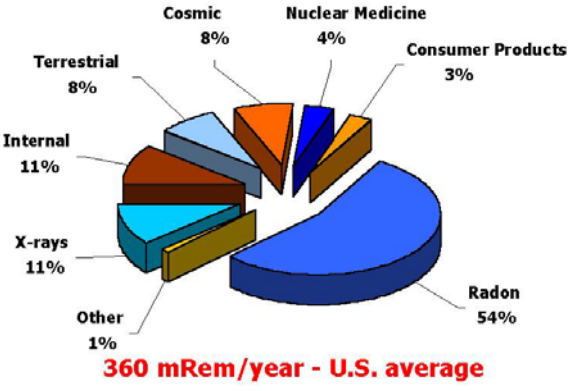


Unit Conversion Exercises



To understand the effect that radiation has on biological systems, a number of different systems for measurement have arisen over the last 50 years. European scientists prefer to use Grays and Seiverts while American scientists still use Rads and Rems!

The chart to the left shows your typical radiation dosage on the ground and the factors that contribute to it.

Basic Unit Conversions:	
1 Curie = 37 billion disintegrations/sec	
1 Gray = 100 Rads	0.001 milli
1 Rad = 0.01 Joules/kg	0.000001 micro
1 Seivert = 100 Rems	1 lifetime = 70 years
1 Roentgen = 0.000258 Charges/kg	1 year = 8760 hours
1 microCoulomb/kg = 46 milliRem	1 Coulomb = 6.24 billion billion charges

Convert:

1. 360 milliRem per year tomicroSeiverts per hour
2. 7.8 milliRem per day toRem per year
3. 1 Rad per day toGrays per year
4. 360 milliRem per year toRems per lifetime
5. 3.0 Roentgens to charges per gram
6. 5.6 Seiverts per year tomilliRem per day
7. 537.0 milliGrays per year tomilliRads per hour

Unit Conversion Exercises

Answer Key

1. 360 milliRem per year to**0.41 microSeiverts per hour**
 $360 \text{ milliRem/yr} \times 1 \text{ Rem}/1000 \text{ milliRem} \times 1 \text{ year}/8760 \text{ hours} = 0.000041 \text{ Rem/hour}$
 $0.000041 \text{ Rem/hour} \times 1.0 \text{ Seiverts}/100 \text{ Rem} = 0.00000041 \text{ Seiverts/hour}$
 $0.00000041 \text{ Seiverts/hour} \times 1 \text{ microSeivert}/0.000001 \text{ Seivert} = 0.41 \text{ microSeiverts/hour}$
2. 7.8 milliRem per day to**2.8 Rem per year**
 $7.8 \text{ milliRem/day} \times 365 \text{ days/year} = 2847.0 \text{ milliRem/year}$
 $2847.0 \text{ milliRem/year} \times 1.0 \text{ Rem}/1000 \text{ milliRem} = 2.8 \text{ Rem/year}$
3. 1 Rad per day to**3.65 Grays per year**
 $1 \text{ Rad/day} \times 365 \text{ days/year} \times 1 \text{ Gray}/100 \text{ Rads} = 3.65 \text{ Grays/year}$
4. 360 milliRem per year to**25.2 Rems per lifetime**
 $360 \text{ milliRem/year} \times 70 \text{ years/lifetime} \times 1 \text{ Rem}/1000 \text{ milliRem} = 25.2 \text{ Rems/lifetime}$
5. 3.0 Roentgens to**0.000000774 charges per gram**
 $3.0 \text{ Roentgens} \times 0.000258 \text{ charges/kg per Roentgen} = 0.000774 \text{ charges/kg}$
 $0.000774 \text{ charges/kilogram} \times 1.0 \text{ kg}/1000 \text{ gram} = 0.000000774 \text{ charges/gram}$
6. 5.6 Seiverts per year to**1530 milliRem per day**
 $5.6 \text{ Seiverts/year} \times 1.0 \text{ Year}/365 \text{ days} \times 100 \text{ Rem}/1.0 \text{ Seivert} = 1.53 \text{ Rem/day}$
 $1.53 \text{ Rem/day} \times 1000 \text{ milliRem/Rem} = 1530 \text{ milliRem/day}$
7. 537.0 milliGrays per year to**6.13 milliRads per hour**
 $537.0 \text{ milliGrays/year} \times 1.0 \text{ years}/8760 \text{ hours} \times 100 \text{ Rads}/1.0 \text{ Gray} = 6.13 \text{ milliRads/hour}$

Note: There are many different conversion 'chains' that the students can offer. The challenge is to set up each ratio correctly with the right number in the numerator and denominator!