

3. CHEMICAL AND PHYSICAL INFORMATION

3.1 CHEMICAL IDENTITY

The chemical formula and available identification numbers for radium are listed in Table 3-1.

3.2 PHYSICAL AND CHEMICAL PROPERTIES

Table 3-2 lists important physical properties of radium and selected radium compounds. Radioactive properties of the four naturally-occurring radium isotopes are listed in Table 3-3. In addition to the naturally occurring isotopes, there are 12 other known isotopes of radium. The principal decay schemes of the uranium and thorium decay series that produce the naturally-occurring radium isotopes are presented in Figure 3-1.

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TABLE 3-1. Chemical Identity of Radium

	Value	Reference
Chemical name	Radium	NLM 1988
Natural isotopes	Radium-223; Radium-224; Radium-226; Radium-228	Windholz 1983
Trade name	No data	
Chemical formula	Ra	NLM 1988
Chemical structure	Ra ⁺²	NLM 1988
Valence state	+2	Windholz 1983
Identification numbers:		
CAS Registry	7440-14-4	NLM 1988
NIOSH RTECS	No data	
EPA Hazardous Waste	No data	
OHM/TADS	No data	
DOT/UN/NA/IMCO Shipping	No data	
HSDB	2146	HSDB 1988
NCI	No data	

CAS = Chemical Abstracts Service; NIOSH = National Institute for Occupational Safety and Health; RTECS = Registry of Toxic Effects of Chemical Substances; EPA = Environmental Protection Agency; OHM/TADS = Oil and Hazardous Materials/Technical Assistance Data System; DOT/UN/NA/IMCO = Department of Transportation/United Nations/North America/International Maritime Dangerous Goods Code; HSDB = Hazardous Substances Data Bank; NCI = National Cancer Institute.

TABLE 3-2. Physical and Chemical Properties of Selected Radium Compounds^a

Property	Radium	Radium Bromide	Radium Carbonate	Radium Chloride	Radium Hydroxide	Radium Iodate	Radium Nitrate	Radium Sulfate
Chemical formula	Ra	RaBr ₂	RaCO ₃	RaCl ₂	Ra(OH) ₂	RaIO ₃	RaNO ₃	RaSO ₄
Molecular weight	226.03	385.83	286.03	296.93	No data	575.83	350.04	382.08
Synonyms	No data	No data	Carbonic acid, radium salt	No data	No data	No data	Nitric acid, radium salt	Sulfuric acid, radium salt
CAS number	7440-14-4	10031-23-9	7116-98-5	10025-66-8	98966-86-0	No data	10213-12-4	7446-16-4
Color	Silver-white	White	White	Yellowish-white	No data	No data	No data	White
Physical state	Solid	Solid	Solid	Solid	No data	No data	Solid	Solid
Melting point	700°C	728°C	No data	1000°C	No data	No data	No data	No data
Boiling point	<1140°C	900°C (sublimes)	No data	No data	No data	No data	No data	No data
Density at 20°C	5	5.79	No data	4.91	No data	No data	No data	No data
Odor	No data	No data	No data	No data	No data	No data	No data	No data
Odor threshold:								
Water	No data	No data	No data	No data	No data	No data	No data	No data
Air	No data	No data	No data	No data	No data	No data	No data	No data
Solubility:								
Water at 20°C	Decays	Soluble	Insoluble	Soluble	No data	Soluble	Soluble	Insoluble
Other solvents	Decays in acids	Soluble in alcohol	Decomposes in acids	Soluble in alcohol	No data	No data	No data	Insoluble in acids
Partition coefficients:								
Log octanol/water	NA ^b	NA	NA	NA	NA	NA	NA	NA
Log K _{oc}	NA	NA	NA	NA	NA	NA	NA	NA
Vapor pressure at 20°C	No data	No data	No data	No data	No data	No data	No data	No data
Henry's law constant:	NA	NA	NA	NA	NA	NA	NA	NA
Autoignition temperature	No data	No data	No data	No data	No data	No data	No data	No data
Flashpoint	No data	No data	No data	No data	No data	No data	No data	No data
Flammability limits	No data	No data	No data	No data	No data	No data	No data	No data
Conversion factors	No data	No data	No data	No data	No data	No data	No data	No data

^aSources: CHEMNAME 1989; Sax and Lewis 1987; Weast 1985; Windholz 1983.^bNA = not applicable

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TABLE 3-3. Selected Radioactive Properties of Naturally Occurring Isotopes of Radium^a

Isotope	Decay Mode	Decay Energy (MeV ^b)	Half-life
Radium-223	alpha	5.979	11.4 days
Radium-224	alpha	5.789	3.6 days
Radium-226	alpha	4.870	1600 years
Radium-228	beta	0.045	5.7 years

^aSource: Weast 1985.

