3. Genetics

Exercise Questions

1. Question

Who gave the term ‘Genetics’:

A. Mendel

B. Bateson

C. Morgan

D. Punnett

Answer

Danish botanist Wilhelm Johannsen coined the word "gene" in 1909 to describe the fundamental physical and functional units of heredity. In 1905 William Bateson coined the term genetics from the word gene.

2. Question

On which Mendel did his experiments:

A. Sweet pea

B. wild pea

C. Garden pea

D. All the above

Answer

Mendel selected garden pea for his experiment because it has short life cycle, so can easily can study many generation in short period of time. Artificial self-pollination can easily be done in garden pea plant.

3. Question

What is called the branch of study of heredity and variations?

A. Genetics

B. Geology

C. Forestry

D. none of these

Answer

Genetics is the branch of science which involves the study of genes, heredity, and variation in living organisms. In genetics we study the process of inheritance of characters from parents to offspring.

4. Question

Green colour of pea pod is which type of character:

A. Dominate

B. Recessive

C. Incomplete dominant

D. Co-dominant

Answer

The characters which are not expressed in F_1 generation are recessive character. Example when yellow pod pea plant is crossed with green pod plant. The offspring in F_1 are all plant with yellow pod. Therefore, green pod is a recessive character.

5. Question

Generally how many alleles are of a gene?

A. Four

B. Three

C. Two

D. One

Answer

Alternative form of the same gene is called allele. Example gene for height of a plant is denoted by T for tall plant and t for dwarf (short) plant. So, gene T and t are alleles.

6. Question

How many pairs of contrasting characters were chosen by Mendel for his experiment?

A. 34

B. 2

C. 12

D. 7

Answer

Mendel selected seven (7) pair of contrasting characters. These are plant height, flower colour, position of flower, shape of pod, colour of pod, shape of seed and colour of seed.

Traits	Shape of Seeds	Color of Seeds	Color of Pods	Shape of Pods	Plant Height	Position of Flowers	Flower Color
Dominant trait	Round 	Yellow	Green 	Full 	Tall 	At leaf junctions 	Purple 
Recessive trait	Wrinkled 	Green 	Yellow 	Flat, constricted 	short 	At tips of branches 	White 

7. Question

When F_1 generation plant is crossed with anyone of parent generation plant, then it is known as:

A. Reciprocal cross

B. Test cross

C. Back cross

D. All the above

Answer

When F_1 hybrids are crossed with any of the parent in order to achieve offspring with a genetic identity which is closer to that of the parent. It is used in horticulture, animal breeding and in production of gene.

8. Question

The ratio of offspring obtained by Tt x tt cross :

A. 3:1

B. 1:1

C. 1:2:1

D. 2:1

Answer

50% plants will be heterozygous tall and 50 % are dwarf if gene T determines the height of the plant.

The ratio of tall (Tt) and dwarf (tt) is 1:1

9. Question

Which contrasting character was not chosen by Mendel in his experiments:

A. Colour of root

B. Colour of flower

C. colour of seed

D. Colour of pod

Answer

Mendel selected seven (7) pair of contrasting characters. These are plant height, flower colour, the position of flower, the shape of the pod, the colour of pod, the shape of seed and colour of seed. But he has not chosen the colour of root for his experiment.

10. Question

How many genotypes are formed in F_2 generation of monohybrid cross:

A. 2

B. 3

C. 4

D. 9

Answer

Genotypes are formed in F_2 generation of monohybrid cross are in the ratio 1:2:1. 1 plant is pure tall (TT), 1 plant is a pure dwarf (tt) and 2 plants are hybrid tall (Tt). T is a dominant gene for tallness and t is a recessive gene for dwarfness.

11. Question

Who is known as the father of genetics?

Answer

Gregor Mendel is known as the "Father of Genetics". He had performed an experiment with plants in 1857 that led to increased interest in the study of genetics. Mendel studied at the University of Vienna from where he performed many scientific experiments with plants and postulated ‘Laws of heredity’.

12. Question

On which plant Mendel did his experiments?

Answer

Mendel selected garden pea for his experiment because it has a short life cycle, so can easily can study many generations in a short period of time. Artificial self-pollination can easily be done in garden pea plant.

13. Question

What is called the dominant character?

Answer

A dominant character is an inherited characteristic which appears in an F1 offspring. It is transferred from a parent through a *dominant allele.* For example, tall (T) is a dominant gene over its allele (alternative form of the same gene) that is (t).

