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EXPLORER
CLASS - 10

BRAIN MAPPING ACADEMY



BIOLOGY

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BIOLOGY

CLASS - 10



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Preface

Today's learning culture demands high degree of efficiency from students, both in calculating and functioning, in order to excel. Speed and accuracy play an important role in climbing the competitive ladder. Students need to understand the basic requirements and be on their toes at all times to identify appropriate information sources and use them to their best advantage.

The preparation required for the tough competitive examinations is fundamentally different from that required for the qualifying ones, like board examinations. A student can emerge successful in a qualifying examination by scoring the bare minimum percentage of marks, whereas in a competitive one, he/she has to perform better than others to always score higher.

This book contains all types of questions that a student is required to tackle at the foundation level. The exercises are sequenced as Basic Practice and Further Practice, equipped with Multiple Answer Questions, Paragraph Questions and Conceptual Questions in addition to other basic directing formats such as filling the gaps and true or false. Questions about direct application of concepts are covered under Basic Practice. More challenging questions about direct application are covered under Further Practice. Additionally, questions involving higher order of thinking or an open-ended approach, are covered under Thought-Provoking Questions.

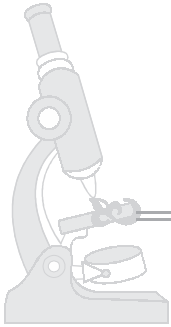
All these encourage students to think analytically, be creative and come up with solutions, all on their own. Regular practice of attempting these questions will not only make them familiar with the pattern of competitive approach but will shape them conceptually sound and give them the confidence to take any competitive/entrance examination and get through the same with ease, with a leading edge.

This **NEET Foundation** series is aimed at providing students with all the necessary skills that would create a firm perceptive ground in **Biology**.

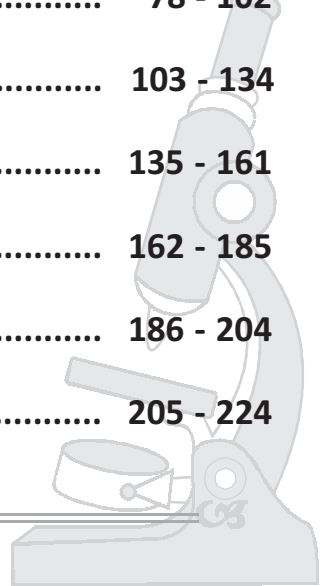
Suggestions and feedback from the teacher and student community are most welcome, as we consider it valuable in shaping a better ensuing edition.

Publisher

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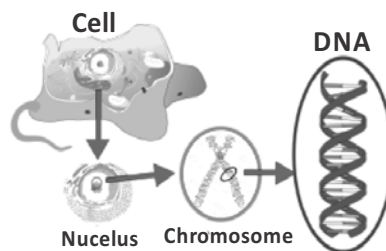
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Synopsis

- **Heredity** is the passing on of traits from parents to their offspring, either through asexual reproduction or sexual reproduction. The offspring cells or organisms acquire the genetic information of their parents.
- The process of genetic transmission of characteristics from parents to offspring is called **inheritance**.
- The hereditary information is present in the sex cells (or gametes) of the parents. Thus, gametes constitute the link between one generation and the next, and pass on the paternal (father's) and maternal (mother's) characters or traits to the offspring.
- Chromosomes are rod like bodies found in all cells except RBC's. They contain the genes code that determine various characters.
- The 23 pairs of chromosomes in each human cell include a pair of sex chromosomes. They determine the sex of an individual. The other 22 pairs of chromosomes are known as autosomes.
- Paired condition of chromosomes is known as **diploid**.
- Unpaired condition of chromosomes is known as **haploid**.
- **Genes** are made up of **DNA** which have the ability to duplicate themselves. Genes are the units of heredity.
- DNA is the genetic material in all organisms. The total amount of DNA is called **Genome**.
- A DNA nucleotide is made of a molecular of sugar, phosphoric acid and a base are the letters that spell out the genetic code as Adenine (A), Thymine (T), Guanine (G) and Cytosine (C).

