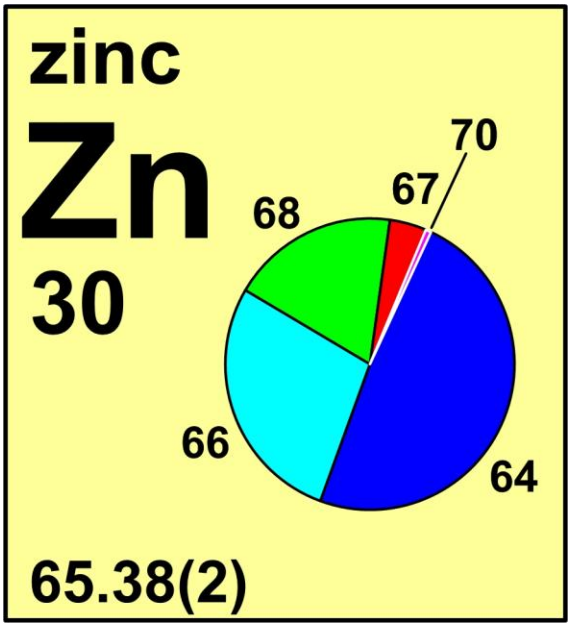
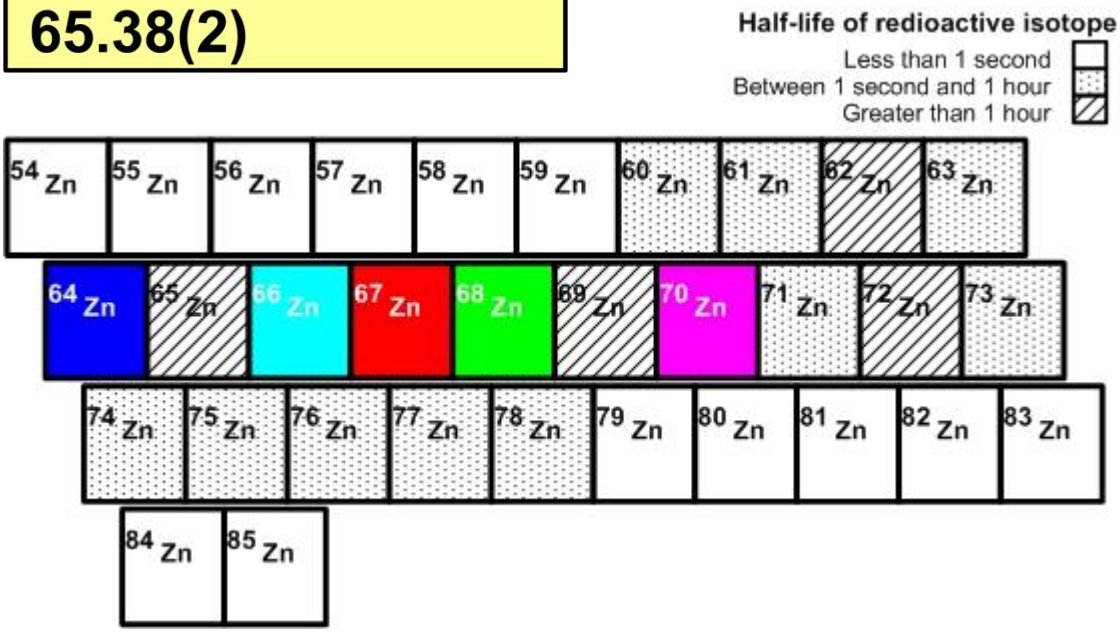
zinc



Stable isotope	Atomic mass*	Mole fraction
^{64}Zn	89.904 7044	0.4827
^{66}Zn	90.905 6458	0.279 77
^{67}Zn	91.905 0408	0.041 02
^{68}Zn	93.906 3152	0.1902
^{70}Zn	95.908 2734	0.006 31

* Atomic mass given in unified atomic mass units, u.



Important applications of stable and/or radioactive isotopes

Isotopes in medicine

1) The ^{68}Zn (p, 2p) ^{67}Cu reaction (where enriched ^{68}Zn targets are irradiated) and the neutron induced reaction ^{67}Zn (n, p) ^{67}Cu are both processes for producing ^{67}Cu for nuclear medicine therapy.
2) Deuteron irradiation of ^{64}Zn in a Cyclotron will produce radioisotope ^{64}Cu, which can be used for therapeutic applications and diagnosis with PET.
3) Oral isotopic tracers enriched in ^{67}Zn and intravenously injected stable isotopic tracers enriched in ^{70}Zn are used simultaneously to determine the fraction of dietary zinc absorbed (FZA) in humans. FZA is used in studies of zinc metabolism and homeostasis.

