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

Trait B because in asexual reproduction traits which are present in the previous generation are carried over to next generation with minimal variations. Trait B have higher percentage so it is likely to have arisen earlier.

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

Answer

Variations occur due to sexual reproduction and also due to inaccurate copying of DNA. Depending on the nature of variations, different individuals would have different kinds of advantages. For example, bacteria variants which can withstand heat have better chances to survive in a heat wave non-variant bacteria having no capacity to tolerate heat wave. Thus, variations in a population of a species help in survival of a species.

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

Answer

The trait which appears in all the members of F_1 generation and also in 75% numbers of F_2generation obtained by self fertilization of F_1 generation is dominant character.
The trait which does not appear in F generation but after self-fertilization of F_1 generation, reappears in 25% of F_2 generation is known as recessive.

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

Answer

Mendel crossed pure breeding tall plants having round seeds with pure breeding short plants having wrinkled seeds. The plants of F_1 generation were all tall with round seeds indicating that the traits of tallness and round seeds were dominant. Self breeding of F_1 yielded plants with characters of 9 tall round seeded, 3 tall wrinkled seeded , 3 short round seeded and one short wrinkled seeded. Tall wrinkled seeded and short round seeded plants are new combinations which can develop only when the traits are inherited independently.

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?

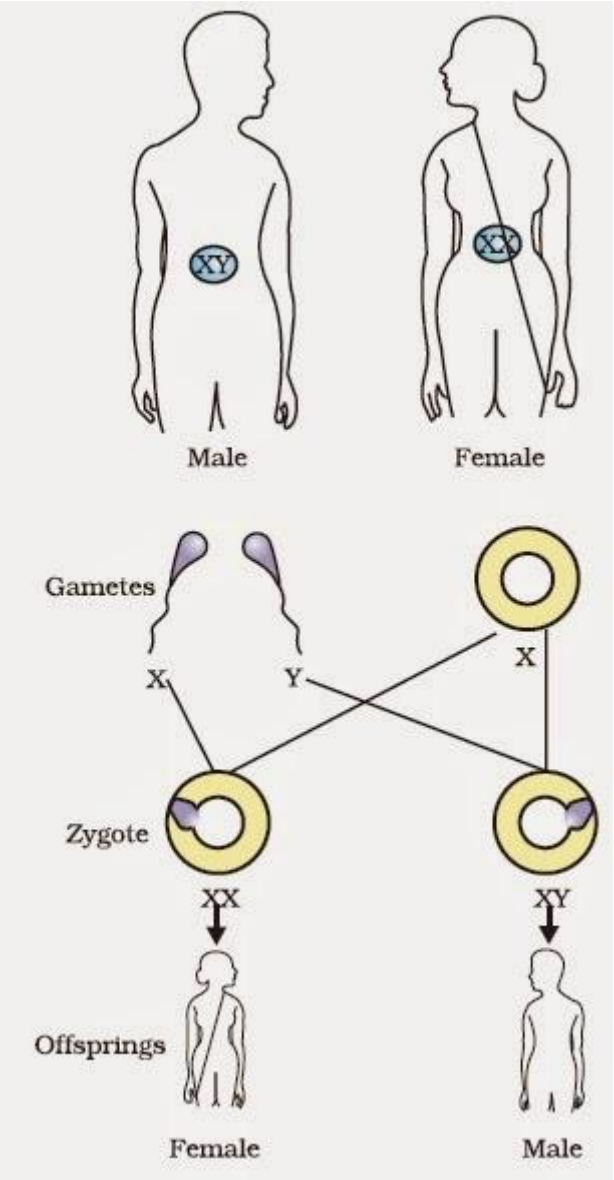
Answer

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.

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

Answer

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



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.

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

Answer

Individuals with a particular trait may increase in a population as a result of the following:
→ Natural selection: When that trait offers some survival advantage.
→ Genetic drift: When some genes governing that trait become common in a population.
→ When that trait gets acquired during the individual's lifetime.

