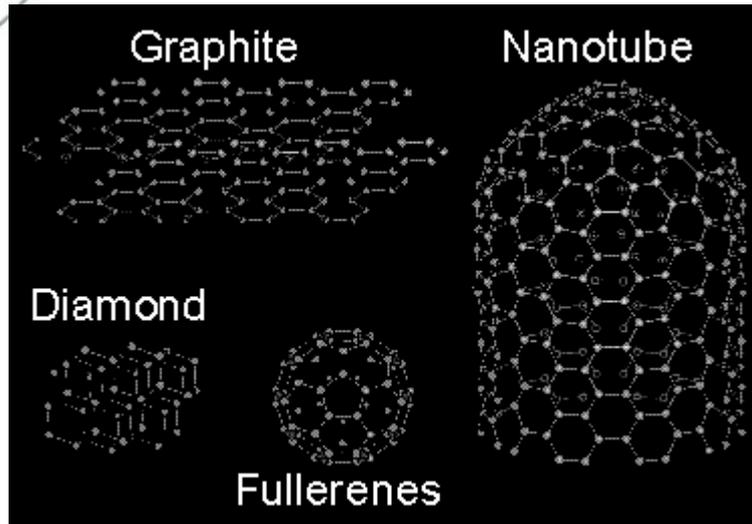
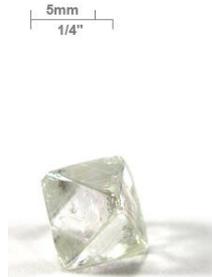
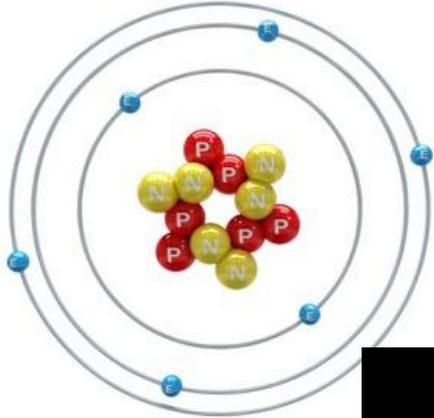
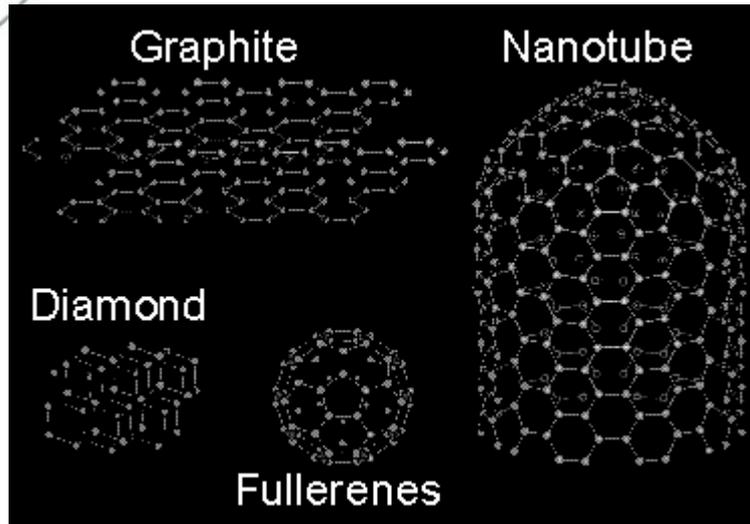
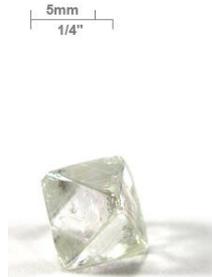
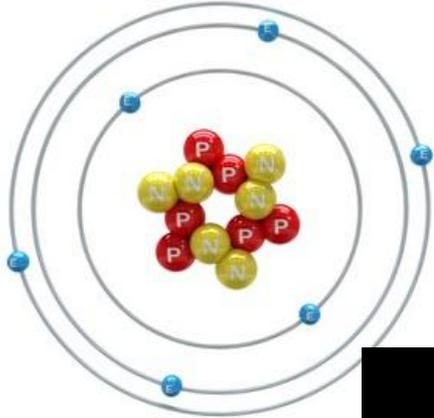


Guess the lesson!



