(8.6) In a GM counter, sample A gave 12630, B 15480, and A+B together 25147 cpm. (a) What is the resolving time of the counter? With the same counter, the distribution of radioactive samarium between an organic phase and water was measured according to $D_m=R_{org}/R_{aq}$. The measured R_{org} is 37160 cpm, and that of R_{aq} is 2965. (b)What is the measured D_m? (c) Using the corrections for the resolving time, what is the true D-value?

First some definitions of useful units:

$\mu s := 10^{-6} \cdot sec$ $\quad cpm := min^{-1}$

Ignore the background count rate in calculating the dead-time. $R_0 := 0 \cdot cpm$

$R_A := 12630 \cdot cpm$ $\quad R_B := 15480 \cdot cpm$ $\quad R_{AB} := 25147 \cdot cpm$

$x := R_A \cdot R_B - R_{AB} \cdot R_0$ $\quad y := R_A \cdot R_B \cdot (R_{AB} + R_0) - R_{AB} \cdot R_0 \cdot (R_A + R_B)$

$$z := y \cdot \frac{R_A + R_B - R_{AB} - R_0}{x^2} \qquad t_r := x \cdot \frac{1 - \sqrt{1 - z}}{y}$$

(a) $t_r = 5.089 \cdot 10^{-4} \cdot \text{sec}$ $\quad t_r = 509 \cdot \mu s$

(b) $R_{org} := 37160 \cdot cpm$ $\quad R_{aq} := 2965 \cdot cpm$

$$D := \frac{R_{org}}{R_{aq}} \qquad D = 12.53$$

(c) $$R_{orgcorr} := \frac{R_{org}}{1 - R_{org} \cdot t_r} \qquad R_{aqcorr} := \frac{R_{aq}}{(1 - R_{aq} \cdot t_r)}$$

$$D_{corr} := \frac{R_{orgcorr}}{R_{aqcorr}} \qquad D_{corr} = 17.84$$