Heredity and Evolution

EXERSISE 1.1

I. Multiple Choice Questions (1 Mark)

Choose the correct answer from the given options.

1. Exchange of genetic material takes place in
(*a*) vegetative reproduction (*b*) asexual reproduction
(*c*) sexual reproduction (*d*) budding

2. Sugarcane field has little variation because of
(*a*) sexual reproduction (*b*) asexual reproduction
(*c*) Both (*a*) and (*b*) (*d*) None of these

3. When two parents are crossed, the offsprings are referred to
(*a*) F_1 generation (*b*) F_2 generation
(*c*) Either F_1 or F_2 (*d*) None of these

4. A cross between two individuals result are in ratio of 9:3:3:1. The cross is
(*a*) Monohybrid cross (*b*) Dihybrid cross
(*c*) Cross-pollination (*d*) Self pollination

5. A Mendelian experiment consisted of breeding tall pea plants bearing violet flowers with short pea plants bearing white flowers. In the progeny, all bore violet flowers, but almost half of them were short. This suggests that the genetic makeup of tall plant can be depicted as
(*a*) TTWW (*b*) TTww (*c*) TtWW (*d*) TtWw [*NCERT*]

6. Two pea plants one with round green seeds (RRyy) and another with wrinkled yellow (rrYY) seeds produce F_1 progeny that have round, yellow (RrYy) seeds. When F_1 plants are selfed, the F_2 progeny will have new combination of characters. Choose the new combination from the following.
(*i*) Round, yellow (*ii*) Round, green
(*iii*) Wrinkled, yellow (*iv*) Wrinkled, green
(*a*) (*i*) and (*ii*) (*b*) (*i*) and (*iv*) (*c*) (*ii*) and (*iii*) (*d*) (*i*) and (*iii*)

7. Select the statements that describe characteristics of genes
(*i*) genes are specific sequence of bases in a DNA molecule
(*ii*) a gene does not code for proteins
(*iii*) in individuals of a given species, a specific gene is located on a particular chromosome
(*iv*) each chromosome has only one gene
(*a*) (*i*) and (*ii*) (*b*) (*i*) and (*iii*) (*c*) (*i*) and (*iv*) (*d*) (*ii*) and (*iv*)

II. Assertion-Reason Type Questions (1 Mark)

For question numbers 1 to 4 two statements are given-one labeled as **Assertion** (A) and the other labeled **Reason** (R). Select the correct answer to these questions from the codes (*a*), (*b*), (*c*) and (*d*) as given ahead:
(*a*) Both 'A' and 'R' are true and 'R' is correct explanation of the Assertion.
(*b*) Both 'A' and 'R' are true but 'R' is not correct explanation of the Assertion.
(*c*) 'A' is true but 'R' is false.
(*d*) 'A' is false but 'R' is true.

1. Assertion: If one bacterium divides then two resultant bacteria divide again to generate four individual bacteria which will be highly identical.
Reason: It is due to asexual reproduction.

2. Assertion: Two pink coloured flowers on crossing resulted in 1 red, 2 pink and 1 white flower progeny.
Reason: It is due to double fertilisation.

3. Assertion: The sex of a child in human beings will be determined by the type of chromosome he/she inherits from the father.
Reason: A child who inherits 'X' chromosome from his father would be a girl (XX), while a child who inherits a 'Y' chromosome from the father would be a boy (XY). [*CBSE* 2020]

4. Assertion: Dominant traits express itself with or without the presence of recessive trait.
Reason: Recessive trait can express itself only in absence of dominant trait.

5. Assertion: A geneticist crossed a pea plant having violet flowers with a pea plant with white flowers, he got all violet flowers in first generation.
Reason: White colour gene is not passed on to next generation.

III. Very Short Answer Type Questions (1 Mark)

1. If a trait 'A' exists in 10% of the population of asexually reproducing species and trait 'B' exists in 60% of the same population, which trait is likely to have arisen earlier? [*NCERT*]

2. How does the creation of variations in a species promote survival? [*NCERT*]

3. What is DNA? [*Delhi* 2016]

4. Where is DNA found in the cell? [*Delhi* 2015]

5. Give the respective scientific names used for studying:
(*i*) the mechanism by which variations are created and inherited by organism from the previous generation.
(*ii*) the development of new type of organisms from the existing ones. [*Delhi* 2014]

6. What is a gene? [*Delhi* 2014]

7. Name the information source for making proteins in the cells. [*Delhi* 2014]

8. What is heredity? [*Delhi* 2014]

9. No two individuals are absolutely alike in a population. Why?

10. All the variations in the species do not have equal chances of survival. Why? [*Delhi* 2014]

11. Why do mice whose tails were surgically removed, continue to produce mice with tails?

12. A tall plant is crossed with a dwarf plant. What will be the ratio of homozygous tall and heterozygous dwarf plant in F_2 generation?

