

Chapter-8

Heredity and Evolution

2 MARKS QUESTIONS

1. Why are acquired traits not inherited?

Answer:

Acquired traits are those that organisms develop over the course of their lives. These characteristics can't be handed down because they're caused by non-reproductive tissue.

2. How evolution and classification are linked?

Answer:

The organisation of organisms into groups based on their properties is known as classification. Characteristics are physical or behavioural characteristics. The most advanced and effective classification system is based on evolution. The division of organisms/species into groups reflects their shared origins, as well as their evolutionary relationship.

3. What are coacervates?

Answer:

Coacervates are the first life molecules created when a membrane forms around amino acids, sugars, and nitrogenous bases aggregates. Coacervates continue to evolve, eventually leading to the origin of life.

4. How do the two factors for a character, present in diploid cells, behave at the time of gamete formation?

Answer:

During gamete development, two components named X and Y separate. As a result, the gamete is either X or Y.

5. Give the pair of contrasting traits of the following characters in the plant and mention which one is recessive and which is dominant?

(a) yellow seed

Answer:

Green seed- Dominant

Yellow seed- Recessive

(b) round seed

Answer:

Wrinkled seed – Recessive

Round seed- Dominant

6. Mention two important features of fossils that help in evolution.

Answer:

Two important features of fossils that help in evolution:

(i) Fossils are a type of ancient species preservation.

(ii) Fossils aid in the identification of evolutionary relationships between creatures and their forefathers and mothers.

7. What do you understand by the term natural selection?

Answer:

Natural selection theory states that nature selects the fittest animals for breeding, while those who do not fit are removed by nature.

8. Mention the complement of a sperm and the egg which will determine the birth of a female child.

Answer:

The X chromosome is found in both the sperm and the egg of a female child and it is the complement of a sperm and the egg which will determine the birth of a female child.

9. What is emasculation? Why is it done?

Answer:

Emasculation is the removal of an anther to prevent pollination in an experimental plant.

10. What is a gene? Where are genes located?

Answer:

The term "gene" refers to DNA segments.
Chromosomes are where genes are found.

11. How many contrasting characters did Mendel see in garden pea? Give any two of them.

Answer:

In the pea plant, Mendel discovered seven distinct characteristics.
For example, axial and terminal flower positions. Round and wrinkled seed form.

4 MARKS QUESTIONS

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

Answer:

Individuals with a certain attribute can increase in a variety of ways, including:

- a. Natural selection- Certain differences give individuals in a group a survival edge in a changing context, resulting in population growth.
- b. Genetic drift—In a small population, even if no survival benefit is gained, accidents can lead to an increase in the number of specific individuals.

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

Answer:

The minimal number of living tigers is concerning because it could lead to a loss of genetic diversity. The abrupt demise of tigers and their genes will have an impact on natural diversity. Because the tiger population is declining, the genetic pool of tigers is shrinking. It will have an impact on the frequency of selection, which is necessary for survival. The population must have an indefinitely a vast number of individuals in order for selection to be effective.

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

Answer:

The evolutionary distance between humans and apes can be determined using the example of humans and apes. Both of their bodies are similar in appearance. Both animals have hair on their bodies and mammary glands. As a result, these two animals are tightly linked in terms of evolution.

- Homologous organs share a common origin and basic structure, although they serve diverse purposes in different organisms.

- Analogous organs have similar functions but vary in basic anatomy.
- Homologous organs have evolved in different ways.
- Analogous organs have evolved in a similar way. They form in creatures that are connected to one another.

4. 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:

Humans differ from one another in terms of size and colour, but they are all members of the same species. This is due to the fact that, despite the tremendous diversity of human shapes and traits among different human races around the world, all human beings' genetic footprints can be traced back to the same common heritage of African origins. Humans are a single species that descended from the earliest members of the human species in Africa, *Homo sapiens*. Because there has been no well-defined geographical or reproductive isolation among members of the human species, this has resulted in a wide range of genetic makeups for features with minor differences.

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

Answer:

We can't say whether germs, spiders, fish, or chimps have a "superior" body design in evolutionary terms. The idea that various animals have better bodily designs is unjustifiable. Because the evolutionary process considers the development of the most efficient and suitable elements in organisms' body designs for survival and adaptation to a specific niche. Organisms with a complex and ostensibly better body architecture, for example, may not be able to live in a given context. Bacteria, on the other hand, can survive in the most hostile and severe environmental circumstances, such as extremely hot, cold, or acidic, due to their rudimentary body design and simple microbial lifestyle. Bacterial microorganisms can be found deep beneath arctic ice, in deserts, near

volcanic eruptions on the surface of the world, at thermal vents under the deep sea or on the surface of the globe, and even in outer space.