Guess the lesson!



carbon



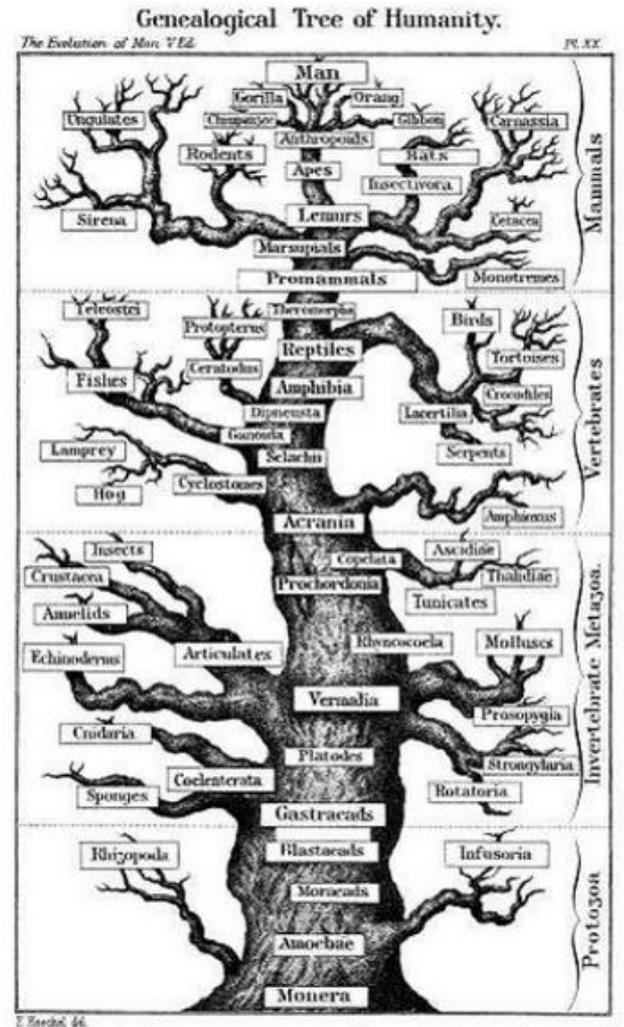
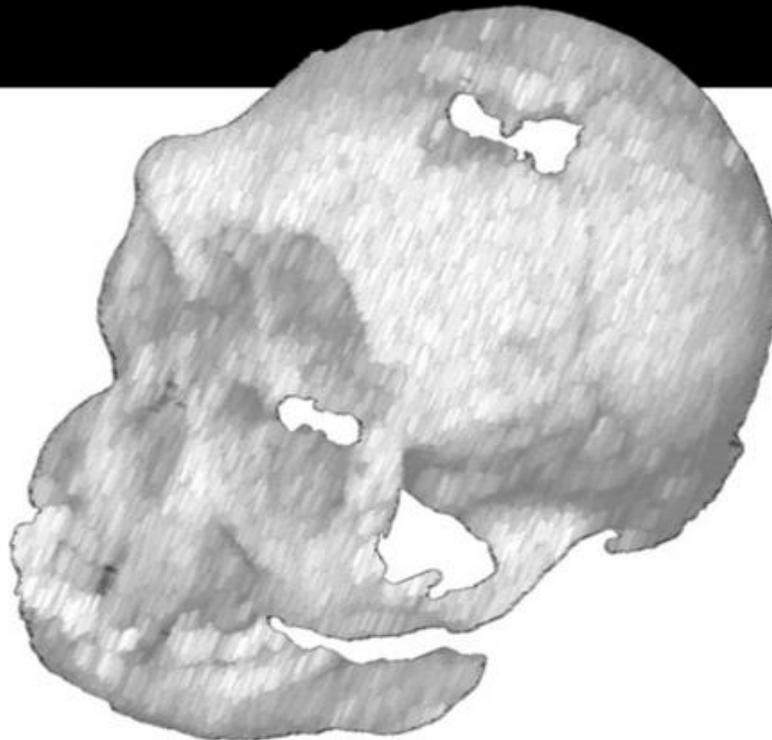
dating