13. Name the genetic material that is responsible for the inheritance of traits. [*Delhi* 2014]

14. Do genetic combination of mothers play a significant role in determining the sex of a new born? [**HOTS**]

15. A man with blood group 'A' marries a woman with blood group 'O' and their daughter has blood group O. Is this information enough to tell you which of the traits-blood group A or O is dominant? Why or why not? [*NCERT*] [**HOTS**]

16. What type of traits are phenotype? [**HOTS**]

17. What is genotype? [**HOTS**]

18. State Mendel's first law of inheritance. [**HOTS**]

19. State Mendel's second law of inheritance. [**HOTS**]

20. What is variation?

21. Name the human traits which show variations. [**HOTS**]

22. What is monohybrid cross? [**HOTS**]

23. What is the scientific name of man and garden pea?

24. What are sex chromosomes? [**HOTS**]

25. What are chromosomes? Where are they located? [**HOTS**]

26. What indication do we get by appearance of dwarf plant in F_2 generation?

27. Why is it that asexual reproduction produces exact copies but sometimes minor variations are seen in next progeny?

28. Name the term used for traits that are exhibited externally. [*CBSE* 2014]

29. Give an example where sex determination is regulated by environmental factors. [*CBSE* 2014]

30. Name the plant on which Mendel performed his experiments. [*CBSE* 2013, 14]

31. Mendel observed a contrasting trait in relation to position of flowers. Mention that trait.

32. In order to ensure than Mendel gets pure breeding plants in his experiments, what did he do?

33. A Mendelian experiment consisted of breeding pea plants bearing violet flowers with pea plants bearing white flowers. What will be the result in F_1 progeny? [*CBSE* 2018]

34. How can chromosomes be identified? [*CBSE* 2015]

35. What is sex of the baby that inherits Y-chromosome from the father? [*CBSE* 2014]

IV. Short Answer Type Questions-I (2 Marks)

1. The chromosomal number of the sexually producing parents and their offspring is the same. Justify this statement. [*Delhi* 2014]

2. How do Mendel's experiments show that traits may be dominant or recessive? [*NCERT*]

3. List two differences in tabular form between dominant traits and recessive traits.

4. Why are small number of surviving tigers a cause of worry from genetics point of view? [*NCERT*]

5. A study found that children with light-coloured eyes are likely to have parents with light-coloured eyes. On this basis, can we say anything whether the light eye colour trait is dominant or recessive? Why or why not? [*NCERT*] [**HOTS**]
6. (*a*) On what rules inheritance is based? [*CBSE* 2016]
   (*b*) Is each trait influenced by both parental and maternal DNA?
7. What is F_2 generation? [*CBSE* 2015]
8. If YYRR is round yellow, what do the following represent? [*CBSE* 2015]
   yyrr yyRR
9. In a monohybird cross between tall pea plants denoted by TT and short pea plant by tt, Sehaj Anant obtained only tall plants denoted by Tt in F_1 generation. However in F_2 generation she obtained both tall and short plants. Using the above information explain the law of dominance. [*CBSE* 2013, 14]
10. How can we say that change in genes can be brought by the change in DNA? [*CBSE* 2014]
11. Where are genes located? What is the chemical nature of genes? [*CBSE* 2014]
12. Sex determination in man depends upon 23rd pair of chromosomes, called the sex chromosomes. If it were a homologous pair-XX, it would be a female. If it were a heterologous pair – XY, it would be a male. Based on this statement, answer these questions:
   (*i*) How many types of eggs/ova and how many type of sperms female and male human being will produce respectively ?
   (*ii*) Which parent's contribution of sex chromosomes determines sex of the child?
13. (*a*) What is genetic constitution of human sperm?
   (*b*) Mention the chromosome pair present in zygote determining the sex of male child.

V. Short Answer Type Questions-II (3 Marks)

1. Study the following cross showing self pollination in F_1, fill in the blank and answer the question that follow:

Parents	RRYY	×	rryy
	Round, yellow		Wrinkled, green
F_1	Rr Yy	×	.....