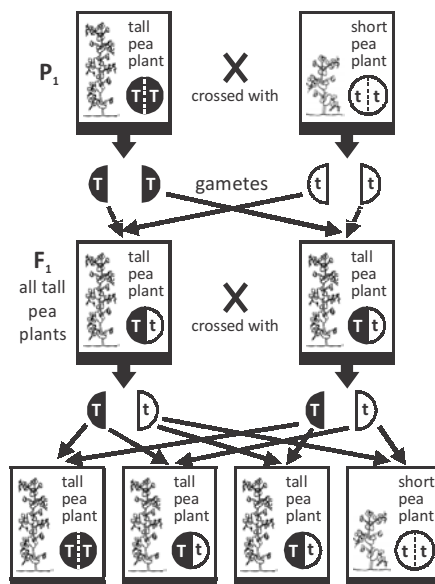


SEED		FLOWER	POD		STEM	
Form	Cotyledon	Colour	Form	Colour	Place	Size
 Round	 Yellow	 White	 Full	 Green	 Axial pods	 Tall
 Wrinkled 1	 Green 2	 Violet 3	 Constricted 4	 Yellow 5	 Terminal pods 6	 Short 7

- **Law of Independent Assortment:** The two factors of each trait assort at random and independent of the factors of other trait at the time of meiosis and get randomly as well as independently arranged in the offspring.

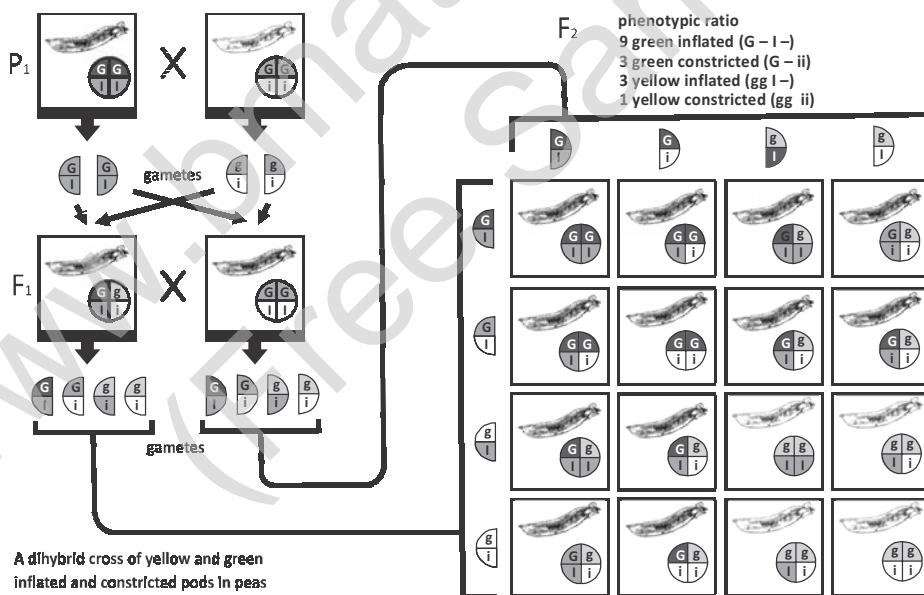
Monohybrid Inheritance and the Law of Segregation:

- When pure (TT) tall pea plants are crossed with pure (tt) short pea plants then in F₁ generation only tall plants (Tt) were obtained.
- F₂ progeny of F₁ tall plants are not all tall but one quarter of them are short indicating that both tallness and shortness traits were inherited in F₁ but only tallness trait was expressed due to dominance. Both the traits appear in the ratio of 3:1 (three tall and one dwarf). It is called monohybrid ratio.
- Mendel called the repressed trait of 'dwarfness' as 'recessive trait' and the expressed trait of 'tallness' as the 'dominant trait'.
- According to Mendel's first law of inheritance: The characteristics of an organism are determined by internal 'factors' which occur in pairs. Only one of a pair of such factors can be present in a single gamete.



Dihybrid Inheritance and the Law of Independent Assortment:

- According to Mendel’s second law of inheritance: In the inheritance more than one pair of traits in a cross simultaneously, the factors responsible for each pair of traits are distributed independently to the gametes.
- In dihybrid cross two pairs of contrasting characters were considered. Tall plant with round seeds were crossed with short plant with wrinkled seeds. In F_1 tall plants with round seeds were obtained. On selfing these F_1 plants F_2 showed tall plants with round seeds, short plant with wrinkled seeds and same new combinations (tall plant with wrinkled seeds and short plant with round seeds) were also obtained in the ratio of 9:3:3:1. It is called dihybrid ratio.
- The tall/short trait and round wrinkled traits are independently inherited.
- The expression of a particular trait is controlled by gene.
- Plants have hormones that can trigger growth, e.g. Plant height can depend on the amount of a particular hormone. The amount of that hormone will depend on the efficiency of the process of making it.
- The characteristics or traits of parents are transmitted to their progeny through genes present on their chromosomes during the process of sexual reproduction.



