

CBSE CLASS X
Science (086)

QUESTION PAPER

From previous CBSE Board Exam questions

Code: CYMQV4**Questions: 63****Maximum Marks: 135****Generated: 2026-06-15 13:05****SELECTIONS USED**

Source	Previous-year board
Subject	Science
Lessons	Heredity
Year	2022-2026
Questions selected	63

Composition — Types: 21 Short · 19 MCQ · 9 Assertion–reason · 5 Case-based · 5 source_based · 5 Very short

Q1. § Introduction § 8.1 ACCUMULATION OF VARIATION DURING REPRODUCTION

[2]

What is variation ? List two main reasons that may lead to variation in a population.

Previously asked in: 2022 31/1/1 Q5 (a)

♦ **Heredity**

Variation – Definition and Causes

Q2. § Introduction § 8.1 ACCUMULATION OF VARIATION DURING REPRODUCTION

[2]

"Variation is useful for the survival of species over time." Explain this statement with the help of an example.

Previously asked in: 2026 31/2/1 Q11

♦ **Heredity**

Importance of Variation for Survival of Species

Q3. § 8.2 HEREDITY § 8.2.2 Rules for the Inheritance of Traits – Mendel's Contributions

[1]

In an experiment to study independent inheritance of two separate traits : shape and colour of seeds, the ratio of the different combinations in F₂ progeny would be

A 1 : 3

B 1 : 2 : 1

C 9 : 3 : 3 : 1

D 9 : 1 : 1 : 3

Previously asked in: 2024 31/3/1 Q10

♦ **Heredity**

Dihybrid Cross and Independent Assortment (9:3:3:1 ratio)

Q4. § Introduction § 8.1 ACCUMULATION OF VARIATION DURING REPRODUCTION § 8.2 HEREDITY

[1]

Assertion (A) : Human populations show a great deal of variations in traits.

Reason (R) : All variations in a species have equal chances of surviving in the environment in which they live.

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

(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).

(c) Assertion (A) is true, but Reason (R) is false.

(d) Assertion (A) is false, but Reason (R) is true.

Previously asked in: 2023 31/5/1 Q18

♦ **Heredity**

Survival advantage of variations / Natural selection

Variations in human populations

Q5. § Introduction § 8.2.3 How do these Traits get Expressed?**[1]**

If pea plants with round and green seeds (RRyy) are crossed with pea plants having wrinkled and yellow seeds (rrYY), the seeds developed by the plants of F₁ generation will be :

- (A) 50% round and green
- (B) 75% wrinkled and green
- (C) 100% round and yellow
- (D) 75% wrinkled and yellow

Previously asked in: 2025 31/1/1 Q11

◆ Heredity

Dihybrid Cross and Law of Independent Assortment

Q6. § 8.2 HEREDITY**[1]**

Assertion (A) : A mango seed will germinate to form a mango tree.

Reason (R) : Heredity determines the process by which traits and characteristics are reliably inherited from parents to offspring.

- (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
- (B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of Assertion (A).
- (C) Assertion (A) is true, but Reason (R) is false.
- (D) Assertion (A) is false, but Reason (R) is true.

Previously asked in: 2025 31/2/1 Q18

◆ Heredity

Heredity and inheritance of traits from parents to offspring

Q7. § 8.2 HEREDITY § 8.2.1 Inherited Traits § 8.2.4 Sex Determination**[1]**

Assertion (A) : A human child bears all the basic features of human beings.

Reason (R) : It looks exactly like its parents, showing very little variations.

- (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
- (B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of Assertion (A).
- (C) Assertion (A) is true, but Reason (R) is false.
- (D) Assertion (A) is false, but Reason (R) is true.

Previously asked in: 2025 31/1/1 Q18

◆ Heredity

Heredity and Variation

Q8. § 8.1 ACCUMULATION OF VARIATION DURING REPRODUCTION**[1]**

Assertion (A) : Bacteria that can withstand heat have better chances of survival in a heat wave.

Reason (R) : Accumulation of variations in a species increases the chances of its survival in changing environment.

- (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
- (B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
- (C) Assertion (A) is true, but Reason (R) is false.
- (D) Assertion (A) is false, but Reason (R) is true.

Previously asked in: 2026 31/5/1 Q8

◆ Heredity

Accumulation of Variations and Survival Advantage

Natural Selection and Adaptation

Q9. § 8.2 HEREDITY**[1]**

Identify the traits that cannot be transmitted from parents to the offsprings :

- (i) Swimming technique
- (ii) Blood group
- (iii) Eye colour
- (iv) Dancing skills

Options :

- (A) (i) and (ii)
- (B) (i) and (iv)
- (C) (iii) and (iv)
- (D) (ii) and (iii)

Previously asked in: 2026 31/4/1 Q4

♦ Heredity

Acquired vs Inherited Traits

Q10. § Introduction § 8.2 HEREDITY § 8.2.2 Rules for the Inheritance of Traits – Mendel's Contributions**[2]**

In a cross between red coloured and white coloured flowers, when plants with red coloured flowers of F₁ generation were self pollinated, plants of F₂ generation were obtained in which 75% of plants were with red flowers and 25% plants were with white flowers. Explain the inheritance of traits in the above cross with the help of a flow chart only along with the ratio of plants obtained.