   What are the combinations of character in the F_2 progeny? What are their ratios? [*NCERT Exemplar*]
2. Explain the Mendel's concept of heredity, by giving three points. [*CBSE* 2016]
3. An angiosperm plant having red flowers when crossed with the other having same colour flower produced 40 progenies, out of which 30 were red coloured flowers, 10 plants were with white flowers. Find out:
   (*i*) What is the possible genotype of parent plants?
   (*ii*) Which trait is dominant and recessive?
   (*iii*) What is the cross called and what is phenotype ratio? [*CBSE* 2016]
4. In a pea plant, find the contrasting trait if
   (*i*) The position of flower is terminal.
   (*ii*) The flower is white in colour
   (*iii*) Shape of pod is constricted.
5. A cross was carried out between pure breed tall pea plant with pure dwarf pea plant and F_1 progeny was obtained. Later, F_1, progeny was selfed to obtain F_2 progeny. Answer the following questions: [*CBSE* 2013, 2014]
   (*a*) What is the phenotype of the F_1 progeny and why?
   (*b*) Give the phenotypic ratio of the F_2 progeny.
   (*c*) Why is F_2 progeny different from the F_1 progeny?
6. 'DNA is the carrier of the genetic information'. Justify.
7. "It is a matter of chance whether a couple will have a male or a female child." Justify this statement by drawing a flow chart. [*Foreign* 2015]

OR

In humans, there is a 50% probability of the birth of a boy and 50 % probability that a girl will be born. Justify the statement on the basis of the mechanism of sex-determination in human beings.

[*CBSE Sample Paper* 2021]

8. What do you understand by the following terms:
(*i*) Phenotype (*ii*) Genotype
(*iii*) Dominant trait (*iv*) Recessive trait
(*v*) Factors or Genes

9. Mention the total number of chromosomes along with the sex chromosomes that are present in a human female and a human male. Explain how in sexually producing organisms the number of chromosomes in the progeny remains the same as that of the parents. [*Delhi* 2017]

OR

What are chromosomes? Explain how in sexually reproducing organisms the number of chromosomes in the progeny is maintained. [*CBSE* 2020]

10. How did Mendel explain that it is possible that a trait is inherited but not expressed in an organism? [*CBSE* 2017]

OR

"It is possible that a trait is inherited but may not be expressed." Give a suitable example to justify this statement. [*Foreign* 2015]

11. In a pea plant, the trait of flowers bearing purple colour (PP) is dominant over white colour (pp). Explain the inheritance pattern of F_1 and F_2 generations with the help of a cross following the rules of inheritance of traits. State the visible characters of F_1 and F_2 progenies.

12. After self-pollination in pea plants with round, yellow seeds, following types of seeds were obtained by Mendel:

Seeds	Number
Round, yellow	630
Round, green	216
Wrinkled, yellow	202
Wrinkled, green	64

Analyse the result and describe the mechanism of inheritance which explains these results.
[*CBSE Sample Paper* 2021]

VI. Long Answer Type Questions (5 Marks)

1. How do Mendel's experiments show that traits are inherited independently? [*AI* 2016]

2. How do Mendel's experiments show that
(*a*) traits may be dominant or recessive?
(*b*) inheritance of two traits is independent of each other? [*Delhi* 2017]

3. (*a*) What is the law of dominance of traits? Explain with an example.
(*b*) Why are the traits acquired during the life time of an individual not inherited? Explain.
[*CBSE* 2020]

Answers 1.1

I. 1. (*c*) sexual reproduction **2.** (*b*) asexual reproduction
3. (*a*) F_1 generation **4.** (*b*) Dihybrid cross.
5. (*c*) TtWW **6.** (*b*) (*i*) and (*iv*)
7. (*b*) (*i*) and (*iii*)

II. 1. (*a*) Both 'A' and 'R' are true and 'R' is correct explanation of the assertion.
2. (*c*) 'A' is true but 'R' is false because it is due to self pollination.
3. (*a*) Both 'A' and 'R' are true and 'R' is correct explanation of the assertion.
4. (*b*) Both 'A' and 'R' are true but 'R' is not correct explanation of the assertion.
5. (*a*) Both 'A' and 'R' are true and 'R' is correct explanation of the assertion.

III. 1. Trait 'B' is likely to have arisen earlier, because it has higher percentage in the population. In asexual reproduction, the traits which are present in parent generation are carried over to next generation with minimum variation.

