Multiple Choice Questions

1. Exchange of genetic material takes place in

(a) vegetative reproduction

(b) asexual reproduction

(c) sexual reproduction

(d) budding

Soln:

Answer is (c) sexual reproduction

Explanation:

Apart from sexual reproduction, other options are a type of asexual reproduction where only single parent is involved. Hence exchange of genetic material takes place in the sexual mode of reproduction.

2. Two pink-coloured flowers on the crossing resulted in 1 red, 2 pink and 1 white flower progeny. The nature of the cross will be

(a) double fertilisation

(b) self-pollination

(c) cross-fertilisation

(d) no fertilization

Soln:

Answer is (c) cross-fertilisation

3. A cross between a tall plant (TT) and a short pea plant (tt) resulted in progeny that was all tall plants because

(a) tallness is the dominant trait

(b) shortness is the dominant trait

(c) tallness is the recessive trait

(d) height of pea plant is not governed by gene 'T' or 't'

Soln:

Answer is (a) tallness is the dominant trait

Explanation:

In a monohybrid cross, only dominant characters are expressed in first progeny.

4. Which of the following statement is incorrect?

(a) For every hormone, there is a gene.

(b) For every protein, there is a gene.

(c) For the production of every enzyme, there is a gene.

(d) For every molecule of fat, there is a gene

Soln:

The answer is (d) for every molecule of fat there is a gene

Explanation:

Every protein enzyme and hormone are controlled by a specific gene whereas fats are not controlled by a gene hence option d is a wrong statement.

5. If a round, green seeded pea plant (RR yy) is crossed with wrinkled, yellow seeded pea plant, (rr YY) the seeds produced in the F1 generation are

(a) round and yellow

(b) round and green

(c) wrinkled and green

(d) wrinkled and yellow

Soln:

Answer is (a) round and yellow

Explanation:

Round and yellow are the dominant characters hence in f1 generation all seeds will be round and yellow.

6. In human males, all the chromosomes are paired perfectly except one. This/these unpaired chromosome is/are

(i) large chromosome

(ii) small chromosome

(iii) Y-chromosome

(iv) X-chromosome

(a) (i) and (ii)

(b) (iii) only

(c) (iii) and (iv)

(d) (ii) and (iv)

Soln:

Answer is (c) (iii) and (iv)

Explanation:

These are sex-determining chromosomes that are not paired perfectly due to half size of the Y chromosome.

7. The maleness of a child is determined by

(a) the X chromosome in the zygote

(b) the Y chromosome in the zygote

(c) the cytoplasm of the germ cell which determines the sex

(d) sex is determined by chance

Soln:

The answer is (b) the Y chromosome in zygote

Explanation:

If sperm with Y chromosome fertilizes the egg, the zygote will develop into a male child. If sperm with an X chromosome fertilizes the egg, the zygote will develop into a female child.

8. A zygote which has an X-chromosome inherited from the father will develop into a:

(a) boy

(b) girl

(c) X- chromosome does not determine the sex of a child

(d) either boy or girl

Soln:

The answer is (b) girl

Explanation:

If sperm with the Y chromosome fertilizes the egg, the zygote will develop into a male child. If sperm with an X chromosome fertilizes the egg, the zygote will develop into a female child.

9. Select the incorrect statement

(a) Frequency of certain genes in a population change over several generations resulting in evolution

(b) Reduction in weight of the organism due to starvation is genetically controlled

(c) Low-weight parents can have heavyweight progeny

(d) Traits which are not inherited over generations do not cause evolution

Soln:

The answer is (b) Reduction in weight of the organism due to starvation is genetically controlled

Explanation:

Option b) is a wrong statement because weight loss and gain are controlled by external factors and they are not controlled genetically.