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

Answer

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

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

Answer

The small number of members in a population of tigers do not allow large number of variation to occur which are essential to survival of the species. A deadly disease or calamity may cause death of all the tigers. The small number of tiger also indicates that existing tiger variants are not well adopted to the existing environment and may extinct soon.

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

Answer

Natural selection, genetic drift and acquisition of traits during the life time of an individual can give rise to new species.
2. Will geographical isolation be a major factor in the speciation of a self-pollinating plant species? Why or why not?

Answer

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.

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

Answer
No, because geographical isolation does not affect much in asexually reproducing organisms. Asexually reproducing organisms pass on the parent DNA to offsprings that leaves no chance of speciation. However, geographical isolation works as a major factor in cross pollinated species. As it would result in pollinated species. As it would result in accumulation of variation in the two geographically separated population.

Page No: 156

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

Answer

Feathers in some ancient reptiles like dinosaurs, as fossils indicate, evolved to provide insulation in cold weather. However, they cannot fly with these feathers later on birds adapted the feathers to flight. This means that birds are very closely related to reptiles, since dinosaurs were reptile.

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

Answer

The wing of a butterfly and the wing of a bat are similar in function. They help the butterfly and the bat in flying. Since they perform similar function, they are analogous organs and not homologous.

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

Answer

Fossils are the remains of organisms that once existed on earth.
They tell us about the development of the structures from simple structured to complex structured organisms.They tell us about the phases of evolutions through which they must have undergone in order to sustain themselves in the competetive environment.

Page No: 158

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

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 genetic but also environmentally controlled. Various human races are formed based on these features. All human races have more than enough similarities to be classified as same species. 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.

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

Answer

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.

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Exercise

1. A Mendelian experiment consisted of breeding tall pea plants bearing violet flowers with short pea plants bearing white flowers. The progeny all bore violet flowers, but almost half of them were short. This suggests that the genetic make-up of the tall parent can be depicted as
(a) TTWW
(b) TTww
(c) TtWW
(d) TtWw
► (c) TtWW

2. An example of homologous organs is
(a) our arm and a dog's fore-leg.
(b) our teeth and an elephant's tusks.
(c) potato and runners of grass.
(d) all of the above.
► (b) our teeth and an elephant's tusks.

3. In evolutionary terms, we have more in common with
(a) a Chinese school-boy.
(b) a chimpanzee.
(c) a spider.
(d) a bacterium.
► (a) a Chinese school-boy.

4. 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 about whether the light eye colour trait is dominant or recessive? Why or why not?

Answer

This information is not sufficient. For considering a trait as dominant or recessive, we need data of at least three generations. This data is about only two generations.

5. How are the areas of study - evolution and classification - interlinked?

Answer

Classification involves grouping of organism into a formal system based on similarities in internal and external structure or evolutionary history.
Two species are more closely related if they have more characteristics in common. And if two species are more closely related, then it means they have a more recent ancestor. For example, in a family, a brother and sister are closely related and they have a recent common ancestor i.e., their parents. A brother and his cousin are also related but less than the sister and her brother. This is because the brother and his cousin have a common ancestor i.e., their grandparents in the second generation whereas the parents were from the first generation.
With subsequent generations, the variations make organisms more different than their ancestors.
This discussion clearly proves that we classify organisms according to their resemblance which is similar to creating an evolutionary tree.

6. Explain the terms analogous and homologous organs with examples.

Answer

Homologus organs are those organs which have the same basic structural design and origin but have different functions.
For Example: The forelimbs of humans and the wings of birds look different externally but their skeletal structure is similar.

Analogus organs are those organs which have the different basic structural design and origin but have similar functions.
For Example: The wings of birds and insects.

