Heredity and Evolution

(A) Objective Type Questions — 1 Mark Each

Stand Alone MCQs (1 Mark Each)

1. 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 production of every enzyme there is a gene.
(D) For every molecule of fat there is a gene. U

Ans. Option (D) is correct.

> *Explanation:* Hormone and enzymes are proteins and formation of any particular protein is controlled by a particular gene. Hence, all other options are correct.

AI **2. If a round, green seeded pea plant (RRyy) is crossed with wrinkled, yellow seeded pea plant, (rrYY) the seeds produced in F1 generation are :**

(A) Round and yellow.
(B) Round and green.
(C) Wrinkled and green.
(D) Wrinkled and yellow. AE

Ans. Option (A) is correct.

> *Explanation:* Round and green peas are represented by RRyy.
> Wrinkled and yellow peas are represented by rrYY. Dominant 'RR' i.e. green and dominant character YY *i.e.*, Yellow are produced.
> When they are crossed they produce round and yellow seed.

3. The maleness of a child is determined by

(A) The X chromosome in the zygote.
(B) The Y chromosome in zygote.
(C) The cytoplasm of germ cell which determines the sex.
(D) Sex is determined by chance. R

Ans. Option (B) is correct.

> *Explanation:* Y-chromosome in zygote means that the zygote would develop into a male child.

AI **4. 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. U

Ans. Option (B) is correct.

> *Explanation:* A zygote with XX chromosomes in the 23rd pair would develop into a girl child.

5. 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. AE

Ans. Option (C) is correct.

> *Explanation:* As it is mentioned in the question that two pink coloured flowers were crossed, thus it is cross fertilization.

6. A cross between a tall plant (TT) and short pea plant (tt) resulted in progeny that were 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*'. U

Ans. Option (A) is correct.

> *Explanation:* This is a case of monohybrid cross, in which all the progenies in the F_1 generation show dominant character. Hence, tallness is the dominant trait.

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

(A) One. **(B)** Two.
(C) Three. **(D)** Four. R

Ans. Option (A) is correct.

> *Explanation:* The sex chromosomes are in the 23rd pair.

Assertion and Reason Based MCQs (1 Mark Each)

Directions : In the following questions, A statement of Assertion (A) is followed by a statement of Reason (R). Mark the correct choice as.

(A) Both A and R are true and R is the correct explanation of A.

(B) Both A and R are true but R is NOT the correct explanation of A.

(C) A is true but R is false.

(D) A is false and R is true.

1. **Assertion:** A geneticist crossed a pea plant having violet flowers with a pea plant having white flowers, he got all violet flowers in first generation.

   Reason: White colour gene is not passed on to next generation. A **[CBSE SQP, 2021]**

Ans. Option (C) is correct.

> ***Explanation:*** The gene for violet flowers is dominant over the gene for white flowers so that only the violet gene is expressed as violet flowers in the first generation. White colour flower shows its trait in the second generation, after the selfing of two plants of the first generation.

2. **Assertion (A):** Mendel choose a number of varieties of garden pea as plant material for his experiments.

   Reason (R): Garden pea has well defined characters and is bisexual.

Ans. Option (A) is correct.

> ***Explanation:*** Mendel choose garden pea as plant material for his experiment because garden pea plants were easily available / they grow in one season / fertilization was easy.

3. **Assertion (A):** In humans, males play an important role in determining the sex of the child.

   Reason (R): Males have two X chromosomes.

Ans. Option (C) is correct.

> ***Explanation:*** Sex of a child is dependent on the type of the male gamete that fuses with the female gamete. Human beings possess 23 pairs of chromosomes. Out of these, 22 pairs are known as autosomes, while the remaining one pair comprises sex chromosomes (XX in females and XY in males). At the time of fertilisation, the egg cell fuses with the sperm cell, resulting in the formation of the zygote.
>
> If the egg cell carrying an X chromosome fuses with the sperm carrying an X chromosome, the resulting child would be a girl. If the egg cell carrying an X chromosome fuses with the sperm carrying a Y chromosome, the resulting child would be a boy.
>
> → Males have one X-chromosome and one Y-chromosome.

4. **Assertion:** A zygote with two X chromosomes develops into a boy.

   Reason: If the egg cell carrying an X chromosome fuses with the sperm carrying a Y chromosome, the resulting child would be a boy.

Ans. Option (D) is correct.

> ***Explanation:*** A Zygote having two X-Chromosome develops into a girl or female (XX) and a Zygote having one X and one Y-Chromosome develops into a boy (male).

5. **Assertion (A):** Mendel proposed the law of inheritance of traits from the first generation to the next generation.

   Reason (R): Mendel's Law of segregation is also known as "Law of purity of gametes.

Ans. Option (B) is correct.

> ***Explanation:*** Mendel proposed the law of inheritance of traits from the first generation to the next generation. Law of inheritance is made up of three laws: Law of segregation, law of independent assortment and law of dominance. Law of segregation is also known as "Law of purity of gametes".

6. **Assertion (A):** Mendel in his experiment selected only two characters of seed.

   Reason (R): He studied single character at one time.

Ans. Option (D) is correct.