IB Biology
Option D

D3 Human Evolution

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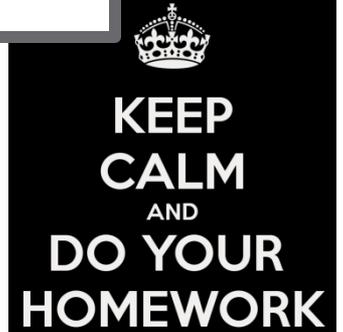
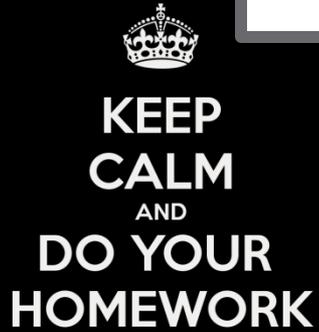
http://commons.wikimedia.org/wiki/File:LB1_skull.jpg

<http://commons.wikimedia.org/wiki/File:Human-evolution.jpg>

Aim

To be able to **deduce** the age of fossils using a curve of radioactive decay





Homework

Carbon dating exam questions – for Thursday

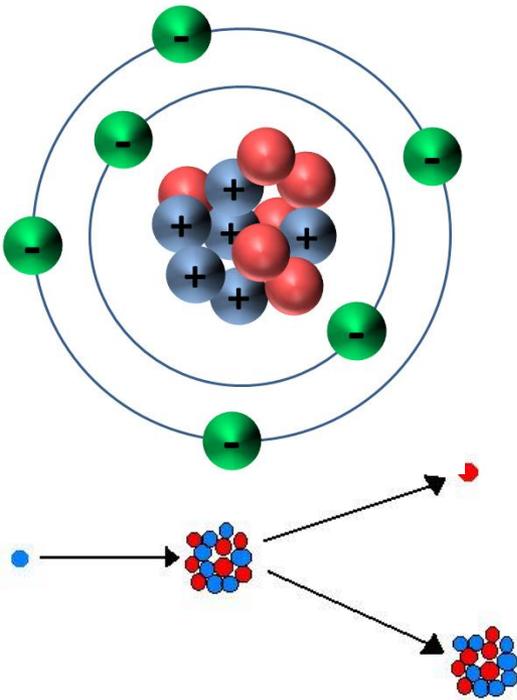
CW DESIGN due before Thursday



•D.3.1 Outline the method for dating rocks and fossils using radioisotopes, with reference to ^{14}C and ^{40}K

Radiocarbon Dating

http://www.youtube.com/watch?feature=player_embedded&v=31-P9pcPStg



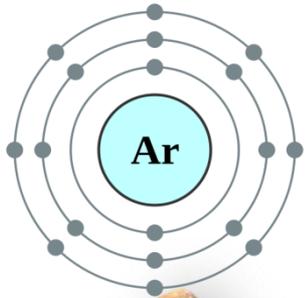
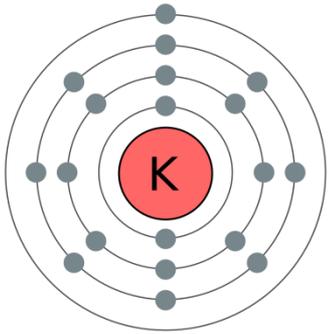
- All living things are carbon-based
- While alive, this carbon is a mix of two isotopes maintained in constant proportions:
 - ^{12}C (stable)
 - ^{14}C (radioactive)

- When dead, the proportion of radioactive ^{14}C decreases as it's not being replaced anymore
- Proportions of ^{14}C remaining are used to determine age
- ^{14}C – only an effective means of dating for sample up to ~60,000 years due to 5,730 year half life



•D.3.1 Outline the method for dating rocks and fossils using radioisotopes, with reference to ^{14}C and ^{40}K

Potassium-Argon Dating



- Longer range dating by dating rocks around a fossil to determine an **age range** (i.e. relative dating)
- Can only be undertaken on igneous rocks, not fossils or sedimentary rock
- ^{40}K is released in lava from active volcanos and decays into ^{40}Ar with a half life of 1,300 million years
- Time of the volcanic eruption = zero time point and age of strata in which fossil is found can be determined
- Any ^{40}Ar would have been released as a gas, levels of ^{40}Ar in strata provide indication of **relative age**

