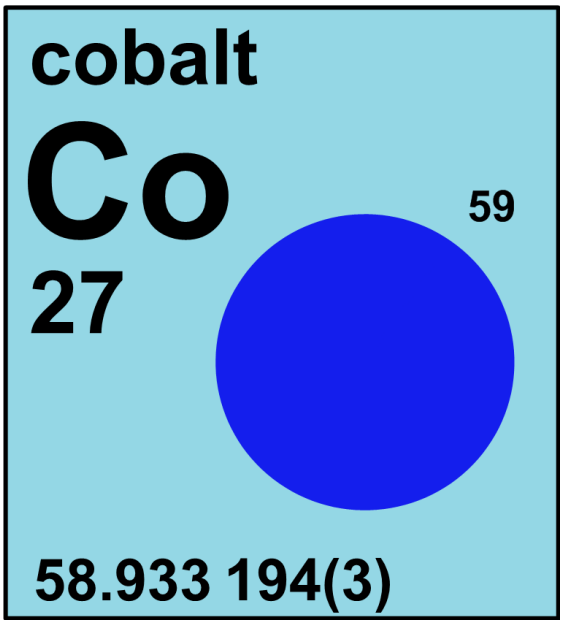
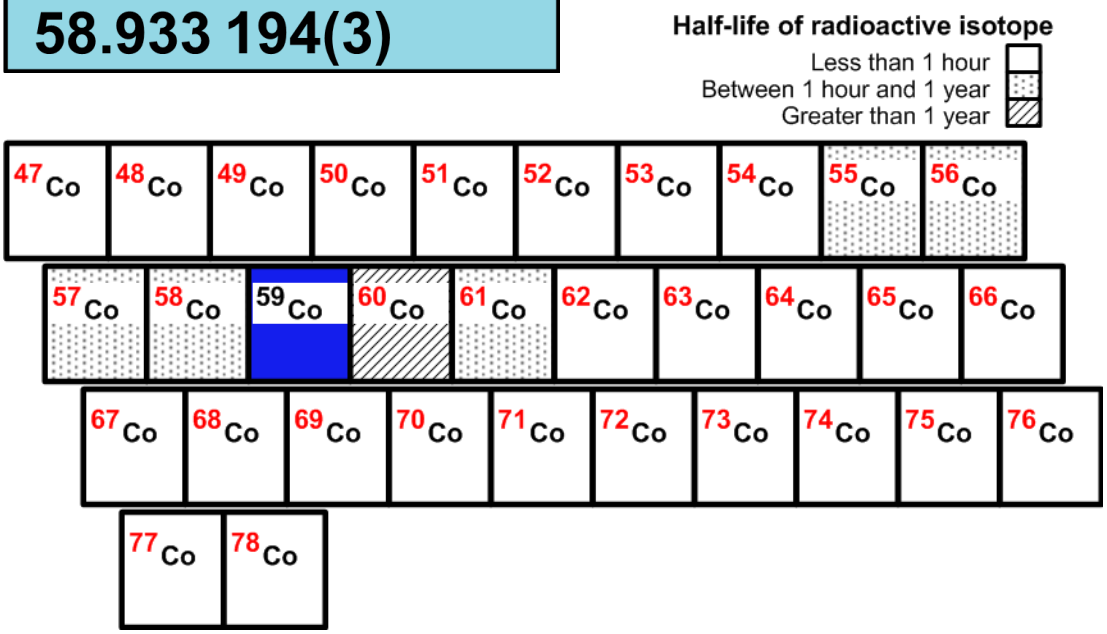
4.27 cobalt



Stable isotope	Relative atomic mass	Mole fraction
^{59}Co	58.933 194	1



4.27.1 Cobalt isotopes in industry

^{60}Co (with a **half-life** of 5.27 years) is used to irradiate food sources as a method of preserving food (Figure 4.27.1). The **gamma radiation** from ^{60}Co kills bacteria and other organisms that cause disease and spoilage of food (see Figure 4.27.1). The use of radioactive compounds for preserving food is not always viewed positively. Some individuals are concerned that harmful compounds will be produced during the irradiation process. However, there is no evidence to support the claim that irradiation is dangerous for food preservation [105]. Many medical products today are sterilized using **gamma rays** from a ^{60}Co source. This technique of sterilization is generally much cheaper and more effective than steam-heat sterilization because it

is a cold process. For example, it can be performed on packaged items, such as disposable syringes. This sterilization technique is applicable to a wide range of heat-sensitive items, such as powders, ointments, and solutions, as well as biological preparations, such as bone, nerve, skin, etc., used in tissue grafts [105].

^{60}Co is also used in industrial **radiography** to detect structural flaws in metal parts. The radiation can penetrate metals and the **X-ray** pattern produced by the radiating material can provide information on its strength, composition, and other properties [105]. Because of the above property, ^{60}Co is also used in leveling devices and thickness gauges used to test welds and castings [105].

Fig. 4.27.1: Plants growing in the gamma greenhouse at Brookhaven National Laboratory. The plants are arranged in concentric rings around the radioactive ^{60}Co source, which is in the pipe extending into the floor (circa 1959) [220]. (Photo Source: Life Sciences Foundation (LSF) Magazine).

4.27.2 Cobalt isotopes in medicine

^{60}Co is a radioactive metal **isotope** that is used in cancer treatments by **radiotherapy**. When ^{60}Co undergoes **radioactive decay**, high-energy gamma rays (energies of 1.17 MeV and 1.33 MeV) are emitted and have been used in **brachytherapy** to treat various types of cancer. Brachytherapy (brachy is Greek meaning "short distance") is a method of radiation treatment in which sealed sources are used to deliver a radiation dose at a distance of up to a few centimeters by surface, intracavitary (insertion of the **radioactive isotope** in a body cavity), or interstitial (between cells) application [72]. ^{60}Co is used as a source of high-energy **ionizing** gamma radiation that can be directed to cancer cells from a device outside the body (external radiotherapy).

^{60}Co (and sometimes ^{57}Co and ^{58}Co, with half-lives of 0.75 year and 71 days, respectively) is the key component of the Schilling test, which is a method for determining whether a patient's body is making and using vitamin B12 properly. The cobalt isotope is used to label cobalt in vitamin B12 to monitor how the body processes this essential vitamin [221].

^{57}Co delivers the smallest radiation dose of all the cobalt isotopes. As a result, it has been used in the past for imaging and estimating organ size and location and in evaluating tumors of the head and neck [72, 96, 222-224].