

36.1 Inheritance, variation and probability

Name: _____ Class: _____ Date: _____ Total: 10 marks

KEY WORDS allele • genotype

Objective

Inheritance, variation and probability. Supported HL concept preparation; original classroom practice, not an official IB paper or assessed learner work.

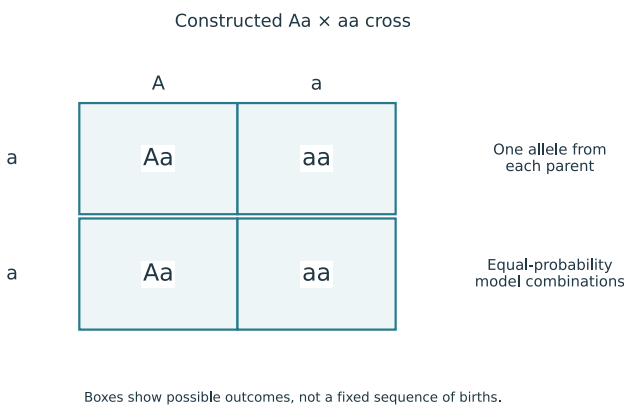
1 Key knowledge and worked examples

■ What would explain this observation?

- Two parents can carry a recessive **allele** without expressing the associated phenotype. Their children do not have to match the parents phenotypically.
- Start with a prediction. State the quantities or features you would compare, then decide what evidence could distinguish two explanations.

■ Build the model

- An allele is a variant of a gene. A **genotype** lists alleles; a phenotype is the expressed characteristic, influenced by genotype and sometimes environment. Dominant and recessive describe the relationship between alleles, not how common they are.
- allele: A variant of a gene; genotype: The alleles an organism carries.



■ Choose evidence that can test it

- In a simple monohybrid cross Aa × Aa, gametes carry A or a. Combining independent gametes gives AA, Aa, Aa and aa. The predicted probabilities describe many possible fertilizations, not a fixed order of children.
- Write parental genotypes and gametes before making the grid. State the inheritance model and phenotype key. Use a pedigree to check consistency with a model; do not infer certainty from a small family alone.

■ Work from known quantities

- State the known values and their units. Choose the relation because its assumptions fit this case, then rearrange before substitution.
- Known: Aa × Aa with complete dominance. Probability of aa = 1/4 = 25%. Probability of the dominant phenotype = 3/4 = 75%. If four children are born, there is no guarantee that exactly one has the recessive phenotype.

Example:

In Aa × aa, what percentage of offspring are predicted to be aa? Use the same sequence: known quantities → model → relation → substitution → unit and interpretation.

■ Check the conclusion and its limits

- A dominant allele can be rare. Mutation is a source of new variation; selection changes the relative success of existing variants rather than directing mutations toward a goal.
- Return to the original observation. Explain what the result supports, which conditions it assumes, and one way to test a competing explanation.

Warn:

A dominant allele must be the most common allele in a population. This claim is false: A dominant allele can be rare. Mutation is a source of new variation; selection changes

the relative success of existing variants rather than directing mutations toward a goal.

Key:

Inheritance, variation and probability: In a simple monohybrid cross $Aa \times Aa$, gametes carry A or a. Combining independent gametes gives AA, Aa, Aa and aa. The predicted probabilities describe many possible fertilizations, not a fixed order of children.

2 Practice

2.1 What does a 25% probability in $Aa \times Aa$ mean? Choose one answer.

- **A** Exactly one of every four siblings must be aa
 - **B** Each fertilization has probability one quarter of aa under this model
 - **C** The fourth child must be aa
- [1]

2.2 In $Aa \times aa$, what percentage of offspring are predicted to be aa? Show the relation, substitution and units.

[2]

2.3 Decide whether this claim is true and justify: A dominant allele must be the most common allele in a population.

[2]

2.4 A variant of a gene: write the technical term.

[1]

3 Exam-style questions

3.1 For $Aa \times aa$ under complete dominance, find the probability that two independently conceived offspring both have the recessive phenotype. Does a family of two have to match the ratio?

[4]
