CBSE CLASS X

Science (086)

QUESTION PAPER

AI-generated question paper

Code: 4T6X1P **Questions: 33** **Maximum Marks: 96** **Generated: 2026-06-25 17:36**

SELECTIONS USED

Subject	Science
Lessons	8 Heredity
Level of understanding	Thorough understanding
Question selection	Curated chapter coverage (~5 questions per section + 8 synthesis)
Model	claude-sonnet-4-6

Composition — Difficulty: 20 medium · 13 deep | Types: 24 Short · 5 Long · 3 MCQ · 1 Very short

Q1. medium · thorough-understanding · § Introduction **[3]**

Sexual reproduction generates far greater variation among offspring than asexual reproduction. (a) Explain why this is so, linking your answer to what happens to DNA during sexual reproduction. (b) Explain why such variation is considered useful for the long-term survival of a species, giving one suitable example.

◆ **Heredity**

Q2. medium · thorough-understanding · § 8.1 ACCUMULATION OF VARIATION DURING REPRODUCTION **[2]**

In an asexually reproducing bacterial population, trait A is present in 10% of individuals and trait B is present in 60% of individuals. Which trait most likely arose earlier, and why?

◆ **Heredity**

Q3. medium · thorough-understanding · § 8.1 ACCUMULATION OF VARIATION DURING REPRODUCTION **[3]**

Population X reproduces only asexually for many generations, while Population Y of the same species reproduces sexually. After several generations, which population would show greater variation among its individuals? Give two reasons to justify your answer.

◆ **Heredity**

Q4. medium · thorough-understanding · § 8.1 ACCUMULATION OF VARIATION DURING REPRODUCTION **[1]**

A sudden rise in environmental temperature kills most individuals in a species, but a small number survive and reproduce. Which of the following best explains why only some individuals survived?
(i) The survivors had acquired heat tolerance by living in warm conditions.
(ii) Pre-existing variations in the population gave some individuals better heat tolerance.
(iii) All individuals tried to adapt, but only the strongest succeeded.
(iv) The survivors belonged to a different species.

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

◆ **Heredity**

Q5. deep | thorough-understanding | § 8.2 HEREDITY **[3]**

In Mendel's dihybrid cross, F1 plants with round yellow seeds (RrYy) were self-pollinated. Among the F2 offspring, two phenotypic classes — round green seeds and wrinkled yellow seeds — were not present in either parent. (i) Explain the biological mechanism that produces these new combinations. (ii) What does the appearance of these new combinations tell us about the inheritance of seed shape and seed colour relative to each other?

◆ **Heredity**

Q6. deep | thorough-understanding | § 8.2.1 Inherited Traits **[3]**

In a class, some students have free earlobes and some have attached earlobes. A student notices that both her parents have attached earlobes, yet she has free earlobes. What does this tell us about the inheritance of earlobe type, and what does it reveal about the nature of the free earlobe trait? Justify your answer.

◆ **Heredity**

Q7. medium | thorough-understanding | § 8.2.2 Rules for the Inheritance of Traits – Mendel's Contributions **[3]**

When Mendel crossed tall pea plants with short pea plants, all F1 progeny were tall. Yet when these F1 plants were self-pollinated, one-quarter of the F2 progeny were short. What does the reappearance of short plants in F2 prove about what the F1 tall plants were actually carrying?

◆ **Heredity**

Q8. medium | thorough-understanding | § 8.2.2 Rules for the Inheritance of Traits – Mendel's Contributions **[1]**

[mcq] A pea plant has the genotype Tt. Which of the following best explains why it appears tall?
(A) Both T and t alleles combine to produce an intermediate height that is still classified as tall.
(B) The T allele is dominant and its single copy is sufficient to express the tall trait, masking the effect of t.
(C) The t allele mutates into T during plant development, giving a full tall phenotype.
(D) The plant expresses tallness because T alleles are always more numerous than t alleles in body cells.

A It has two copies of the T allele, both contributing to tallness.
B One copy of T is sufficient to produce enough hormone to make the plant tall, so the t allele has no visible effect.
C The t allele is lost during cell division, leaving only T to be expressed.
D The T and t alleles blend to produce a medium height, which is classified as tall.

◆ **Heredity**

Q9. medium | thorough-understanding | § 8.2.2 Rules for the Inheritance of Traits – Mendel's Contributions **[2]**

Mendel observed no medium-height plants in the F1 generation when he crossed tall and short pea plants. Why does this outcome rule out the idea that inherited traits blend together in the offspring?