10. New species may be formed if

(i) DNA undergoes significant changes in germ cells

(ii) chromosome number changes in the gamete

(iii) there is no change in the genetic material

(iv) mating does not take place

(a) (i) and (ii)

(b) (i) and (iii)

(c) (ii), (iii) and (iv)

(d) (i), (ii) and (iii)

Soln:

Answer is (a) (i) and (ii)

Explanation:

Evolution will not take place without change and variation the genetic material. Hence, the change in genetic material and variation in chromosomes is required for the evolution of new species.

11. Two pea plants one with round green seeds (RRyy) and another with wrinkled yellow (rrYY) seeds produce F1 progeny that has round, yellow (RrYy) seeds. When F1 plants are selfed, the F2 progeny will have a 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)

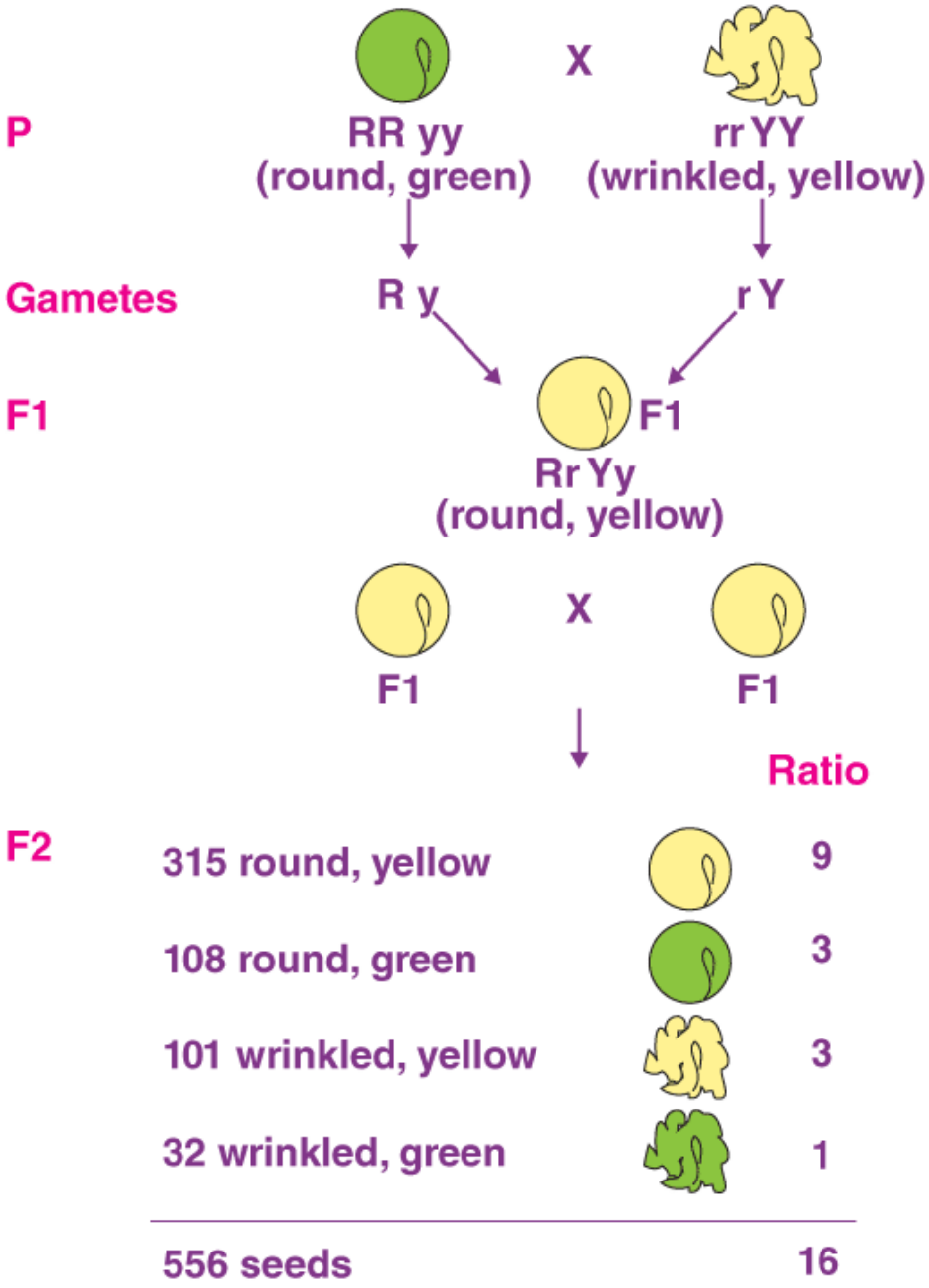
(c) (ii) and (iii)

