

2026 MCAS Sample Student Work and Scoring Guide

High School Biology

Question 36: Constructed-Response

Reporting Category: Heredity

Practice Category: Mathematics and Data

Standard: [HS.LS.3.3](#) - Apply concepts of probability to represent possible genotype and phenotype combinations in offspring caused by different types of Mendelian inheritance patterns.

Item Description: Complete a Punnett square to predict offspring phenotypes, identify and explain the expected percentage of a phenotype, and identify and explain possible genotypes of parents based on an offspring with a certain phenotype.

This item can be found in the released item sets on the [MCAS Resource Center](#).

Scoring Guide

Select a score point in the table below to view the sample student response.

Score*	Description
3A 3B	The response demonstrates a thorough understanding of the codominance inheritance pattern. The response correctly completes a Punnett square for two parents with different blood types. The response correctly identifies the expected percentage of children with blood type O and clearly explains the reasoning. The response also correctly identifies the genotypes of parents based on the child's blood type and clearly explains the reasoning.
2	The response demonstrates a partial understanding of the codominance inheritance pattern.
1	The response demonstrates a minimal understanding of the codominance inheritance pattern.
0	The response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.

*Letters are used to distinguish between sample student responses that earned the same score (e.g., 3A and 3B).

Module Introduction

Human blood types are categorized based on the ABO blood group system. In this system, an individual has one of four different blood types: A, B, AB, or O. These four blood types result from interactions of the alleles **A**, **B**, and **O**.

The **A**, **B**, and **O** alleles code for various forms of an enzyme involved in the production of molecules called antigens. Antigens are found on the surface of red blood cells. The table shows how the three alleles interact.

Allele	Interaction with Allele A	Interaction with Allele B	Interaction with Allele O
A	-	codominant with B	dominant to O
B	codominant with A	-	dominant to O
O	recessive to A	recessive to B	-

A person who needs a blood transfusion must receive a compatible blood type. If the person receives an incompatible blood type, their immune system will react to the antigens in the blood by producing proteins called antibodies. The antibodies will attack the antigens, causing the blood to clump in the person's blood vessels. To prevent such complications, blood-type compatibility is always tested before a blood transfusion.

Score Point 3A

This question has three parts.

Two parents, a father who is heterozygous for blood type A and a mother with blood type O, had biological children.

Part A

Complete the Punnett square for these parents.

Drag and drop an allele or allele pair into each box. Each allele or allele pair may be used once, more than once, or not at all.

	A	B	O	AA	AB	AO	BO	OO
	A	O						
O	AO	OO						
O	AO	OO						

Part B

Based on the Punnett square, identify the expected percentage of biological children with blood type O. Explain your reasoning.

The percentage of biological children that will be blood type O is 50%. I know this because according to the punnett square, since both the parents have O alleles, the mother with two, there are two possible children out of four that will be blood type OO.

Part C

One of the female children grew up and had a biological child. The child has blood type AB.

Identify the genotype of this child's mother **and** a possible genotype of the biological father. Explain your reasoning.

The genotype of the mother is AO because she got her own mothers O allele and her father's A allele. The father could be AB or BO since either could give the child the B allele necessary for an AB blood type child.

[Back to Scoring Guide](#)

Score Point 3B

This question has three parts.

Two parents, a father who is heterozygous for blood type A and a mother with blood type O, had biological children.

Part A

Complete the Punnett square for these parents.

Drag and drop an allele or allele pair into each box. Each allele or allele pair may be used once, more than once, or not at all.

A	B	O	AA	AB	AO	BO	OO
	A	O					
O	AO	OO					
O	AO	OO					

Part B

Based on the Punnett square, identify the expected percentage of biological children with blood type O. Explain your reasoning.

The expected percentage of biological children with blood type O is 50% because 2/4 of their potential children were homozygous for blood type O in the Punnett Square.

Part C

One of the female children grew up and had a biological child. The child has blood type AB.

Identify the genotype of this child's mother **and** a possible genotype of the biological father. Explain your reasoning.

The genotype of this child's mother is AO because her biological child got blood type A from her. The possible genotype of the biological father would be BB because when allele A interacts with allele B, the A allele is codominant with B, making their child have a AB blood type.

[Back to Scoring Guide](#)

Score Point 2

This question has three parts.

Two parents, a father who is heterozygous for blood type A and a mother with blood type O, had biological children.

Part A

Complete the Punnett square for these parents.

Drag and drop an allele or allele pair into each box. Each allele or allele pair may be used once, more than once, or not at all.

	A	B	O	AA	AB	AO	BO	OO
	A	O						
O	AO	OO						
O	AO	OO						

Part B

Based on the Punnett square, identify the expected percentage of biological children with blood type O. Explain your reasoning.

50% because a cross of AO and OO leaves 2 AO and 2 OO meaning, 50% chance of A blood because the dominant allele is expressed and 50% O blood.

Part C

One of the female children grew up and had a biological child. The child has blood type AB.

Identify the genotype of this child's mother **and** a possible genotype of the biological father. Explain your reasoning.

The mothers genotype must have been A blood and the fathers blood must have been B so that they blood type AB could be expressed.

[Back to Scoring Guide](#)

Score Point 1

This question has three parts.

Two parents, a father who is heterozygous for blood type A and a mother with blood type O, had biological children.

Part A

Complete the Punnett square for these parents.

Drag and drop an allele or allele pair into each box. Each allele or allele pair may be used once, more than once, or not at all.

	A	B	O	AA	AB	AO	BO	OO
	A	O						
O	AO	OO						
O	AO	OO						

Part B

Based on the Punnett square, identify the expected percentage of biological children with blood type O. Explain your reasoning.

A 100% chance the biological children have type O blood because it is in every square

Part C

One of the female children grew up and had a biological child. The child has blood type AB.

Identify the genotype of this child's mother **and** a possible genotype of the biological father. Explain your reasoning.

The mother would have AO blood type and the father would have AB blood type the kids genotype would most likely be AO

[Back to Scoring Guide](#)

Score Point 0

This question has three parts.

Two parents, a father who is heterozygous for blood type A and a mother with blood type O, had biological children.

Part A

Complete the Punnett square for these parents.

Drag and drop an allele or allele pair into each box. Each allele or allele pair may be used once, more than once, or not at all.

A B O AA AB AO BO OO

	O	O
A	AO	AO
A	AO	AO

Part B

Based on the Punnett square, identify the expected percentage of biological children with blood type O. Explain your reasoning.

100% because Both of the Mother allele blood type is OO so the children have both type of blood cells from each parent. AO

Part C

One of the female children grew up and had a biological child. The child has blood type AB.

Identify the genotype of this child's mother **and** a possible genotype of the biological father. Explain your reasoning.

The Father Blood type Had to be BO for that the happen

[Back to Scoring Guide](#)