◆ **Heredity**

Q10. medium | thorough-understanding | § 8.2.2 Rules for the Inheritance of Traits – Mendel's Contributions **[3]**

In a dihybrid cross, an F1 plant with genotype RrYy is self-pollinated. Among the F2 seeds, new combinations appear that were not present in either parent. Explain why offspring with round, green seeds (Rryy) can appear even though neither parent carried that combination, and state which principle of inheritance this demonstrates.

◆ **Heredity**

Q11. deep | thorough-understanding | § 8.2.2 Rules for the Inheritance of Traits – Mendel's Contributions **[3]**

A pea plant true-breeding for tall stem (TT) is crossed with a true-breeding short plant (tt). In the F2 generation, the expected ratio of TT : Tt : tt plants is 1 : 2 : 1. Describe the cross you would perform to experimentally confirm that the 'tall' plants in F2 are actually a mixture of TT and Tt genotypes rather than all being the same.

◆ **Heredity**

Q12. medium | thorough-understanding | § 8.2.2 Rules for the Inheritance of Traits – Mendel's Contributions **[2]**

Why must each germ cell carry only one copy of each gene, rather than two, for Mendel's laws of inheritance to hold true in sexually reproducing organisms?

◆ **Heredity**

Q13. deep | thorough-understanding | § 8.2.2 Rules for the Inheritance of Traits – Mendel's Contributions **[3]**

Two traits — seed shape (round R, wrinkled r) and seed colour (yellow Y, green y) — are controlled by genes on separate chromosomes. A plant with genotype RRyy is crossed with a plant of genotype rrYY. All F1 plants are round and yellow. When F1 plants are self-pollinated, what fraction of the F2 seeds will be wrinkled and yellow? Show your reasoning.

◆ **Heredity**

Q14. medium | thorough-understanding | § 8.2.2 Rules for the Inheritance of Traits – Mendel's Contributions **[1]**

[very_short_answer] In Mendel's monohybrid crosses, one parental trait disappeared in F1 but reappeared in one-fourth of the F2 progeny. How does this observation support the conclusion that organisms carry two copies of a gene for each trait rather than one?

◆ **Heredity**

Q15. medium | thorough-understanding | § 8.2.2 Rules for the Inheritance of Traits – Mendel's Contributions **[3]**

A gene controls the production of an enzyme involved in making a growth hormone in pea plants. Explain, using this example, how a change in a gene can lead to a change in the physical characteristics (phenotype) of the plant.

◆ **Heredity**

Q16. deep | thorough-understanding | § 8.2.2 Rules for the Inheritance of Traits – Mendel's Contributions **[5]**

[long_answer] Mendel's law of independent assortment holds true only when the two genes considered are located on different (non-homologous) chromosomes. Explain why the results of a dihybrid cross would be fundamentally different if both genes were located on the same chromosome. What change would you expect in the F2 phenotypic ratio, and why?

◆ **Heredity**

Q17. medium | thorough-understanding | § 8.2.3 How do these Traits get Expressed? **[3]**

A pea plant is tall because it produces a large amount of a particular growth hormone. Explain the chain of molecular events — from DNA to trait — that accounts for this tallness.

◆ **Heredity**

Q18. deep | thorough-understanding | § 8.2.3 How do these Traits get Expressed? **[3]**

A mutant pea plant produces an enzyme involved in growth-hormone synthesis, but that enzyme functions at only 20% of normal efficiency. Predict the likely appearance of this plant and justify your answer using the relationship between genes, enzymes, and traits.

◆ **Heredity**

Q19. medium | thorough-understanding | § 8.2.3 How do these Traits get Expressed? **[2]**

Why must each gamete (reproductive cell) carry only ONE copy of each gene, even though all other body cells carry two copies? What would happen to the chromosome number in offspring if gametes were not formed this way?

◆ **Heredity**

Q20. deep | thorough-understanding | § 8.2.3 How do these Traits get Expressed? **[3]**

In Mendel's dihybrid cross, two traits — seed shape and seed colour — are inherited independently. Explain why this independent inheritance would be impossible if each parent contributed a single, unbroken set of all genes to their offspring.

◆ **Heredity**

Q21. deep | thorough-understanding | § 8.2.3 How do these Traits get Expressed? **[3]**

A student argues: 'If all genes were located on a single, continuous DNA strand with no division into chromosomes, Mendel's law of independent assortment could not hold true.' Do you agree or disagree? Justify your answer by explaining the role of chromosomes in the inheritance of different traits.