Half Life



The half life of a radioisotope is a measure of the time taken for the radioactivity to fall to half its original level
In other words, it is a measure of the time taken for half the atoms in a radioactive sample to decay

Radioactive Decay



Calculating Age:

Identify proportion
of radioisotope
remaining
(e.g. 0.33)



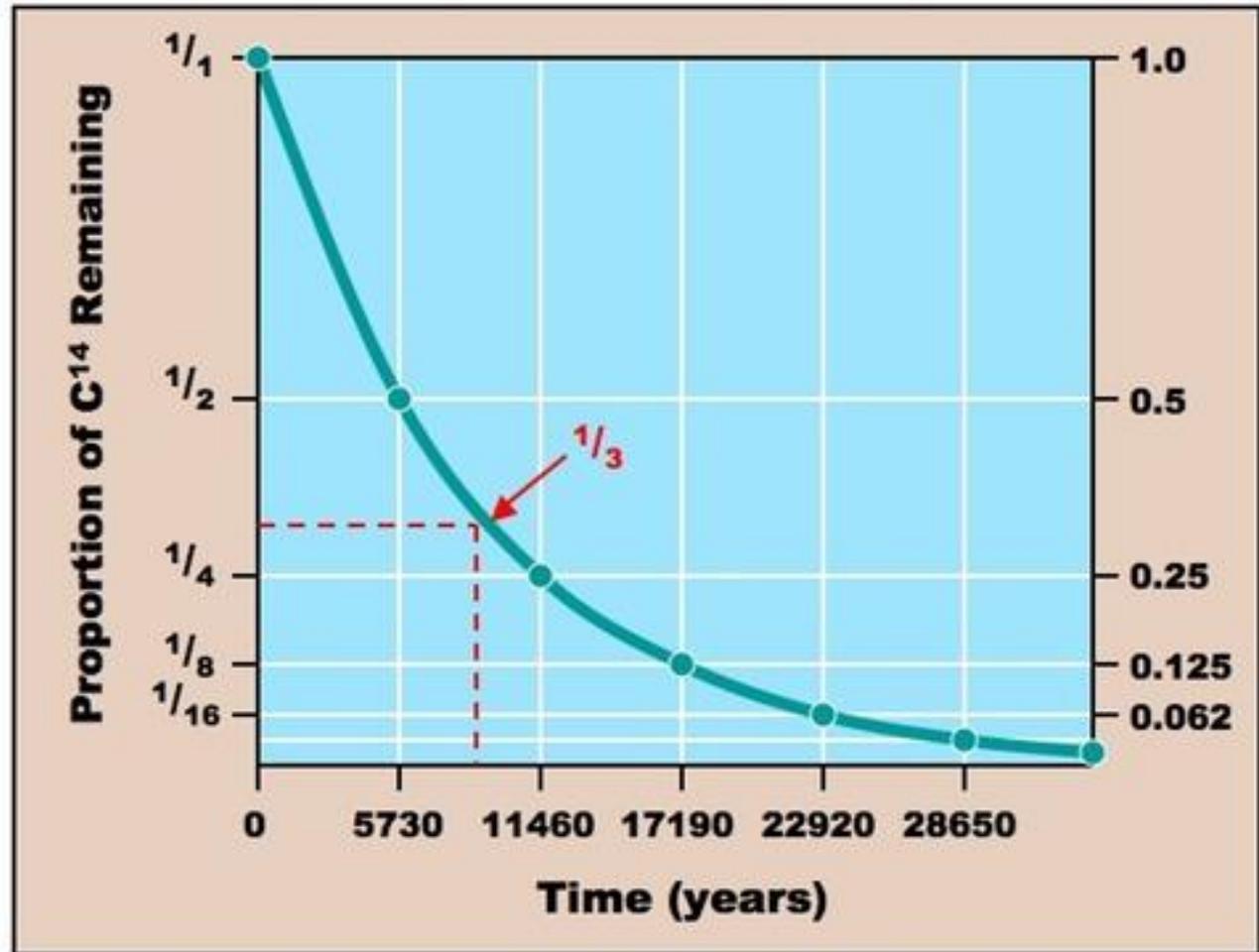
Identify number of
half lives that have
occurred
(e.g. 1.5)