> ***Explanation:*** Mendel considered total 7 characters :
>
> (i) 3 characters of seed *i.e.*, seed shape, seed colour, cotyledon colour
>
> (ii) 2 characters of pod *i.e.*, pod shape and pod colour
>
> (iii) 2 characters of plant *i.e.*, plant height and position of pods on the stem.
>
> Mendel's success was mainly based on the fact that he considered a single character at one time.

Case-based MCQs (1 Mark Each)

I. Read the passage and answer the following questions.

In a cross between plants with purple flowers and plants with white flowers, the offspring of F_1 generation all had white flowers. When the F_1 generation was self-crossed, it was observed in the F_2 generation that out of 100, 75 flowers were white. Make a cross and answer the following questions:

1. The above cross is known as:

(A) Monohybrid cross **(B)** Dihybrid cross

(C) Test cross **(D)** Back cross

Ans. Option (A) is correct.

> ***Explanation:*** A cross between two plants, which differ in only one pair of contrasting characters is called monohybrid cross. In this cross, F_2 phenotypic ratio is 3 : 1 and genotypic ratio is 1 : 2 : 1.

White flowers WW × Purple Flowers ww

Ww

White Flowers

2. In a monohybrid cross between two heterozygous individuals, percentage of pure homozygous individuals obtained in F_1 generation is:

(A) 25% **(B)** 50%

(C) 75% **(D)** 100%

Ans. Option (B) is correct.

> ***Explanation:*** Parents: Tt × Tt
>
> Gametes : T t T t
>
> TT Tt Tt tt
>
> (∵ Percentage of pure homozygous individuals (TT and tt) obtained in F_1-generation is 50%)

3. Which of these is not the genotype of F_2 progeny?

(A) WW **(B)** Ww

(C) ww **(D)** Wp

Ans. Option (D) is correct.

> ***Explanation:*** Genotypes of F_2 progeny are WW, Ww, ww.

4. The ratio of 'White: Purple' flowers in the F_2 generation is:

(A) 3 : 1 **(B)** 1 : 2

(C) 1 : 3 **(D)** 2 : 1

Ans. Option (A) is correct.

> ***Explanation:*** Ratio between White : Purple flowers are 3 : 1.

AI II. Study the given cross showing self pollination in F_1 and answer the following questions from Q.1. to Q.4

RRYY × rryy Parents

(Round Yellow) (Wrinkled Green)

RrYy × _____ F_1 generation

(Round Yellow)

1. The missing blank in the above cross is:

(A) RrYy **(B)** RRYY

(C) RryY **(D)** rryy

Ans. Option (A) is correct.

> ***Explanation:*** RrYy (Round Yellow) is the missing blank in the above cross.

2. The combination of characters in the F_2 progeny are:

(A) Round Yellow: Round Green: Wrinkled Yellow: Wrinkled Green

(B) Round Green : Round Yellow : Wrinkled yellow : Wrinkled Green

(C) Round Yellow : Round Green : Wrinkled Green: Wrinkled yellow

(D) Round Green : Round Yellow : Wrinkled yellow : Wrinkled Green

Ans. Option (A) is correct.

> $_2$ generation, the combination of characters is Round Yellow: Round Green: Wrinkled yellow: Wrinkled Green.

3. The ratio of the combination of characters in the F_2 progeny is:

(A) 3 : 1 **(B)** 1 : 2 : 1

(C) 1 : 1 : 1 **(D)** 9 : 3 : 3 : 1

Ans. Option (D) is correct.

> ***Explanation:*** The ratio of the combination of characters in the F_2 progeny is 9: 3: 3: 1.

4. A Mendelian experiment consists 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 cod depicted as

(A) TTWW **(B)** TTww

(C) TtWW **(D)** TtWw

Ans. Option (C) is correct.

> ***Explanation:*** All progeny bore violet flower, so they all must have gene for violet flower. As violet colour appears in hybrids thus it must be the dominant character. So, white flowered plant should have ww genes to show recessive white character. It indicates that all progenies got allele W (violet colour) from tall-violet flowered plant, thus its all gametes should have this allele. To serve the purpose plant must have WW genes. But, tallness was

found in 50% progenies thus half of its gametes contained T gene and other half contained t gene. Inclusively, the tall plant had TtWW genotype.

III. Read the given passage and answer the following questions.

Seema crossed pure breed pea plants having round-yellow seeds with wrinkled green seeds and found that only A-B type of seeds were produced in the F_1 generation. When F_1 generation pea plants having A-B type of seeds were cross-breed by self pollination, then in addition to the original round yellow and wrinkled green seeds, two new varieties A-D and C-B types of seeds were also obtained.

1. What are A-B type of seeds?

(A) Round -yellow **(B)** Round- green

(C) Wrinkled- yellow **(D)** Wrinkled- green

Ans. Option (A) is correct.

Explanation: A-B type of seeds are round in shape and yellow in colour.

2. A and B are _____ traits.

(A) dominant **(B)** recessive

(C) Both (A) and (B) **(D)** None of these

Ans. Option (A) is correct.

Explanation: A-B type is dominant traits.

3. A-D are _____ and C-B are _____ type of seeds.

(A) Round green and wrinkled yellow respectively

(B) Round yellow and wrinkled green respectively

(C) Wrinkled green and round green respectively

(C) Wrinkled green and round yellow respectively

Ans. Option (A) is correct.