(d) (i) and (iii)

Soln:

The new combinations in F2 progenies will be round yellow and wrinkled green. When F1 progeny that has round yellow (RrYy) seeds is selfed we get the phenotypic ratio of 9 : 3: 3: 1 for round yellow, round green,

wrinkled yellow and wrinkled green seeds in F2 generation.



12. A basket of vegetables contains carrot, potato, radish and tomato. Which of them represents the correct homologous structures?

(a) Carrot and potato

(b) Carrot and tomato

(c) Radish and carrot

(d) Radish and potato

Soln:

Answer is (c) Radish and carrot

Explanation:

They both have a similar structure and they both grow beneath the earth (Roots)

13. Select the correct statement

(a) Tendril of a pea plant and phylloclade of Opuntia are homologous

(b) Tendril of a pea plant and phylloclade of Opuntia are analogous

(c) Wings of birds and limbs of lizards are analogous

(d) Wings of birds and wings of bat are homologous

Soln:

Answer is (a) Tendril of a pea plant and phylloclade of Opuntia are homologous

Explanation:

Tendril of a pea plant and phylloclade of Opuntia are homologous because they have similar design and origin.

14. If the fossil of an organism is found in the deeper layers of the earth, then we can predict that

(a) the extinction of the organism occurred recently

(b) the extinction of the organism occurred thousands of years ago

(c) the fossil position in the layers of earth is not related to its time of extinction

(d) time of extinction cannot be determined

Soln:

The answer is (b) the extinction of organism has occurred thousands of years ago

Explanation:

Older fossils are found deep in the earth. Hence option b) is the right answer.

15. Which of the following statements is not true with respect to variation?

(a) All variations in a species have an equal chance of survival

(b) Change in genetic composition results in variation

(c) Selection of variants by environmental factors forms the basis of evolutionary processes.

(d) Variation is minimum in asexual reproduction

Soln:

Answer is (a) All variations in a species have an equal chance of survival

Explanation

Statement a) is wrongs because only useful variations have a chance of survival. Nature chooses the fittest variation to survive.

16. A trait in an organism is influenced by

(a) paternal DNA only

(b) maternal DNA only

(c) both maternal and paternal DNA

(d) neither by paternal nor by maternal DNA

Soln:

Answer is (c) both maternal and paternal DNA

Explanation:

DNA is contributed to an offspring by both the parents hence traits are contributed by both the parents.

17. Select the group which shares the maximum number of common characters

(a) two individuals of a species

(b) two species of a genus

(c) two genera of a family

(d) two genera of two families

Soln:

Answer is (a) two individuals of a species

Explanation:

Species is the lowest taxon hence members of same species share a maximum number of common characteristics.

18. According to the evolutionary theory, the formation of a new species is generally due to

(a) sudden creation by nature

(b) accumulation of variations over several generations

(c) clones formed during asexual reproduction

(d) movement of individuals from one habitat to another

Soln:

The answer is (b) accumulation of variations over several generations

Explanation:

New species are formed due to variation in the DNA for several generations. Asexual reproduction will not result in variation as there are no gametes involved.) Movement of individuals from one habitat to another will not affect DNA change hence it cannot be the right answer.

19. From the list given below, select the character which can be acquired but not inherited

(a) colour of eye

(b) colour of skin

(c) size of body

(d) nature of hair

Soln:

Answer is (c) size of body

Explanation:

Person's food habits decide the nature of the body. Regular exercise helps in building a muscular body. Body nature is not transferred to offspring hence the size of the body is not inherited.

