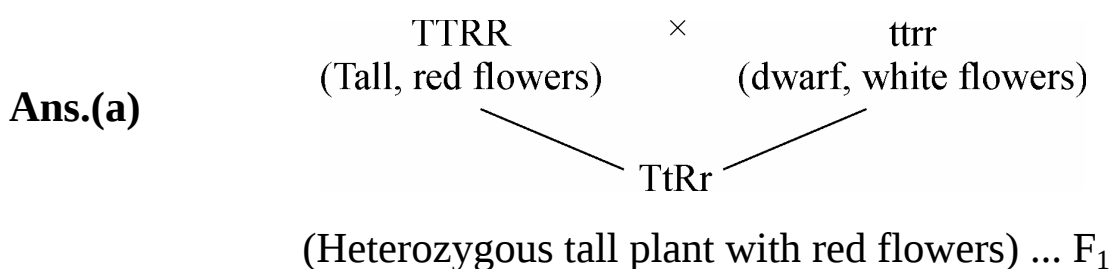
Wrinkled green $\rightarrow$ rryy

$$F_2 = 9 : 3 : 3 : 1$$

15. If a dominant homozygous tall plant bearing red flowers is crossed with a recessive homozygous dwarf plant bearing white flower.

(a) What will be the genotype and phenotype of the F_1 generation?

(b) If the F_1 plants are self-pollinated, what will be the genotype and phenotype of the resulting F_2 generation



(b) self-pollination among F_1

$$TtRr \times TtRr$$

Self-pollination	TR	tR	Tr	tr
TR	TTRR●	TtRR●	TTRr●	TtRr●
Tr	TTRr●	TtRr●	TTrr✓	Ttrr✓
tR	TtRR●	ttRR△	TtRr●	ttRr△
tr	TrRr●	ttRr△	Ttrr✓	ttrr□

Tall red : Tall white : Dwarf red : Dwarf white

9 3 3 1

Tall red (●),

Tall white, (✓),

Dwarf red, (Δ),

Dwarf white (□),

16. (i) State Mendel's law of dominance.

(ii) What is a dihybrid ratio?

(iii) Define Phenotype.

(iv) What are Autosomes?

Ans.(i) When a cross is made between two individuals differing in single allelic pair, then only dominant phenotype is expressed in F₁ generation.

(ii) 9 : 3 : 3 : 1.

(iii) The external appearance of an individual is called phenotype.

(iv) The chromosomes which have the genes of somatic characters are called autosomes.

17. List any three features of garden pea with their dominant and recessive traits.

Ans. The features of garden pea are —

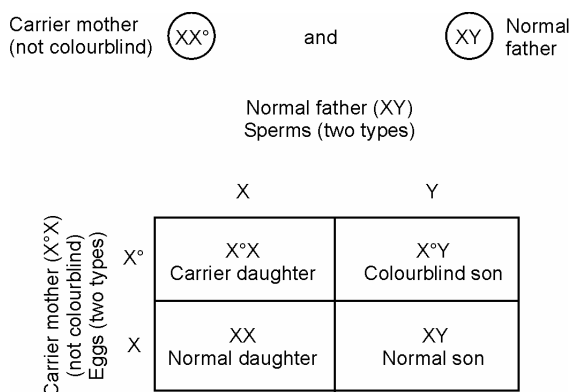
Character	Dominant	Recessive
(i) Flower colour	Purple	White
(ii) Seed shape	Round	Wrinkled
(iii) Flower position	Axial	Terminal

18. Does the sex of the child depend on the father or it is just a matter of chance. Discuss.

Ans. The sex of a child depends on the father. If the egg (X) is fused by Y bearing sperm at the time of fertilisation, the resulting combination is XY, i.e., male constitution and the child produced will be male (son).

19. Explain why generally only male child suffers from colourblindness not the female?

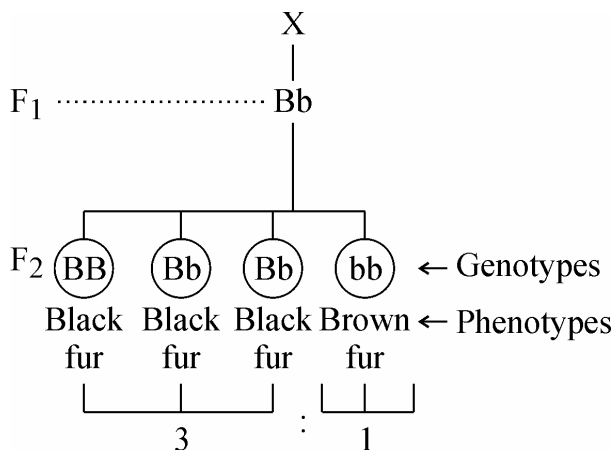
Ans. Colourblindness is more common in males than the females because this defect occurs due to a recessive gene which occurs in X chromosome.



20. In a certain species of animals, blackfur (B) is dominant over brown fur (b).

Show possible ratio of genotype and phenotypes of the offspring.

Ans. Parents BB



21. (i) Name two animals which have nineteen pairs of chromosomes.

(ii) Differentiate between genotype and phenotypes.

Ans.(i) Both lion and tiger have nineteen pairs of chromosome.

(ii)

Genotype	Phenotype
It is a combination of genes in an organism.	The expressed character which is genetically controlled.
TT, Tt and tt are genotypes.	Tall pea plant, dwarf pea plant etc. are phenotype.