Comparing Equal Counts From Two Model Isotopes

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

A simulation records decays from two separate isotope samples during the same short interval. Each parent that decays contributes one detected event. The table gives the expected fraction of the starting parents that decay in that interval. Assume the detector records every event and there is no background.

Sample	Fraction of parents expected to decay	Expected events
P	1/8	24
Q	1/4	24

1 Which sample starts with more parent nuclei?

(1) P, because a smaller fraction gives the same event count.

(2) Q, because a larger fraction always means more parents.

(3) They start with the same number because both give 24 events.

(4) The two fractions cannot be compared because their numerators match.

2 Calculate the starting parent populations for P and Q. Show how each fraction is used. [1]

Answer and work

The same model records for a second interval of equal duration immediately after the first. The expected fractions apply to the parents remaining at the start of each interval.

3 Calculate the expected event count for each sample during the second interval. [1]

Answer and work

4 Explain why the second event counts can differ even when both starting event counts were 24. [1]

Answer and work