2. Variations lead to adaptation of an organism, which is then able to survive in difficult and unfavourable environmental conditions. It means variations promote survival.
3. DNA stands for deoxyribonucleic acid. It is self replicative, molecule present in all living organisms as the main constituent of chromosomes. It passes on genetic characteristics to offsprings.
4. DNA is found in the nucleus of the eukaryotic cells and cytoplasm of prokaryotic cells. It is also present in plastids and mitochondria.
5. (*i*) Heredity (*ii*) Evolution
6. Gene is the unit of heredity present in chromosomes, DNA which directs specific protein synthesis, when it is passed from the parent to the offspring.
7. DNA
8. Heredity is a process in which traits are passed onto the offspring from parents.
9. Sexual reproduction involves combination of genes from two parents, the genetic material gets exchanged between pairs of chromosomes before formation of their gametes which cause changes.
10. All variations will not be able to survive in the environmental changes, which is an essential requirement for survival.
11. It is because cutting of tail is done surgically and it is not inherited.
12. The ratio of homozygous tall and heterozygous dwarf plant in F_2 generation is 3 : 1.
13. Gene or DNA
14. No, mother does not play an important role because mother has only 'X' chromosomes whereas father has both X and Y chromosomes. When offspring takes 'X' from mother and 'Y' from father, then baby boy is born.

    If offspring takes 'X' chromosomes from mother as well as father, girl child is born. The probability of getting boy or girl is 50 : 50.
15. The information is not sufficient because information is confined upto two generation. We need information about third generations to predict the dominant trait.
16. The traits which are visible to us are called phenotype, e.g. tall or dwarf (short) are phenotype traits of the plants.
17. Genotype shows the genetic constituent of an organism, i.e. it is the description of genes present in an organism. For example, TT, Tt or tt where T and t are the different forms of the same gene. The genotype of tall plant is TT and that of dwarf plant is 'tt'.
18. Mendel's first law, also known as the law of segregation states that 'during gamete formation, the alleles of the character segregate in such a way that each gamete carries only one allele for each gene'.
19. Mendel's second law, also known as the law of independent assortment states 'that for different traits genes segregate independently during the formation of gametes'.
20. Variation is the difference in characteristics or traits among the individuals in a particular species.
21. (*i*) Colour of eye, (*ii*) Height, (*iii*) Colour of skin
22. Monohybrid cross is the cross between two individuals with one pair of different traits.
23. Man — *Homo sapiens*

    Garden pea — *Pisum sativum*
24. Those chromosomes which decide whether the offspring will be male or female are called sex chromosomes. Many animals have two types of chromosomes. Human beings have 'X' and 'Y' sex chromosomes.
25. Chromosomes are long thread like structures which contain genetic information of an individual. These are located in the nucleus of a cell.
26. After obtaining F_2 progeny from F_1 generation in the dihybrid cross, Mendel concluded that when two pairs of traits are combined in a hybrid, one pair of character segregates independently from the other pair of character.
27. Bio-chemical reactions are not fully reliable, therefore, it may cause slight difference which causes these variations.
28. Phenotype.
29. In snail, sex is determined by temperature i.e., environmental factor.
30. Garden pea (*Pisum Sativum*)
31. Terminal flowers have recessive trait whereas axial flowers have dominant trait.

32. Mendel allowed each variety to self fertilise for several generations.

33. Violet flowers

34. Individual chromosomes can be identified by their lengths, position of centromere and binding pattern of staining and shape.

35. Male

IV. 1. Offspring always takes 23 chromosomes from father and 23 chromosomes from mother and in total has 46 chromosomes. It means that total number of chromosomes remain constant.

2.
- Mendel selected pure breed of tall (TT) and short (tt) pea plants.
- He crossed these plants and carefully produced seeds. This is called F_1 generation.
- All the plants in F_1 generation were tall, showing that tallness is dominant trait.
- Now these plants were self pollinated.
- In the F_2 generation, 3 out of 4 plants, i.e. 75% were tall and one out of four, i.e. 25% were short plants. It shows that shortness is the recessive trait.

3.

Dominant traits	Recessive traits
It expresses itself with or without the presence of recessive trait.	It is able to express itself only in the absence of dominant trait.
For example: tall plant, round seed, violet flower etc. are dominant traits in a pea plant.	Dwarf plant, wrinkled seed, white flower, etc. are recessive traits in a pea plant.

4. (*i*) Tigers may get extinct in near future due to natural calamities, lack of available food and due to their small number.

