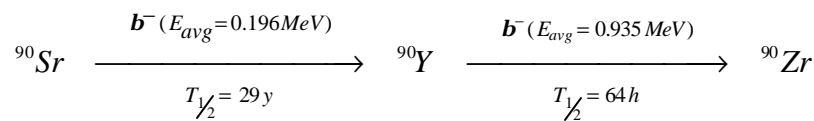


QUESTION 12

You are assisting the radiochemist at Ace Analytical Laboratory analyze urine samples for ^{90}Sr by co-precipitation of ^{90}Sr , removal of the initial ^{90}Y activity in the sample, precipitation of ^{90}Sr (as strontium carbonate) onto a filter paper, and counting with a low background gas-flow proportional counter. Since it is not always possible to count the sample immediately after the initial ^{90}Y separation, correction factors have to be applied for the ingrowth of ^{90}Y . Counting efficiencies for ^{90}Sr and ^{90}Y are determined as functions of the final sample precipitate weight by a two-count process wherein each calibration sample is counted twice at different ingrowth times, and then solving for the efficiencies. Data for a selected Calibration Sample are given below.

GIVENCalibration Standard Data

Total $^{90}\text{Sr} + ^{90}\text{Y}$ activity added to sample: 20,000 dpm.
Radiochemical Recovery: 90%.

Calibration Standard Counting Results

Count	Time elapsed since initial ^{90}Y separation (hours)	Counting Time (minutes)	Beta (net cpm)
1	5	10	3000
2	100	10	6400

STATE ALL ASSUMPTIONS**POINTS**

- 30 A. Calculate the ^{90}Y activity in the **Calibration Standard final precipitate** at 5 hours after initial ^{90}Y separation. **Show all work.**

- 40 B. **GIVEN:** Following calibration, the sample was counted at 5 hours after ^{90}Y separation.

Sample Data

Expected precipitate weight: 40 mg
 Radiochemical recovery: 0.90 ± 0.02
 Uncertainty in ^{90}Sr and ^{90}Y efficiencies: 5% each

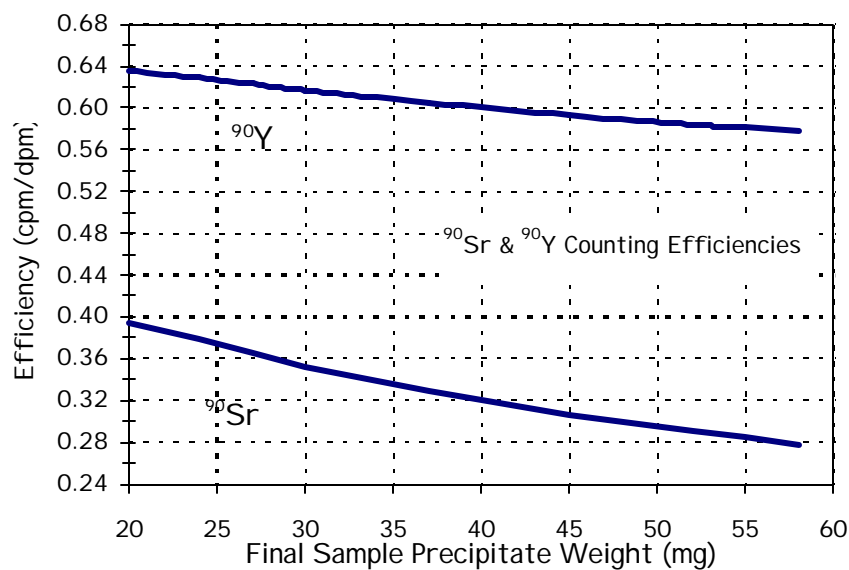
Sample Counting Results

Time elapsed since initial ^{90}Y separation (hours)	Counting Time (minutes)	Beta (gross cpm)
5	10	4.5 ± 0.7

Detector Background

Background counting time: 10 minutes
 Beta Background: 0.5 ± 0.2 cpm

Beta Counting Efficiency



Calculate the ^{90}Sr activity in the sample. Determine the efficiencies from the graph provided above.

- 30 C. Two samples were spiked with 50 dpm of ^{90}Sr and processed by a technician undergoing training. Initial count results from both samples were higher than expected. Subsequent recount results were also higher than expected. Because of their unusual behavior, the samples were recounted repeatedly for a period extending over several ^{90}Y half-lives, with the results on the following plots. In each case, provide the most likely explanation for the observed results.