20. The two versions of a trait (character) which are brought in by the male and female gametes are situated on

(a) copies of the same chromosome

(b) two different chromosomes

(c) sex chromosomes

(d) any chromosome

Soln:

The answer is (b) two different chromosomes

Explanation:

This is the reason behind the expression of one progeny in one version and other versions in another progeny.

21. Select the statements that describe the characteristics of genes

(i) genes are a 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)

Soln:

The answer is (b) (i) and (iii)

Explanation:

Statement ii) is wrong because genes code for specific proteins. Statement 4 is wrong because chromosomes have any number of genes.

22. In peas, a pure tall plant (TT) is crossed with a short plant (tt). The ratio of pure tall plants to short plants in F2 is

(a) 1 : 3

(b) 3: 1

(c) 1: 1

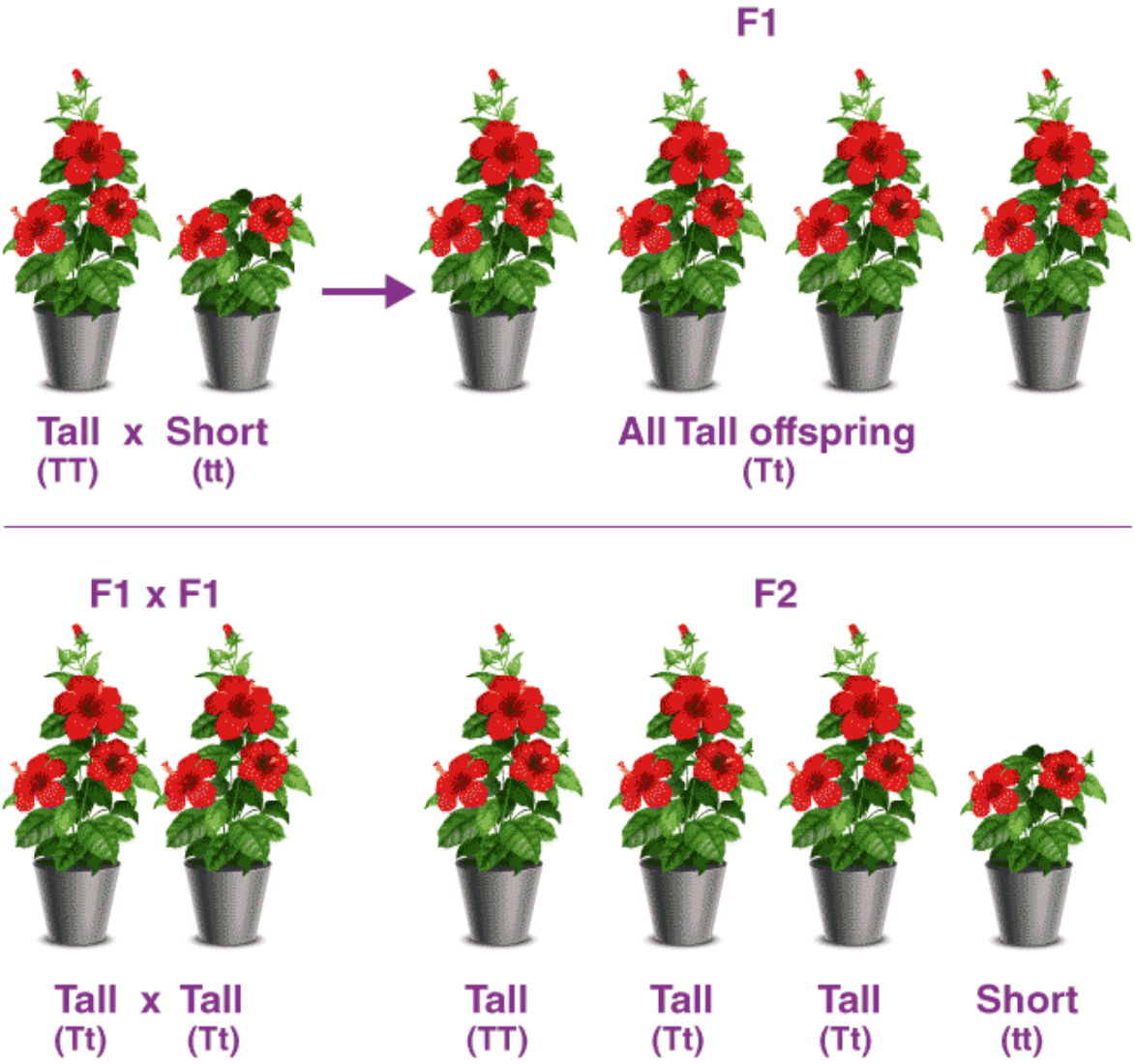
(d) 2: 1

Soln:

The answer is (c) 1: 1

Explanation:

A cross between a homozygous or pure tall plant (TT) and a short plant (tt) will produce all tall plants in F1 generation but with the genotype 'Tt', i.e. heterozygous. When F1 progeny (Tt) is selfed we get tall and short plants in the ratio of 3:1. The genotypes of progenies produced in the F2 generation are TT (pure tall), tt (short) and Tt (heterozygous tall) in the ratio of 1:2:1. Hence, the ratio of pure tall plants (TT) and short plants (tt) is 1:1.



23. The number of pair(s) of sex chromosomes in the zygote of humans is

(a) one

(b) two

(c) three

(d) four

Soln:

Answer is (a) one

Explanation:

23rd pair of chromosomes determines the sex of the offspring hence it is called a sex chromosome.

24. The theory of evolution of species by natural selection was given by

(a) Mendel

(b) Darwin

(c) Morgan

(d) Lamarck

Soln:

The answer is (b) Darwin

Explanation:

Mendel proposed laws of heredity.

Morgan discovered a mutation in drosophila.

Lamarck proposed the use and disuse theory.

25. Some dinosaurs had feathers although they could not fly but birds have feathers that help them to fly. In the context of evolution, this means that

(a) reptiles have evolved from birds