Previously asked in: 2022 31/4/1 Q3 (OR)

♦ Heredity

Mendel's Laws – Dominance and Segregation

Monohybrid Cross and F₁/F₂ Generation Ratios**Q11.** § 8.2.2 Rules for the Inheritance of Traits – Mendel's Contributions**[4]**

Mendel blended his knowledge of Science and mathematics to keep the count of the individuals exhibiting a particular trait in each generation. He observed a number of contrasting visible characters controlled in pea plants in a field. He conducted many experiments to arrive at the laws of inheritance.

Read the case and answer the following questions:

- (c) If 1600 plants were obtained in F₂ progeny, write the number of plants having traits : (i) Tall with round seeds (ii) Short with wrinkled seeds Write the conclusion of the above experiment.

Previously asked in: 2022 31/2/1 Q14 (OR-2)

♦ Heredity

Dihybrid Cross and F₂ progeny ratios

Law of Independent Assortment

Mendel's Laws of Inheritance

Q12. § Introduction § 8.2.2 Rules for the Inheritance of Traits – Mendel's Contributions § 8.2.3 How do these Traits get Expressed?**[1]**

When a pure-tall pea plant is crossed with a pure-dwarf pea plant, the percentage of tall pea plants in F₁ and F₂ generation pea plants will be respectively :

- (a) 100% ; 25%
- (b) 100% ; 50%
- (c) 100% ; 75%
- (d) 100% ; 100%

Previously asked in: 2025 31/4/1 Q9

♦ Heredity

Mendel's monohybrid cross – F₁ and F₂ generation ratios

Q13. § 8.2 HEREDITY**[4]**

The most obvious outcome of the reproductive process is the generation of individuals of similar design, but in sexual reproduction they may not be exactly alike. The resemblances as well as differences are marked. The rules of heredity determine the process by which traits and characteristics are reliably inherited. Many experiments have been done to study the rules of inheritance.

Read the following and answer the questions:

- (i) Why an offspring of human being is not a true copy of his parents in sexual reproduction ? [1]
- (ii) While performing experiments on inheritance in plants, what is the difference between F₁ and F₂ generation ? [1]
- (iii) Answer (A) or (B): [2]

Previously asked in: 2023 31/4/1 Q38

♦ Heredity

F₁ and F₂ generations in Mendel's experiments

Rules of heredity and transmission of traits

Sexual reproduction and variation in offspring

Q14. § 8.2.2 Rules for the Inheritance of Traits – Mendel's Contributions**[4]**

Mendel took garden pea plants with different characteristics, such as height to study the inheritance pattern of factors (genes). He crossed tall pea plant with short pea plant and obtained all the tall plants in the F₁ generation. Answer the following questions :

- (a) Why only tall pea plants were observed in F₁ progeny ? [1]
- (b) By which method did Mendel obtain F₂ progeny ? [1]
- (c) Write one difference between dominant and recessive trait. [2]

Previously asked in: 2026 31/1/1 Q15

♦ Heredity

Mendel's Monohybrid Cross and Dominant/Recessive Traits

Q15. § 8.2.2 Rules for the Inheritance of Traits – Mendel's Contributions § 8.2.3 How do these Traits get Expressed?**[3]**

Table showing Mendelian cross results:

Parents: A pea plant with red flowers was crossed with a pea plant with white flowers.

F₁: 30 seeds were sown and all bore plants with red flowers.

F₂: 44 seeds were sown, 33 plants bore red flowers and 11 plants bore white flowers.

Study the given table and answer the following questions :

- (a) Depict the information given in the table in the form of a cross.
- (b) Deduce the F₂ phenotypic ratio/F₂ ratio showing external look as well as genotypic/genetic makeup ratio.

Previously asked in: 2026 31/4/1 Q14

♦ Heredity

Mendel's Monohybrid Cross and Dominant/Recessive Traits

Q16. § Introduction § 8.2.2 Rules for the Inheritance of Traits – Mendel's Contributions § 8.2.3 How do these Traits get Expressed? [1]

Two pea plants, one with round green seeds (RRyy) and another with wrinkled yellow (rrYY) seeds were crossed with each other which produced F₁ progeny that have only round yellow (RrYy) seeds. When F₁ plants are self-pollinated, the F₂ progeny will have which new combination of characters, as compared to the parents :

- (i) Round, yellow
- (ii) Round, green
- (iii) Wrinkled, yellow
- (iv) Wrinkled, green

Correct options are :

