Checking Bond Orders in Equal-Atom Mixtures

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

A display uses three two-carbon models. A molecule with a single carbon–carbon bond has six H atoms, one with a double bond has four, and one with a triple bond has two. In the model a double bond takes one H_2 molecule to become single. A triple bond takes two H_2 molecules. A single bond takes none.

Mixture	Number of single-bond molecules	Number of double-bond molecules	Number of triple-bond molecules
P	1	0	1
Q	0	2	0

1 Which comparison correctly describes the starting mixtures?

(1) P has more carbon atoms.

(2) Q has more carbon atoms.

(3) Both contain four carbon atoms and eight hydrogen atoms.

(4) Both contain two molecules with double bonds.

2 Calculate the total number of H_2 molecules each mixture would take up in the model. [1]

Answer and work

An independent detector responds only to a carbon–carbon triple bond. An unknown is either P or Q. Its hydrogen uptake is two H_2 molecules, and the independent detector gives a signal.

3 Identify the unknown and explain what the independent detector resolves. [1]

Answer and work

4 Draw the molecule that produces the independent detector signal. Show its carbon and hydrogen connections. [1]

Draw and label the molecule