Tracing the Source of Oxygen in a Leaf Model

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

A classroom simulation traces oxygen atoms during photosynthesis. It can mark oxygen atoms with a stable isotope label without changing their modeled chemistry. In each run only one starting substance carries the label. The model does not let the label move between water and carbon dioxide before oxygen gas forms.

Run	**Starting substance with labeled oxygen atoms**	**Label detected in released O_2?**
J	Water	Yes
K	Carbon dioxide	No

1 Which source of oxygen atoms in the released oxygen gas is supported by the two runs?

(1) Water

(2) Carbon dioxide

(3) Both substances contribute equally.

(4) Neither substance contributes.

2 Explain why a run with both starting substances labeled would be less useful for deciding which one supplies the oxygen atoms. [1]

Answer and work

A student notices that the carbon dioxide in K still contains oxygen atoms. The student concludes that oxygen atoms in carbon dioxide must be released as O_2 because photosynthesis consumes carbon dioxide.

3 Use the label result in K to evaluate the student’s conclusion. [1]

Answer and work

4 Describe a control run that checks whether the detector reports the label even when none was added. [1]

Answer and work