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

Answer:

Organisms are categorised into categories based on the similarities and differences they have with one another. The more features that two species share, the more closely they are related. The proximity of the two species shows that they shared a similar ancestry. As a result, species taxonomy reflects their evolutionary relationship.

8. What is fossilization? How are fossils formed?

Answer:

Fossilization is the term for the process of forming fossils. When organisms die, their corpses disintegrate and become fossilised. The body, or a portion of it, maybe in an environment that prevents it from fully decomposing. The mud will solidify over time and maintain the impression of the organism's bodily parts. This mud with the imprint will be referred to as an organism's fossil.

9. What are homologous and analogous organs? Explain with the help of an example.

Answer:

Homologous organs have a similar basic structure and origin, but may perform diverse tasks. Human hands, for example, and avian wings, for example.

Organs that have a similar function but a different basic structure and origin are referred to as comparable organs.

For example,

1. a bat's wing and a bird's wing.
2. a bird's wing and an insect's wing

10. Describe how the sex of the offspring is determined in the zygote in human beings?

Answer:

Males have the ability to create either X-type or Y-type gametes. The females only generate the X-type of gametes or ova. If X-type sperm unites with the ovum, the infant will have feminine sex. If Y-type sperm is used in conjunction with the ovum, the kid will be male. The baby's gender is determined at the time of conception. The baby's sex is determined at the time of conception.

11. Give a suitable explanation for “geographical isolation of individuals of a species lead to the formation of a new species?”

Answer:

Between the subpopulations, a reproduction barrier such as a river (geographical isolation) leads to:

- a. Genetic drift, or chance changes in gene frequency, such as the selection of red or blue beetles over green beetles in the presence of crows.
- b. Natural selection, or selection of the fittest by nature, e.g., in the presence of crows, green beetles are preferred over red beetles.

12. State the evolutionary force which leads to the origin of a new species.

Answer:

The following are some of the evolution's elemental forces:

- a. Mutation
- b. Recombination (crossing over during meiosis, random gene assortment during gamete production)
- c. Survival of the fittest or natural selection
- d. Genetic drift is a term used to describe the process of a person's

7 MARKS QUESTIONS

1. Answer the following questions:

(i) Who provided the evidence of DNA as genetic material?

Answer: Mendel.

(ii) Why is DNA called polynucleotide?

Answer: DNA is made up of many different nucleotide units.

(iii) List three important features of the double-helical model of DNA.

Answer: Important features-

- (a) In helical, both chains run antiparallel.
- (b) Purine (A, G) and pyrimidine are two nitrogenous bases (T, C).
- (c) A will always bind to T, and C will always bind to G.

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

Answer:

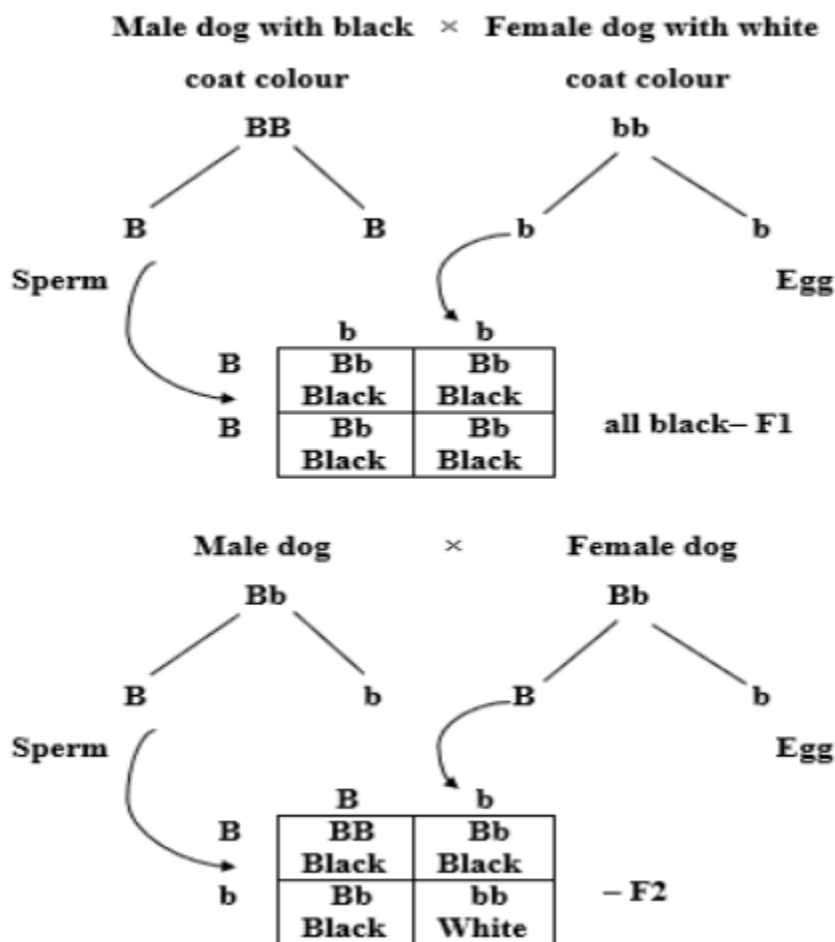
Characteristics of the inheritance mechanism-