14. Question

Transmission of genetic character from one generation to another generation is known as……..

Answer

Transmission of genetic character from one generation to another generation is known as **heredity**. Transmission of hereditary characters from parental generation to offspring generation is called heredity. The term 'Heredity' was given by Spencer (1863).

15. Question

Who rediscovered the Mendel's law?

Answer

The laws of inheritance presented by Mendel were ignored for 35 Years. Hugo De Vries of Holland Carl Correns of Germany, and Erick Von Tschermak, they worked separately and rediscovered the laws of inheritance of Mendel in 1900.

16. Question

What is the full name of Mendel?

Answer

Full name of Mendel: Gregor Johann Mendel.

He was an Austrian monk who discovered the basic principles of heredity through experiments on the garden pea.

Gregor Johann Mendel

17. Question

Write the names of laws given by Mendel.

Answer

After performing his breeding experiments on garden pea, Mendel postulated three laws:

I. Law of dominance

II. Law of segregation or law of purity of gametes

III. Law of independent assortment

18. Question

What is called a test cross?

Answer

A *test cross was* first introduced by Gregor Mendel, to identify whether an organism showing a dominant character is homozygous or heterozygous for a particular allele. The organism in question is crossed with an organism that is homozygous for the recessive character, and the offspring of the *test cross* is studied.

19. Question

What is meant by out cross?

Answer

Out cross is a cross in which F1 plant (Tt) is crossed with dominant parent plant (TT). All the offspring plants obtained by this cross are 100% tall. Among all tall 50%, offspring are homozygous (TT) tall and 50% are heterozygous (Tt) tall plants.

20. Question

Which law given by Mendel cannot be explained by monohybrid cross?

Answer

Law of independent assortment can be explained by monohybrid cross because to explain the law of independent assortment, two pairs of contrasting characters such as the height of the plant and seed colour are required.

21. Question

Write differences between phenotype and genotype?

Answer

Phenotype	Genotype
The phenotype of an organism is the observable physical or biochemical characteristics of an organism	Genotype is the genetic constitution of any living being.
Example - tall, colour are phenotypic characters	Examples – homozygous, heterozygous

22. Question

Explain dihybrid cross.

Answer

● In a dihybrid cross, two plants having two or more contrasting characters such as characters for example height of a plant and shape of a seed, are crossed then inheritance of one character is unaffected by inheritance of another character.

● Example: let's observe the cross between a tall plant with round seeds (TTYY) and a dwarf plant with wrinkled seeds (ttyy). Tall plant with round seed is dominant characters.

23. Question

Write the causes behind the success of Mendel.

Answer

The reason behind Mendel success are as follows:

(a) He studied only one character of a garden pea at a time in his breeding experiment.

(b) Mendel analyzed all the data statistically to obtain the result of experiments of hybridization.

(c) Mendel wisely selected garden pea (*Pisum sativum*) plant for his experiment.

24. Question

Why Mendel selected garden pea plant for his experiments?

Answer

Mendel selected garden pea plant for his experiment because the following characters present in garden pea:

● Garden pea is an annual plant, it became easy to study many generations in a shorter period of time.

● Garden pea have bisexual flowers, it was very easy to obtain pure or homozygous plant through the process of self-pollination.

● Artificial cross-pollination was easily done by emasculation (removal of anthers).

● Various pairs of contrasting characters are found in pea plant.

25. Question

Write a brief introduction to Mendel's life.

Answer

● Gregor Johann Mendel was born at Silicon village of Heizendarf state in Austria on 22nd July 1822.

● He became a monk of a church of Brunn city of Austria in 1843 after finishing his studies.

● He performed breeding experiments on garden pea (*Pisum sativum*) for seven years in the garden of the church (1856-1863).

● He presented the conclusions of experiments in 1865 as his research papers in front of Brunn society of Natural history.

● In 1866 these results were published as "Experiments on plant hybridization" in the annual report of the society.

● Based on the results of experiments on garden pea, he formulated 'Laws of inheritance' which were known as 'Mendelism'.

● He died on 6 January 1884.

