Question 1:
If a trait A exists in 10% of a population of an asexually reproducing species and a trait B exists in 60% of the same population, which trait is likely to have arisen earlier?

Answer 1:
In asexual reproduction, the reproducing cells produce a copy of their DNA through some chemical reactions. However, this copying of DNA is not accurate and therefore, the newly formed DNA has some variations.

It can be easily observed in the above figure that in asexual reproduction, very few variations are allowed. Therefore, if a trait is present in only 10% of the population, it is more likely that the trait has arisen recently. Hence, it can be concluded that trait B that exists in 60% of the same population has arisen earlier than trait A.

Question 2:
How does the creation of variations in a species promote survival?

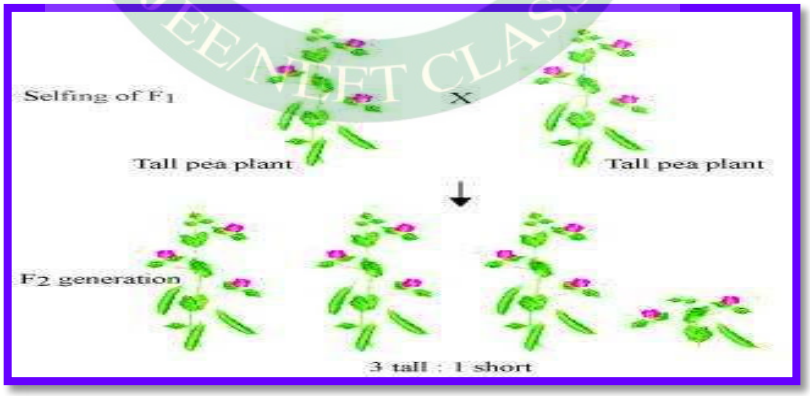
Answer 2:
Sometimes for a species, the environmental conditions change so drastically that their survival becomes difficult. For example, if the temperature of water increases suddenly, most of the bacteria living in that water would die. Only few variants resistant to heat would be able to survive. If these variants were not there, then the entire species of bacteria would have been destroyed. Thus, these variants help in the survival of the species.
However, not all variations are useful. Therefore, these are not necessarily beneficial for the individual organisms.

Question 1:
How do Mendel's experiments show that traits may be dominant or recessive?

Answer 1:
Mendel selected true breeding tall (TT) and dwarf (tt) pea plants. Then, he crossed these two plants. The seeds formed after fertilization were grown and these plants that were formed represent the first filial or F_1 generation. All the F_1 plants obtained were tall.

Cross-pollination of tall and short plant

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.

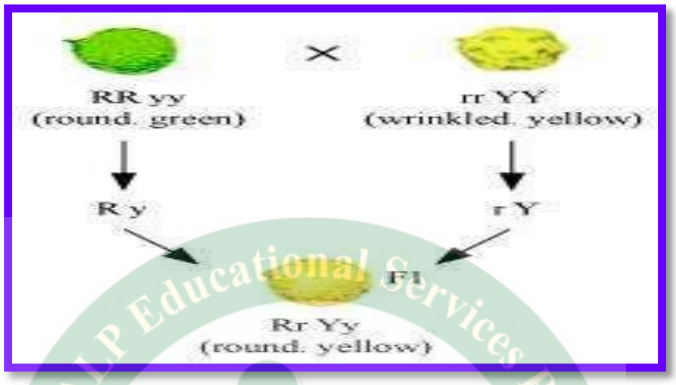


Self-pollination of F_1 plants

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 tall trait is dominant over the dwarf trait.

Question 2:
How do Mendel's experiments show that traits are inherited independently?

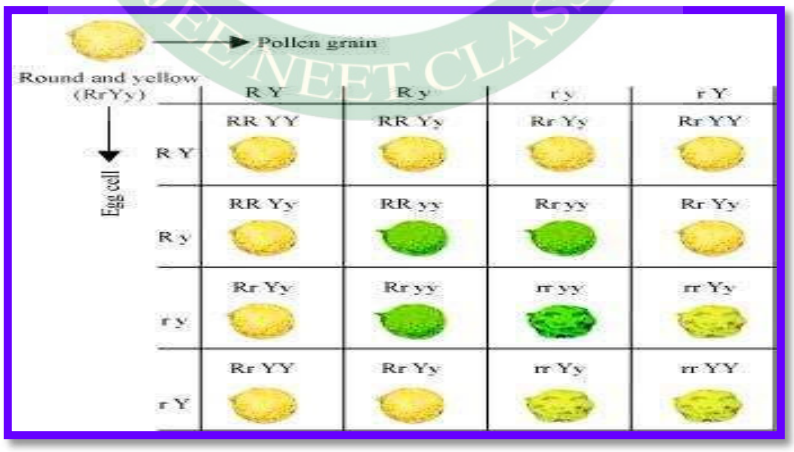
Answer 2:
Mendel crossed pea plants having round green seeds (RRyy) with pea plants having wrinkled yellow seeds (rrYY).



An example of dihybrid crosses

Since the F_1 plants are formed after crossing pea plants having green round seeds and pea plants having yellow wrinkled seeds, F_1 generation will have both these characters in them. However, as we know that yellow seed colour and round seeds are dominant characters, therefore, the F_1 plants will have yellow round seeds.

Then this F_1 progeny was self-pollinated and the F_2 progeny was found to have yellow round seeds, green round seeds, yellow wrinkled seeds, and green wrinkled seeds in the ratio of 9:3:3:1.



Independent inheritance of two different traits

In the above cross, more than two factors are involved, and these are independently inherited.

Question 3:
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?

