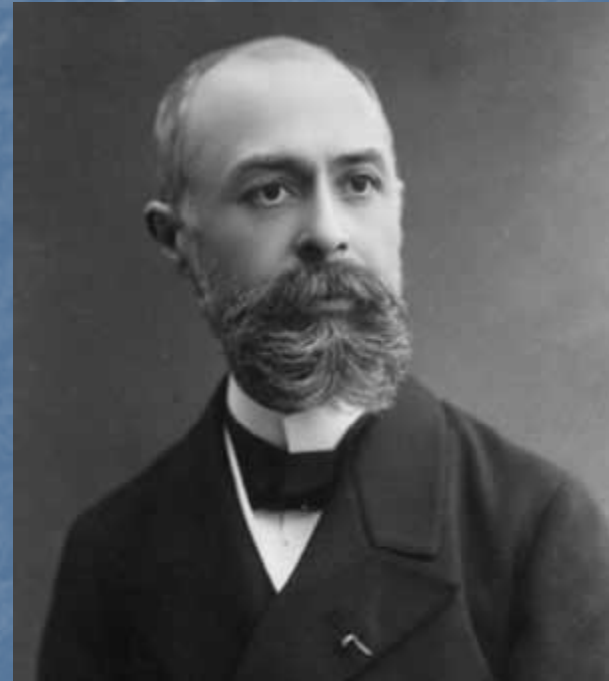


Absolute Dating

It's a decaying relationship.

Radioactivity

- Henri Becquerel discovered radioactivity in 1895.
- Until then there was no way of finding the absolute age of a rock or fossil.



Elements

- Elements are composed of atoms.
- Atoms are composed of 3 different kinds of particles: protons (+), neutrons (0) and electrons(-).
- Protons and neutrons are found in the nucleus, electrons in the space around the nucleus.

PERIODIC TABLE OF THE ELEMENTS

<http://www.kj-soft.hr/periodni/en/>

PERIOD	GROUP IUPAC																18							
	1	2	3-10										11	12	13	14	15	16	17	18				
	IA	IIA	IIIB-VIIB										IB	IIB	IIIA	IVA	VA	VIA	VIIA	VIIIA				
	RELATIVE ATOMIC MASS (A)																							
	GROUP CAS																							
	ATOMIC NUMBER (Z)																							
	SYMBOL																							
	ELEMENT NAME																							
1	1 1.0079 H HYDROGEN																		2 4.0026 He HELIUM					
2	3 6.941 Li LITHIUM	4 9.0122 Be BERYLLIUM																	5 10.811 B BORON	6 12.011 C CARBON	7 14.007 N NITROGEN	8 15.999 O OXYGEN	9 18.998 F FLUORINE	10 20.180 Ne NEON
3	11 22.990 Na SODIUM	12 24.305 Mg MAGNESIUM																	13 26.982 Al ALUMINIUM	14 28.086 Si SILICON	15 30.974 P PHOSPHORUS	16 32.065 S SULPHUR	17 35.453 Cl CHLORINE	18 39.948 Ar ARGON
4	19 39.098 K POTASSIUM	20 40.078 Ca CALCIUM	21 44.956 Sc SCANDIUM	22 47.867 Ti TITANIUM	23 50.942 V VANADIUM	24 51.996 Cr CHROMIUM	25 54.938 Mn MANGANESE	26 55.845 Fe IRON	27 58.933 Co COBALT	28 58.693 Ni NICKEL	29 63.546 Cu COPPER	30 65.39 Zn ZINC	31 69.723 Ga GALLIUM	32 72.64 Ge GERMANIUM	33 74.922 As ARSENIC	34 78.96 Se SELENIUM	35 79.904 Br BROMINE	36 83.80 Kr KRYPTON						
5	37 85.468 Rb RUBIDIUM	38 87.62 Sr STRONTIUM	39 88.906 Y YTRIUM	40 91.224 Zr ZIRCONIUM	41 92.906 Nb NIObIUM	42 95.94 Mo MOLYBDENUM	43 (98) Tc TECHNETIUM	44 101.07 Ru RUTHENIUM	45 102.91 Rh RHODIUM	46 106.42 Pd PALLADIUM	47 107.87 Ag SILVER	48 112.41 Cd CADMIUM	49 114.82 In INDIUM	50 118.71 Sn TIN	51 121.76 Sb ANTIMONY	52 127.60 Te TELLURIUM	53 126.90 I IODINE	54 131.29 Xe XENON						
6	55 132.91 Cs CAESIUM	56 137.33 Ba BARIUM	57-71 La-Lu Lanthanide	72 178.49 Hf HAFNIUM	73 180.95 Ta TANTALUM	74 183.84 W TUNGSTEN	75 186.21 Re RHENIUM	76 190.23 Os OSMIUM	77 192.22 Ir IRIDIUM	78 195.08 Pt PLATINUM	79 196.97 Au GOLD	80 200.59 Hg MERCURY	81 204.38 Tl THALLIUM	82 207.2 Pb LEAD	83 208.98 Bi BISMUTH	84 (209) Po POLONIUM	85 (210) At ASTATINE	86 (222) Rn RADON						
7	87 (223) Fr FRANCIUM	88 (226) Ra RADIUM	89-103 Ac-Lr Actinide	104 (261) Rf RUTHERFORDIUM	105 (262) Db DUBNIUM	106 (266) Sg SEABORGIUM	107 (264) Bh BOHRINIUM	108 (277) Hs HASSIUM	109 (268) Mt MEITNERIUM	110 (281) Uuq UNUNQUADIUM	111 (272) Uub UNUNBIUM	112 (285) Uuq UNUNQUADIUM	114 (289) Uuq UNUNQUADIUM											