◆ **Heredity**

Q22. deep | thorough-understanding | § 8.2.3 How do these Traits get Expressed? **[5]**

During sexual reproduction, a child receives one chromosome from each pair from each parent. Explain how this mechanism both preserves the normal chromosome number across generations and accounts for the genetic variation seen in offspring.

◆ **Heredity**

Q23. medium | thorough-understanding | § 8.2.4 Sex Determination **[2]**

In human beings, females have XX chromosomes and males have XY chromosomes. Explain why the sex of a child is determined by the father and not the mother.

◆ **Heredity**

Q24. medium | thorough-understanding | § 8.2.4 Sex Determination **[3]**

A couple has four daughters. The father argues that it is the mother's genetics that keeps 'producing' girls. Is he correct? Justify your answer using the mechanism of sex determination in humans.

◆ **Heredity**

Q25. medium | thorough-understanding | § 8.2.4 Sex Determination **[3]**

In human beings, sex is determined by chromosomes inherited at the time of fertilisation, whereas in some organisms sex can be influenced by environmental factors such as temperature. What does this tell us about the role of genes versus environment in determining characteristics of an organism?

◆ **Heredity**

Q26. deep | thorough-understanding | § 8.2.4 Sex Determination **[5]**

A couple is expecting their fourth child. Their first three children are all girls. What is the probability that the fourth child will be a boy? Draw a diagram showing the possible chromosomal combinations at fertilisation and explain why the probability remains the same for every pregnancy.

◆ **Heredity**

Q27. medium | thorough-understanding | § (whole-chapter synthesis) **[3]**

A population of bacteria reproduces asexually, while a population of pea plants reproduces sexually. Both populations encounter a sudden change in environmental temperature. Which population is more likely to have survivors, and why does the mode of reproduction affect this outcome?

◆ **Heredity**

Q28. medium | thorough-understanding | § (whole-chapter synthesis) **[3]**

Mendel found that when F1 tall pea plants (Tt) self-pollinate, one-quarter of the F2 offspring are short. Yet the gene for shortness was present in the F1 plants all along. Explain, at the level of genes and their expression, why the shortness trait was hidden in F1 but reappeared in F2.

◆ **Heredity**

Q29. medium | thorough-understanding | § (whole-chapter synthesis) **[3]**

A student argues: 'Since sex in humans is genetically determined, and each chromosome pair provides one copy from each parent, a mother must be responsible for determining the sex of her child.' Identify the flaw in this argument and explain the correct mechanism.

◆ **Heredity**

Q30. deep | thorough-understanding | § (whole-chapter synthesis) **[3]**

Two traits of a pea plant — seed shape (round R / wrinkled r) and plant height (tall T / short t) — are located on different chromosomes. When a plant of genotype RrTt self-pollinates, are the alleles for seed shape and plant height inherited independently or together? Explain how the physical location of genes on chromosomes determines the answer, and use a cross to support your reasoning.

◆ **Heredity**

Q31. medium | thorough-understanding | § (whole-chapter synthesis) **[1]**

During the formation of germ cells in sexually reproducing organisms, one chromosome from each pair is included in each germ cell. How does this process ensure that an offspring ends up with two copies of each gene — one from each parent? What would happen to the chromosome number of offspring if this reduction did NOT occur during germ cell formation?

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.

◆ **Heredity**

Q32. deep | thorough-understanding | § (whole-chapter synthesis) **[5]**

A plant hormone is produced by an enzyme encoded by gene T. Plants with genotype TT produce a large amount of this hormone, Tt plants produce a moderate amount, yet both TT and Tt plants are equally tall. Plants with genotype tt produce very little hormone and are short.
(i) Using this information, explain at the molecular level why T is dominant over t.
(ii) In a cross between two Tt plants, what fraction of the offspring would be short? Show the cross.
(iii) If variations in height arose in an asexually reproducing plant population, what would be the likely source of those variations?

◆ **Heredity**

Q33. deep thorough-understanding § (whole-chapter synthesis) **[5]**

A tall pea plant with genotype TT is crossed with a short plant (tt) to produce F1 plants (Tt), which are all tall. The F1 plants are then self-pollinated to produce F2 offspring. Answer the following:
(a) How is the gene T transmitted from the parent plant to a germ cell? What happens to the chromosome pair carrying this gene during germ cell formation?
(b) In the F1 plant (Tt), both T and t alleles are present. Why is only the tall trait expressed? What determines whether a trait is expressed or hidden?
(c) In the F2 generation, a plant inherits alleles for both height (T/t) and seed colour (Y/y), which are located on different chromosomes. Explain how the chromosome mechanism during germ cell formation allows these two traits to be inherited independently.

◆ **Heredity**

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