

(9.2) A mixture of amino acids is to be assayed for cysteine. A 1.0 ml sample (density 1 g ml<sup>-1</sup>) is withdrawn, and 2.61 mg of <sup>32</sup>S labeled cysteine of specific activity 0.862 μCi mg<sup>-1</sup> is added. From this mixture pure cysteine is isolated by liquid-partition chromatography; 30.6 mg is isolated and measured to give 169000 cpm in 27% detection efficiency. What is the percentage of cysteine in the original mixture?

First the normal definitions:

$$Bq := \text{sec}^{-1} \quad cpm := \text{min}^{-1} \quad Ci := 3.7 \cdot 10^{10} \cdot Bq$$

Then the data given in the text; assume density of blood is about the same as water:

$$v_{\text{sample}} := 1.0 \cdot \text{mL} \quad \rho_{\text{sample}} := 1 \cdot \frac{\text{gm}}{\text{mL}} \quad m_{\text{sample}} := v_{\text{sample}} \cdot \rho_{\text{sample}}$$

$$m_{\text{syst}} := 2.61 \cdot \text{mg} \quad S_{\text{syst}} := 0.862 \cdot 10^{-6} \cdot Ci \cdot \text{mg}^{-1} \quad S_{\text{syst}} = 3.189 \cdot 10^7 \cdot \frac{Bq}{\text{gm}}$$

$$m_{\text{isol}} := 30.6 \cdot \text{mg} \quad R_{\text{isol}} := 169000 \cdot \text{cpm} \quad \psi := 27 \cdot \%$$

From these data calculate as follows (neglect the added amount):

$$A_{\text{isol}} := \frac{R_{\text{isol}}}{\psi} \quad S_{\text{isol}} := \frac{A_{\text{isol}}}{m_{\text{isol}}} \quad S_{\text{isol}} = 3.409 \cdot 10^5 \cdot \frac{Bq}{\text{gm}}$$

$$\text{Use eqn. } S_0 \cdot m_0 = S_x \cdot m_x \quad m_x := \frac{S_{\text{syst}} \cdot m_{\text{syst}}}{S_{\text{isol}}} \quad m_x = 2.442 \cdot 10^{-4} \cdot \text{kg} \quad \text{or} \quad m_x = 244 \cdot \text{mg}$$

$$P_{\text{cyst}} := \frac{m_x}{m_{\text{sample}}} \quad P_{\text{cyst}} = 0.244 \quad \text{or} \quad P_{\text{cyst}} = 24 \cdot \%$$