- (A) (i) and (ii)
- (B) (i) and (iv)
- (C) (ii) and (iv)
- (D) (i) and (iii)

Previously asked in: 2026 31/4/1 Q6

♦ Heredity Mendel's Dihybrid Cross and New Trait Combinations in F₂

Q17. § Introduction § 8.2.2 Rules for the Inheritance of Traits – Mendel's Contributions [1]

In an experiment with pea plants, a pure tall plant (TT) is crossed with a pure short plant (tt). The ratio of pure tall plant to pure short plants in F₂ generation will be

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

Previously asked in: 2023 31/6/1 Q9

♦ Heredity Monohybrid Cross and F₂ Generation Ratios (TT × tt)

Q18. § 8.2.2 Rules for the Inheritance of Traits – Mendel's Contributions [3]

How did Mendel's experiments show that traits are inherited independently? Explain.

Previously asked in: 2022 31/3/1 Q13

♦ Heredity Dihybrid Cross Mendel's Law of Independent Assortment

Q19. § Introduction § 8.1 ACCUMULATION OF VARIATION DURING REPRODUCTION § 8.2.2 Rules for the Inheritance of Traits – Mendel's Contributions [1]

A cross between pea plant with white flowers (vv) and pea plant with violet flowers (VV) resulted in F₂ progeny in which ratio of violet (VV) and white (vv) flowers will be :

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

Previously asked in: 2023 31/4/1 Q10

♦ Heredity Monohybrid Cross and F₂ Genotypic Ratio

Q20. § Introduction § 8.1 ACCUMULATION OF VARIATION DURING REPRODUCTION § 8.2.3 How do these Traits get Expressed? [1]

The genotype of green stemmed tomato plant is denoted by 'GG' and that of purple stemmed tomato plant as 'gg'. Hybrid of a cross between these two were self-pollinated to obtain F₂ progeny. What will be the ratio of GG, Gg and gg in this F₂ progeny ?

- (A) 2:1:1
- (B) 3:1:0
- (C) 1:1:2
- (D) 1:2:1

Previously asked in: 2026 31/2/1 Q1

♦ Heredity Monohybrid Cross and F₂ Genotypic Ratio

Q21. § 8.2.2 Rules for the Inheritance of Traits – Mendel's Contributions § 8.2.3 How do these Traits get Expressed? [3]

Based on Mendel's experiment show the cross between round, yellow seeds of pea plant (RRYY) with wrinkled and green seeds of pea plant (rryy) upto F₂ generation. Write the number of seeds/plants with following genetic (Genotype) makeup in F₂ generation :

- (i) RRYY
- (ii) rryy

Previously asked in: 2026 31/5/1 Q13

♦ Heredity Genotypic Ratio in F₂ Generation of Dihybrid Cross Mendel's Dihybrid Cross (RRYY × rryy) up to F₂ Generation

Q22. § 8.2.4 Sex Determination [4]

Draw a flow chart to show that sex is determined genetically in human beings.

Previously asked in: 2022 31/4/1 Q15 (OR)

♦ Heredity Genetic determination of sex in human beings

Q23. § 8.2.4 Sex Determination [4]

Sex of an individual is determined by different factors in various species. Some animals rely entirely on the environmental cues, while in some other animals the individuals can change their sex during their life time indicating that sex of some species is not genetically determined. However, in human beings, the sex of an individual is largely determined genetically.

Answer the sub-questions based on the case below. Part (a) and (b) are compulsory; an internal choice has been provided in Part (c).

- (a) In what way are the sex chromosomes 'X' and 'Y' different in size ? Name the mismatched pair of sex chromosome in humans.
- (b) Write the number of pair/pairs of sex chromosomes present in human beings. In which one of the parent (male / female) perfect pair / pairs of sex chromosomes are present ?
- (c) Citing two examples, justify the statement "Sex of an individual is not always determined genetically".

Previously asked in: 2022 31/4/1 Q15 (main)

♦ Heredity

Environmental and non-genetic sex determination (e.g., temperature-dependent sex determination in reptiles, sequential hermaphroditism in snails)

Sex determination in humans – X and Y chromosomes

Q24. § 8.2 HEREDITY § 8.2.2 Rules for the Inheritance of Traits – Mendel's Contributions § 8.2.4 Sex Determination**[3]**

Answer the following:

- (a) Name the two types of gametes produced by men. ($\frac{1}{2} + \frac{1}{2}$)
- (b) Does a male child inherit X chromosome from his father ? Justify. ($\frac{1}{2} + 1$)
- (c) How many types of gametes are produced by a human female ? ($\frac{1}{2}$)

Previously asked in: 2022 31/2/1 Q10

♦ Heredity Sex determination and sex chromosomes in humans

Q25. § 8.2.4 Sex Determination**[4]**

All human chromosomes are not paired. Most human chromosomes have a maternal and a paternal copy, and we have 22 such pairs. But one pair called the sex chromosomes, is odd in not always being a perfect pair. Women have a perfect pair of sex chromosomes. But men have a mismatched pair in which one is normal sized while the other is a short one.

