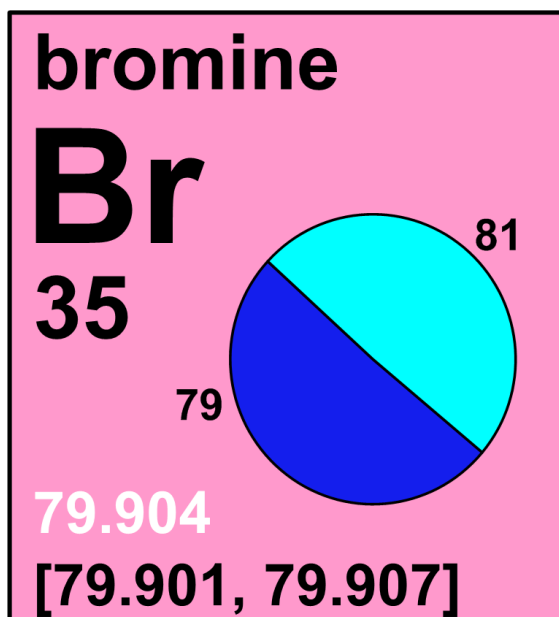
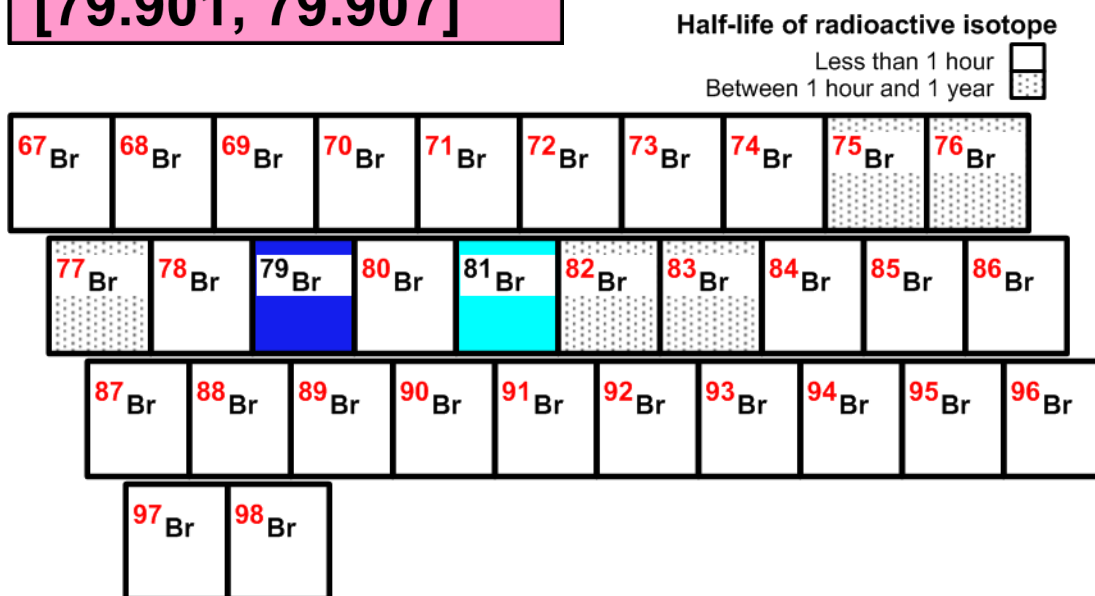


4.35 bromine



Stable isotope	Relative atomic mass	Mole fraction
^{79}Br	78.918 338	[0.505, 0.508]
^{81}Br	80.916 290	[0.492, 0.495]



4.35.1 Bromine isotopes in Earth/planetary science

Molecules, atoms, and ions of the **stable isotopes** of bromine possess slightly different physical and chemical properties, and they commonly will be fractionated during physical, chemical, and biological processes, giving rise to variations in **isotopic abundances** and in **atomic weights**. There are substantial variations in the isotopic abundances of bromine in natural terrestrial materials (Figure 4.35.1). These variations are useful in investigating the origin of substances and studying environmental, hydrological, and geological processes [10, 275]. ^{79}Br has been used as a groundwater **tracer** (Figure 4.35.2). Introduction of a solution spiked with ^{79}Br to

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groundwater and measurement of the change in the **isotope-amount ratio** $n(^{79}\text{Br})/n(^{81}\text{Br})$ over time has been used to monitor tracer breakthrough and to calculate bromide travel time [276].