(*ii*) Cross breeding may be less possible. Variations will not occur, which is essential for the survival.

(*iii*) Adaptation due to changing environment, like cutting of forests, global warming becomes difficult.

(*iv*) Protection from enemies is easy if they are more in number.

5. We cannot predict because information is not sufficient. We can decide dominant or recessive trait if we have the data for at least three generations. More information is required.

6. (*a*) (*i*) Law of dominance. (*ii*) Law of segregation (*iii*) Law of independent assortment

(*b*) Yes, each trait is influenced by DNA of both parents.

7. The generation produced by the offsprings of F_1 generation is called F_2 or second generation.

8. yyrr – wrinkled, green seeds

yyRR – Round, green seeds.

9. According to law of dominance, dominant trait is expressed in F_1 generation although dominant as well as recessive traits are inherited. Single copy of dominant trait is sufficient for expression of tall dominant trait in F_1 generation.

10. A gene is present on a segment of DNA chromosome.

(*i*) It provides information of one protein to another and is responsible for its change.

(*ii*) It ensures stability of DNA.

It means change in gene segment of DNA will bring change in DNA.

11. Genes are located on chromosomes at fixed positions. They are made of nucleic acid (DNA) therefore acidic in nature.

12. (*i*) Male produces two genetic types of sperms, half with X and other half with Y chromosome. The female produces only one genetic type of ova, all carrying X chromosome.

(*ii*) Sex of children will be determined by what they inherit from their father, and not from their mother.

13. (*a*) 22 + Y chromosome or 22 + X chromosomes.

(*b*) (22 + X + 22 + Y) = (44 + X + Y) chromosomes.

V. 1. F_1 progeny is Rr Yy-Round, Yellow

Combinations of character in the F_2 progeny are:

(*i*) Round yellow — 9 (Both dominant traits)

(*ii*) Round green — 3 (One recessive, one dominant)

(*iii*) Wrinkled yellow — 3 (One dominant, one recessive)
(*iv*) Wrinkled green — 1 (both recessive traits)
The ratio is 9 : 3 : 3 : 1

2. (*i*) Mendel worked on pea plant.
(*ii*) He found that traits are controlled by genes which come in pairs.
(*iii*) Genes are inherited as separate units, one from each parent.

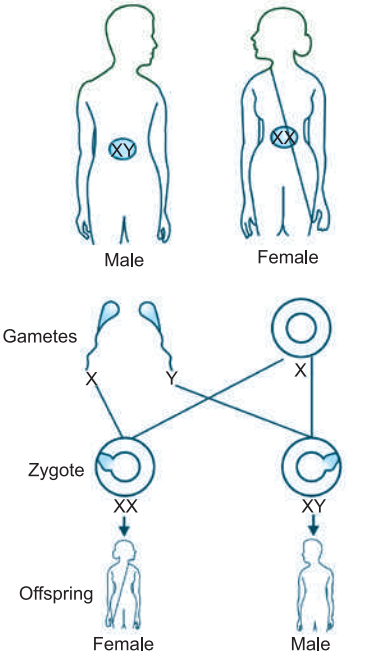
3. (*i*) Rr and Rr
(*ii*) Red colour of flower is dominant trait while white colour is the recessive trait.
(*iii*) Monohybrid cross, phenotype ratio is 3 : 1.

4. (*a*) Axial position of flower.
(*b*) The flower is violet in colour.
(*c*) Shape of pod is inflated.

5. (*a*) Tall because it is a dominant trait whereas dwarf is a recessive trait.
(*b*) 3 : 1 is ratio between tall to dwarf.
(*c*) In F_2 generation, recessive genes are also expressed in homozygous condition.

6. Most of the characters or traits of an organism are controlled by the genes. Genes are actually segments of DNA guiding the formation of proteins by the cellular organelles. These proteins may be enzymes, hormones, antibodies, and structural components of different types of tissues. In other words, DNA (genes) is responsible for structure and functioning of a living body. Genotype of an individual controls its phenotype.

In human beings there are 23 pairs of chromosome. We inherit half of our chromosomes (genes) from our two parents. This means half of DNA in each cell has been inherited from each parent, hence we resemble both of them or their side of family members.



7. Justification: Women produce only one type of ovum (carrying X chromosome) and males produce two types of sperms (carrying either X or Y chromosome) in equal proportions. So the sex of a child is a matter of chance depending upon the type of sperm fertilising the ovum.