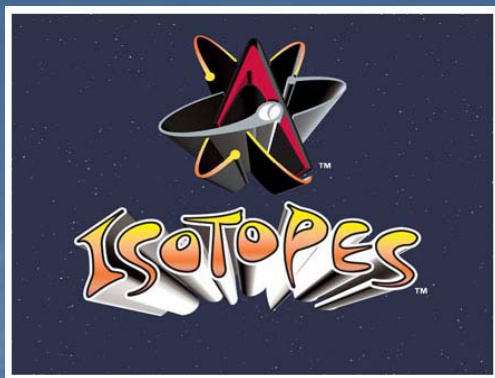
LANTHANIDE

57 138.91 La LANTHANUM	58 140.12 Ce CERIUM	59 140.91 Pr PRASEODYMIUM	60 144.24 Nd NEODYMIUM	61 (145) Pm PROMETHIUM	62 150.36 Sm SAMARIUM	63 151.96 Eu EUROPIUM	64 157.25 Gd GADOLINIUM	65 158.93 Tb TERBIUM	66 162.50 Dy DYSPROSIUM	67 164.93 Ho HOLMIUM	68 167.26 Er ERBIUM	69 168.93 Tm THULIUM	70 173.04 Yb YTTERIUM	71 174.97 Lu LUTETIUM
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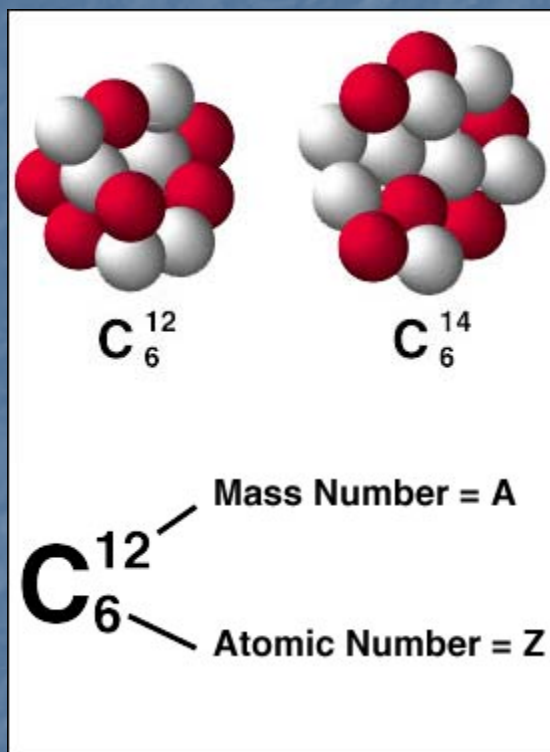
ACTINIDE