Explanation: A-D is round-green while C-B is wrinkled- yellow.

4. Which one of these will be produced in maximum number in the F_2 generation?

(A) A-B **(B)** A-D

(C) Both (A) and (B) **(D)** None of these

Ans. Option (A) is correct.

Explanation: A-B is produced in maximum number as they are dominant traits while C-D will be produced in minimum number.

(B) Subjective Questions

Very Short Answer Type Questions
(1 Mark Each)

1. Mendel took tall pea plants and short pea plants and produced F_1 progeny through cross-fertilisation. What did Mendel observe in the F_1 progeny? AE **[CBSE Comptt. Set-I, II & III, 2018]**

Ans. All pea plant were tall in F_1 generation. **1**
[CBSE Marking Scheme, 2018]

AI **2. A Mendelian experiment consisted of breeding pea plants bearing violet flowers with pea plants bearing white flowers. What will be the result in F_1 progeny?** AE **[CBSE Delhi & O.D. Set, 2018]**

Ans. Violet flowers. **1**
[CBSE Marking Scheme, 2018]

Topper Answer, 2018

Ans.

As violet colour of flowers is dominant,
Genotype of white flowers : 'vv'
Genotype of violet flowers : 'VV'

Genotype of F_1 progeny :- 'Vv'
According to law of dominance, colours of flowers in F_1 progeny will be violet.

3. What is DNA?

R **[CBSE Term II, Foreign Set II, 2016]**

Ans. DNA is the carrier of hereditary information from parents to the next generation. **1**
[CBSE Marking Scheme, 2016]

4. How many pairs of chromosomes are present in human beings? R **[CBSE Term-II, 2015]**

Ans. 23 pairs. **1**

5. Where is DNA found in a cell?

R **[CBSE O.D. Set-II, 2015]**

Ans. DNA is found in the cell nucleus. **1**

6. What is a gene?

R **[CBSE O.D. Set-I, 2014]**

Ans. Gene is a part of DNA that encodes the instructions that allow a cell to produce a specific protein or enzyme. **1**

AI **7. What is heredity?**

R **[CBSE O.D. Set-II, 2014]**

Ans. The transmission of characteristics from one generation to another is known as **heredity**. **1**

8. Name the information source for making proteins in the cells. R **[CBSE Delhi Set-II, 2014]**

Ans. Cellular DNA is the information source for making proteins in cells. **1**

Short Answer Type Questions-I
(2 Marks Each)

1. "The chromosome number of the sexually reproducing parents and their offspring is the same." Justify this statement. **[O.E.B.]** A

Ans. Male individual have 46 chromosomes but because the gametes are always haploid *i.e.*, they have half the number of chromosomes; sperms will be haploid (23 chromosomes). Female individual also contains only 23 chromosomes in egg. It is the fusion of the sperm and egg which leads to an offsprings with 46 chromosomes. **2**

2. Give the respective scientific terms used for studying:

(i) The mechanism by which variations are created and inherited and

(ii) The development of new type of organisms form from the existing ones. **[O.E.B.]** R

Ans. (i) Genetics is the study of mechanism by which variations are created and inherited.

(ii) Evolution is used for studying the development of new type of organisms from the existing ones. **1+1**

AI **3. Differentiate between dominant and recessive traits.** **[O.E.B.]** U

Ans. (a) The character which gets expressed in the presence of its contrasting form is termed as dominant trait.

(b) The trait which remains unexpressed in the presence of its contrasting form is called recessive trait. **1+1**

4. 'Gene control traits'? Explain this statement with an example. [O.E.B.] A

Ans. Gene controls the trait by synthesizing the specific enzyme. Consider tallness as a trait. Plant height depends upon particular plant hormone which in turn will depend on the efficiency of the process for making it. If the enzyme responsible for the production of this hormone is efficient, plant will be tall. If the gene for that enzyme has an alteration that makes enzyme less efficient, the amount of hormone will be less and plant will be short. **2**

Short Answer Type Questions-II

(3 Marks Each)

1. After self-pollination in pea plants with round, yellow seeds, following types of seeds were obtained by Mendel:

Seeds	Number
Round, yellow	630
Round, green	216
Wrinkled, yellow	202
Wrinkled, green	64

Analyse the result and describe the mechanism of inheritance which explains these results.

A **[CBSE SQP, 2021]**

Ans. The ratio obtained is 9:3:3:1 in which parental as well as new combinations are observed. This indicates that progeny plants have not inherited the whole set of genes from each parent.

Every germ cell takes on chromosome from the pair of maternal and paternal chromosomes. When two germ cells combine, segregation of one pair of characters is independent of other pair of characters. **[CBSE Marking Scheme, 2021] 3**

AI **2. In humans, there is a 50% probability of the birth of a boy and 50 % probability that a girl will be born. Justify the statement on the basis of the mechanism of sex-determination in human beings.**

A **[CBSE SQP, 2021]**

Ans. In human beings, the genes inherited from our parents decide whether it will be a boy or girl. Women have a perfect pair of sex chromosomes (XX). But, men have a mismatched pair (XY).