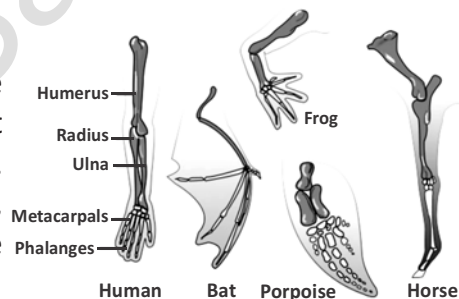
- Genes are responsible for the characteristic features of an organism : plant or animal. The characteristics or traits of parents are transmitted to their progeny through genes present on their chromosomes during the process of sexual reproduction.

Role of Environment in sex determination

- Temperature in **snails** can change sex, indicating that sex is not genetically determined.
- Incubation of chrysemapicta turtle at high temperature produces females.
- In Agama agama lizard high temperature produces males.
- **Variation** is the difference in the characters or traits among the individuals of a species. Variations can be seen in physical appearance, metabolism, behaviour and learning.
- Heritable variations lead to the evolution and formation of new species. Variations in an individual may be an advantage or a disadvantage.
- The variation is a necessity for organic evolution.
- The significance of a variation shows up only if it continues to be inherited by the offspring for several generations.
- The great advantage of variation to a species is that it increases the chances of its survival in a changing environment.
- **Evolution:** It is the sequence of gradual changes which take place in the primitive organisms over millions of years in which new species are produced.

➤ The evidences of evolution are

- **Homologous organs:** The organs which have same fundamental structure but different in functions are called homologous organs. The examples are forelimb of frog, lizard, pigeon, mole, bat and humans have the same basic structural plan.



- **Analogous organs:** The organs which have similar functions but are different in their structural detail and wings of bird. The organ which are present in reduced form and do not perform any function in the body but correspond to the fully developed functional organs of related animals called vestigial organs. E.g. Muscles which are responsible for movement of ear are found in man but have lost their power to move the ear.



Evidences from embryology

- There are striking similarities in various stages of development of embryos of vertebrates. The early human embryo resembles early embryos of fish, frog, bird, rabbit and man but their adult forms are quite different from one another. These similarities in embryonic development are cited as evidence of relationship among the vertebrates.
- **Fossils:** Fossils are the remains of the past. The study of fossils is known as paleontology.



Fossil invertebrate



Trilobite fossils



Fossil dinosaur skull

Vestigial Organs in Man

Tonsils	Adenoids
Coccyx (tail bone)	Nictitating membrane of eye
Thymus	Appendix
Little toe	Wisdom teeth
Nipples on males	Parathyroid
Nodes on ears "Darwin's points"	Ear muscles for wiggling
Pineal gland	Body hair

- **THEORIES OF EVOLUTION:** The mechanism of the origin of new species was explained first by **Jean Baptiste Lamarck** gave the first theory of evolution.

DARWIN'S THEORY OF EVOLUTION

Charles Robert Darwin (1809-1882) explained the evolutionary principle in his famous book "**The origin of species**". The theory proposed by him is popularly known as theory of **natural selection**.

- The main features of the theory of natural selection are as follows:
 - i) **Over production:** All organisms possess enormous fertility. They multiply in geometric ratio, e.g.: plants produce thousands of seeds, insects lay hundreds of eggs, etc.
 - ii) **Limited food and space:** Despite of rapid multiplication of all types of species, food and space and other resources remain limited. They are not liable to increase.

- Mutation involves a permanent change in the structure of gene. Mutation is an important factor which cause sudden and large or major variation in population. We have studied that according to Darwin's theory it is on variations, evolution operates. Mutation adds new heritable variations in populations. The accumulation of advantageous mutations over a long period of time is generally regarded as the dominant factor in evolution and in development of a new species.
- In nature the frequency of gene mutations is quite low. Mutations can artificially be induced by various mutagenic agents such as X-rays, ultra-violet radiations, beta and gamma rays, neutron beams, high temperature various chemicals like formaldehyde, mustard gas and nitrous acid.