89 (227) Ac ACTINIUM	90 232.04 Th THORIUM	91 231.04 Pa PROTACTINIUM	92 238.03 U URANIUM	93 (237) Np NEPTUNIUM	94 (244) Pu PLUTONIUM	95 (243) Am AMERICIUM	96 (247) Cm CURIUM	97 (247) Bk BERKELIUM	98 (251) Cf CALIFORNIUM	99 (252) Es EINSTEINIUM	100 (257) Fm FERMIUM	101 (258) Md MENDELEVIUM	102 (259) No NOBELIUM	103 (262) Lr LAWRENCIUM
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(1) Pure Appl. Chem., 73, No. 4, 667-683 (2001)
Relative atomic mass is shown with five significant figures. For elements having no stable nuclides, the value enclosed in brackets indicates the mass number of the longest-lived isotope of the element.
However three such elements (Th, Pa, and U) do have a characteristic terrestrial isotopic composition, and for these an atomic weight is tabulated.
Editor: Aditya Verdhan (adivar@netlinx.com)

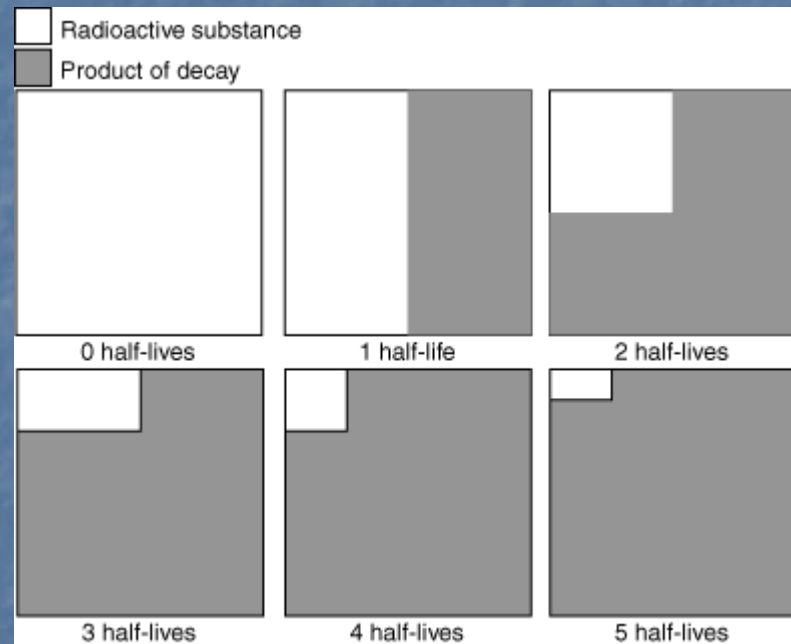


- An isotope of an element differs in the number of neutrons in the nucleus.
- Some isotopes are unstable and undergo radioactive decay.
- During the decay process they are transformed into more stable elements.