All children will inherit an X chromosome from their mother regardless of whether they are boys or girls. Thus, the sex of the children will be determined by what they inherit from their father. A child who inherits an X chromosome from her father will be a girl, and one who inherits a Y chromosome from him will be a boy. **3**

[CBSE Marking Scheme, 2021]

3. A green stemmed rose plant denoted by GG and a brown stemmed rose plant denoted by gg are allowed to undergo a cross with each other. AE

(a) List your observations regarding:

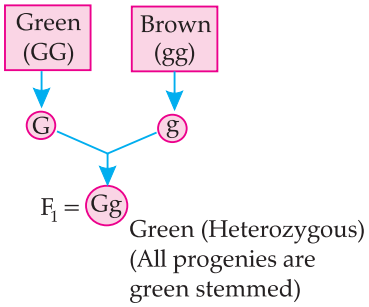
(i) Colour of stem in their F_1 progeny

(ii) Percentage of brown stemmed plants in F_2 progeny if F_1 plants are self pollinated.

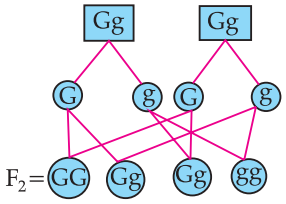
(iii) Ratio of GG and Gg in the F_2 progeny.

(b) Based on the finding of this cross, what conclusion can be drawn? **[CBSE O.D. Set-I, 2020]**

Ans. (a) (i) Colour of the stem in F_1 progeny: All green



(ii) Percentage of brown stem: 25 %



(iii) GG: Gg is 1: 2

(b) Based on the above cross, it can be concluded that green colour is dominant and get expressed in F_1 generation. The brown stem, which does not get express itself in the F_1 generation, is the recessive character. This is the law of dominance. **2+1=3**

4. In a pea plant, the trait of flowers bearing purple colour (PP) is dominant over white colour (pp). Explain the inheritance pattern of F_1 and F_2 generations with the help of a cross following the rules of inheritance of traits. State the visible characters of F_1 and F_2 progenies.

A **[CBSE SQP, 2020]**

Ans. Let purple trait be represented by: PP and White trait be: pp

Parental PP × pp ½

↓

F_1 generation Pp × Pp (Selfing) **1**

Selfing of F_1

↓

Gametes of F_2

	P	p
P	PP	Pp
p	Pp	pp

½ + ½

Visible characters of F_1 progeny: all flowers are purple coloured and in F_2 progenies: 3 are purple coloured and 1 is white coloured flower **3**

[CBSE Marking Scheme, 2020]

COMMONLY MADE ERROR

- Students often get confused between phenotype and genotype and between F_1 and F_2 generation.

ANSWERING TIP

- Practice concept of phenotype along with F_1 and F_2 generation and genotype with the help of examples.

5. Name the plant Mendel used for his experiment. What type of progeny was obtained by Mendel in F_1 and F_2 generations when he crossed the tall and short plants? Write the ratio he obtained in F_2 generation plants. R **[CBSE Delhi, Set- I, 2019]**

Ans. Pea Plant / Garden pea / *Pisum sativum*

F_1 – All tall; F_2- Tall and short

Ratio – Tall: Short

3: 1 / 1: 2: 1 **1+ 1 +1**

[CBSE Marking Scheme, 2019]

Detailed Answer:

Mendel used *Pisum sativum* (Pea plant) for his experiment.

Mendel took a tall pea (*TT*) plant and a short pea (*tt*) plant. When he crossed both, the first filial generation (F_1) obtained were tall. When F_1 progeny was self-pollinated, all plants obtained in F_2 generation were not tall. Instead, three tall pea (dominant) plants and one short pea (recessive) plant was obtained.

Parents : TT (Tall) × tt (Short)

F_1 generation

Tt (Tall)

Selfing of F_1 : Tt (Tall) × Tt (Tall)

F_2

	T	t
T	TT Tall	Tt Tall
t	Tt Tall	tt Short

Phenotypic ratio 3 Tall: 1 short **Genotypic ratio** 1 Pure Tall (TT): 2 Hybrid (Tt): 1 Pure short (tt) **3**

Phenotypic ratio 3 Tall: 1 short **Genotypic ratio** 1 Pure Tall (TT): 2 Hybrid (Tt): 1 Pure short (tt) **3**

COMMONLY MADE ERROR

- Mostly students explain this answer incorrectly.

ANSWERING TIP

- Practice a number of examples for Monohybrid and Dihybrid cross.

AI **6. If we cross-bred tall (dominant) pea plant with pure-bred dwarf (recessive) pea plant, we will get plants of F_1 generation. If we now self-cross the pea plant of F_1 generation, we obtain pea plants of F_2 generation.**

(i) What do the plants of F_1 generation look like?

(ii) State the ratio of tall plant to dwarf plants in F_2 generation.