8. (*i*) **Phenotype:** The set of characteristics observed in an individual as a result of interaction of its genotype with the environment.
(*ii*) **Genotype:** The genetic make up of the cell which determines the characteristics (phenotype) of an organism.
(*iii*) **Dominant trait:** The trait of the parent that expresses itself in the offspring.
(*iv*) **Recessive trait:** The trait of the parent appearing in the offspring which cannot express itself in the presence of dominant trait.
(*v*) **Factors or Genes:** The units of inheritance responsible for a trait in an individual.

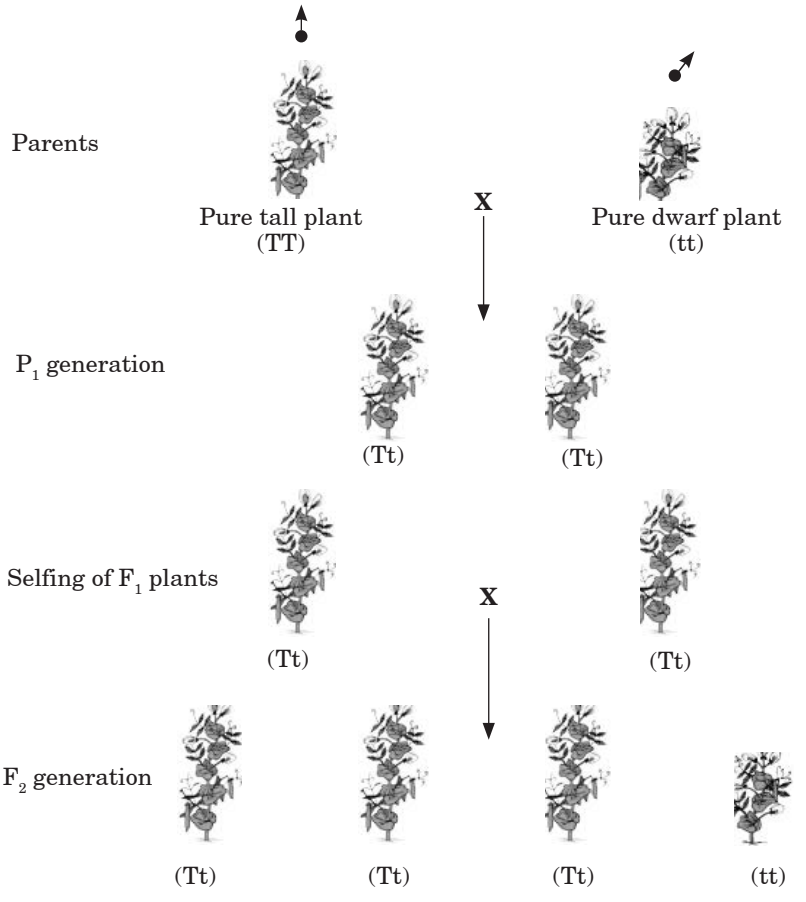
9. Chromosomes are long thread like structures which contain heriditary information of individual and are carrier of genes.

The total number of chromosomes present in both human male and female is 46. Out of these, two chromosomes are the sex chromosomes. In human males, the two sex chromosomes present are X and Y, while in human female, both sex chromosomes are X.

During sexual reproduction, the new individual is formed by the fusion of gametes from both the parents. These gametes are haploid in nature, i.e. they contain only one set of the chromosomes. They are formed by the meiosis, a type of cell division which reduces chromosome number to half. When these haploid gametes fuse during fertilisation, the two nuclei of these gametes fuse and the chromosome number is then restored to normal. Hence, the progeny formed has the same number of chromosomes as that of the parents.

10. Some traits that are inherited may not express themselves. Such hidden traits are known as recessive traits. Mendel explained this phenomenon with the help of monohybrid cross. In a monohybrid cross performed by Mendel, a tall plant was crossed with a dwarf plant which produced all tall plants in F_1 progeny.

However, when these F_1 tall plants were crossed with each other, 'dwarf' trait, which was not observed in the F_1 generation, reappeared in the F_2 progeny.



By this, it is concluded that dwarfness is a trait of parent pea plant that was not lost. It was suppressed in the F_1 generation by the tallness trait and reappeared in the F_2 generation. So, we can say that a trait that is inherited may not be always expressed in an organism.

11. Let purple trait be represented by: PP, White trait be : pp

parents: PP X pp

↓

F_1 Pp X Pp (Selfing)

↓

Gametes	P	p
P	PP	Pp
p	Pp	pp

Visible characters of F_1 progeny has all flowers purple coloured and in F_2 progeny 3 are purple coloured and 1 is white coloured flower.