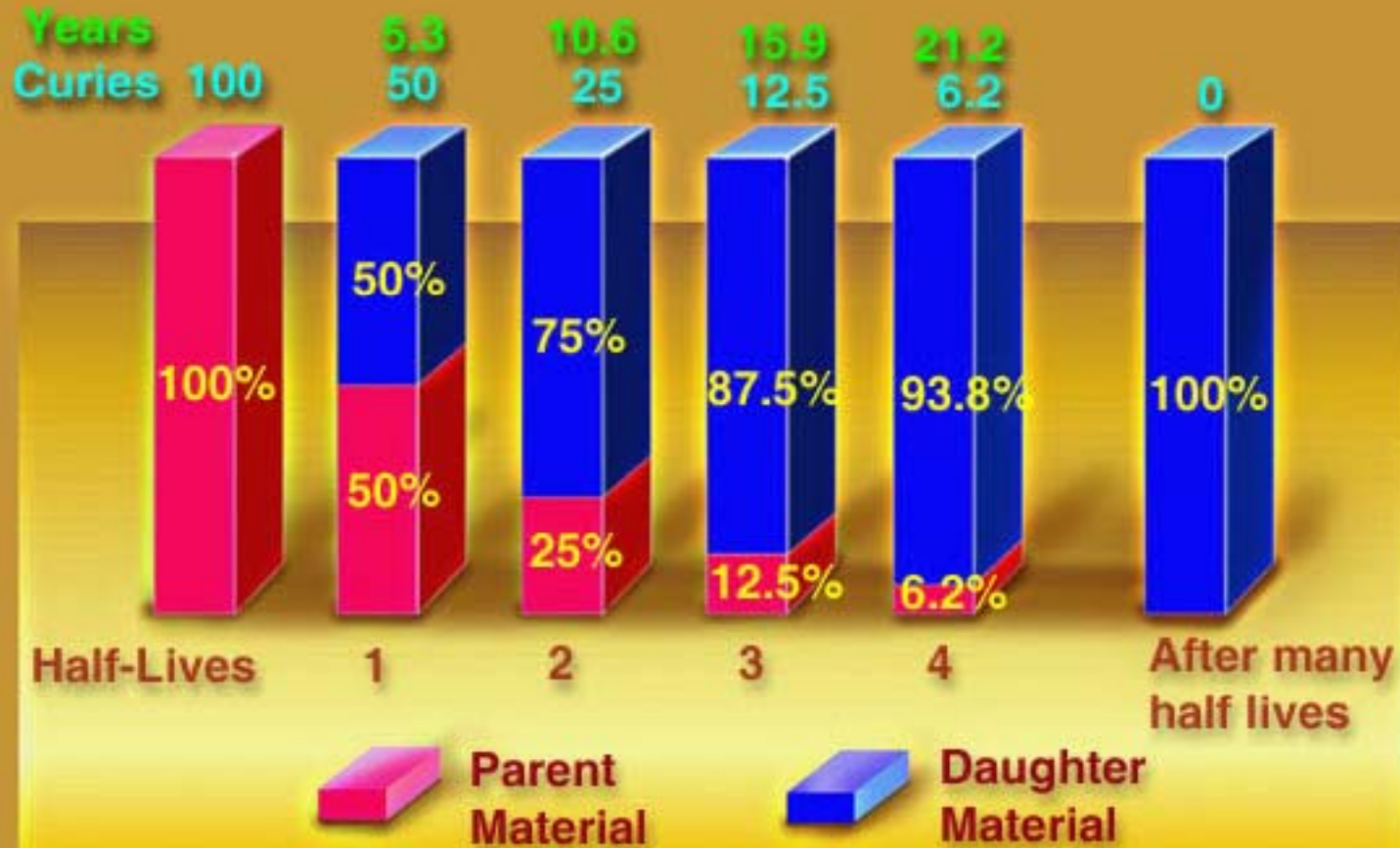


Half-life

- Each radioisotope has a predictable constant rate of decay. (Look in your ESRTs!)
- The length of time needed for half of the sample to convert to a stable form of the isotope is called the half-life.
- The original element is called the parent isotope and the product of decay is called the daughter isotope.