Answer the sub-parts based on the given passage about human chromosomes and sex determination.

- (a) In humans, how many chromosomes are present in a Zygote and in each gamete ?
- (b) A few reptiles rely entirely on environmental cues for sex determination. Comment.
- (c) "The sex of a child is a matter of chance and none of the parents are considered to be responsible for it." Justify it through flow chart only.

Previously asked in: 2023 31/6/1 Q38

♦ Heredity Flow chart of sex determination – role of chance Human chromosomes and sex chromosomes (XX/XY)
Sex determination in humans and environmental sex determination in reptiles**Q26.** § 8.2.4 Sex Determination**[1]**

Assertion (A) : Genes inherited from the parents decide the sex of a child.

Reason (R) : X chromosome in a male child is inherited from his father.

- (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, but (R) is true.

Previously asked in: 2023 31/1/1 Q18

♦ Heredity Sex Chromosomes (X and Y) Sex Determination

Q27. § 8.2.4 Sex Determination**[1]**

Assertion (A) : Human female has a perfect pair of sex chromosome.

Reason (R) : Sex chromosome contributed by the human male in the zygote decides the sex of a child.

- (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, but (R) is true.

Previously asked in: 2024 31/2/1 Q18

♦ Heredity Sex determination in humans – sex chromosomes (XX/XY)

Q28. § 8.1 ACCUMULATION OF VARIATION DURING REPRODUCTION § 8.2 HEREDITY § 8.2.4 Sex Determination**[1]**

Chromosomes :

- (i) carry hereditary information from parents to the next generation.
- (ii) are thread like structures located inside the nucleus of an animal cell.
- (iii) always exist in pairs in human reproductive cells.
- (iv) are involved in the process of cell division.

The correct statements are :

- (a) (i) and (ii)
- (b) (iii) and (iv)
- (c) (i), (ii) and (iv)
- (d) (i) and (iv)

Previously asked in: 2024 31/1/1 Q9

◆ Heredity

Structure and Function of Chromosomes

Q29. § 8.2.4 Sex Determination**[2]**

Explain with the help of a flow chart that in human beings father is responsible for the sex (male or female) of the child.

Previously asked in: 2025 31/4/1 Q24

◆ Heredity

Sex Determination in Humans – Role of Father

Q30. § 8.2.4 Sex Determination**[1]**

Assertion (A) : In reptiles, the temperature at which the fertilized eggs are kept decides the sex of the offsprings.

Reason (R) : Sex is not genetically determined in some animals.

- (a) Both, Assertion (A) and Reason (R) are true, and Reason (R) is the correct explanation of Assertion (A).
- (b) Both, Assertion (A) and Reason (R) are true, and Reason (R) is not the correct explanation of Assertion (A).
- (c) Assertion (A) is true, but Reason (R) is false.
- (d) Assertion (A) is false, but Reason (R) is true.

Previously asked in: 2025 31/4/1 Q19

◆ Heredity

Environmental sex determination in reptiles

Sex determination – genetic vs. environmental factors

Q31. § 8.2.4 Sex Determination**[4]**

The mechanism by which the sex of an individual is determined is called sex-determination. In human beings, sex of a newborn is genetically determined, whereas in some others it is not. There are 46 (23 pairs) chromosomes in human beings. Out of these, 44 (22 pairs) control the body characters and 2 (one pair) are known as sex chromosomes. The sex chromosomes are of two types – X chromosome and Y chromosome. At the time of fertilisation, depending upon which type of male gamete fuses with the female gamete, the sex of the newborn child is decided.

Read the passage and answer the following questions:

- (a) Why is a pair of sex chromosomes in human beings called a mismatched pair in terms of type and size ? [1]
- (b) Out of male or female, which of them has a perfect pair of sex chromosomes ? In case of a perfect pair, will the gametes produced be of the same kind or of a different kind ? [1]
- (c) Choose one of the following alternatives: [2]

Previously asked in: 2022 31/1/1 Q14

◆ Heredity

Gamete Formation and Sex Chromosomes

Sex Chromosomes – X and Y Chromosomes

Sex determination in human beings

Q32. § Introduction § 8.2 HEREDITY § 8.2.4 Sex Determination [1]

When a sperm carrying the Y chromosome fertilises an egg, the resulting zygote would have the following combination of chromosomes :

- (a) $44 + XX$
- (b) $44 + XY$
- (c) $22 + XX$
- (d) $22 + XY$

Previously asked in: 2023 31/2/1 Q12

♦ Heredity Sex Determination – Chromosomal Combination in Zygote

Q33. § 8.2.4 Sex Determination [1]

Assertion (A) : Sex of the children will be determined by what they inherit from their mother.

Reason (R) : Women have XX sex chromosomes.