(b) there is no evolutionary connection between reptiles and birds

(c) feathers are homologous structures in both organisms

(d) birds have evolved from reptiles

Soln:

Answer is (d) birds have evolved from reptiles

Explanation:

Dinosaurs were reptiles. Some dinosaurs had feathers but they could not use them to fly. Feathers in dinosaurs started as providing insulation in cold weather and later birds adapted them to flight. So, in the context of evolution, this means that birds have evolved from reptiles.

Short Answer Questions

26. How is the sex of a newborn determined in humans?

Soln:

The sex of the individual is determined by the genes inherited from the parents. If a newborn acquires X chromosomes from father-child will be a female and if the newborn receives a Y chromosome from the father it will be a male.

27. Do the genetic combination of mothers play a significant role in determining the sex of a newborn?

Soln:

No Sex of a newborn will be determined by the chromosome donated by the father. Mothers have XX in their 23rd chromosome pair and they always donate One X. But fathers have X And Y in their 23rd chromosome pair. If the father donates X child will be a girl and if the father donates Y child will be a boy.

28. Mention three important features of fossils which help in the study of evolution.

Soln:

- Fossils are the preserved ancient species
- Fossils help determine evolutionary differences between organisms and their ancestors.
- Fossils determine the living period of specific species.

29. Why do all the gametes formed in human females have an X chromosome?

Soln:

Females possess XX in their 23 pairs of chromosomes. During meiosis one X chromosome enters each gamete hence all female gametes possess X chromosomes.

30. In human beings, the statistical probability of getting either a male or female child is 50: 50. Give a suitable explanation.

Soln:

The sex of the offspring is determined by the gamete donated by the male. Males possess X and Y chromosomes in their 23rd pair. The ratio between X and Y is 1:1. Hence the probability of getting either a male or female child is 50: 50.