EVOLUTION AND CLASSIFICATION

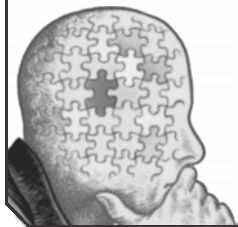
- i) Evolution of complex organs have taken place bit-by-bit over generations. e.g., eye, feathers of birds have evolved because of survival advantage of intermediate stages.
- ii) Man had cultivated wild cabbage as a food plant and generated different vegetables like kohlrabi, kale, cauliflower, broccoli, red cabbage from it through artificial selection.
- iii) Thus changes in DNA during reproduction are the main cause of evolution.

HUMAN EVOLUTION The ancestry or phylogeny determined by a comparative study of DNA sequences is called molecular phylogeny.

- i) All human beings belong to single species *Homo sapiens*, although there were many races of humans.
- ii) They have originated in Africa, some ancestors left Africa and migrated to West Asia, Central Asia, Eurasia, South Asia, East Asia, Indonesia, Australia, America, while others stayed there.
- iii) Excavating, time-dating, studying fossils and determining DNA sequences have been used for studying human evolution.

Thought Provoking

What is Rhesus factor ?



BASIC PRACTICE

Fill in the blanks

- _____ trait is received by organism from its parents.
- Genetic drift and _____ could give rise to a new species.
- The group of organisms having similar fundamental characteristics which can reproduce _____ is called species.
- An _____ trait is not inherited from one generation to next generation.
- The origin of species was written by _____.
- The number of autosomes in the human zygote is _____.
- The study of the pattern of inheritance of chromosomes from parents to offspring is called _____.
- In Mendel's experiment, the trait which did not appear in the F_1 generation was said to be _____.
- The sources of variations are _____ and _____ recombination.
- The number of X chromosomes in a human ovum is _____.
- _____ are quite apparent among closely related groups of organisms.
- The factors which are responsible for character or trait of an organism, are now named as _____.
- Each human cell contains 23 pairs of chromosomes. Out of these, 22 pairs are called _____ and one pair is called _____.
- Mendel had chosen _____ consisting of seven distinguishing forms: flower colour, position, seed colour, shape, pod colour, pod shape, stem length.
- In the inheritance of more than one pair of characters, the factors for each pair of characters assort independently of the other pairs. This is known as _____.

True or False

- Asexually reproducing animals show variations in the characters of their offsprings. ()
- Sudden change in the genetic makeup of an organism is called migration. ()

3. Attached earlobe is recessive trait. ()
4. Traits which are not inherited over generation do not cause evolution. ()
5. Low weight parents can have heavy weight progeny. ()
6. Organic evolution is the gradual change from simple life forms to complex life form. ()
7. Variation could not be lead during gametogenesis and fertilisation. ()
8. The total amount of DNA is called Genome. ()
9. Evolution is the formation of new organisms from the pre-existing ones through gradual changes. ()
10. Variation could only lead through environmental changes. ()

Match the Following

1. ()

Column-I	Column-II
P) $TT \times tt$	1) 100% Tt
Q) $Tt \times Tt$	2) 25% TT, 50% Tt, 25% tt
R) $TT \times TT$	3) 100% TT
S) $t \times tt$	4) 100% tt

- (A) P - 2, Q - 1, R - 3, S - 4 (B) P - 1, Q - 2, R - 3, S - 4
 (C) P - 1, Q - 2, R - 4, S - 3 (D) P - 1, Q - 4, R - 2, S - 3

2. ()

Column-I	Column-II
P) Fossils	1) Comparing similarities and differences between amino acid sequences in two organisms.
Q) Embryology	2) Comparing and constrasting cell structures found within an organism.
R) Cytology	3) Comparisons of the early development stages of an organism.
S) DNA evidence	4) The remains of decreased organisms that are studied.

- (A) P - 4, Q - 3, R - 2, S - 1 (B) P - 3, Q - 4, R - 2, S - 1
 (C) P - 3, Q - 4, R - 1, S - 2 (D) P - 3, Q - 1, R - 4, S - 2

3.