- (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
- (B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
- (C) Assertion (A) is true, but Reason (R) is false.
- (D) Assertion (A) is false, but Reason (R) is true.

Previously asked in: 2024 31/5/1 Q18

♦ Heredity Sex Determination and Sex Chromosomes

Q34. § 8.2.4 Sex Determination [3]

Answer the following :

- (a) Giving two examples, justify the statement that the sex of the offspring in all animals is not always genetically determined.
- (b) Differentiate between the sex chromosomes of male and female human beings.

Previously asked in: 2026 31/2/1 Q14

♦ Heredity Environmental determination of sex in animals Sex chromosomes in human beings (XX and XY)

Q35. § Introduction § 8.2.4 Sex Determination [1]

When a human egg is fertilized by a sperm having 'Y' chromosome, the zygote has the following combination of chromosomes :

- (A) $44 + XX$
- (B) $22 + XX$
- (C) $44 + XY$
- (D) $22 + XY$

Previously asked in: 2026 31/5/1 Q5

♦ Heredity Sex Determination and Chromosomal Combination in Zygote

Q36. § 8.2.4 Sex Determination**[1]**

Sex is determined by different factors in various species. However, in human beings, it is determined genetically. Which amongst the following option(s) is/are correct for human beings ?

- (i) Gamete carrying X chromosome from female parent.
- (ii) Gamete carrying X chromosome from male parent.
- (iii) Gamete carrying Y chromosome from male parent.

- A (ii) and (iii)
- B (i) only
- C (i) and (iii)
- D (iii) only

Previously asked in: 2026 31/1/1 Q6

♦ **Heredity**

Sex determination in human beings

Q37. § 8.2.2 Rules for the Inheritance of Traits – Mendel's Contributions**[4]**

Mendel blended his knowledge of Science and mathematics to keep the count of the individuals exhibiting a particular trait in each generation. He observed a number of contrasting visible characters controlled in pea plants in a field. He conducted many experiments to arrive at the laws of inheritance.

Read the case and answer the following questions:

- (a) What do the F₁ progeny of tall plants with round seeds and short plants with wrinkled seeds look like ?
- (b) Name the recessive traits in above case.
- (c) Mention the type of the new combinations of plants obtained in F₂ progeny along with their ratio, if F₁ progeny was allowed to self pollinate. (1+1+2 = 4)

Previously asked in: 2022 31/2/1 Q14 (OR-1)

♦ **Heredity**Dihybrid Cross and F₂ progeny ratios

Dominant and Recessive Traits

Mendel's Laws of Inheritance

Q38. § 8.2.2 Rules for the Inheritance of Traits – Mendel's Contributions**[4]**

In order to trace the inheritance of traits Mendel crossed pea plants having one contrasting character or a pair of contrasting characters. When he crossed pea plants having round and yellow seeds with pea plants having wrinkled and green seeds, he observed that no plants with wrinkled and green seeds were obtained in the F₁ generation. When the F₁ generation pea plants were cross-bred by self-pollination, the F₂ generation had seeds with different combinations of shape and colour also.

Read the passage and answer the following:

- (a) Write any two pairs of contrasting characteristics of pea plant used by Mendel other than those mentioned above. [1]
- (b) Differentiate between dominant and recessive traits. [1]
- (c) State the ratio of the combinations observed in the seeds of F₂ generation (in the above case). What do you interpret from this result ? [2]

Previously asked in: 2023 31/1/1 Q38

♦ **Heredity**Dihybrid cross and F₂ generation phenotypic ratio (9:3:3:1)

Dominant and Recessive Traits

Mendel's experiments and contrasting characters in pea plants

Q39. § 8.2 HEREDITY

[1]

The statement that correctly describes the characteristic(s) of a gene is :

- (a) In individuals of a given species, a specific gene is located on a particular chromosome.
- (b) A gene is not the information source for making proteins in the cell.
- (c) Each chromosome has only one gene located all along its length.
- (d) All the inherited traits in human beings are not controlled by genes.

Previously asked in: 2023 31/1/1 Q10

◆ Heredity

Characteristics of a Gene

Q40. § 8.2.2 Rules for the Inheritance of Traits – Mendel's Contributions

[1]

A cross between two tall pea plants resulted in offsprings having a few dwarf plants. The gene-combination of the parental plants must be

- A Tt and Tt
- B Tt and tt
- C TT and tt
- D TT and Tt

Previously asked in: 2024 31/3/1 Q12

◆ Heredity

Monohybrid Cross and Genotype Determination

Q41. § Introduction § 8.2.2 Rules for the Inheritance of Traits – Mendel's Contributions

[1]

A cross made between two pea plants produces 50% tall and 50% short pea plants. The gene combination of the parental pea plants must be

- (A) Tt and Tt
- (B) TT and Tt
- (C) Tt and tt
- (D) TT and tt

Previously asked in: 2024 31/2/1 Q12

◆ Heredity

Monohybrid cross and genotype determination from offspring ratio

Test cross (heterozygous × homozygous recessive)

Q42. § 8.2.2 Rules for the Inheritance of Traits – Mendel's Contributions

[3]

The gene combination of purple flowered pea plants is denoted as (WW) and that of white flowered pea plants as (ww), when these two plants are crossed F₁ generation is obtained.