26. Question

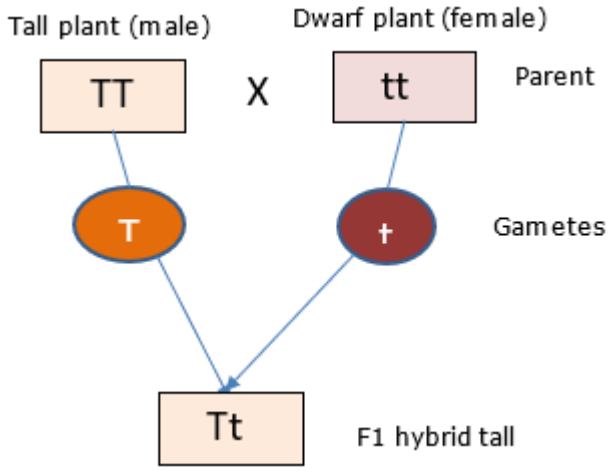
Explain Mendel's law of dominance.

Answer

● Law of Dominance was based on the results of monohybrid cross (crossing plants with one contrasting characters).

● When two homozygous plants, with one contrasting character, is crossed, the character which is expressed in an F_1 generation is known as a dominant character while the character which is not expressed in an F_1 generation is known as recessive character.

● Example: If pure or homozygous tall plants (TT) are crossed with pure homozygous dwarf plant (tt), then we obtains all the plants in F_1 generation (100%) as tall plants.



The appearance of all tall pants proves the law of dominance.

27. Question

Write about the important of Mendel's laws of inheritance.

Answer

● The expression of dominant character in living is very importantly because many harmful genes cannot express their character due to their recessive nature.

● Due to Mendel's law of segregation, the concept of gene came into being.

● New characters produced in the hybrid is due to our knowledge by the law of Mendel.

● Useless characters can be removed and useful characters can be brought together in the same species.

● Disease resistant and more yielding crops can be developed by the use of Mendel's laws of inheritance.

28. Question

Explain Mendel's law of segregation with an example.

Answer

● Law of Segregation is also known as Law of Purity of gametes. According to this law, during gamete formation in the F_1 hybrid plant both the alleles are got separated from each other and goes into separate gametes.

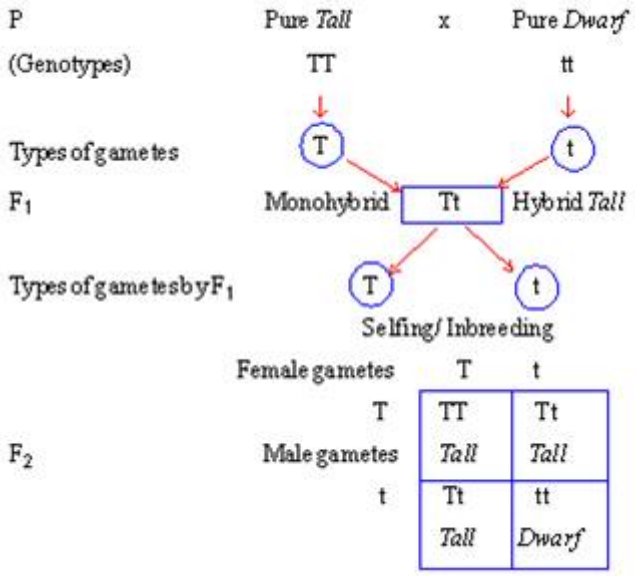
● Hence, it is known as the law of segregation or law of purity of gametes.

● Each gamete contains only one allele for one character. Thus no mixing of characters, gametes are always pure.

● Example: If homozygous tall plant (TT) is crossed with the homozygous dwarf plant (tt), then all the offspring of F_1 generation are heterozygous tall plants.

● In the heterozygous plant, both the alleles remain with each other but do not get mixed with each other.

● Both alleles are separated and go into separate gametes. Due to this reason dwarf plant again reappear in the F_2 generation.



Appearance of dwarf plant in F_2 generation confirms segregation of gametes.

29. Question

What is Mendelism? Explain the law of independent assortment in detail.