Multiply this number
by the half life of the
radioisotope
(e.g. 5,730)



$$1.5 \times 5,730 = 8,595$$

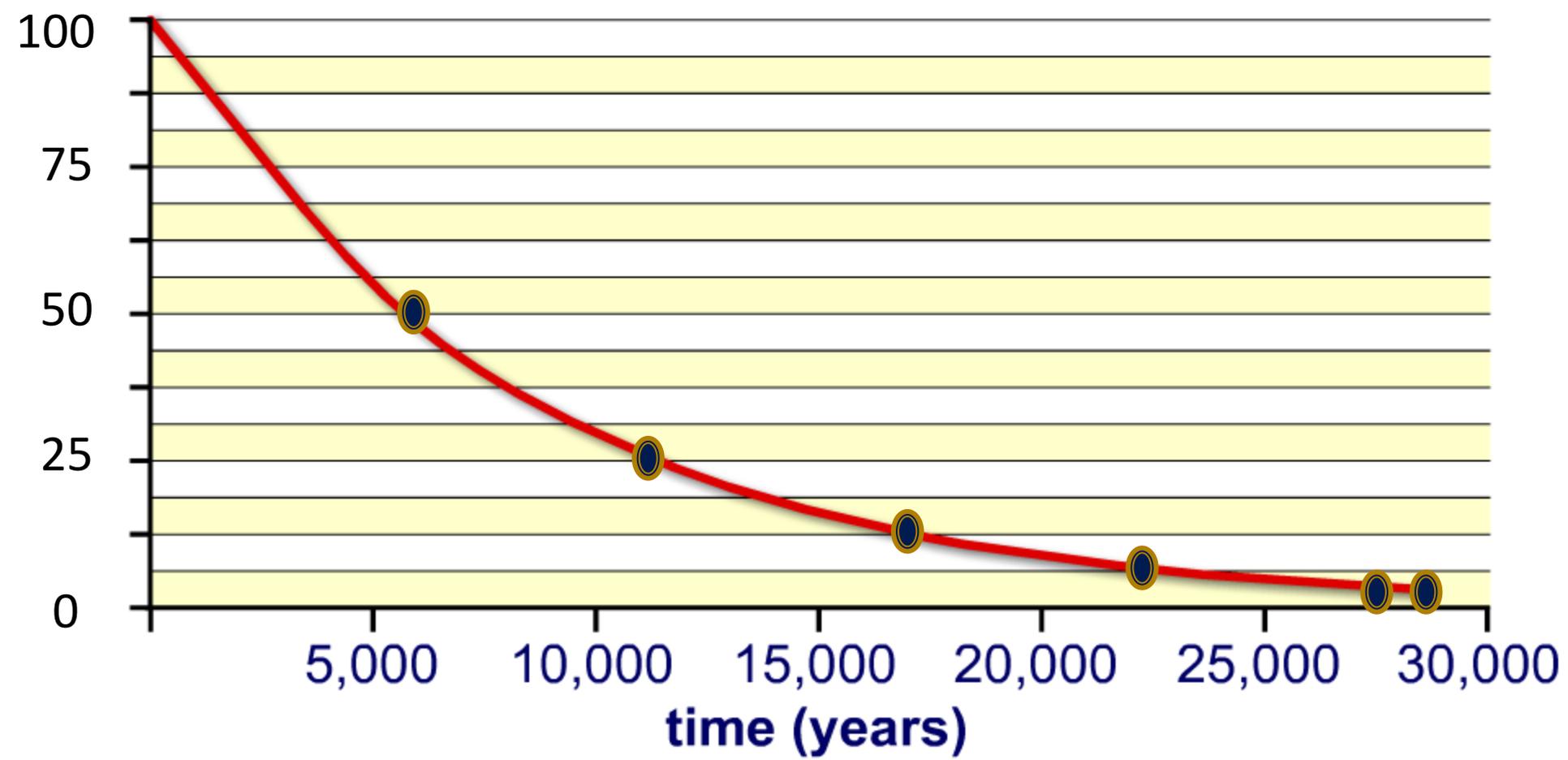


Carbon 14 Half life

5,730

Where are the half-lives?

Percentage of Carbon 14 (%)



Carbon 14 Half life

5,730

Step 1

Calculate the number of half lives that have occurred:

If there is 33% of the C^{14} - there has been one half life but not two (Half life one = 50%, two = 25%).