31. A very small population of a species faces a greater threat of extinction than a larger population. Provide a suitable genetic explanation.

Soln:

A very small population of a species faces a greater threat of extinction than a larger population because of the following reasons

Inbreeding:

Small population promotes inbreeding. Inbreed results in lesser variations.

Genetic drift:

Small population is vulnerable to a sudden change in environment. Because of genetic drift chances of species with a small populations may wipe out.

Inbreeding depression:

This lead to negative population growth which is detrimental to the survival of the species with a smaller population.

32. What are homologous structures? Give an example. Is it necessary that homologous structures always have a common ancestor?

Soln:

Homologous structures are those which have a common basic structure and perform different functions. e.g. forelimbs of reptiles, amphibians and mammals. If they don't have common ancestry they are called analogous structures.

33. Does the occurrence of the diversity of animals on earth suggest their diverse ancestry also? Discuss this point in the light of evolution.

Soln:

In spite of the fact that animals have a different variety of structures, they do not have a common ancestry. This is because common ancestry may greatly limit the extent of diversity. Many of the animals are inhabiting the same habitat, their evolution by geographical isolation and speciation is also not likely. Hence common ancestry for all the animals is not the likely theory.

34. Give the pair of contrasting traits of the following characters in the pea plant and mention which is dominant and recessive

(i) yellow seed (ii) round seed

Soln:

1. Yellow- dominant

Green- Recessive

1. Round-dominant

Wrinkled-Recessive

35. Why did Mendel choose the pea plant for his experiments?

Soln:

Mendel chose the pea plant for his experiments for the following reasons

- Pea plants are easy to grow
- They have a short life span
- They got larger size flower
- Pea plants are self-pollinated

36. A woman has only daughters. Analyse the situation genetically and provide a suitable explanation.

Soln:

A woman has only a daughter; it means the egg always received an X chromosome from the sperm. If sperm donates X chromosomes the resultant child will be female and if Sperm donates y chromosome baby will be male.

Long Answer Questions

37. Does geographical isolation of individuals of a species lead to the formation of a new species? Provide a suitable explanation.

Soln:

Geographical isolation of individuals of a species leads to genetic drift. This limits the sexual reproduction of the separated population. This results in separated individuals reproducing among themselves. This

leads to the formation of a new variation. Accumulation and transfer of these variations through generation will lead to the formation of new species.

38. Bacteria have a simpler body plan when compared with human beings. Does it mean that human beings are more evolved than bacteria? Provide a suitable explanation.

Soln:

This is an issue of debate. It depends on the way we evaluate evolution. If the complexity of the body is a parameter then humans are far superior to bacteria. Bacteria have a cellular level of organization and humans have an organ-level organization.

On the other hand, if we consider the ability of survive bacteria has evolved more than human beings. Humans can live in any environment but with artificial protection. Humans cannot live in a harsher climate whereas bacteria can be found anywhere on earth. They can survive even harsh climates such as

Hydrothermal vents, and sulphur springs.

39. All the human races like Africans, Asians, Europeans, Americans and others might have evolved from a common ancestor. Provide a few pieces of evidence in support of this view.

Soln:

All human races appear to be different but they have evolved from common ancestry. The following is the evidence to support this view.

- Similar size of the brain.
- Bipedal locomotion
- Hair on the body.
- Ability to handle tools.
- Ability to communicate using language.
- Highly complex social behaviour.
- Same body design.

40. Differentiate between inherited and acquired characters. Give one example for each type.

Soln:

Inherited Characters	**Acquired Characters**
Characters that are passed on from parents to offspring	Characters appearing in an individual's lifetime but cannot be transmitted to the next generation
Alters Genotype and Phenotype	Alters Phenotype only
Transmitted to further generation	Cannot be transmitted to further generation
Results in genetic recombination	Results in response to environmental changes

Ex: the colour of seeds, the colour of eyes.	Ex: obese body, loss of a finger in an accident.