12. The ratio obtained is 9:3:3:1 in which parental as well as new combinations are observed. This indicates that progeny plants have not inherited a single whole gene set from each parent. Every germ cell takes one chromosome from the pair of maternal and paternal chromosomes. When two germ cells combine, segregation of one pair of characters is independent of other pair of characters.

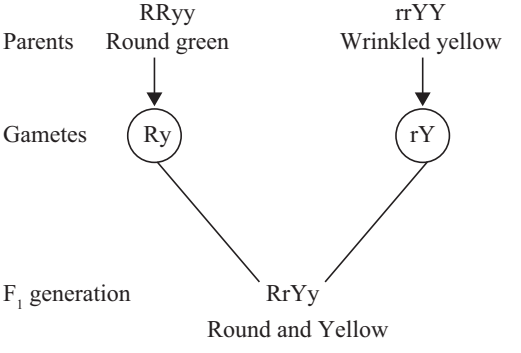
VI. 1. Mendel carried out dihybrid crosses by crossing two pea plants differing in contrasting traits of two characters. For example, he crossed a pea plant having yellow colour and round seed characters with another pea plant bearing green colour and wrinkled seed characters. In the F_2 generation, he obtained pea plants with two parental and two recombinant phenotypes as yellow round and green wrinkled (parental) and yellow wrinkled and green round (recombinant). This indicated that traits separated from their original parental combinations and got inherited independently.

2. (*a*) Mendel demonstrated that traits can be either dominant or recessive through his monohybrid cross. He crossed true-breeding tall (TT) and dwarf (tt) pea plants. The seeds formed after fertilisation were grown and the plants that were formed represent the first filial or F_1 generation. All the F_1 plants obtained were tall.

Then, Mendel self-pollinated the F_1 plants and observed that all plants obtained in the F_2 generation were not tall. Instead, one-fourth of the F_2 plants were short.

(*For diagram refer to Ans. 10, Short Answer Type Questions-II*)

From this experiment, Mendel concluded that the F_1 tall plants were not true breeding; they were carrying traits of both short height and tall height. They appeared tall only because the tallness trait was dominant over the dwarfness trait. This shows that traits may be dominant or recessive.



(*b*) Mendel demonstrated that traits are inherited independently through his dihybrid cross. He considered two traits at a time, seed colour and seed shape in which yellow colour (YY) and round shape (RR) are dominant over green colour (yy) and wrinkled shape (rr), respectively.

Mendel cross bred the plants and observed that the F_2 progeny of dihybrid cross had a phenotypic ratio of 9 : 3 : 3 : 1 and produced nine plants with round yellow seeds, three plants with round green seeds, three plants with wrinkled yellow seeds and one plant with wrinkled green seeds.

	RY	**Ry**	**rY**	**ry**
RY	RRYY Round yellow	RRYy Round yellow	RrYY Round yellow	RrYy Round yellow
Ry	RRYy Round yellow	RRyy Round green	RrYy Round yellow	Rryy Round green
rY	RrYY Round yellow	RrYy Round yellow	rrYY Wrinkled yellow	rrYy Wrinkled yellow
ry	RrYy Round yellow	Rryy Round green	rrYy Wrinkled yellow	rryy Wrinkled green

In this experiment, he found that round yellow and wrinkled green are parental combinations whereas round green and wrinkled yellow are the new combinations. In a dihybrid cross between two plants having round yellow (RRYY) and wrinkled green seeds (rryy), four types of gametes (RY, Ry, rY, ry) are produced. Each of these gametes segregate independently of each other and each has a frequency of 50% of the total gametes produced.

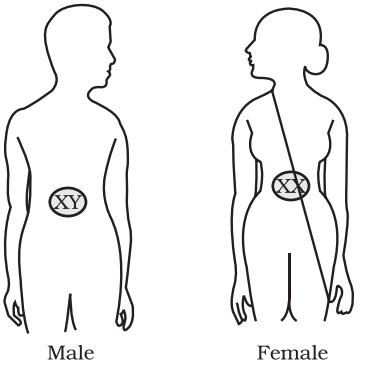
From this experiment, he concluded that when two pairs of traits are combined together in a hybrid, one pair of character segregates independently of the other in terms of character. This is known as the law of independent assortment.

