

CLASS 10

SCIENCE

EXTRA QUESTIONS

Class 10 Science Chapter 8 Extra Questions – Heredity (HOTS)

For complete step-by-step answers and a quick summary, check the Class 10 Science Chapter 8 Solutions and Class 10 Science Chapter 8 Revision Notes. These Class 10 Science Chapter 8 important questions are handy for last-minute exam practice.

Contents

Class 10 Science Chapter 8 Extra Questions (HOTS Level) – Heredity and Evolution

Class 10 Science Chapter 8 – Solutions and Notes

Class 10 Science Chapter 8 Extra Questions (HOTS Level) – Heredity and Evolution

Q1 (Assertion-Reason). Assertion (A): A recessive trait can be present in an organism without being expressed in its phenotype.

Reason (R): A recessive allele is only expressed in the phenotype when present in the homozygous condition.

Options: (a) Both A and R true, R explains A. (b) Both true, R does not explain A. (c) A true, R false. (d) A false, R true.

Answer: (a). A heterozygous individual (Aa) carries the recessive allele silently; it is masked by the dominant allele and only shows up phenotypically when paired with another recessive allele (aa).

Q2 (Reverse-engineering from a ratio). In guinea pigs, black fur (B) is dominant over white fur (b). A cross between two black guinea pigs produces 32 black and 11 white offspring. What are the likely genotypes of the parents, and why?

	TL	B	MT	b	TR
B	•	BB	•	Bb	•
	ML			MR	
b	•	Bb	•	bb	•
	BL		MB		BR

Bb × Bb cross: F2 ratio 3 black (BB, Bb, Bb) : 1 white (bb) → matches observed 32:11.

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Answer: The ratio 32:11 is close to 3:1, the classic monohybrid F2 ratio. Both parents are heterozygous (Bb × Bb) — each contributes either B or b, giving offspring in the ratio 1 BB : 2 Bb : 1 bb, i.e. 3 black : 1 white.

Q3 (Cross-prediction with a fresh trait pair). A plant with round seeds (R, dominant) and green pods (G, dominant) is crossed as RrGg × RrGg. Out of 160 offspring, how many are expected to show both recessive traits (wrinkled seeds, yellow pods)?

	TL RG	V1Rg	V2 rG	V3rg	TR
RG	H1				H1b
Rg	H2				H2b
rG	H3				H3b
rg	BL	V1b	V2b	V3b <i>rrgg</i>	BR

RrGg × RrGg: double-recessive rrgg (wrinkled, yellow) = 1/16 of offspring → 160 × 1/16 = 10.

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Answer: A dihybrid cross RrGg × RrGg gives a 9:3:3:1 ratio; the double-recessive class (rrgg) is 1/16 of the total. $1/16 \times 160 = 10$ offspring.

Q4 (Pedigree/probability reasoning). Two carrier (heterozygous) parents for an autosomal recessive trait, neither showing the trait, have three children. What is the probability that all three children are unaffected?

Answer: Each child independently has a 3/4 probability of being unaffected. Probability all three unaffected = $(3/4)^3 = 27/64$ (~42%).

Q5 (General/abstract reasoning). Explain, in general terms, why a trait controlled by two independently assorting genes produces a 9:3:3:1 ratio in F₂, rather than simply 3:1 for each trait combined.

Answer: Each gene independently follows a 3:1 dominant:recessive segregation pattern (probability 3/4 dominant, 1/4 recessive). Since the two genes assort independently, the joint probabilities multiply: dominant-dominant = $3/4 \times 3/4 = 9/16$, each single-recessive combination = $3/4 \times 1/4 = 3/16$, and double-recessive = $1/4 \times 1/4 = 1/16$ — giving 9:3:3:1.

Q6 (Sex-determination, multi-part). A couple already has 3 daughters and is told the fourth child is “due” to be a son. Explain, using the biology of sex determination, whether this reasoning is scientifically correct, and state the probability the fourth child is a son.

Answer: The reasoning is incorrect. Each pregnancy is an independent event: the sperm that fertilises the egg carries an X or Y chromosome with equal (1/2) probability regardless of earlier children — there is no “memory” effect. The probability the fourth child is a son remains **1/2 (50%)**.

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