An example of one of these studies includes patients being administered these isotopic tracers to determine if there is impairment of zinc absorption in their bodies caused by taking certain supplements. For example, a study conducted on Peruvian women showed that prenatal iron supplements affect the absorption of zinc during pregnancy. Another example of one of these studies includes the administration of these isotopic tracers in order to research zinc deficiency in children with Crohn's disease.

4) ^{65}Zn is used in oral doses of zinc chloride to determine intestinal absorption and body retention of zinc.

Isotopes in tracer studies

1) ^{66}Zn can be used as a tracer of biogeochemical and chemical processes due to its isotopic variations in these reactions, which can determine cases of environmental contamination. The relation between isotopic fractionation, extraction processes and extraction yields of Zn are used in these investigations.
2) The ^{66}Zn/^{64}Zn isotope ratio is currently being studied as an environmental tracer for detecting the pathways of anthropogenic Zn.
3) ZnO nanoparticles enriched with ^{67}Zn are being studied for use as biological/environmental nanotoxicity tracers.

Isotopes in industry

1) In order to prevent stress corrosion cracking and reduce the release of stable ^{59}Co in nuclear reactors, depleted ^{64}Zn is added to the cooling water of the reactor. It is added to the water in the form of acetate or oxide and forms a thin spinel layer on the Co containing steel surfaces.
2) ^{68}Zn or enriched ^{67}Zn can be used in smaller cyclotrons for the production of radioactive ^{67}Ga.
3) Custom-made facilities use advanced gas centrifuges to deplete diethyl zinc gas. A single pass through a cascade of these centrifuges can provide enough depletion to reduce the natural abundance of ^{64}Zn from 48% to less than 1%.

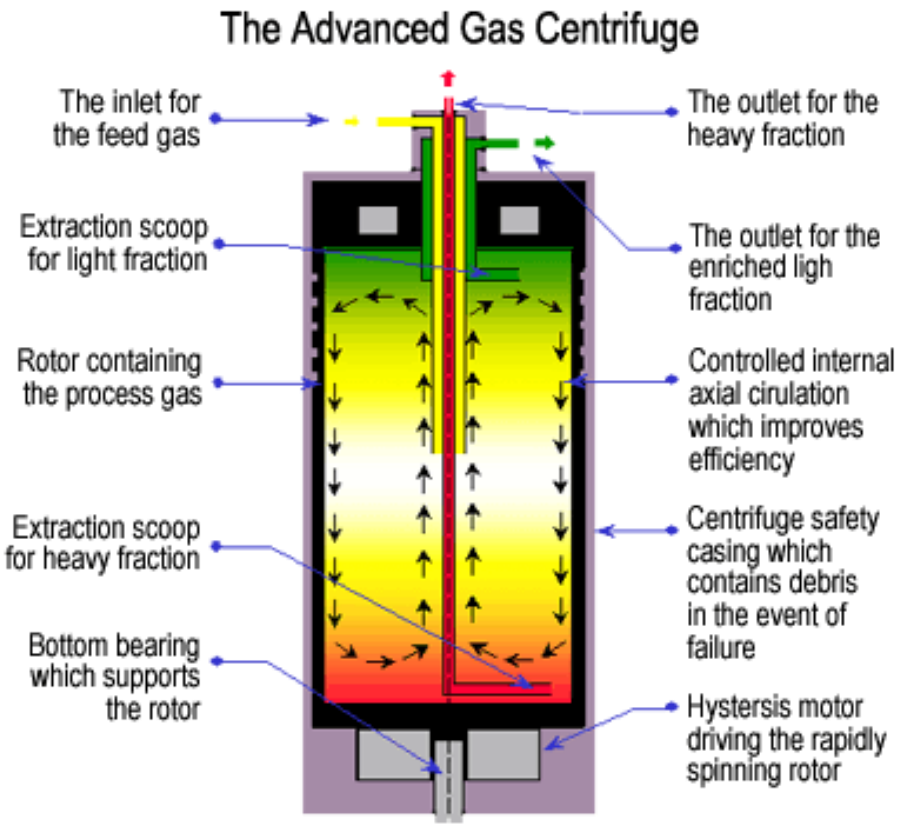


Figure 1: The ultracentrifuge has a vacuum recipient containing a fast spinning rotor. The diethyl zinc gas enters the rotor and is then accelerated until its rotational frequency is almost the same as the rotor. Centripetal acceleration then subjects the gas molecules to centrifugal forces causing the heavy molecules to migrate towards the rotor wall because they are subjected to larger forces than light molecules. A set of gas extraction scoops will extract the diethyl zinc gas from the centrifuge.