

Trait Transfer Trail

Follow genetic information from DNA to offspring predictions.

LS.10 "The student will investigate and understand that organisms reproduce and transmit genetic information to new generations. Key ideas include DNA has a role in making proteins that determine organism traits..."

NAME _____

DATE _____

1 READ AND MARK _____ Read it twice

YOUR JOB Underline statements that explain how DNA, genes, proteins, or meiosis affect inherited traits. Circle the sentence that explains why a Punnett square cannot guarantee the trait of one offspring.

From Instructions to Offspring

- ① At a community garden, students noticed that some pea plants had purple flowers while others had white flowers. Inside nearly every cell, DNA stores instructions. A gene is a section of DNA with instructions for making a particular protein. Proteins help build cell structures and control cell processes, so they influence traits such as flower color. Different versions of a gene can lead to proteins that work differently. An organism's environment can also affect how some traits appear, but DNA provides the inherited instructions.
- ② Before a pea plant makes sex cells, it copies its DNA. Then meiosis is a cell division that produces sex cells with half the usual number of chromosomes. Each sex cell receives one chromosome from each pair, so it contains one set of genetic information. When a pollen cell and an egg cell join during fertilization, their genetic information combines. The new plant receives one set from each parent. Meiosis therefore helps transfer traits while creating genetic variation among offspring.
- ③ Scientists use Punnett squares as mathematical models to predict trait probabilities. For flower color, suppose P represents an allele associated with purple flowers and p represents an allele associated with white flowers. If one parent is Pp and the other is pp, the square pairs each possible sex cell. Two of four predicted offspring combinations are Pp, and two are pp. The model predicts a 50 percent chance for each combination. It does not promise the result for any one seed, because probability describes many possible offspring, not a guarantee.

2 ANSWER WITH EVIDENCE _____ Use the passage

1 How does a gene affect an organism's traits, according to the passage?

2 How do meiosis and fertilization help a new pea plant receive genetic information from two parents?

3 For the cross $Pp \times pp$, what two offspring combinations does the Punnett square predict, and what is the probability of each?

4 Why can a Punnett square not guarantee the flower color of one seed?

3 YOUR TURN _____ Your own words

Choose a made-up organism trait and let S and s represent two alleles for it. Write four or five sentences that connect the gene to a protein, use the cross $Ss \times ss$ to give all four predicted combinations and probabilities, and explain meiosis's role.

PART 1 • READ AND MARK

Underline statements that explain how DNA, genes, proteins, or meiosis affect inherited traits. Circle the sentence that explains why a Punnett square cannot guarantee the trait of one offspring. Accept any marking that follows this job and points at the right text.

PART 2 • ANSWERS

#	QUESTION	ANSWER
1	How does a gene affect an organism's traits, according to the passage?	A gene is a section of DNA with instructions for making a protein. Proteins influence traits by building cell structures and controlling cell processes.
2	How do meiosis and fertilization help a new pea plant receive genetic information from two parents?	Meiosis makes sex cells with one set of genetic information. During fertilization, a pollen cell and an egg cell join, so the new plant receives one set of genetic information from each parent.
3	For the cross Pp × pp, what two offspring combinations does the Punnett square predict, and what is the probability of each?	The predicted combinations are Pp and pp. Each combination has a 50 percent probability.
4	Why can a Punnett square not guarantee the flower color of one seed?	A Punnett square shows probabilities for many possible offspring. It does not predict a guaranteed result for one seed.

PART 3 • YOUR TURN (SAMPLE ANSWER)

In a fictional lizard, a gene gives instructions for a protein that helps make striped skin. Let S represent an allele that makes the working protein, and let s represent an allele for a changed protein that results in plain skin. For the cross Ss × ss, the four predicted combinations are Ss, ss, Ss, and ss. This gives a 50 percent chance of striped offspring and a 50 percent chance of plain offspring. Meiosis makes sex cells with one allele, allowing each offspring to receive genetic information from both parents.

Accept equivalent explanations that accurately connect a gene, a protein, and a trait. For the open task, accept any sensible invented trait and allele labels if the Ss × ss outcomes are two Ss and two ss, with 50 percent probability for each combination and a correct explanation of meiosis.