^bMillion electron volts

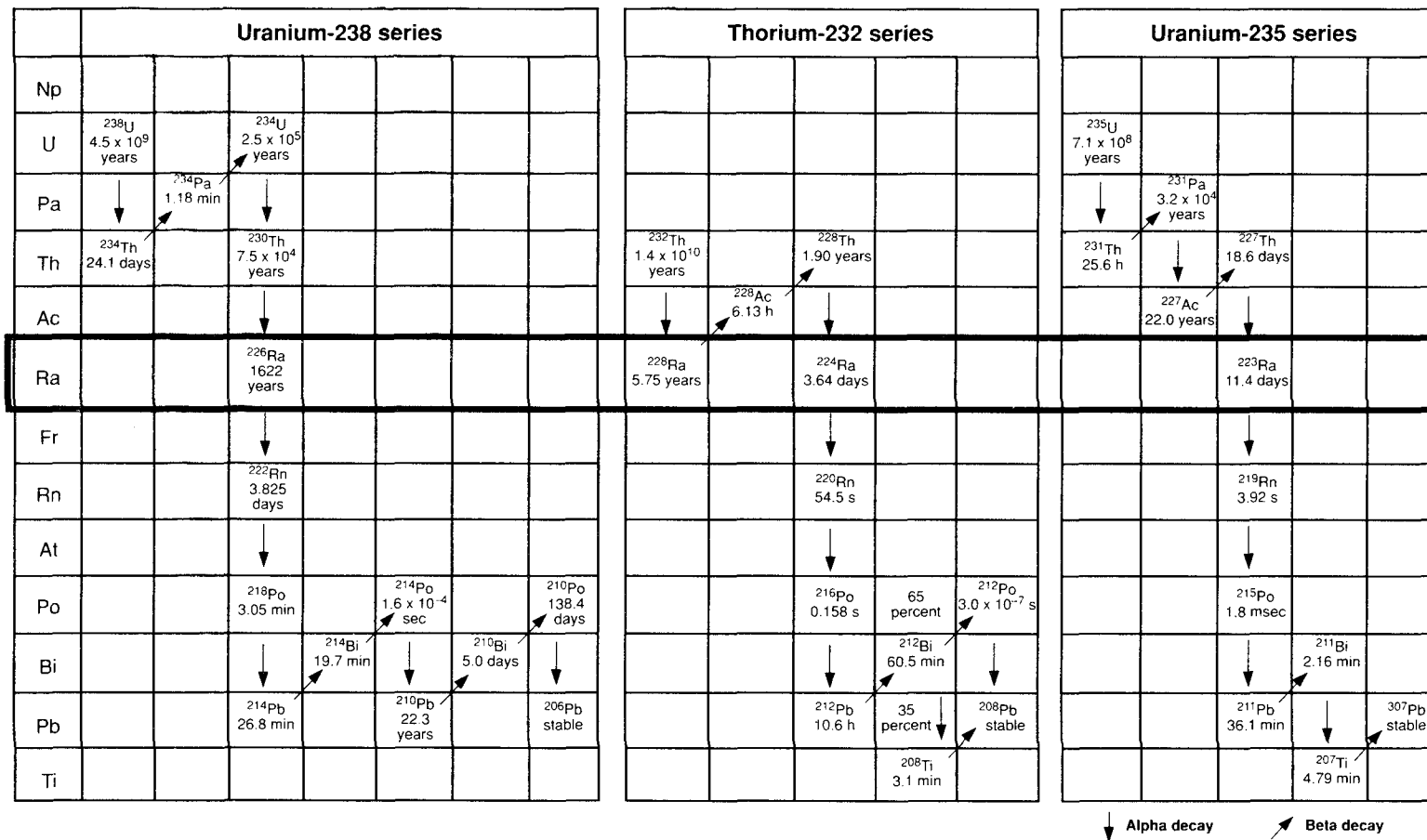


FIGURE 3-1. Uranium and Thorium Isotope Decay Series Showing the Sources and Decay Products of the Four Naturally-Occurring Radium Isotopes

Adapted from: Aieta et al. 1987.

