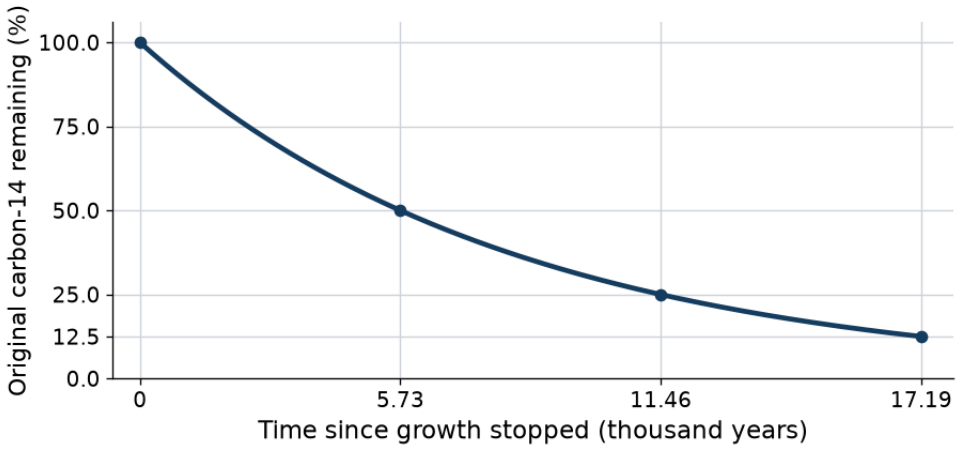
Dating Buried Wood Beneath a Mill

Base your answers on the information provided and your knowledge of chemistry. Use the 2025 Chemistry Reference Tables as needed.

Workers inspecting an old mill find preserved wood in saturated sediment far below the foundation. A lab uses the carbon-14 remaining in the wood to estimate when it stopped exchanging carbon with the environment. The graph shows a simplified model. Each percent is relative to the carbon-14 expected in the same mass of carbon from living wood.



Model of carbon-14 remaining after wood stops exchanging carbon.

1 A clean piece of the wood has 25% of its original carbon-14 remaining. Estimate how many years have passed since it stopped exchanging carbon. Show your reasoning from the graph. [1]

Answer and work

2 Carbon-14 undergoes beta-minus decay. The mass number stays 14 and the atomic number increases from 6 to 7. Use the periodic table to identify the product nucleus.

(1) Carbon-13

(2) Boron-14

(3) Nitrogen-14

(4) Oxygen-14

A second piece has the same age as the clean piece, but the carbon measured from it includes fibers from a recently grown plant. Of the measured carbon, 90% comes from the old wood and 10% comes from the recent fibers. Use 100% of the living-wood carbon-14 level for the recent fibers.

3 Use a weighted average to predict the measured carbon-14 percentage for the second piece. [1]

Answer and work

4 If a student treats the second piece as clean, would the graph make it appear older or younger than the first piece? Explain using the shape of the curve. [1]

Answer and work

5 A report says the clean sample gives the date when the mill was built. Explain why the dating measurement does not establish that date. [1]

Answer and work