3. (*a*) **Law of dominance:** Some alleles are dominant while others are recessive. An organism with at least one dominant allele will display the effect of dominant trait e.g. If we carry out a cross between pure breed tall pea plant with pure dwarf pea plant then F_1 progeny will be tall plant because it is dominant trait whereas dwarf is a recessive trait.

(*b*) Acquired traits even if cause genetic changes in non-reproductive tissues, can not be passed on to next generation.
Genetic changes in reproductive tissues can only be passed on to next generation.

CASE STUDY QUESTION

1. In some animals, the temperature at which fertilised eggs are kept determines whether the animal developing in the egg will be male or female. In other animals, such as snails, individuals can change sex, that is sex is not genetically determined. In human beings, sex of individuals is largely genetically determined. All chromosomes in human beings are not paired. We have 22 pairs and one pair of sex chromosomes which is odd and not always a perfect pair.



(*i*) Which pair of chromosomes are present in Male

(*a*) XX (*b*) YY

(*c*) XY (*d*) XXY

(*ii*) Which pair of chromosomes are present in female?

(*a*) XX (*b*) YY

(*c*) XY (*d*) XXY

(*iii*) Who is responsible for birth of male child?

(*a*) Father (*b*) Mother

(*c*) Father only in first pregnancy.

(*d*) Mother only in first pregnancy

(*iv*) How many pairs of chromosomes are called autosomes?

(*a*) 23 (*b*) 22

(*c*) 21 (*d*) 20

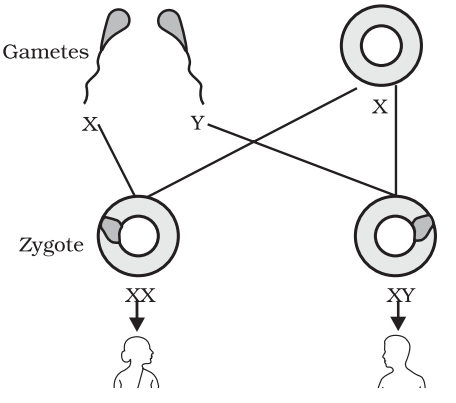
(*iv*) Which of the following statement is true?

(*a*) Men have short sized X chromosome

(*b*) Men have one long sized Y chromosome

(*c*) Men have normal sized Y chromosome

(*d*) Men have one short sized Y chromosome



Ans. (*i*) (*c*) (*ii*) (*a*) (*iii*) (*a*)
(*iv*) (*b*) (*v*) (*d*)

ASSIGNMENT

Total Marks : 20

I. Multiple Choice Questions (1 Mark)

Choose the correct answer from the given options.

1. Colour of eyes is

(*a*) Acquired trait (*b*) Inherited trait

(*c*) Due to changes in non-reproductive tissue

(*d*) Can't be passed on to offspring

2. A cross between two individuals result are in ratio of 9:3:3:1. The cross is

(*a*) Monohybrid cross (*b*) Dihybrid cross

(*c*) Cross-pollination (*d*) Self pollination

II. Assertion-Reason Type Questions (1 Mark)

Note: Use instructions as given in topical exercises of the chapter.

1. Assertion: A sperm carrying Y-chromosome fertilise an egg with X-chromosome to develop a male zygote XY.

Reason: A sperm carrying X-chromosome fertilise an egg to develop a female zygote.

2. Assertion: Change in genetic composition results in variation.

Reason: All variations in a species have equal chance of survival.

III. Very Short Answer Type Questions (1 Mark)

1. What are alleles? Give example.

2. Mendel took tall pea plants and short pea plants and produced F_1 progeny through cross fertilization. What did Mendel observe in F_1 progeny? [*CBSE* 2018(C)]

IV. Short Answer Type Questions-I (2 Marks)

1. Give two differences between somatic variation and genetic variation.

2. A man with blood group A marries a woman with blood group O and their daughter has blood group O. Is this information enough to tell you which of the traits- blood group A or O is dominant? Why?

3. How do Mandel's experiments show that traits may be dominant or recessive?

V. Short Answer Type Question-II (3 Marks)

1. Define the term variation. Why is variation beneficial to a species? List two reasons for the appearance of variations among the progeny formed by sexual reproduction [*CBSE* 2020]

VI. Long Answer Type Question (5 Marks)

1. Name the plant Mendel use for his experiment. What type of progeny was obtained by Mendel in F_1 and F_2 generation when he crossed the tall and short plants? Write the ratio he obtained in F_2 generation plants. [*Delhi,* 2015, 2019]