- (a) A pair of elements influence each character. It's possible that the factors are similar or dissimilar.
- (b) When two distinct character factors are present in an organism, only one of them manifests itself, while the other remains silent.
- (c) At the moment of gamete production, two elements of a character are separated, leaving only one factor for that character.
- (d) Inheritance of two or more pairs of contrasting features in such a way that one pair is independent of the other pairs.

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

Answer:

Dogs have a variety of coats. Select a pure-bred male and female dog with a black coat (hair) colour or a pure-bred male and female dog with a brown coat (hair) colour to find the dominant coat (hair) colour in dogs. Cross a homozygous male BB with a homozygous female BB, then look at the coat colour of the offspring (offspring). If all of the progeny are black, this indicates that in dogs, black will be the dominant coat colour, and if the progeny has brown coats, brown will be the dominant coat colour.



And, if we make the Punnett square of the
F1  1

generation, we obtain Bb, Bb, Bb, Bb, i.e., all progeny is black. As a result, the dominant colour is determined to be black.

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

Answer:

Mendel showed that the traits could either be dominant or recessive through his experiments that focused on the mono-hybrid cross. The experiment involved him crossing tall (TT) pea plants with dwarf (tt) pea plants. The resultant plants which formed after fertilisation represented the F₁ (or filial) generation. All the F₁ plants were tall. Mendel then proceeded to self-pollinate the filial generation plants, and the result was that 1/4th of the plants obtained in the F₂ generation were dwarfs. From this experiment, Mendel concluded that the F₁ tall plants were not true-breeding; instead, they carried the traits for both tall and dwarf heights. A portion of the plants was tall due to the fact that the traits for tallness were dominant over the traits for dwarfness. This cements the notion that traits can either be dominant or recessive.

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

Answer:

Mendel's experiments show that traits are inherited independently through his dihybrid cross experiment. The experiment involved him using two traits – namely, seed shape and seed colour. The colour yellow (YY) is dominant over green (yy), while the round shape (RR) is dominant over the wrinkled shape (rr). The F₂ progeny of the dihybrid cross resulted in a phenotypic ratio of 9:3:3:1; therefore, 9 plants with round yellow (RRYY) seeds, 3 plants with round green (RRyy) seeds and 3 plants with wrinkled yellow (rrYY) seeds and one with wrinkled green seeds (rryy). He further observed that the wrinkled greens and the round yellow are parental combinations

while the round green and wrinkled yellow are new. A dihybrid cross between two seeds with dominant traits (RRYY) and non-dominant traits (rryy) resulted in the production of 4 types of gametes (RY, Ry, rY and ry). This means each of the gametes segregates independently of the other, and each with a frequency of 25% of the total gametes produced.

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

Solution:

An individual attribute could increase a population in the following 2 ways:

(a) **Natural selection:** If an attribute is useful to a population, it'll increase naturally.

For example, mosquitoes which are resilient against a particular pesticide will pass on their genes so that future generations become resistant as well. The mosquitoes which are affected by the pesticide die out.

(b) **Genetic drift:** If a species faces a catastrophic event where most of the population is wiped out, the surviving population can pass on their traits to the following generations. This may result in a rise in the attribute within the population.

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

Solution:

Let us take the instance of humans and chimpanzees. Chimpanzees are able to express a wide range of emotions, such as busting out in laughter or smiling – this trait was once thought to be a feature exclusive to humans. The smile can be linked to the activation of the brain's limbic system, where the orbicularis oculi muscle involuntarily contracts and raises the cheeks, forming wrinkles around the eyes. This implies that the smile is a true and genuine smile. Interestingly, this type of reflex has a name – the Duchenne smile. Moreover, research has shown that chimpanzees share 98.6% of our DNA – This means that humans and chimpanzees shared a common ancestor aeons ago. It is also important to note that chimpanzees are the closest living relatives to humans.

