NAME _____ DATE _____

Scenario

An elastic string's equilibrium length is measured while the string is in a warm laboratory. The string is left outside on a cold winter night. In the morning, the string, while still outside, is measured again and its equilibrium length is found to have decreased by a very small amount.

The string is returned to the laboratory and allowed to warm back to room temperature. The string is fixed between two points and plucked so that a first-order standing wave forms on the string, producing a sound of a certain frequency. Carlos finishes drinking a glass bottle of water then blows across the bottle, noticing that the standing wave that resonates inside the bottle has the same frequency as the wave on the elastic string.

Still fixed to its points, the string and the bottle are again left outside in the cold. In the morning, it is observed that the frequency produced by plucking the string is greater than when it was in the laboratory, but the frequency produced by blowing across the bottle is lower.

Data Analysis

PART A: Which of the following wavelengths is the same in the cold outdoors as it was in the warm laboratory? Mark all that are correct.

_____ The wavelength of the wave on the string itself.

_____ The wavelength of the sound wave in air produced by the vibrating string.

_____ The wavelength of the sound wave in air produced by the air vibrating in the bottle.

Justify your answer(s).

Argumentation

PART B: State how the speed of waves on the string and the speed of waves in the bottle change as these two objects are left outside in the cold. Support your assertions with reasoning based on physical principles.

PART C: Explain why the waves on the string are a higher pitch in the cold but the waves from the bottle are a lower pitch after both are left outside in the cold.