Separating Two Decay Signals in a Simulation

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

A class simulates a sample containing two independent radioactive species. Its detector reports separate signals for P and Q. Each signal is proportional to the number of parent nuclei remaining. Ignore background counts.

Species	Initial signal (units)	Half-life (h)
P	80	2
Q	40	4

1 Calculate the signal from each species after four hours. Show how the number of half-lives differs. [1]

Answer and work

2 Which statement compares the fractions of the initial signals lost by four hours?

(1) P loses a greater fraction than Q.

(2) Q loses a greater fraction than P.

(3) Both species lose the same fraction.

(4) Both species lose all of their signals.

The class replaces the detector with one that reports only the sum of the two signals. A student assigns the mixed sample a single half-life of four hours.

3 Use the summed readings at zero and four hours to test that claim. [1]

Answer and work

4 At eight hours, which species supplies more of the summed signal? Support your conclusion with its signal and the other species' signal. [1]

Answer and work