- (a) List two observations made by Mendel in F₁ generation plants.
- (b) Give the (i) percentage of white flowered plants and (ii) ratio of the gene combinations WW, Ww and ww in F₂ generation.
- (c) Write one difference between dominant and recessive trait.

Previously asked in: 2025 31/6/1 Q30

◆ Heredity

Dominant and Recessive Traits

Genotypic and Phenotypic Ratios in F₂ generation

Mendel's Laws of Inheritance – Monohybrid Cross

Q43. § 8.2.3 How do these Traits get Expressed?**[1]**

A tall pea plant with round seeds (TTRR) is crossed with a short pea plant with wrinkled seeds (ttrr). The F₁ generation will be

- (A) 25% tall with round seeds
- (B) 50% tall with wrinkled seeds
- (C) 75% tall with wrinkled seeds
- (D) 100% tall with round seeds

Previously asked in: 2025 31/6/1 Q8

♦ **Heredity**

Dihybrid Cross

F₁ Generation Genotype and Phenotype**Q44.** § 8.2.4 Sex Determination**[4]**

In human beings, there are 23 pairs of chromosomes. Out of these 23 pairs of chromosomes (i.e. 46 chromosomes), 22 pairs of chromosomes are called autosomes and one pair of chromosomes, i.e. two chromosomes are called sex chromosomes. The sex chromosomes are of two types – 'X' chromosomes and 'Y' chromosomes. The sex of a child (i.e. progeny), is decided at the time of fertilisation. In other words, at the time of zygote formation the sex chromosomes inherited from the parents of a child decide whether the new born will be a boy or a girl.

Answer the following sub-parts based on the given passage about chromosomes and sex determination.

- (a) What are chromosomes?
- (b) Why is the pair of sex chromosomes in human males called mismatched pair?
- (c) Show with the help of a flow chart that the statistical probability of getting a boy or a girl is 50 : 50.

Previously asked in: 2025 31/5/1 Q38

♦ **Heredity**

Chromosomes – structure and definition

Sex chromosomes and sex determination in human beings

Statistical probability of sex determination (50:50 ratio) using flow chart

Q45. § 8.2.2 Rules for the Inheritance of Traits – Mendel's Contributions**[2]**

Mendel crossed two pea plants with two visible contrasting characteristics and found that there were no half-way characteristics in the plants of F₁ progeny. Explain the reason for this observation of Mendel.

Previously asked in: 2022 31/3/1 Q6(a)

♦ **Heredity**Law of Dominance – no blending of traits in F₁ progenyMendel's Dihybrid Cross and F₁ generation**Q46.** § Introduction § 8.2 HEREDITY § 8.2.2 Rules for the Inheritance of Traits – Mendel's Contributions**[2]**

Answer the following:

- (i) In a cross between violet flowered plants and white flowered plants, state the characteristics of the plants obtained in the F₁ progeny.
- (ii) If the plants of F₁ progeny are self-pollinated, then what would be observed in the plants of F₂ progeny ?
- (iii) If 100 plants are produced in F₂ progeny, then how many plants will show the recessive trait ?

Previously asked in: 2022 31/1/1 Q5 (b)

♦ **Heredity**

Dominant and Recessive Traits

F₁ and F₂ Generation Outcomes

Monohybrid Cross and Mendel's Laws of Inheritance

Q47. § 8.2 HEREDITY § 8.2.2 Rules for the Inheritance of Traits – Mendel's Contributions**[1]**

Consider the following two statements :

- (i) The trait that expresses itself in F₁ generation.
- (ii) The trait that keeps on passing from one generation to another.

The appropriate terms for the statements (i) and (ii) respectively are :

- (a) Recessive trait, Dominant trait
- (b) Dominant trait, Recessive trait
- (c) Dominant trait, Inherited trait
- (d) Recessive trait, Inherited trait

Previously asked in: 2023 31/5/1 Q10

♦ Heredity

Dominant and Recessive Traits

Q48. § 8.1 ACCUMULATION OF VARIATION DURING REPRODUCTION § 8.2 HEREDITY § 8.2.2 Rules for the Inheritance of Traits – Mendel's Contributions **[1]**

Assertion (A) : In humans, if gene (B) is responsible for black eyes and gene (b) is responsible for brown eyes, then the colour of eyes of the progeny having gene combination Bb, bb or BB will be black only.

Reason (R) : The black colour of the eyes is a dominant trait.

- (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 but (R) is true.