41. Give reasons why acquired characters are not inherited.

Soln:

Acquired characters are the results of our body's response to external stimuli such as food, disease, and climate change. This results in the development of a particular trait where a change of phenotype is observed. But for characters to get inherited by generations Genotype of an organism should be changed. In acquired characters, there is no change in the DNA of germ cells. Hence acquired characters cannot be inherited.

42. Evolution has exhibited greater stability of the molecular structure when compared with morphological structures. Comment on the statement and justify your opinion.

Soln:

Structures which are apparent to our eyes is called morphological structures. Molecular structures are those biomolecules which are the integral components of organisms. We see a lot of diversity all around us. This diversity is possible because of diversity in morphological structures. This shows that morphological structures are the least stable. The life which began as simple forms on the earth is now composed of many complex forms.

Life has evolved for millions of years but the structure of basic biomolecules such as DNA remains the same. DNA is the same in a human and in a mouse. A protein has the same structure in a bird and in a fungi. So, the molecular basis of life has not changed through all these years. This proves that evolution has exhibited a greater stability of the molecular structure when compared with morphological structure.

43. In the following crosses write the characteristics of the progeny

Cross	**Progeny**
1. **RR YY x RR YY …… Round, yellow Round, yellow**	2.
1. **Rr Yy x Rr Yy …… Round, yellow Round, yellow**	2.
1. **rr yy x rr yy …… wrinkled, green wrinkled, green**	2.
1. **RR YY x rr yy …… Round, yellow wrinkled green**	2.

Soln:

Cross	**Progeny**
1. RR YY x RR YY …… Round, yellow Round, yellow	Round, yellow

1. Rr Yy x Rr Yy …… Round, yellow Round, yellow	Round, yellow Round, green Wrinkled, yellow Wrinkled, green
1. rr yy x rr yy …… wrinkled, green wrinkled, green	Wrinkled, green
1. RR YY x rr yy …… Round, yellow wrinkled green	Round, yellow

44. Study the following cross and show self-pollination in F1, fill in the blank and answer the question that follows

Parents RRYY x rryy

Round, yellow wrinkled green

F1 — Rr Yy x ?

Round, yellow

Soln:

RrYy- Round yellow

rryy

	ry	ry	ry	ry
RY	RrYy	RrYy	RrYy	RrYy
RY	RrYy	RrYy	RrYy	RrYy
RY	RrYy	RrYy	RrYy	RrYy
RY	RrYy	RrYy	RrYy	RrYy

RRYY

45. In question 44, what are the combinations of character in the F2 progeny? What are their ratios?

Soln:

rryy

	ry	ry	ry	ry
RY	RrYy	RrYy	RrYy	RrYy

RY	RrYy	RrYy	RrYy	RrYy
RY	RrYy	RrYy	RrYy	RrYy
RY	RrYy	RrYy	RrYy	RrYy

RRYY

(i) Round yellow — 9

(ii) Round green — 3

(iii) Wrinkled yellow — 3

(iv) Wrinkled green — 1

9 : 3 : 3: 1

46. Give the basic features of the mechanism of inheritance.

Soln:

Basic features of the mechanism of inheritance are as follows

- Genes control the characters
- Genes are present in two or more forms
- One form of a gene may be dominant over another
- Genes are present on chromosomes
- Individual genes exist in two forms may be similar or dissimilar
- Two forms of the gene separate at the time of gamete formation
- Two forms of genes are brought together in the zygote

47. Give reasons for the appearance of new combinations of characters in the F2 progeny.

Soln:

F1 plants have round and yellow seeds. Cross between generations can give rise to new combinations in the F2 generation with round-yellow, round green, wrinkled yellow and wrinkled green in the ratio of 9 : 3 : 3: 1.

This shows that the chances for the pea seed to be round or wrinkled do not depend on their chances to be yellow or green. Hence each pair of alleles is independent of the other pair. This is called an independent assortment.