Step 2

If it is not a full number calculate the percentage of the LAST half life that has occurred:

33% = 1 half life, but is 8 more than 25 (the size of the next half life) so.....

$$8 / 25 = 0.32$$

Step 3

Number of complete half lives + partial half lives

$$1 + 0.32 = 1.32$$

Step 3

Age of fossil 5730 x Number of half lives that have occurred

$$1.32 \times 5730 = 7563.6$$

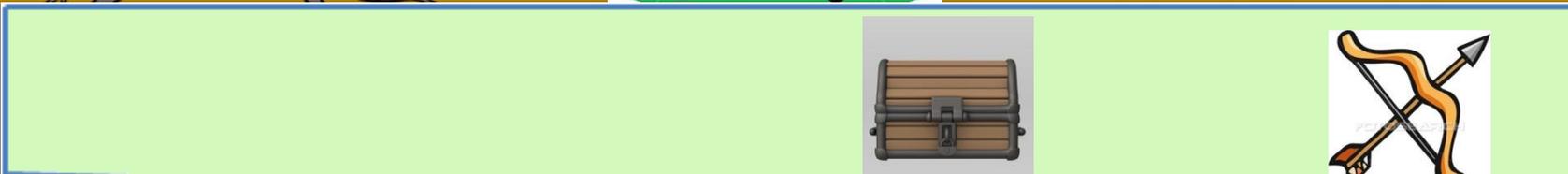
Use this method to calculate the age of something that has 9% of its C^{14} left?

D.3.3 Deduce the approximate age of materials based on a simple decay curve for a radio-isotope.

Now use the graph you have to calculate the half life of the following items.....

Practice at home:

<http://phet.colorado.edu/en/simulation/radioactive-dating-game>





The percentage of
carbon-14 found in this
wooden bow:

88%

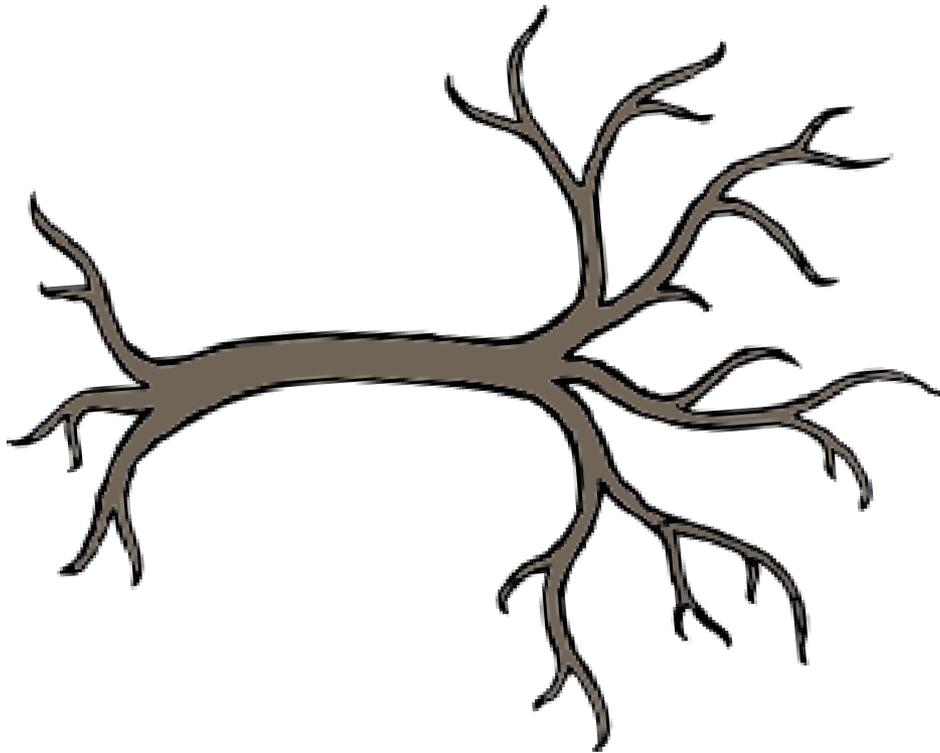
➤ **What is the age of the bow?**



The percentage of
carbon-14 found in this
wooden bow:

