

Name: _____ Period: _____ Date: _____

Open **peebedu.com** and navigate to **CFTR Channel Simulation**. Read through the **Introduction** slides, which cover the CFTR protein, the central dogma, the deltaF508 mutation, membrane transport, and the cholera connection. Click **Get Started** to begin.

Free Response Questions

Question 1 — Conceptual Analysis

Simulation Task: Set both the Maternal Allele and Paternal Allele to Wild-type and click Run Simulation. Observe the central dogma steps displayed on the left panel (DNA, mRNA, protein sequence) and the chloride ion movement on the membrane canvas. Then change one allele to deltaF508 and run again. Compare the DNA sequences, mRNA codons, and protein products for both alleles.

(A) (1 pt) **Describe** what the law of segregation states about the alleles an individual passes to its offspring.

(B) (1 pt) **Explain** why two parents who do not have cystic fibrosis can have a child who does.

(C) (1 pt) **Predict** the fraction of offspring expected to be unaffected when two carriers have children together.

(D) (1 pt) **Justify** your prediction.

Question 2 — Analyze Model / Visual Representation

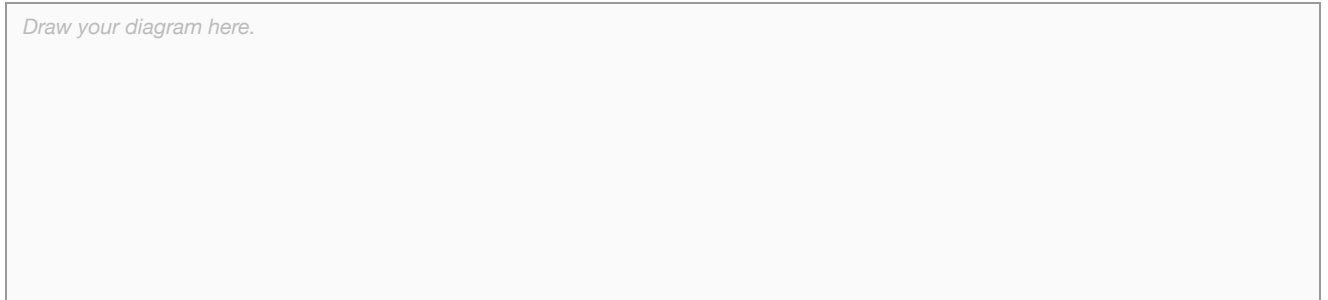
Simulation Task: Set the simulation to each of the three genotypes in turn and record the number of functional CFTR channels shown in the membrane for each. Note which genotypes the simulation labels as carriers and which as affected.

(A) (1 pt) **Describe** the number of functional CFTR channels the simulation shows for each of the three genotypes.

(B) (1 pt) **Explain** why a heterozygous individual produces functional channels while a homozygous recessive individual does not.

(C) (1 pt) **Represent** a cross between two carriers by drawing a labeled Punnett square that shows the genotypes of the offspring.

Draw your diagram here.



(D) (1 pt) **Explain** how the movement of chloride ions through CFTR channels causes water to move across the membrane by osmosis.

5.3.A.2