7. Outline a project which aims to find the dominant coat colour in dogs.

Answer

Dogs have a variety of genes that govern coat colour. There are at least eleven identified gene series (A, B, C, D, E, F, G, M, P, S, T) that influence coat colour in dog.
A dog inherits one gene from each of its parents. The dominant gene gets expressed in the phenotype. For example, in the B series, a dog can be genetically black or brown. Let us assume that one parent is homozygous black (BB), while the other parent is homozygous brown (bb)

bb	BB	
	B	B
b	Bb	Bb
b	Bb	Bb

In this case, all the offsprings will be heterozygous (Bb).
Since black (B) is dominant, all the offsprings will be black. However, they will have both B and b alleles.
If such heterozygous pups are crossed, they will produce 25% homozygous black (BB), 50% heterozygous black (Bb), and 25% homozygous brown (bb) offsprings.

	B	b
B	BB	Bb
b	Bb	Bb

8. Explain the importance of fossils in deciding evolutionary relationships.

Answer

Fossil provide us evidence about
→ The organisms that lived long ago such as the time period during which they lived, their structure etc.
→ Evolutionary development of species i.e., line of their development.
→ Connecting links between two groups. For example, feathers present in some dinosaurs means that birds are very closely related to reptiles.
→ Which organisms evolved earlier and which later.
→ Development of complex body designs from the simple body designs.

9. What evidence do we have for the origin of life from inanimate matter?

Answer

The evidence for the origin of life from inanimate matter, was provided through an experiment, conducted in 1953, by Stanley L. Miller and Harold C. Urey. In experiment, they assembled an atmosphere containing molecules like ammonia, methane and hydrogen sulphide, but no oxygen, over water. This was similar to atmosphere that thought to exist on early earth . This was maintained at a temperature just below 100°C and sparks were passed through the mixture of gases to simulate lightning. At the end of a week, 15% of the carbon from methane, had been converted to simple compounds of carbon including amino acids which make up protein molecules and support the life in basic form. Thus, amply suggesting that life arose afresh on earth.

10. Explain how sexual reproduction gives rise to more viable variations than asexual reproduction. How does this affect the evolution of those organisms that reproduce sexually?

Answer

Sexual reproduction causes more viable variations due to the following reasons:
→ Error in copying of DNA, which are not highly significant.
→ Random seggregation of paternal and maternal chromosome at the time of gamete formation.
→ Exchange of genetic material between homologous chromosomes during formation of gametes.
→ Accumulation of variations occured due to sexual reproduction over generation after generation and selection by nature created wide diversity.

In case of asexual reproduction, only the very small changes due to inaccuracies in DNA copying pass on the progeny. Thus, offsprings of asexual reproduction are more or less genetically similar to their parents. So, it can be concluded that evolution in sexually reproducing organisms proceeds at a faster pace than in asexually repoducing organisms.

11. How is the equal genetic contribution of male and female parents ensured in the progeny?

Answer

In human beings, equal genetic contribution of male and female parents is ensured in the progeny through inheritance of equal number of chromosomes from both parents. There are 23 pairs of chromosomes All human chromosomes are not paired. Out of these 23 pairs, the first 22 pairs are known as autosomes and the remaining one pair is known as sex chromosomes represented as X and Y. Females have a perfect pair of two X sex chromosomes and males have a mismatched pair of one X and one Y sex chromosome.
During the course of reproduction, as fertilization process takes place, the male gamete (haploid) fuses with the female gamete(haploid) resulting in formation of the diploid zygote. The zygote in the progeny receive an equal contribution of genetic material from the parents. Out of 23 pairs of chromosomes in progeny, male parent contributes 22 autosomes and one X or Y chromosome and female parent contributes 22 autosomes and one X chromosome.

12. Only variations that confer an advantage to an individual organism will survive in a population. Do you agree with this statement? Why or why not?

Answer

We agree with the statement that Only variations that confer an advantage to an individual organism will survive in a population. All the variations do not have an equal chance of surviving in the environment in which they find themselves. The chances of surviving depend on the nature of variations. Different individual would have different

kind of advantages. A bacteria that can withstand heat will survive better in a heat wave. Selection of variants by environmental factors forms the basis for revolutionary process.