Counting Both Directions at Equilibrium

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

An exhibit models a reversible change from A to B. Each forward event changes one A into one B, and each reverse event changes one B into one A. The counters report both kinds of event over a 10-second window. The system is closed and temperature stays fixed.

Window	**Forward events**	**Reverse events**
Before the composition settles	12	8
After the composition settles	9	9
After adding a catalyst to the settled mixture	18	18

1 In which window does the number of B particles increase on balance?

(1) Only before the composition settles

(2) Only after the composition settles

(3) Only after adding the catalyst

(4) In all three windows

2 Complete the table with the average forward and reverse rates. Use the observation window. [1]

Condition	**Forward (event/s)**	**Reverse (event/s)**
Settled mixture before catalyst		
Settled mixture with catalyst		

3 A student says the catalyst shifted the mixture toward B because the forward counter doubled. Evaluate the claim using both counters. [1]

Answer and work

A replacement counter reports 36 forward events and 36 reverse events from the same catalyzed mixture. Its observation window is 20 seconds.

4 Explain whether the replacement counter supports a further rate increase. [1]

Answer and work