Reading Molecular Shape From End Distances

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

A molecule exhibit hides the bonds in two models. Each model has one center atom joined by two bonds to identical outer atoms. The outer atoms are on different sides of the center in a straight model. In that case the distance between the outer atoms equals the sum of the two bond lengths.

Model	Center to outer atom 1	Center to outer atom 2	Outer atom to outer atom
P	1.0 unit	1.0 unit	2.0 units
Q	1.0 unit	1.0 unit	1.7 units

1 Which model cannot have its two bonds pointing straight in opposite directions?

(1) P only

(2) Q only

(3) Both models

(4) Neither model

2 A student says the equal center-to-outer distances prove that P and Q have the same shape. Evaluate the claim using all three measurements. [1]

Answer and work

The exhibit adds equal bond dipoles that point from the center toward the outer atoms in each model. Opposite arrows of equal strength cancel.

3 Explain which model can have two polar bonds and no net dipole under these conditions. [1]

Answer and work

4 Sketch Q. Label the center, the two outer atoms, and the 1.7-unit distance. [1]

Draw and label the bent model