(iii) State the type of plants not found in F_1 generation but appeared in F_2 generation. Write the reason for the same. AE **[CBSE O.D. Comptt. Set-I, 2017]**

Ans. (i) Tall **1**

(ii) 3: 1 ½

(iii) Dwarf ½

Reason: Being a recessive trait, dwarfness can only be expressed in the recessive homozygous condition or in the absence of dominant trait. **1**

AI **7. How do Mendel's experiment show that traits are inherited independently?**

C **[CBSE O.D. Set-I, 2016 , Delhi Set-III 2017]**

Ans. (i) When a cross was made between a tall pea plant with round seeds and a short pea plant with wrinkled seeds, the F_1 progeny plants are all tall with round seeds. This indicates that tallness and round seeds are the dominant traits. **1**

(ii) When the F_1 plants are self-pollinated, the F_2 progeny consist of some tall plants with round seeds and some short plants with wrinkled seeds which are the parental traits. **1**

(iii) There were also some new combinations like tall plants with wrinkled seeds and short plants with round seeds. ½

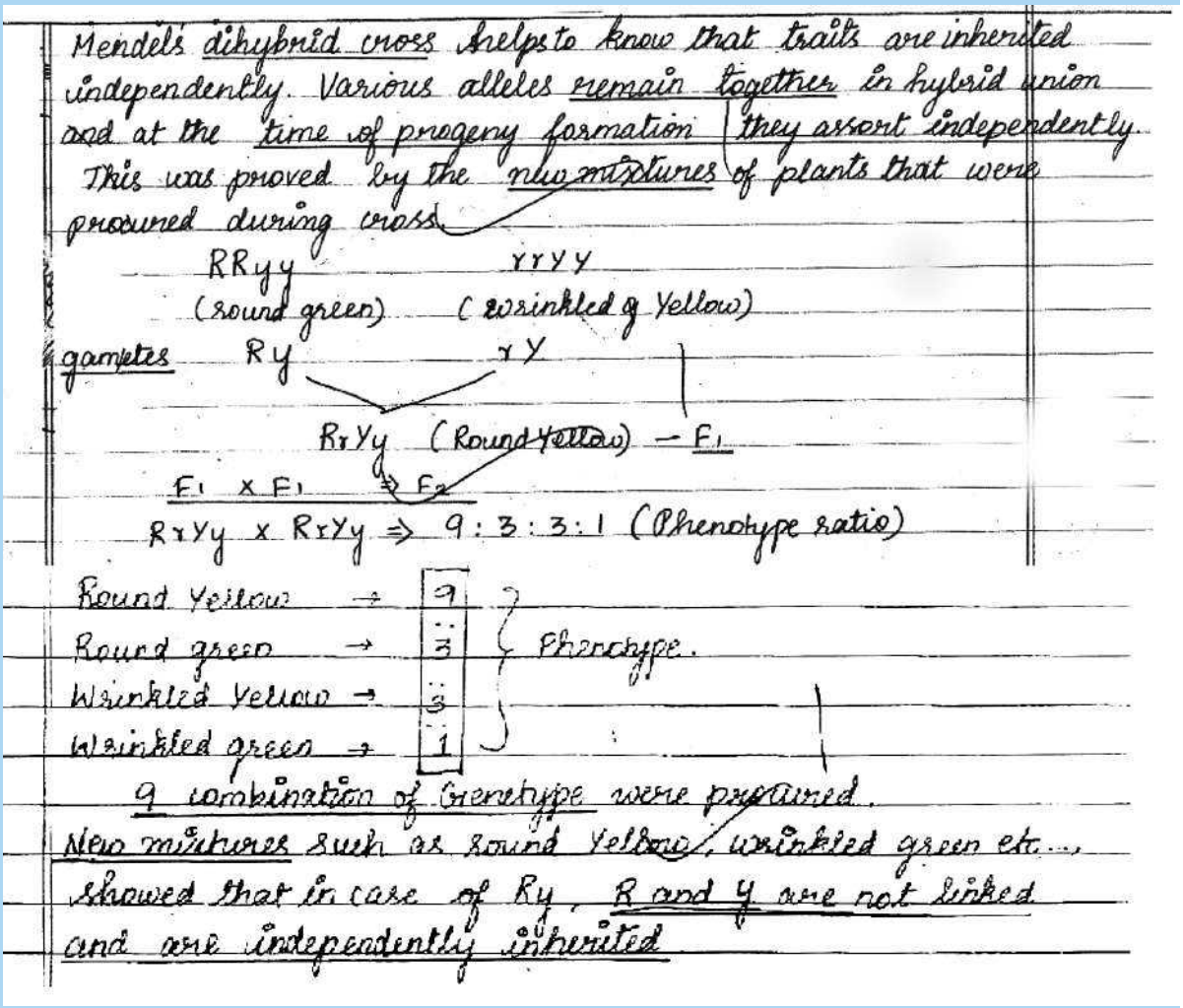
(iv) Thus, it may be concluded that tall and short traits and round and wrinkled seed traits have been inherited independently. ½

OR

A flow chart depicting the same.

Note: Any other contrasting characters can also be taken **[CBSE Marking Scheme, 2016]**

Topper Answer, 2016



Mendel's dihybrid cross helps to know that traits are inherited independently. Various alleles remain together in hybrid union and at the time of progeny formation they assort independently. This was proved by the new mixtures of plants that were produced during cross.

RRyy (round green) × rrYY (wrinkled & Yellow)

gametes Ry × rY

RrYy (Round Yellow) – F1

F1 × F1 ⇒ F2

RrYy × RrYy ⇒ 9 : 3 : 3 : 1 (Phenotype ratio)

Round Yellow → 9
Round green → 3
Wrinkled Yellow → 3
Wrinkled green → 1
} Phenotype.

