Year 13 Science: Dating geological events

Name: _____ Date: _____

Try these without your notes first, then check the answer key.

Practice

1. Charcoal has 25.0% of its original carbon-14. How old is it?

2. Bone has 60.0% of its original carbon-14. How old is it?

3. In a cliff, a dike cuts layers 1 to 3 and is itself offset by a fault. Which happened first, the dike or the fault?

4. A peat layer lies between the Taupō tephra and the Kaharoa tephra. What is its age range?

5. Why can a sandstone not be dated by potassium-argon on its own grains?

Fix the mistake

6. Correct this statement: "Carbon-14 dating shows the granite is 96 million years old."

7. Correct this statement: "After two half-lives all the parent isotope has gone."

8. Correct this statement: "The dike is older than the layers because it is underneath them."

9. Correct this statement: "A sandstone can be dated by measuring argon in its grains."

Answer key (for parents and tutors)

1. Charcoal has 25.0% of its original carbon-14. How old is it?
   25.0% is two half-lives: 2 × 5730 = 11,460 years.
2. Bone has 60.0% of its original carbon-14. How old is it?
   $t = 5730 \times \log_2(1 \div 0.600) = 5730 \times 0.737 = 4220$ years.
3. In a cliff, a dike cuts layers 1 to 3 and is itself offset by a fault. Which happened first, the dike or the fault?
   The dike: the fault cuts it, so the fault is younger.
4. A peat layer lies between the Taupō tephra and the Kaharoa tephra. What is its age range?
   Between about 232 CE and about 1314 CE.
5. Why can a sandstone not be dated by potassium-argon on its own grains?
   The grains crystallised in an older rock before they were eroded and deposited, so their clocks date the source rock, not the sandstone.
6. Correct this statement: "Carbon-14 dating shows the granite is 96 million years old."
   Carbon-14 only reaches about 50 000 years and dates once-living material; old igneous rocks need potassium-argon or uranium-lead.
7. Correct this statement: "After two half-lives all the parent isotope has gone."
   Half remains after one half-life and a quarter after two; the amount halves each time and never quite reaches zero.
8. Correct this statement: "The dike is older than the layers because it is underneath them."
   A dike that cuts through layers is younger than every layer it cuts.
9. Correct this statement: "A sandstone can be dated by measuring argon in its grains."
   Its grains crystallised before being eroded and deposited, so date volcanic layers above and below it instead.