

Quiz-2 on Radiation Dosimetry – External Exposure (April 16, 2001)

Problem 1 (30 points): Briefly explain the following terms:

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|-------------------------------|------------------------------|
| a. roentgen | b. absorbed dose |
| c. dose equivalent | d. dose commitment |
| e. TEDE | f. committed dose equivalent |
| g. collective dose | h. specific gamma emission |
| i. radiation weighting factor | j. distribution factor |

Problem 2 (10 points): Find the total energy absorbed (in Joules) by a 60-kg human body for 0.5 Gy liver dose.

Data: Mass of liver = 1.2 kg.

Problem 3 (10 points): Find the dose-equivalent rate to bone for 0.5 Gy/hour absorbed dose if the radioactive isotope is Ra, and the type of radiation is alpha.

Problem 4 (10 points): Find the absorbed dose rate of soft tissue by exposure of 0.3 MeV photon flux of 1,000 #/sec.cm².

Data: $(\mu_e/\rho)_t = 31.7 \text{ cm}^2/\text{kg}$ for 0.3 MeV photon.

Problem 5 (10 points): In 10CFR20, we consider 1 rem = 1 rad = 1 r for X- and γ -rays. Please explain the reason why.

Problem 6 (20 points): Calculate the exposure rate (r/hr) at 3 meters away from an infinite line source of Cs-137 having source strength of 1 mCi/cm.

Data: Cs-137: $T_{1/2} = 30.0$ year
 $E_\gamma = 0.661 \text{ Mev}$ (95%)
 $(\mu_e)_{\text{air}} = 0.0035 \text{ m}^{-1}$.
 $1 \text{ R} = 5.48 \times 10^{10} \text{ MeV/kg}(\text{air})$

$0.5 \times E_\gamma \frac{A}{r^2}$

$\frac{R \text{ m}^2}{\text{Ci hr.}}$

R
Xunit/hr.