9 combination of Genotype were produced.

New mixtures such as round Yellow, wrinkled green etc..., showed that in case of Ry, R and y are not linked and are independently inherited

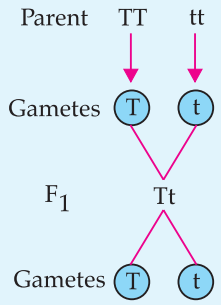
8. In one of his experiments with pea plants Mendel observed that when a pure tall pea plant is crossed with a pure dwarf pea plants, in the first generation, F_1 only tall plants appear.

(i) What happens to the traits of the dwarf plants in this case?

(ii) When the F_1 generation plants were self-fertilised, he observed that in the plants of second generation, F_2, both tall plants and dwarf plants were present. Why it happened? Explain briefly.

AE **[CBSE Term II, Delhi Set-I, 2016]**

Ans. (i)



1

Due to the Presence of dominant tall trait, plant was not able to express Recessive dwarf trait.

Tall: Dwarf = 3: 1 ratio **1**

(ii) In the F_2 generation, both the tall and dwarf traits are present in the ratio of 3: 1. This showed that the traits for tallness and dwarfness are present in the F_1 generation, but the dwarfness, being the recessive trait, does not express itself in the presence of tallness, the dominant trait. **1**

[CBSE Marking Scheme, 2016]

COMMONLY MADE ERROR

- Mostly students make error while drawing the cross. Some of them forget to label the stages.

ANSWERING TIP

- Practice cross with the help of different characteristic features in three stages:
  (a) Parents
  (b) F_1 generation
  (c) F_2 generation

9. How did Mendel interpret his result to show that traits may be dominant or recessive? Describe briefly. U **[CBSE Term II, Delhi Set-II, 2016]**

Ans. Mendel conducted breeding experiments on Pea plants.

(i) He selected pure breed tall and dwarf plants. ½

(ii) He cross-pollinated these plants. ½

(iii) In the F_1 generation, he obtained only tall plants. Tallness is the dominant trait. ½

(iv) Then, he produced F_2 generation by self cross of hybrids / F_1. ½

(v) He found that $3/4^{th}$ of the plants were tall and $1/4^{th}$ were dwarf. ½

(vi) The trait which remains hidden in F_1 generation plants is the recessive traits. ½

[CBSE Marking Scheme, 2016]

10. In a monohybrid cross between tall pea plants (TT) and short pea plants (tt) a scientist obtained only tall pea plants (Tt) in the F_1 generation. However, on self cross of the F_1 generation pea plants, he obtained both tall and short plants in F_2 generation. On the basis of above observations with other angiosperms also, can the scientist arrive at a law? If yes, explain the law. If not, give justification for your answer.

U **[CBSE Term II, Delhi Set-III, 2016]**

Ans. Yes, the scientist may arrive at the law of dominance according to which the trait that is expressed in the F_1 generation is the dominant trait, although both the dominant and recessive traits are present in the F_1 generation. In the F_2 generation the recessive traits is also expressed along with the dominant traits. **1 + 1 + 1**

[CBSE Marking Scheme, 2016]

11. 'Different species use different strategies to determine sex of a newborn individual. It can be environmental cues or genetically determined.' Explain the statement by giving example for each strategy. A **[CBSE Term II, SQP, 2016]**

Ans. Environmental Cue: (i) In some animals, the temperature at which fertilised eggs are kept determines whether the developing animal in egg is male or female.

(ii) In some animals like snail, individual can change sex.

Genetical Cue: A child who inherits an X-chromosome from her father will be a girl and one who inherits a Y- chromosome from the father will be a boy. **1 + 1 + 1**

[CBSE Marking Scheme, 2016]

12. What is DNA copying? State its importance.

R **[CBSE Term II, Delhi Set-II, 2015]**

Ans. DNA replication or DNA copying is the process of producing two identical replicas from one original DNA molecule during cell division.

Importance of DNA Copying:

(i) DNA replication needs to occur so that during cell division, new cells will also have a copy of organism's DNA.

(ii) DNA is necessary to make all the RNA and proteins needed for cells to carry out necessary reactions and cellular processes in order to survive. **1+ 1 + 1**

AI 13. (a) What is variation? How is variation created in a population? How does the creation of variation in a species promote survival?

(b) Explain how, offspring and parents of organisms reproducing sexually have the same number of chromosomes. U [CBSE Comptt. Set-I, II, III, 2018]

Ans. (a) Occurrence of differences between organisms is called **variation**.

New variation may arise during the process of DNA copying that already has variations accumulated from previous generations.

Combining variations from two or more individuals would thus create new combinations of variations.

Species having suitable variations have more chances of survival in case of change in environment conditions.

(b) In sexually reproducing organisms, male and female gametes/reproductive cells with only half the number of chromosomes (as in the parent cell) are produced. During fertilization, when male and female gametes fuse to give rise to a zygote, original number of chromosomes are restored.