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

Solution:

Dogs have a certain set of genes that govern coat colour. There are a minimum of eleven known sequence series (A, B, C, D, E, F, G, M, P, S, T) that influence the colour of a dog. A dog inherits one copy from each of its parents. As an example, within the B series, a dog is genetically black or brown. Assume that one parent is homozygous black (BB), whereas the other parent is homozygous brown (bb).

bb	BB	
	B	B
	bB	bB
	bB	bB

In this case, all the offspring are going to be heterozygous (Bb).

Since black (B) is dominant, all the offspring are going to be black. However, they are going to have each B and b alleles. If such heterozygous pups are crossed, they are going to produce 25 homozygous blacks (BB), 50 heterozygous black (Bb), and 25 homozygous brown (bb) offspring.

	B	b
B	BB	Bb
b	Bb	bb

9.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?

Solution:

Sexual reproduction causes a lot of viable variations because of the following reasons:

- Error in copying of DNA (though it was rare)
- Random segregation of paternal and maternal chromosomes at the time of sex cell formation.
- Exchange of genetic material between homologous chromosomes during the formation of gametes.
- Accumulation of variations occurred because of reproduction over generation after generation, and choice naturally created wide diversity.
- In the case of asexual reproduction, variation is severely limited as there is only one parent involved. Hence, the offspring is genetically similar to the parent

MULTIPLE CHOICE QUESTIONS

1.Mendel conducted his famous breeding experiments by working on the following:

- (a) Drosophila
- (b) Escherichia Coli
- (c) Pisum Sativum
- (d) All of these

Correct Answer: Option (c)

2) Which section of DNA provides information for one protein?

- (a) Nucleus
- (b) Chromosome
- (c) Trait
- (d) Gene

Correct Answer: Option (d)

3) Which of the following is an example of genetic variation?

- (a) One person has a scar, but his friend doesn't
- (b) One person is older than the other
- (c) Reeta eats meat, but her sister Geeta is a vegetarian
- (d) Two children have different eye colour

Correct Answer: Option (d)

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

- (a) 1:3
- (b) 3:1
- (c) 1:1
- (d) 2:1

Correct Answer: Option (c)

5) Humans have two different sex chromosomes, X and Y. Based on Mendel's laws, a male offspring will inherit which combination of chromosomes?

- (a) Both the X chromosomes from one of its parents
- (b) Both the Y chromosomes from one of its parents
- (c) A combination of X chromosomes from either of its parents
- (d) A combination of X and Y chromosomes from either of its parents

Correct Answer: Option (d)

6) Two pea plants, one with round green seeds (RR yy) and another with wrinkled yellow (rrYY) seeds, produce F₁ progeny that have round yellow (RrYy) seeds. When F₁ plants are self-pollinated, the F₂ progeny will have a new combination of characters. Choose the new combinations 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)

Correct Answer: Option (b)

7) Miller and Urey performed an experiment to prove the origin of life from organic compounds. The gases they took were:

(a) methane, ethane, ammonia, water vapour

(b) methane, ethane, hydrogen, ammonia

(c) ammonia, water vapour, butane, hydrogen

(d) methane, ammonia, hydrogen, water vapour

Correct Answer: Option (d)

8) Which of the following is a pair of analogous organs?

(a) Wings of a pigeon and a bat

(b) Forelimbs of a frog and a bird

(c) Forelimbs of a rabbit and a lizard

(d) Leaves of a pitcher plant and a Venus fly trap

Correct Answer: Option (a)

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

(a) double fertilization

(b) self-pollination

(c) cross-fertilization

(d) no fertilization

Correct Answer: Option (c)

10) 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

Correct Answer: Option (b)

FILL IN THE BLANKS

1.The passing of traits from parents to offspring is known as _____.

(Answer: heredity)

2.The study of heredity and variations is called _____.

(Answer: genetics)

3.The different forms of a gene are called _____.

(Answer: alleles)

4._____ is the process by which traits that provide a better chance of survival become more common in a population.

(Answer: natural selection)

5.The preserved remains or traces of ancient organisms are known as _____.

(Answer: fossils)

6.The appearance of new species over long periods of time is referred to as _____.

(Answer: evolution)

7.The father of modern genetics is _____.

(Answer: Gregor Mendel)

8.The genetic makeup of an organism is called its _____.

(Answer: genotype)

9._____ are structures with similar functions in different organisms but with different evolutionary origins.

(Answer: analogous structures)

10.The fundamental unit of heredity is the _____.

(Answer: gene)