Checking a Decay Signal After Dilution

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

A classroom decay simulation distributes parent particles evenly in a liquid model. It reports expected decay events over the same short interval from the whole container or from a small portion, using the same detection efficiency. An instantaneous dilution step doubles the liquid volume and keeps the same number of parents. The chance of decay per parent over the interval stays fixed.

Record before dilution	**Reading**
Liquid volume in the container	200 mL
Portion volume	20 mL
Expected decay events per interval from the whole container	120
Decay events per interval expected from the portion	12

1 Immediately after dilution, what fraction of the parent particles is in a 20 mL portion?

(1) 1/20

(2) 1/10

(3) 1/2

(4) All of them

2 Predict the expected event counts from the whole container and a 20 mL portion immediately after dilution. [1]

Answer and work

3 A student sees the smaller portion reading and says the dilution caused one half-life to pass. Use the whole-container prediction to evaluate the claim. [1]

Answer and work

The container remains at 400 mL. At a later check, its expected whole-container reading has fallen from 120 to 60 events per interval.

4 Predict the expected reading of a 20 mL portion at the later check. Explain how this later change differs from the immediate dilution step. [1]

Answer and work