Column-I	Column-II
P) Gregor Mendel	1) Gene
Q) Charles Darwin	2) Father of Genetics
R) Factor	3) The origin of species
S) Lamarck	4) Theory of inheritance of acquired character.

 ()

- (A) P - 3, Q - 2, R - 4, S - 1 (B) P - 2, Q - 3, R - 4, S - 1
 (C) P - 2, Q - 3, R - 1, S - 4 (D) P - 2, Q - 1, R - 3, S - 4

4.

Column-I	Column-II
P) Male human beings	1) Homologous organs
Q) Wing of a bat and a wing of a bird	2) Fossil
R) Remnant of ancient animals	3) XY
S) Arm of a man and whales flippers	4) Analogous organ

 ()

- (A) P - 4, Q - 3, R - 2, S - 1 (B) P - 3, Q - 4, R - 2, S - 1
 (C) P - 3, Q - 4, R - 1, S - 2 (D) P - 3, Q - 1, R - 4, S - 2

Multiple Choice Questions

1. **Who coined the term genetics ?** ()
 (A) Mendel (B) Morgan (C) Bateson (D) Boveri
2. **Identify the term used to describe the transmission of genetic characters from parents to offspring ?** ()
 (A) Heredity (B) Genetics (C) Evolution (D) Mutation
3. **Which of these was formulated by Mendel ?** ()
 (A) Law of germplasm (B) Laws of origin of species
 (C) Laws of recapitulation (D) Laws of inheritance
4. **Who said that acquired characteristics are inherited ?** ()
 (A) Lamarck (B) Lysenko (C) Mendel (D) Huxley
5. **Which of these is a complete set of chromosomes inherited as a unit from one parent ?** ()
 (A) Karyotype (B) Gene pool
 (C) Genome (D) Genotype

14. **According to Mendel's law of inheritance** ()
(A) traits in human beings are related to the fact that both the parents have contributed practically amount of genetic material to the child.
(B) each trait will be influenced by both maternal and paternal DNA.
(C) for each trait there will be two versions in each child.
(D) all these three statements describe the law of inheritance.
15. _____ **is a section of cellular DNA that provides information for one protein.** ()
(A) Progeny (B) Traits (C) Gene (D) Hormone
16. **A pure tall plant can be differentiated from a hybrid tall plant.** ()
(A) by measuring length of plant
(B) by spraying gibberellins
(C) if all plants are tall after self-pollination
(D) if all plants are dwarf after self-pollination
17. **In humans, male sex determination is due to** ()
(A) X-chromosome. (B) Y-chromosome.
(C) A-chromosome. (D) B-chromosome.
18. **A gene has two separate independent pieces, each called chromosome. Each cell will have two copies of each chromosome.** ()
(A) one each from the male and female parents
(B) both from the male parent
(C) both from the female parent
(D) both different from those of the parents
19. **Which of these defines the term evolution ?** ()
(A) Fossils are old (B) Life began in sea
(C) Living things constantly change (D) Life began on land
20. **Homologous structures have** ()
(A) similar origin but dissimilar functions.
(B) dissimilar origin but similar functions.
(C) dissimilar origin but dissimilar functions.
(D) dissimilar origin but dissimilar structures.

- 28. Characteristics** ()
- (A) decide more fundamental differences among organisms.
 - (B) are details of appearance - particular form.
 - (C) are details of behaviour - particular function.
 - (D) all of these
- 29. Classification of species is done on the basis of** ()
- (A) cell design - nucleated or non-nucleated.
 - (B) unicellular or multi-cellular.
 - (C) specialisation of cell types and tissues - autotrophs or heterotrophs.
 - (D) all of these
- 30. In peas, a pure tall plant (TT) is crossed with a short plant (tt). The ratio of pure tall plants to short plants in F_2 is** ()
- (A) 1:3 (B) 3:1 (C) 1:1 (D) 2:1
- 31. 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 the organisms.
 - (D) birds have evolved from reptiles.
- 32. If two parents have the genotypes AA × aa, the probability of having an aa genotype in the F_1 generation is** ()
- (A) 25 % (B) 50 %
(C) 75 % (D) none of these
- 33. Complex organs may have evolved from simpler one because of** ()
- (A) survival advantage of even the intermediate stages.
 - (B) human intervention.
 - (C) environmental changes.
 - (D) competition among the same species.

