Radioisotope and Radiation Applications
EXERCISES
Week 4a

Problem 22:
For the data given in the Table below, determine the treatment time to deliver 200 cGy (rad) at the center of rotation, given the following data: dose rate free space for 6×6-cm field at the SAD is 86.5 cGy/min.

TABLE 9.3 **Determination of Average *TAR* at the Center of Rotation**[a]

Angle	*Depth along Radius*	*TAR*	*Angle*	*Depth along Radius*	*TAR*
0	16.6	0.444	180	16.2	0.450
20	16.0	0.456	200	16.2	0.450
40	14.6	0.499	220	14.6	0.499
60	11.0	0.614	240	12.4	0.563
80	9.0	0.691	260	11.2	0.606
100	9.4	0.681	280	11.0	0.614
120	11.4	0.597	300	12.0	0.580
140	14.0	0.515	320	14.2	0.507
160	15.6	0.470	340	16.0	0.456

[a] ^{60}Co beam, field size at the isocenter = 6 × 6 cm. Average tissue-air ratio ($\overline{TAR}$) = 9.692/18 = 0.538.

Problem 23:
Discuss the Bohr-Bethe formula:

$$\frac{dE}{dx} = -\frac{4\pi e^4 z^2 n_e}{m_e \nu^2}\left[\ln\left(\frac{2m_e\nu^2}{I}\right)\right]$$

in the limits of $\nu \longrightarrow \infty$ and $\nu \longrightarrow 0$ for the velocity ν.

Problem 24:
As the sources decay with a half-life $T_{1/2}$, also the dose rate they deliver decreases exponentially with time as:

$$\dot{D}(t) = \dot{D}_0 \cdot e^{-\frac{\ln 2}{T_{1/2}}t}$$

with $\dot{D}_0$ = initial dose rate at time t=0.

Calculate the cumulated dose rate $D_c(t)$ as a function of t and also for the case of a permanent implant.

Problem 25:
A prostate gland implant with ^{125}I seeds delivered an initial dose rate of 0.07 Gy/h to the prostate gland. What will be the dose delivered (a) after 1 month and (b) after complete decay of the sources?

Problem 26:
Repeat Problem 25 for a ^{103}Pd implant with an initial dose rate of 0.21 Gy/h and discuss the differences.