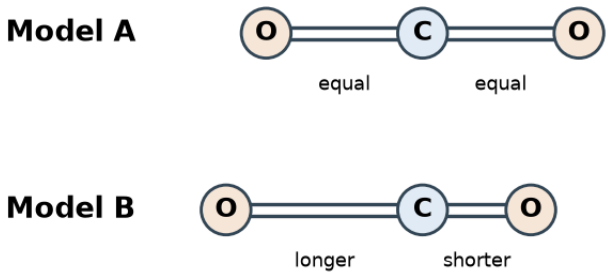
Stretching Carbon Dioxide in an Infrared Cell

Base your answers on the information provided and your knowledge of chemistry. Use the 2025 Chemistry Reference Tables as needed.

A class models a carbon dioxide sensor. Infrared light travels through a cell containing the gas. To interpret a drop in transmitted light, the students compare two snapshots of how the carbon dioxide molecule can stretch. In an undistorted molecule, the carbon and oxygen atoms lie on a straight line with equal C–O bond lengths. On the same electronegativity scale, carbon is about 2.6 and oxygen is about 3.4.

1 Use the relative electronegativities of carbon and oxygen to explain which atom has the partial negative charge in each C–O bond. [1]

Answer and work



Two snapshots of stretching motions. The atoms remain in a straight line.

2 Which model shows a stretch that preserves left-right symmetry in this snapshot?

(1) Model A only

(2) Model B only

(3) Both models

(4) Neither model

3 In the stretch shown by Model A, both bonds shorten by the same amount and then lengthen by the same amount. Explain why the overall dipole stays zero through this motion. [1]

Answer and work

The class uses this rule: a stretching motion can absorb infrared light when the motion changes the molecule’s overall dipole. In the motion represented by Model B, one bond lengthens as the other shortens, and then their roles switch.

4 Use the model and the rule to explain why the cell can absorb infrared light during the stretch represented by Model B. [1]

Answer and work