40. A mendelian experiment consisted of crossing tall pea plants TT with short pea plants tt. All plants of F_1 generation consists of tall pea plant. Then the genetic make up of the tall parents can be defined as ()
- (A) TT (B) Tt
(C) tt (D) none of these

Multiple Answer Questions

1. **The changes in non-reproductive tissues.** ()
(A) cannot be passed on the DNA of the germ cells
(B) cannot direct evolution
(C) are the acquired traits
(D) are the genetical
2. **Evolutionary relationships can be followed by** ()
(A) similar homologous characteristics indicate common origins even in apparently different species.
(B) similar analogous characteristics may not have common origins.
(C) relation between biotic and abiotic.
(D) observing feeding habits.
3. **Age of a fossil can be estimated by** ()
(A) how closer to earth surface the fossil was found.
(B) detecting the ratio of different isotopes of the same element in the fossil.
(C) comparing DNA of different species.
(D) comparing external features.
4. **Genetics is the study of** ()
(A) inheritance. (B) cell structure.
(C) heredity. (D) genes.
5. **In human males all the chromosomes are paired perfectly except one. This/these unpaired chromosomes is/are** ()
(A) large chromosome. (B) small chromosome.
(C) Y-chromosome. (D) X-chromosome.

FURTHER PRACTICE

Give one word answers

1. Modification in structure or function acquired by an organism during its life, caused by environmental factors.
2. The result of either self hybridization or inbreeding from F_1 individuals.
3. The lengthy process of change by which people originated from ape like ancestors.
4. The first generation of an offspring.
5. The process by which heritable traits that increase an organism's chances of survival and reproduction are favoured than less beneficial traits.
6. Sex determining chromosomes which differ in appearance or behaviour from autosomes and are some times unequally distributed among the germ cells.
7. Two different alleles for a single trait.
8. The genetic makeup of an individual usually with reference to a specific characteristic under consideration.
9. The observable properties of an organism that are produced by the interaction of the genotype and the environment. These characters can be seen.
10. The process of change in the genetic composition of a population due to chance or random events rather than by natural selection, resulting in changes in allele frequencies over time.

Comprehension

Fossils are the remains, impression or trace of a living organism from the geologic age such as a skeleton, foot print, etc and the scientists generally date them to know their age, i.e., how old the organism is ? The two main methods used to date a fossil are absolute dating method and relative dating method. Absolute dating method tells us about the actual age of an organism by using radioactive elements that occur naturally in various types of minerals and organic matter. Relative dating method is a method that gives us idea about whether an organism is older or younger than other but it cannot pin point the actual age of an organism in years.

1. What are fossils ?
2. Scientists who study fossils are known as
3. Give an example of imprints.
4. What are the two methods used to date a fossil ?

Assertion and Reasoning Questions

In the following questions two statements Assertion and Reason are given. Use the following options to choose an appropriate answer.

- (A) If both Assertion and Reason are true and the Reason is a correct explanation of the Assertion.
- (B) If both Assertion and Reason are true but Reason is not a correct explanation of the Assertion.
- (C) If Assertion is true but the Reason is false.
- (D) If both Assertion and Reason are false.
1. **Assertion :** Mendel was successful in his hybridization experiments.
Reason : Garden pea proved ideal experimental material.
 2. **Assertion :** Mutations are discontinuous variations.
Reason : Mutations occur suddenly.
 3. **Assertion :** The principle of segregation given by Mendel is the principle of purity of gametes.
Reason : Gametes are pure for a character.
 4. **Assertion :** Test cross is a back cross.
Reason : In test cross, individual is crossed with recessive parent.

Explanations:

STRUCTURED QUESTIONS

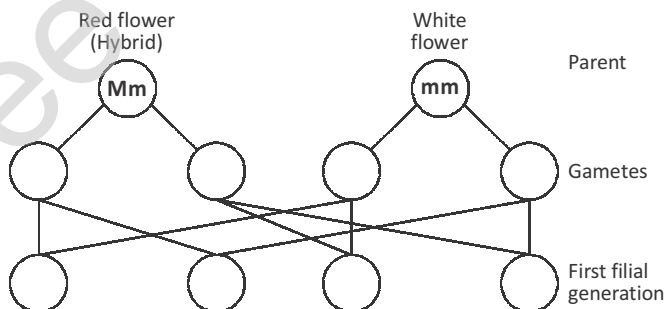
1. What is the law of independent assortment ?
2. When we cross two sets of 'pure' pea plants, one with yellow seeds with smooth skin and second is green seeds with wrinkled cover, in the F_1 generation, we will get the seeds which are yellow and smooth. Each pea will now have factors $YyRr$.

