

# The Rhind papyrus

\* named after the Scottish Egyptologist Alexander Henry Rhind, who purchased it in 1858

\* written around **1650 BC** by the scribe Ahmes who copied a document 200 years older

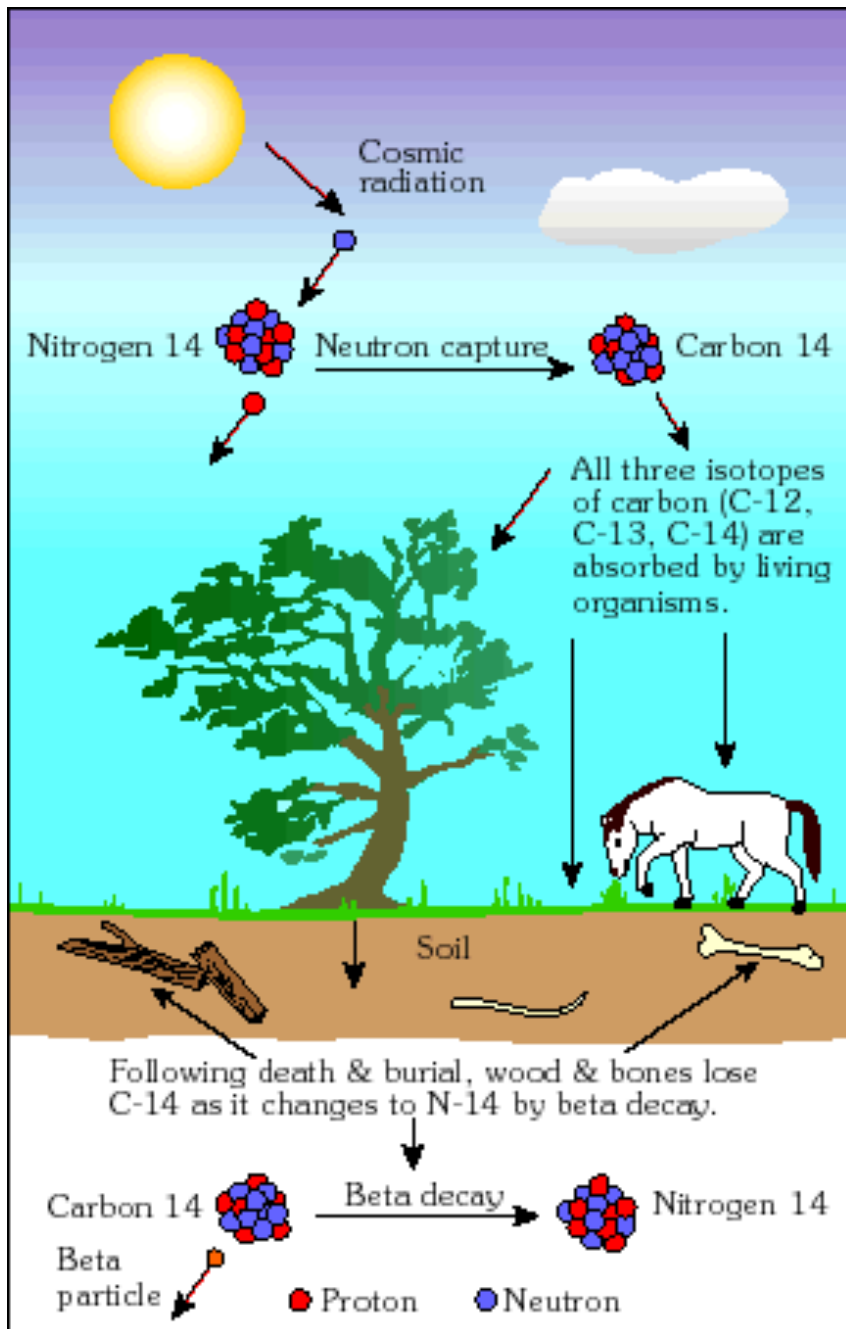
\* contains mathematical and geometric problems

\* Uses the value  $\pi = 3.1605$



how do we know?

# Radiocarbon dating



[from: [earthsci.org/fossils/geotime/radate/radate.html](http://earthsci.org/fossils/geotime/radate/radate.html)]

Used in archeology, geology, geophysics and other branches of science

... to estimate the age of organic remains: wood, charcoal, marine and fresh-water shell, bone and antler, peat and organic-bearing sediments, carbonate deposits such as tufa, dissolved carbon dioxide and carbonates in ocean, lake and ground-water sources

Developed by Willard Libby and colleagues at the University of Chicago in 1949

[Reference: McGraw-Hill Encyclopedia of Science & Technology, volume 15, pages 136-144]

## Issues:

- \* Amount of Carbon 14 in atmosphere is not constant
- \* Carbon 14 decay depends on environment (water, soil, etc.), weather conditions, etc.
- \* Volcanic eruptions, nuclear explosions create additional Carbon 14

The estimate obtained from calculation of exponential decay needs to be adjusted (calibrated) to account for the above

Half-life of Carbon 14 is 5730 years.

(in practice, some other values are used)

$$C(t) = C(0)e^{-0.0001209t}$$

Rhind papyrus ... 65% Carbon 14  
how old is it?

	Half-life
Tetrahydrocannabinol ... Marijuana (infrequent users)	1.3-3 days
Marijuana (frequent users)	1-10 days
Marijuana (if taken orally as pills)	25-36 hours
Marijuana (smoking/inhaling)	1.6-59 hours
LSD (Lysergic acid diethylamide)	3-5 hours
MDMA ... ecstasy Methylenedioxymethamphetamine	6-10 hours
Caffeine adults	4-5 hours
Caffeine infants	10-20 hours
Caffeine with oral contraceptives	5-10 hours
Caffeine (if pregnant)	9-11 hours
Caffeine (liver disease)	several days
Codeine (Tylenol 3)	3-6 hours
Demerol (pain killer)	3-5 hours
Morphine (pain killer)	2-3 hours
Heroin (IV or inhaled)	3-5 minutes
Cocaine (benzoylecgonine)	1 hour
Psilocin ... magic mushrooms, shrooms	2-3 hours
Phencyclidine ... rocket fuel, killer weed, angel dust	7-46 hours