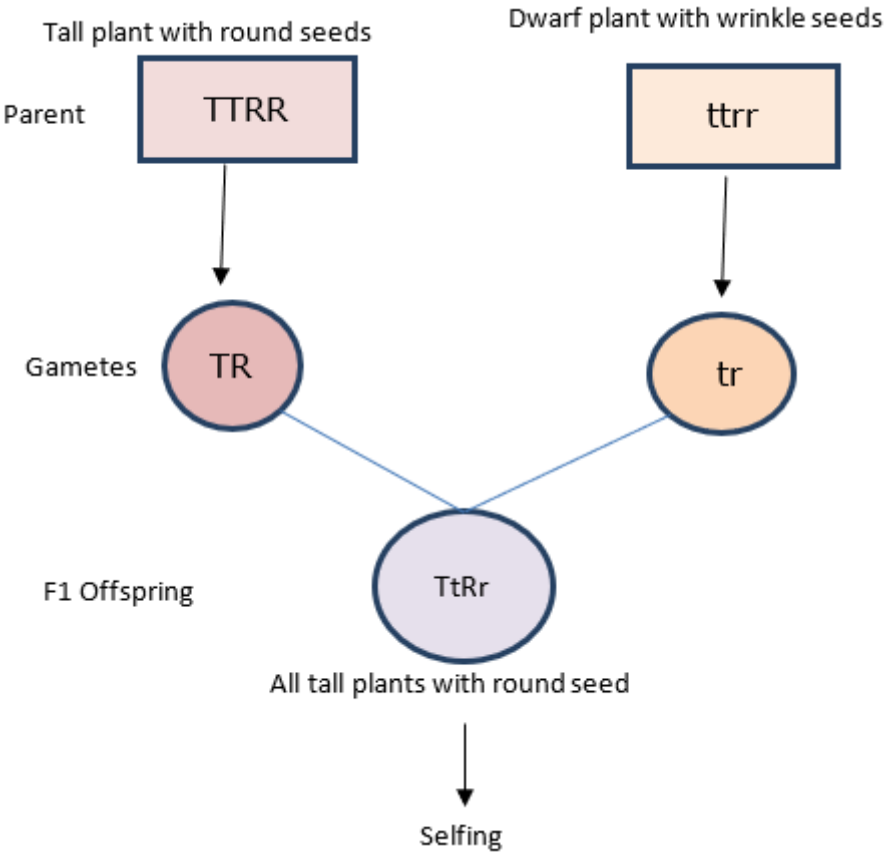
Answer

The three 'laws of inheritance' such as the law of dominance, the law of segregation and law of independent assortment are known as Mendelism.

● Law of independent assortment can explain by a dihybrid cross. In a dihybrid cross, two plants having two or more contrasting characters such as characters for example height of a plant and shape of a seed, are crossed then inheritance of one character is unaffected by inheritance of another character.

● In F_2 generation formation of plants like dwarf plant with yellow seed and tall plants with green seeds, show an independent assortment of characters.

● Example: let's observe the cross between a tall plant with round seeds (TTYY) and a dwarf plant with wrinkled seeds (ttyy). Tall plant with round seed is dominant characters.



Male gametes

Female gametes	TR	Tr	tR	tr
TR	TTRR Tall round	TTRr Tall round	TtRr Tall round	TtRr Tall round
Tr	TTRr Tall round	TTrr Tall wrinkled	TtRr Tall round	Ttrr Tall wrinkled
tR	TtRR Tall round	TtRr Tall round	ttRR Dwarf round	ttRr Dwarf round
tr	TtRr Tall round	Ttrr Tall wrinkled	ttRr Dwarf round	ttrr Dwarf wrinkled

Four types of plants are appeared in the F_2 generation

Tall round: Tall wrinkle: Dwarf Round: Dwarf wrinkle

9 : 3 : 3 : 1

30. Question

Explain Mendel's law of inheritance.

Answer

After performing his breeding experiments on garden pea, Mendel postulated three laws called 'Laws of Inheritance'. These are:

(a) Law of dominance

(b) Law of segregation or law of purity of gametes

(c) Law of independent assortment

• **Law of dominance** states that When two homozygous plants, with one contrasting character, is crossed, the character which is expressed in an F_1 generation is known as a dominant character while the character which is not expressed in an F_1 generation is known as recessive character.

● Example: If pure or homozygous tall plants (TT) are crossed with the pure homozygous dwarf plant (tt), then we obtain all the plants in an F_1 generation (100%) as tall plants.

• **Law of Segregation** or Law of Purity of gametes. According to this law, during gamete formation in the F_1 hybrid plant both the alleles are got separated from each other and goes into separate gametes.

● Hence, it is known as the law of segregation or law of purity of gametes.

● Each gamete contains only one allele for one character. Thus no mixing of characters, gametes are always pure.

● Example: If homozygous tall plant (TT) is crossed with the homozygous dwarf plant (tt), then all the offspring of F_1 generation are heterozygous tall plants.

• **Law of independent assortment** states that when two plants having two or more contrasting characters such as characters for example height of a plant and shape of a seed, are crossed then inheritance of one character is unaffected by inheritance of another character.

● In F_2 generation formation of plants like dwarf plant with yellow seed and tall plants with green seeds, show an independent assortment of characters.