Cobalt 60 - Half Life 5.3 years



Courtesy of Digital Research & Development

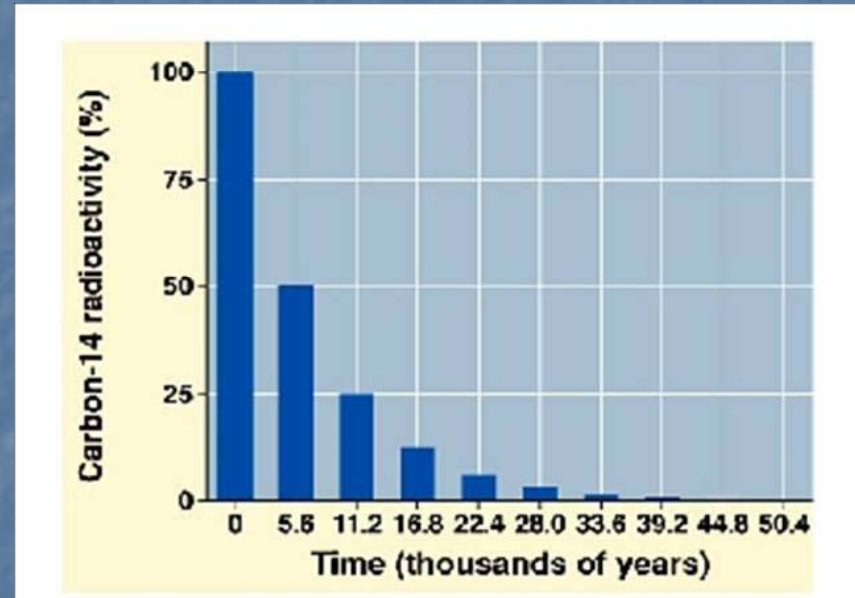
Earth Science Reference Table

Radioactive Decay Data

RADIOACTIVE ISOTOPE	DISINTEGRATION	HALF-LIFE (years)
Carbon-14	$C^{14} \rightarrow N^{14}$	5.7×10^3
Potassium-40	$K^{40} \begin{matrix} \rightarrow Ar^{40} \\ \rightarrow Ca^{40} \end{matrix}$	1.3×10^9
Uranium-238	$U^{238} \rightarrow Pb^{206}$	4.5×10^9
Rubidium-87	$Rb^{87} \rightarrow Sr^{87}$	4.9×10^{10}

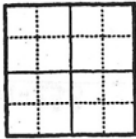
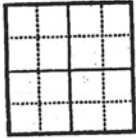
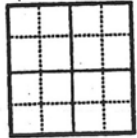
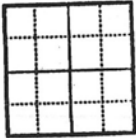
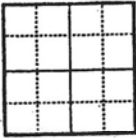
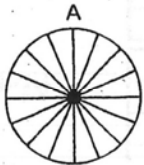
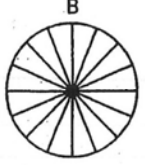
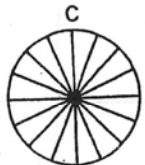
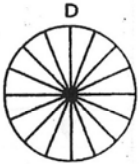
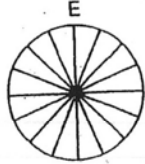
Carbon-14

- Important to scientists studying recent artifacts.
- Can be used only with organic remains. **MUST CONTAIN CARBON!!!!**
- Has a half-life of 5,700 years.
- Only useful with artifacts up to 50,000 years old.



Half-Life Carbon - 14

Directions: Complete the following tables and graphs. Use one color for **Carbon-14**, the radioactive element. Use a different color for the decay product, **Nitrogen-14**.

Beginning Time = 0 years	1 Half-Life Time = ____ years	2 Half-Lives Total time = <u>11,400</u> yrs.	3 Half-Lives Total time = ____ yrs.	4 Half-Lives Total time = ____ yrs.
				
<i>Fraction</i>	<i>Fraction</i>	<i>Fraction</i>	<i>Fraction</i>	<i>Fraction</i>
(C-14) $\frac{\text{All radioactive element}}{\text{No decay product}}$	$\frac{\frac{1}{2} \text{ radioactive element}}{\frac{1}{2} \text{ decay product}}$	$\frac{\text{____ radioactive element}}{\text{____ decay product}}$	$\frac{\text{____ radioactive element}}{\text{____ decay product}}$	$\frac{\text{____ radioactive element}}{\text{____ decay product}}$
A 	B 	C 	D 	E 
<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>
(C-14) $\frac{100\% \text{ radioactive elem. remaining}}{0\% \text{ decay product}}$	$\frac{50\% \text{ radioactive elem. remaining}}{50\% \text{ decay product}}$	$\frac{\text{____}\% \text{ radioactive elem. remaining}}{\text{____}\% \text{ decay product}}$	$\frac{\text{____}\% \text{ radioactive elem. remaining}}{\text{____}\% \text{ decay product}}$	$\frac{\text{____}\% \text{ radioactive elem. remaining}}{\text{____}\% \text{ decay product}}$