Previously asked in: 2023 31/4/1 Q18

♦ Heredity

Assertion-Reason: Genotype and Phenotype Relationship

Dominance and Recessive Traits

Q49. § 8.2.2 Rules for the Inheritance of Traits – Mendel's Contributions**[2]**

Mendel crossed a pure tall pea plant (TT) with a pure short pea plant (tt) and obtained all tall plants in F₁ generation.

- (a) What is the gene combination present in the plants of F₁ generation ?
- (b) Give reason why only tall plants are observed in F₁ progeny.
- (c) What will be the ratio of the plants obtained in the F₂ generation when F₁ plants are self-pollinated ?

Previously asked in: 2023 31/2/1 Q23

♦ Heredity

Dominant and Recessive Traits

F₂ Generation Phenotypic Ratio (3:1)

Mendel's Laws of Inheritance – Monohybrid Cross

Q50. § 8.2.2 Rules for the Inheritance of Traits – Mendel's Contributions**[3]**

Mendel crossed pure tall pea plants (TT) with pure short pea plants (tt) and obtained F₁ progeny. When the plants of F₁ progeny were self-pollinated, plants of F₂ progeny were obtained.

- (a) What did the plants of F₁ progeny look like ? Give their gene combination. [1]
- (b) Why could the gene for shortness not be expressed in plants of F₁ progeny ? [1]
- (c) Write the ratio of the plants obtained in F₂ progeny and state the conclusion that can be drawn from this experiment. [1]

Previously asked in: 2024 31/5/1 Q30

♦ Heredity

Genotypic and Phenotypic Ratios in F₂ generation

Law of Dominance

Mendel's Monohybrid Cross (TT × tt)

Q51. § 8.2.2 Rules for the Inheritance of Traits – Mendel's Contributions**[3]**

List two differences between dominant traits and recessive traits. What percentage of pea plants in the F₂ generation were with yellow seeds when Mendel crossed yellow (YY) and green coloured (yy) seeds ?

Previously asked in: 2024 31/4/1 Q30

♦ **Heredity**

Dominant and Recessive Traits

Mendel's Monohybrid Cross and F₂ Generation Ratios**Q52.** § Introduction § 8.2 HEREDITY § 8.2.2 Rules for the Inheritance of Traits – Mendel's Contributions**[3]**

A pure pea plant having round (R), yellow (Y) seeds is crossed with another pure pea plant having wrinkled (r), green (y) seeds. Subsequently F₁ progeny is self-pollinated to obtain F₂ progeny.

- (a) What do the seeds of F₁ generation look like ? [1]
- (b) Give the possible combinations of traits in seeds of F₂ generation. Also give their ratio. [1]
- (c) State the reason of obtaining seeds of new combination of traits in F₂ generation. [1]

Previously asked in: 2025 31/3/1 Q30

♦ **Heredity**

Dihybrid Cross

Dominance and F₁/F₂ generation phenotype ratios

Law of Independent Assortment

Q53. § 8.2.1 Inherited Traits**[3]**

The lowest part of the ear called earlobe, is closely attached to the side of the head in some of us (Figure 'X'), and not in others, called free earlobe (Figure 'Y'). Attached and free earlobes are two variants found in human populations. The gene for free earlobe is dominant over attached earlobes.

- (a) A man with attached earlobes marries a woman having free earlobes. 50% of their children have free earlobes and 50% have attached earlobes. Explain the inheritance of this trait and write the trait combinations of the progeny. [2]
- (b) Write the gene combinations of the father and the mother in the above case. [1]

Previously asked in: 2025 31/2/1 Q30

♦ **Heredity**

Genotype and phenotype of parents and progeny in a cross

Mendelian cross / Punnett square analysis

Monohybrid inheritance and dominance (earlobe trait)

Q54. § 8.1 ACCUMULATION OF VARIATION DURING REPRODUCTION § 8.2 HEREDITY § 8.2.4 Sex Determination**[3]**

Answer the following :

- (a) What are chromosomes ? [1]
- (b) Explain in brief how stability of DNA content of a species is ensured in sexually reproducing organisms ? [2]

Previously asked in: 2025 31/1/1 Q30

♦ **Heredity**

Chromosomes – structure and definition

Stability of DNA content through meiosis and fertilisation in sexual reproduction

Q55. § 8.2.2 Rules for the Inheritance of Traits – Mendel's Contributions**[2]**

Using height (tallness / dwarfness) of a plant as an example, show that genes control the characteristics or traits in an organism.

Previously asked in: 2022 31/4/1 Q3 (main)

♦ **Heredity**

Dominant and recessive alleles

Genes control traits – height (tallness/dwarfness) in plants as an example

Mendel's experiment – tall and dwarf pea plants

Q56. § 8.2.2 Rules for the Inheritance of Traits – Mendel's Contributions**[2]**

List any two pairs of visible contrasting characters of garden pea plants used by Mendel for his experiments stating the dominant and recessive characters in each pair.