11%

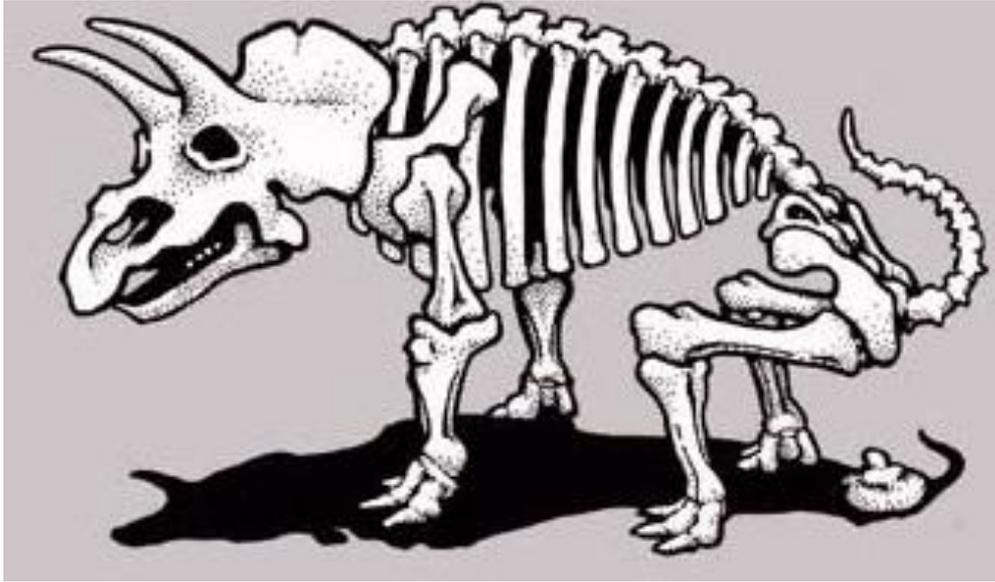
➤ **What is the age of the skull?**



The percentage of
carbon-14 found in this
wooden bow:

93%

➤ **What is the age of the tree?**



The percentage of carbon-14 found in this dinosaur fossil:

0%

- What does it mean if the percentage is zero?
- What problems does this provide for carbon dating?



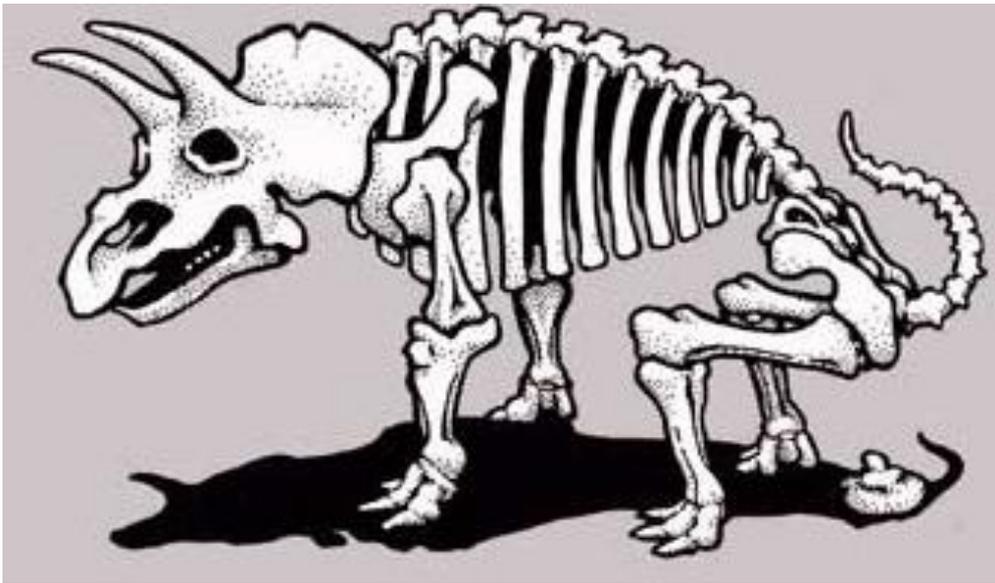
We cannot use carbon-14 to check the age of this rock:

- Why?
- What do we use?