♀ \ ♂	yr	yr
YR		
YR		

3. One self pollination of these seeds we will get some seeds smooth yellow ($YyRr$ or $YYRR$), some seeds smooth and green ($yyRR$ or $yyRr$), some seeds were wrinkled and yellow ($Yyrr$ or $YYrr$) and some seeds were wrinkled and green ($yyrr$).

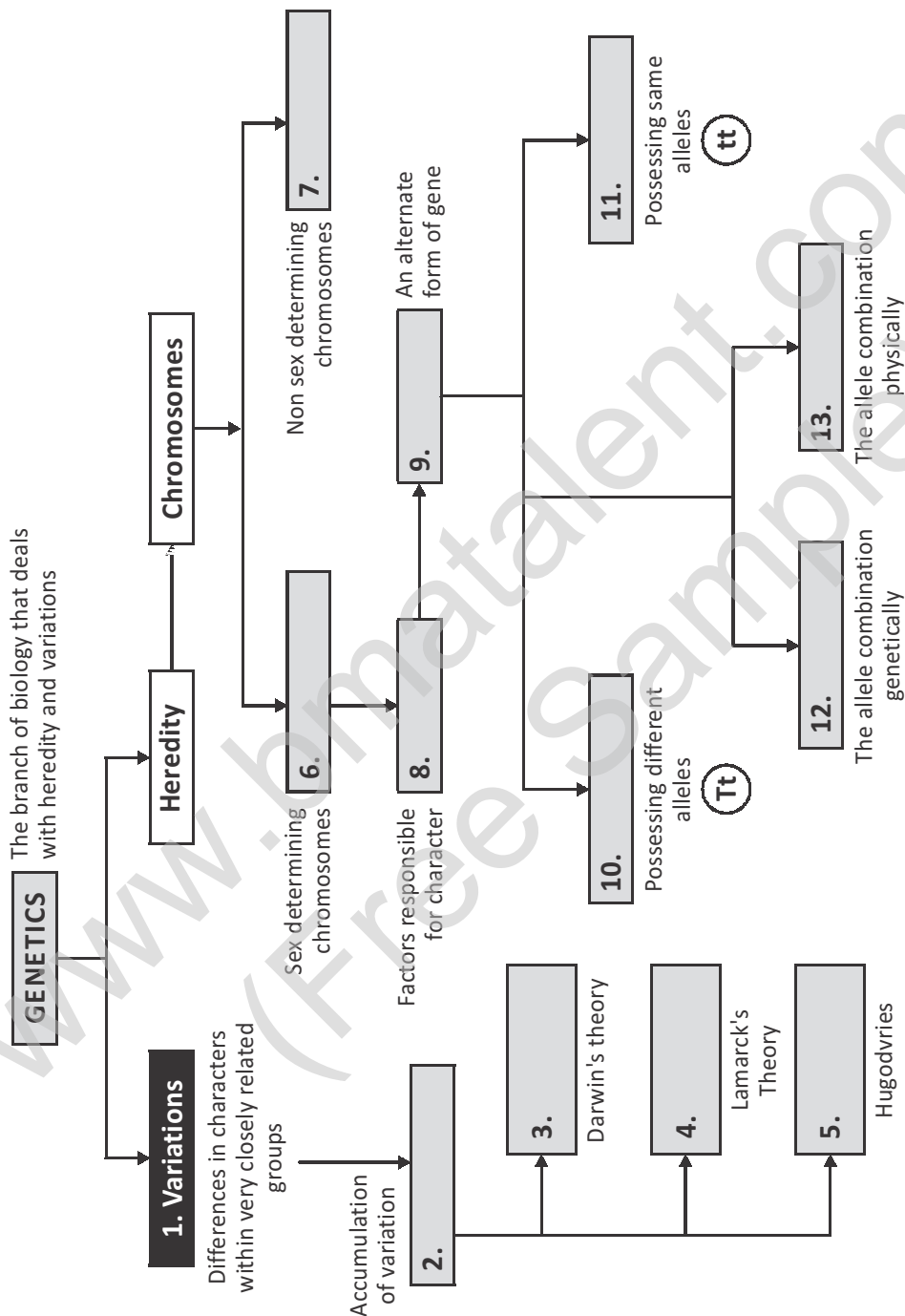
♀ \ ♂	RY	Ry	ry	rY
RY				
Ry				
ry				
rY				