[CBSE Marking Scheme, 2018] **2 + 1**

Long Answer Type Questions

(5 Marks Each)

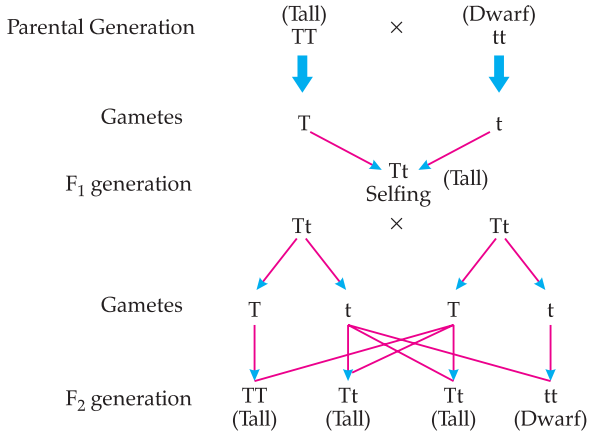
1. (a) What is the law of dominance of traits? Explain with an example.

(b) Why are the traits acquired during the life time of an individual not inherited? Explain.

C [CBSE Delhi Set-I, 2020]

Ans. (a) Law of dominance of traits: It states that "When parents having pure contrasting characters are crossed then only one character expresses itself in F_1 generation. This character is the dominant character and the character which cannot express itself is called recessive character".

Let us take an example of tall and dwarf in pea plant. When pure line tall (TT) plants were crossed with pure line dwarf (tt) plants, offspring were all heterozygous tall (Tt). The appearance of all Tall plants in the F_1 generation shows that tallness is the dominant character while dwarfness is the recessive character. The ratio of Tall to Dwarf in F_2 generation is 3: 1.



(b) Characters that a person acquires during one's life time are known as acquired characters/traits. Such changes do not occur in the reproductive tissues. Changes in the non-reproductive tissues are not passed on to the DNA of the germ cells and therefore not inherited by the next generation. **3+2**

2. (a) What are dominant and recessive traits?

(b) "Is it possible that a trait is inherited but may not be expressed in the next generation?" Give a suitable example to justify this statement.

R [Board O.D. Set- II, 2019]

Ans. (a) Dominant Trait: The trait which expresses itself in F_1 (first) generation after crossing contrasting (opposite) trait is known as **dominant character** (trait). **1½**

Recessive Trait: The trait which is not expressed itself in F_1 (first) generation after crossing contrasting (opposite) trait. **1½**

(b) Yes **2**

Tall TT × Dwarf tt

$F_1 \rightarrow$ Tt

All tall **2**

(∵ t is not expressed in this generation which is recessive trait.)

[CBSE Marking Scheme, 2019]

AI 3.(a) Why did Mendel choose garden pea for his experiments? Write two reasons.

(b) List two contrasting visible characters of garden pea Mendel used for his experiment.

(c) Explain in brief how Mendel interpreted his results to show that the traits may be dominant or recessive. R [CBSE Term II, Foreign Set-I, 2016]

Ans. (a) Reasons:

(i) Pea plant is small and easy to grow.

(ii) A large number of true breeding varieties of pea plant are available.

(iii) Short life cycle.

(iv) Both self and cross-pollination can be made possible. **(Any two reasons) 2 × ½ = 1**

(b) Contrasting characters:

Round / Wrinkled seeds

Tall / Short plants

White / Purple flowers

Green / Yellow seeds **(Or any other)**

(Any two) 2 × ½ = 1

(c) When Mendel crossed two pea plants with a pair of contrasting characters, only one character appeared in all the members of F_1 progeny and the others remain hidden.

On selfing F_1, the hidden characters reappeared in just 25% of the offsprings and the other 75% shared the characters expressed in F_1.

Mendel concluded that the character which expresses itself in F_1 and in 75% of the individuals of F_2 is dominating while the other is recessive. (Or same thing can be explained by using an example) **1 + 1 + 1**

[CBSE Marking Scheme, 2016]

4. How do Mendel's experiments show that

(a) Traits may be dominant or recessive?

(b) Inheritance of two traits is independent of each other? U **[CBSE Delhi Set-I, 2017]**

Ans. (a) Mendel conducted a Monohybrid cross/ (crossed pure tall pea plants with pure dwarf pea plants) he observed only tall pea plants in the F_1 generation, but on self crossing of the F_1 progeny, both tall and dwarf pea plants were observed in F_2 generation in the ratio 3: 1. Appearance of tall character in F_1 and F_2 generations shows tallness to be a dominant character. But absence of dwarf character in F_1 and its reappearance in F_2 confirms that dwarfness is recessive character. **2½**

(b) Mendel conducted a dihybrid cross and observed that though he started with two types of parents, he obtained four types of individuals in F_2. The appearance of new recombination in F_2 generations along with parental type characters showed that traits are inherited independently of each other. **2½**

[CBSE Marking Scheme, 2017]

SELF ASSESSMENT TEST

Maximum Time: 1 hour **MM: 30**

(A) Objective Type Questions — 1 Mark Each

Stand Alone MCQs (1 Mark Each)

Q. 1. Which of these plants are propagated vegetatively?

I. *Hydra* **II.** Potato
III. Yeast **IV.** *Rhizopus*
(A) Only I **(B)** Only II
(C) I and II only **(D)** I, II and IV only **1**

Q. 2. Which of the following is the correct sequence of events of sexual reproduction in a flower?

(A) Pollination, fertilisation, seedling, embryo
(B) Seedling, embryo, fertilisation, pollination
(C) Pollination, fertilisation, embryo, seedling
(D) Embryo, seedling, pollination, fertilisation **1**

Q. 3. Which term is used to refer the transmission of characters from the parents to their off springs?

(A) Evolution **(B)** Heredity
(C) Variation **(D)** All the above **1**

Q. 4. A pea plant is represented by Rr. This represents the

(A) Genetic composition of an individual
(B) Characteristics which are visible in an organism.
(C) Alternate form of genes
(D) None of these **1**

Assertion and Reason Based MCQs (1 Mark Each)

Directions : In the following questions, A statement of Assertion (A) is followed by a statement of Reason (R). Mark the correct choice as.