Previously asked in: 2024 31/3/1 Q23(a)

♦ **Heredity**

Mendel's Experiments on Garden Pea – Contrasting Characters (Dominant and Recessive Traits)

Q57. § 8.2.2 Rules for the Inheritance of Traits – Mendel's Contributions**[4]**

Mendel worked out the rules of heredity by working on garden pea using a number of visible contrasting characters. He conducted several experiments by making a cross with one or two pairs of contrasting characters of pea plant. On the basis of his observations he gave some interpretations which helped to study the mechanism of inheritance.

Read the source given and answer the questions that follow :

- (i) When Mendel crossed pea plants with pure tall and pure short characteristics to produce F₁ progeny, which two observations were made by him in F₁ plants? [1]
- (ii) Write one difference between dominant and recessive trait. [1]
- (iii) In a cross with two pairs of contrasting characters R₂Y₂ × r₂y₂ (Round Yellow) (Wrinkled Green) Mendel observed 4 types of combinations in F₂ generation. By which method did he obtain F₂ generation ? Write the ratio of the parental combinations obtained and what conclusions were drawn from this experiment. [2]

Previously asked in: 2024 31/1/1 Q38

◆ **Heredity** Dihybrid cross and F₂ ratio – independent assortment Dominant and Recessive Traits
Mendel's experiments with garden pea – monohybrid and dihybrid crosses

Q58. § Introduction § 8.2 HEREDITY § 8.2.2 Rules for the Inheritance of Traits – Mendel's Contributions**[2]**

"Proteins control the expression of various characters." Explain this statement by taking an example of "tallness" as a characteristic in plants.

Previously asked in: 2025 31/6/1 Q23(a)

◆ **Heredity** Gene–protein–trait relationship Role of proteins (enzymes) in expression of traits – tallness in plants

Q59. § 8.2 HEREDITY § 8.2.2 Rules for the Inheritance of Traits – Mendel's Contributions**[2]**

Answer the following :

- (a) Explain how the proteins control the 'characteristics' in an organism with the help of an example of 'tallness' trait in pea plant. [1]
- (b) Name the section of DNA that controls the 'characteristics' in an organism. [1]

Previously asked in: 2025 31/3/1 Q24

◆ **Heredity** Gene as the section of DNA that controls characteristics Role of proteins in controlling characteristics – tallness trait in pea plant

Q60. § 8.2.2 Rules for the Inheritance of Traits – Mendel's Contributions**[3]**

Show the cross and observations made by Mendel when he crossed pure tall pea plant with a pure short pea plant to get F₁ progeny.

Previously asked in: 2026 31/3/1 Q14

◆ **Heredity** Law of Dominance Mendel's Monohybrid Cross – F₁ Generation (Tall × Short Pea Plant)

Q61. § 8.2 HEREDITY § 8.2.4 Sex Determination**[1]**

Consider the following statements :

- (i) The sex of a child is determined by what it inherits from the mother.
- (ii) The sex of a child is determined by what it inherits from the father.
- (iii) The probability of having a male child is more than that of a female child.
- (iv) The sex of a child is determined at the time of fertilisation when male and female gametes fuse to form a zygote.

The correct statements are :

- (a) (i) and (iii)
- (b) (ii) and (iv)
- (c) (iii) and (iv)
- (d) (i), (iii) and (iv)

Previously asked in: 2024 31/1/1 Q8

♦ Heredity

Sex Determination in Humans

Q62. § 8.2.4 Sex Determination**[2]**

Justify that the sex determination of a child is based on what they inherit from their father and not from their mother.

Previously asked in: 2022 31/3/1 Q6(b)

♦ Heredity

Sex Determination in Humans

Q63. § 8.2.4 Sex Determination**[4]**

In some families, either rural or urban, females are tortured for giving birth to a female child. They do not seem to understand the scientific reason behind the birth of a boy or a girl. In fact the mother is not responsible for the sex of the child and it has been genetically proved that the sex of a newborn is determined by what the child inherits from the father.

Read the case carefully and answer the questions that follow.

- (a) State the basis on which the sex of a newborn baby is determined in humans. [1]
- (b) Why is the pair of sex chromosomes called a mismatched pair in males ? [1]
- (c) How is the original number of chromosomes present in the parents restored in the progeny ? [2]

Previously asked in: 2023 31/5/1 Q38

♦ Heredity

Restoration of chromosome number through sexual reproduction and fertilisation

Sex Determination in Humans

Sex chromosomes and mismatched pair in males (XY)

Q64. § 8.2.4 Sex Determination**[1]**

A zygote is formed by the fusion of a male gamete and a female gamete. The number of chromosomes in the zygote of a human is :

- A 23
- B 44
- C 46
- D 92

Previously asked in: 2024 31/4/1 Q10

♦ Heredity

Zygote formation and chromosome number in humans

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