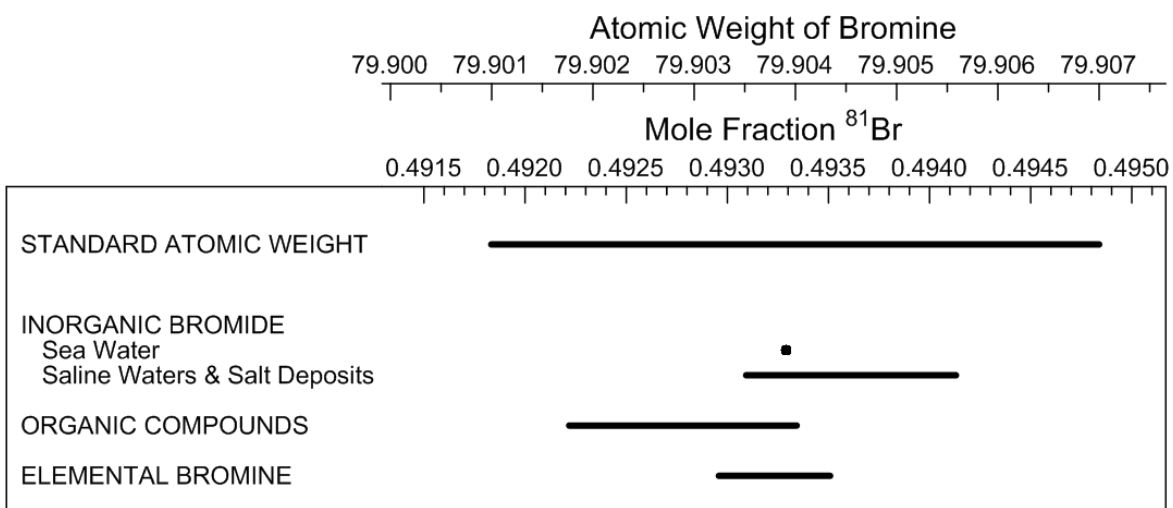


Fig. 4.35.1: Variation in **atomic weight** with **isotopic composition** of selected bromine-bearing materials (modified from [10]).

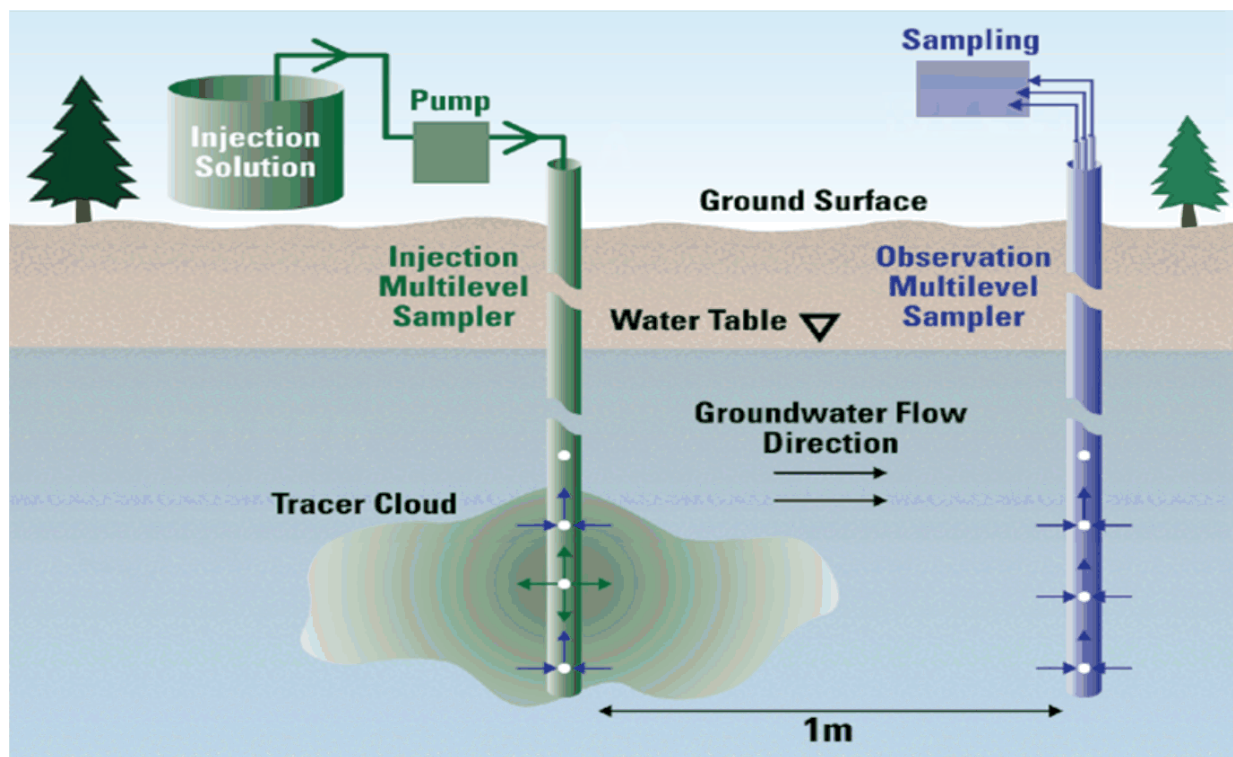


Fig. 4.35.2: Depiction of a hypothetical subsurface/groundwater **tracer** test with ^{79}Br . The tracer cloud identifies the location of the dissolved ^{79}Br spike. ^{79}Br concentration in water of the tracer cloud is compared to ^{79}Br concentration in groundwater samples in the neighboring sample site. (Diagram Source: U.S. Geological Survey, 2009) [277].

4.35.2 Bromine isotopes in medicine

^{77}Br (with a **half-life** of 57 hours) is used to label **radiopharmaceuticals** that bind to estrogen receptors for tumor imaging. ^{75}Br (with a half-life of 97 minutes) is being used with **positron emission tomography (PET)** imaging [278].

4.35.3 Bromine isotopes used as a source of radioactive isotope(s)

^{79}Br is used in the **proton cyclotron** to produce ^{77}Kr , which decays to ^{77}Br via the reaction $^{79}\text{Br}(\text{p}, 3\text{n})^{77}\text{Kr}$, which decays into ^{77}Br [279].