Answer 3:
No. This information is not sufficient to determine which of the traits – blood group A or O – is dominant. This is because we do not know about the blood group of all the progeny. Blood group A can be genotypically AA or AO. Hence, the information is incomplete to draw any such conclusion.

Question 4:
How is the sex of the child determined in human beings?

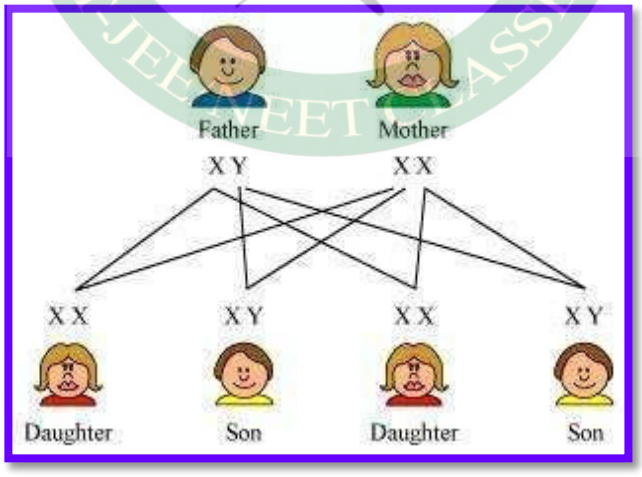
Answer 4:
In human beings, the females have two X chromosomes and the males have one X and one Y chromosome. Therefore, the females are XX and the males are XY.

The gametes, as we know, receive half of the chromosomes. The male gametes have 22 autosomes and either X or Y sex chromosome.

Type of male gametes: 22+X OR 22+ Y.

However, since the females have XX sex chromosomes, their gametes can only have X sex chromosome.

Type of female gamete: 22+X



Sex determination in humans

Thus, the mother provides only X chromosomes. The sex of the baby is determined by the type of male gamete (X or Y) that fuses with the X chromosome of the female.

Question 1:
What are the different ways in which individuals with a particular trait may increase in a population?

Answer 1:
Individuals with a particular trait may increase in a population as a result of the following:

(i) Natural selection: When that trait offers some survival advantage.
(ii) Genetic drift: When some genes governing that trait become common in a population.
(iii) When that trait gets acquired during the individual's lifetime.

Question 2:
Why are traits acquired during the life-time of an individual not inherited?

Answer 2:
This happens because an acquired trait involves change in non-reproductive tissues (somatic cells) which cannot be passed on to germ cells or the progeny. Therefore, these traits cannot be inherited.

Question 3:
Why are the small numbers of surviving tigers a cause of worry from the point of view of genetics?

Answer 3:
Small numbers of tigers means that fewer variations in terms of genes are available. This means that when these tigers reproduce, there are less chances of producing progeny with some useful variations. Hence, it is a cause of worry from the point of view of genetics.

Question 1:
What factors could lead to the rise of a new species?

Answer 1:
Natural selection, genetic drift and acquisition of traits during the life time of an individual can give rise to new species.

Question 2:
Will geographical isolation be a major factor in the speciation of a self-pollinating plant species? Why or why not?

Answer 2:
Geographical isolation can prevent the transfer of pollens among different plants. However, since the plants are self-pollinating, which means that the pollens are transferred from the anther of one flower to the stigma of the same flower or of another flower of the same plant, geographical isolation cannot prevent speciation in this case.

Question 3:
Will geographical isolation be a major factor in the speciation of an organism that reproduces asexually? Why or why not?

Answer 3:
Geographical isolation prevents gene flow between populations of a species whereas asexual reproduction generally involves only one individual. In an asexually reproducing organism, variations can occur only when the copying of DNA is not accurate. Therefore, geographical isolation cannot prevent the formation of new species in an asexually reproducing organism.

Question 1:
Give an example of characteristics being used to determine how close two species are in evolutionary terms.

Answer 1:
The presence of feathers in dinosaurs and birds indicates that they are evolutionarily related. Dinosaurs had feathers not for flying but instead these feathers provided insulation to these warm-blooded animals. However, the feathers in birds are used for flight. This proves that reptiles and birds are closely related and that the evolution of wings started in reptiles.

Question 2:
Can the wing of a butterfly and the wing of a bat be considered homologous organs? Why or why not?

Answer 2:
Wings of a butterfly are composed of membrane, while wings of a bat are composed of bony skeleton.

Hence, these are not homologous organs rather analogous organs.

Question 3:
What are fossils? What do they tell us about the process of evolution?

Answer 3:
Fossils are the remains of organisms that once existed on earth. They represent the ancestors of plants and animals that are alive today. They provide evidences of evolution by revealing the characteristics of the past organism and the changes that have occurred in these organisms to give rise to the present organisms.

Chapter- 9
Heredity and evolution

Question 1:
Why are human beings who look so different from each other in terms of size, colour and looks said to belong to the same species?

Answer 1:
A species is a group of organisms that are capable of interbreeding to produce a fertile offspring. Skin colour, looks, and size are all variety of features present in human beings. These features are generally environmentally controlled. Various human races are formed based on these features. However, there is no biological basis to this concept of races.

Therefore, all human beings are a single species as humans of different colour, size, and looks are capable of reproduction and can produce a fertile offspring.

Question 2:
In evolutionary terms, can we say which among bacteria, spiders, fish and chimpanzees have a 'better' body design? Why or why not?

Answer 2:
Evolution cannot always be equated with progress or better body designs. Evolution simply creates more complex body designs. However, this does not mean that the simple body designs are inefficient. In fact, bacteria having a simple body design are still the most cosmopolitan organisms found on earth. They can survive hot springs, deep sea, and even freezing environment.
Therefore, bacteria, spiders, fish, and chimpanzees are all different branches of evolution.