(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is NOT the correct explanation of A.
(C) A is true but R is false.
(D) A is false and R is true.

Q. 5. Assertion (A): If prostate gland is removed, sperms will become less active.

Reason (R): Secretion of the prostate gland nourishes and activates the spermatozoa to swim. **1**

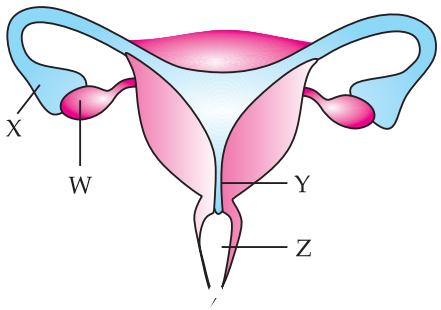
Q. 6. Assertion (A): When a black-furred mouse is bred with a white-furred one, most of the offsprings will have black fur.

Reason (R): In mice, the allele for black fur colour is dominant over the allele for white fur colour. **1**

Case-based MCQs (1 Mark Each)

Study the given paragraph and diagram carefully and answer the questions given below :

Fertilization is the union of a sperm nucleus, of paternal origin, with an egg nucleus, of maternal origin, to form the primary nucleus of an embryo. In all organisms the essence of fertilization is, in fact, the fusion of the hereditary material of two different sex cells, or gametes, each of which carries half the number of chromosomes typical of the species. The result of fertilization is a cell (zygote) capable of undergoing cell divisions called cleavages as it passes down the fallopian tube. After several cleavages have taken place, the cells form a hollow ball called a blastula. In most mammals the blastula attaches itself to the uterine lining, thus stimulating the formation of a placenta, which will transfer nutrients from the mother to the growing embryo. In lower animals the embryo is nourished by the yolk. The given structure represents the structure of a Human- female reproductive system where fertilisation and post-fertilisation events take place.

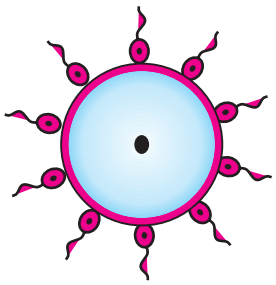


Q. 7. The label marked as X, Y , Z and W in the diagram is:

	W	X	Y	Z
(A)	Ovary	Fallopian tube	Uterus	Vagina
(B)	Vagina	Fallopian tube	Ovary	Uterus
(C)	Uterus	Vagina	Ovary	Fallopian tube
(D)	Ovary	Uterus	Fallopian tube	Vagina

1

Q. 8. The part of the female reproductive system where the given process takes place :



(A) W **(B)** Z

(C) Y **(D)** X **1**

Q. 9. There are three processes which takes place in female reproductive system.

Process I- Ovulation

Process II- Fertilisation

Process III- Implantation.

Identify the place where the above given processes takes place.

	Process I	Process II	Process III
(A)	W	X	Y
(B)	Z	W	X
(C)	Y	Z	W
(D)	X	Y	Z

1

Q. 10. Which of these is not the function of label W?

(A) Progesterone secretion

(B) Estrogen secretion

(C) Ovum formation

(D) Testosterone secretion **1**

(B) Subjective Questions

Very Short Answer Type Questions
(1 Mark Each)

Q. 11. "Cell division is a type of reproduction in unicellular organisms." Justify. **1**

Q. 12. Why is DNA copying necessary during reproduction? **1**

Q. 13. What is gene? **1**

Short Answer Type Questions-I
(2 Marks Each)

Q. 14. Define the term puberty. List two changes observed in girls at the time of puberty. **2**

Q. 15. Explain how in sexually reproducing organisms the number of chromosomes in the progeny is maintained. **2**

Q. 16. How dominant and recessive traits are different from each other ? **2**

Short Answer Type Questions-II
(3 Marks Each)

Q. 17. What are sexually transmitted diseases? Write two examples each of sexually transmitted diseases caused by (i) virus, (ii) bacteria. Explain how the transmission of such diseases be prevented? **3**

Q. 18. (a) "The sex of the children is determined by what they inherit from their father and not their mother." Justify.

(b) Give an example where environmental factors like temperature determines the sex of the offspring. **3**

Long Answer Type Questions
(5 Marks Each)

Q. 19. (a) Explain Mendel's view of a dominant trait. Give an example.

(b) List any two contrasting characters other than height that Mendel used in his experiments in pea plants.

(c) State Mendel's law of independent assortment. **5**