When Removing Water Changes an Ester Model

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

A class models an acid and an alcohol reacting to form an ester and water. In the closed model all four substances stay mixed. The reaction can go in either direction, using one unit of each substance on one side for one unit of each substance on the other.

Acid + alcohol ⇌ ester + water

Record	**Acid units**	**Alcohol units**	**Ester units**	**Water units**
First steady reading	4	4	8	8
Immediately after water removal	4	4	8	3
New steady reading	3	3	9	4

1 Which change is shown between the immediate reading and the new steady reading?

(1) One unit of ester and one of water form on balance.

(2) One unit of acid and one of alcohol form on balance.

(3) Five additional water units leave.

(4) All four amounts remain fixed.

2 Explain why the first and immediate readings show removal of water, rather than a net change from the reaction. [1]

Answer and work

3 Use the equation to explain why the ester increase and water increase from the immediate reading have the same size. [1]

Answer and work

A student wants to repeat the original closed trial with the same starting amounts and a catalyst, without removing any water.

4 Explain why reaching the steady reading faster would not by itself establish that the catalyst increases the final ester amount. [1]

Answer and work