4. Figure shows a pea plant with red flowers (a hybrid) crossed with a pea plant with white flowers. The gene that controls the red flowers is dominant against the gene that controls the white flowers.



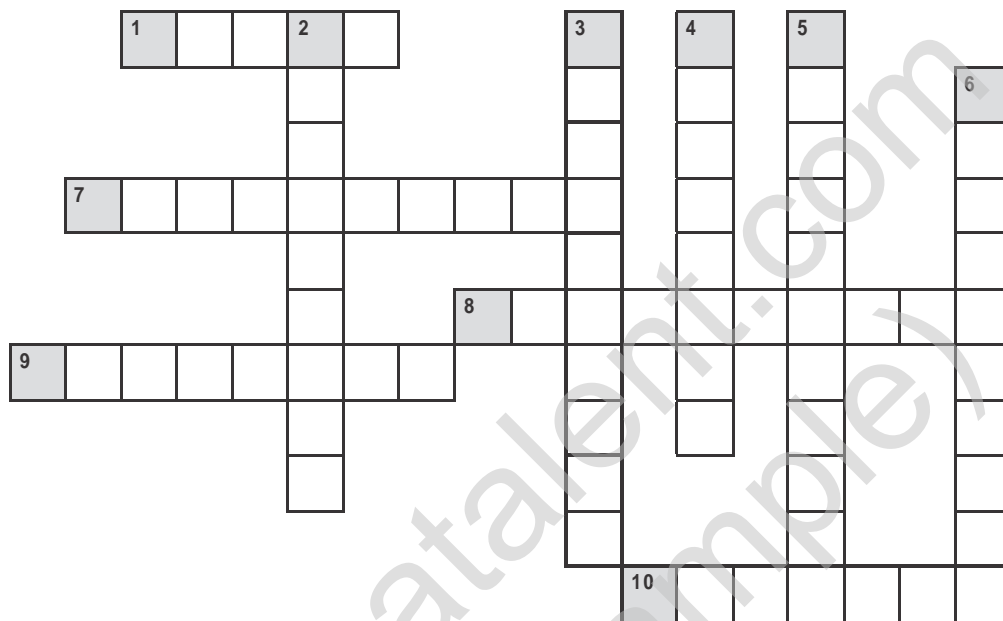
- a) Complete figure to show the genetic material in the gametes and the final filial generation.
- b) What is meant by dominant gene and recessive gene ?
- c) What is the ratio of pea plant having red flowers to white flowers in the first filial generation ?

LINK & LEARN



Phenotype, Allele, Mutation, **Variations**, Heterozygous, Autosomes, Evolution, Homozygous, Autosomes, Natural selection, Genes, Genotype, Use and disuse

CROSSWORD PUZZLE

**ACROSS**

- 1 The factors which are responsible for character or trait of an organism.
- 7 Organs which have a common fundamental anatomical plan and similar embryonic origin.
- 8 Differences in characters within very closely related groups of organisms are referred to as
- 9 The process of acquiring characters or traits from parents.
- 10 One of the possible forms of a given gene.

DOWN

- 2 The change in the inherited characteristics of biological populations over successive generations.
- 3 The young of animals or plants.
- 4 The gene that produces the same phenotype in the organisms whether or not its allele identical.
- 5 The process in which traits are passed from one generation to another generation.
- 6 Gene that produces its characteristic phenotype only when its allele is identical.

This book is one of the plinths that form the NEET Foundation series.

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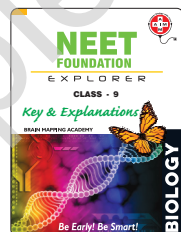
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 - Further Practice
- Structured Questions
- Conceptual Questions
- Assertion - Reasoning
- Thought Provoking Questions



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