The age of this rock
using uranium dating
was found to be:

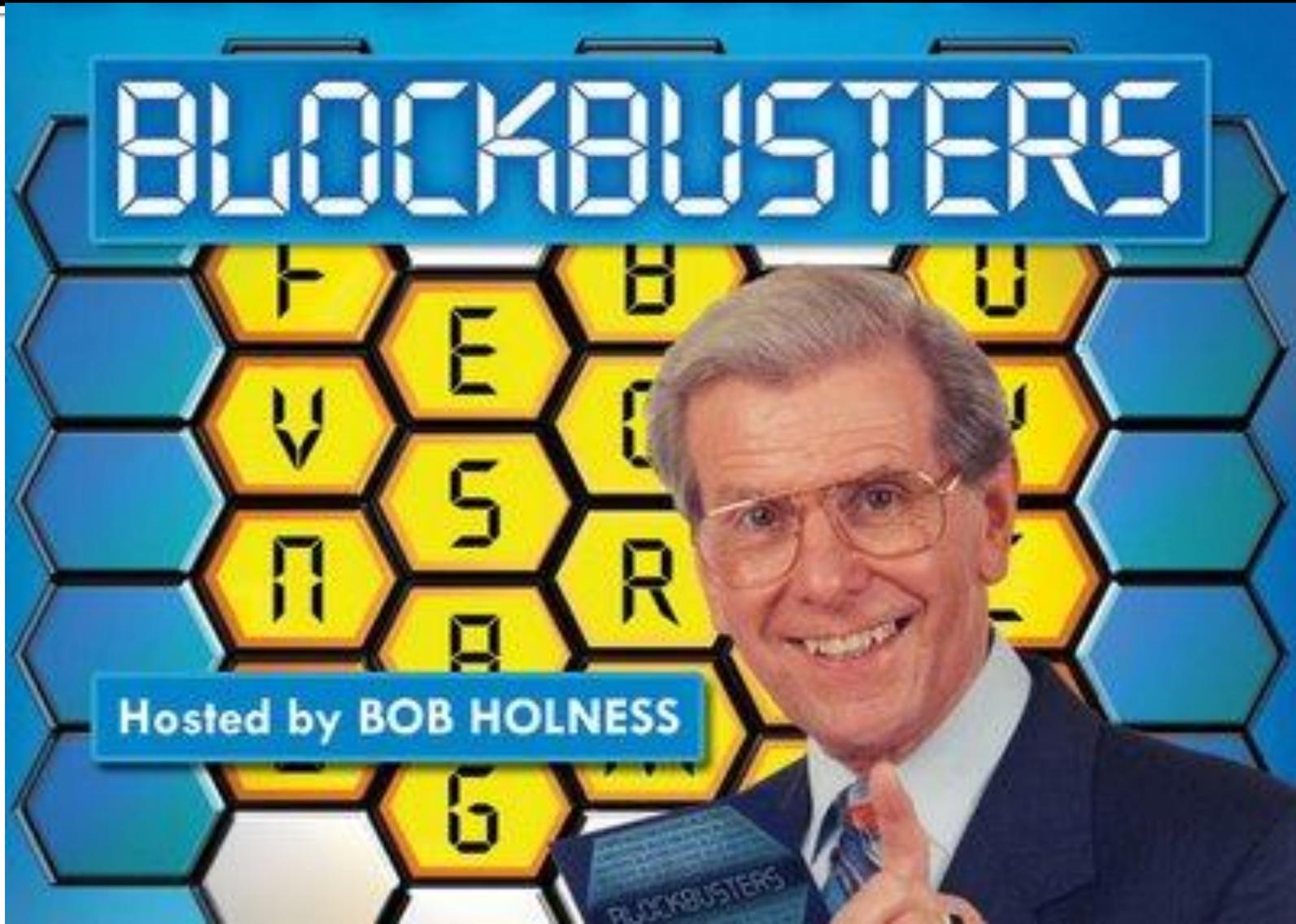
10My



Using previous answers,
calculate a VERY
ROUGH ESTIMATE of
the age of this dinosaur
fossil:

Carbon Dating

- http://www.teachers-direct.co.uk/resources/quiz-busters/quiz-busters-game.aspx?game_id=42532



Aim

To be able to **deduce** the age of fossils using a curve of radioactive decay

