

EduTrend Contents

W4C · EARTH SCIENCE & GEOLOGY · HIGH SCHOOL

Reading the Rocks

Date rock layers with relative and radiometric methods.

Ages 15–18 | Level: Advanced | 75 minutes | Pairs · up to 24 | Activity 05

Inside: activity at a glance · step-by-step session plan · facilitator notes · 3 student worksheets · assessment checklist

ACTIVITY 05 · AT A GLANCE

Reading the Rocks

Students work as field geologists. They interpret a cross-section using the principles of superposition, cross-cutting relationships and inclusions to put events in order. They then model radioactive decay with dice, plot decay curves, determine a half-life and use it to date igneous layers, combining relative and absolute dating.

Learning outcomes

By the end of the session students can:

- apply the principles of stratigraphy to sequence geological events;
- model radioactive decay and determine half-life from data;
- calculate the age of a sample from a parent-daughter ratio;
- evaluate the assumptions and uncertainties in dating methods.

KEY WORDS

superposition · cross-cutting · unconformity · half-life · parent isotope · daughter isotope · radiometric dating

CURRICULUM LINKS

Earth science: geological time. Physics: radioactivity. Maths: exponential decay, logarithms.

1	2	3	4	5	6
QUESTION	**OBSERVE**	**PREDICT**	**TEST**	**RECORD**	**EXPLAIN**
What do we want to know?	Look and handle	What might happen?	Try it fairly	Measure and note	Read the evidence

Materials (per pair)

- Geological cross-section diagram (Worksheet 1)
- 100 dice (or coins) in a tray
- Graph paper or spreadsheet
- Calculator
- Worksheets 1, 2 and 3

Before the session

- Print the cross-section.
- Count dice into cups of 100.
- Prepare a class results table.
- Review the half-life equation.

SAFETY

Low risk. Keep dice in trays to avoid trip hazards.

ACTIVITY 05 · SESSION PLAN

Step by step

Timings are for 75 minutes. Pool class dice data to reduce random scatter.

Time	What happens	Say or ask
0–10 min Hook	Show a photo of layered canyon walls. How old is the bottom layer?	*"How could we know without being there?"*
10–30 min Relative dating	Pairs sequence events in the cross-section using superposition, cross-cutting and inclusions.	*"What must have happened first?"*
30–50 min Decay model	Pairs roll 100 dice, remove sixes (decayed), record and repeat for 15 rolls.	*"Can you predict which die will decay?"*
50–60 min Analyse	Plot parent dice against roll number, find the half-life and compare with class data.	*"Why is the curve smooth only with many dice?"*
60–70 min Absolute dating	Use given isotope ratios and a real half-life to date the igneous intrusion.	*"Which layers can we date directly?"*
70–75 min Evaluate	Discuss assumptions: closed system, known initial amount.	

CHALLENGE CARD (print or copy onto the board)

Put the ten events in the cross-section in order, then use the isotope data to give an absolute age for the dyke and bracket the age of the sandstone layer.

ACTIVITY 05 · FACILITATOR NOTES

The geology in brief

Relative dating puts events in order. In undisturbed layers, younger rocks lie on top of older ones (superposition). A dyke or fault that cuts through layers is younger than the layers it cuts (cross-cutting relationships). Fragments of one rock inside another must be older than the rock that contains them.

Radioactive isotopes decay at a constant rate described by the half-life, the time for half of the parent atoms to decay. If a mineral contained only parent isotope when it formed and has stayed a closed system, age = half-life × log2(original parent ÷ remaining parent). Radiometric dating works best on igneous rocks; sedimentary layers are dated by bracketing them between dated igneous layers.

Common ideas to listen for

- “Each die knows when to decay.” Decay is random for each atom but predictable for large numbers.
- “After two half-lives everything has decayed.” A quarter of the parent remains.
- “Sedimentary rocks can be dated directly by radiometric methods.” Their grains are older than the layer itself.

Adapting the activity

Support

Provide a partly sequenced list of events and a pre-drawn decay graph grid.

Stretch

Fit an exponential curve to class data and compare the fitted half-life with the theoretical value of 3.8 rolls.

WORKSHEET 1

Sequence the events

Name: _____ Class: _____ Date: _____

Use the principles of stratigraphy. Number events from oldest (1) to youngest.

Cross-section

Teacher provides or draws the cross-section here: layers A–F, fault, dyke, erosion surface.

Sequence and principle used

Order	Event	Principle
1		
2		
3		
4		
5		
6		

WORKSHEET 2

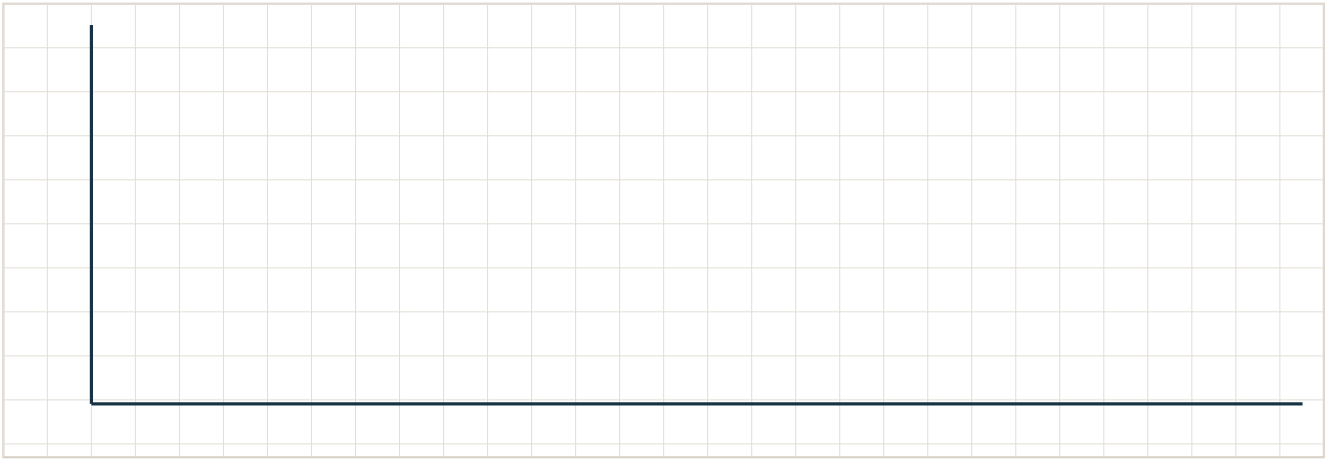
Dice decay

Remove sixes after each roll. Record dice remaining.

Data

Roll	0	1	2	3	4	5	6	8	10	12	15
Dice left											

Decay curve



y-axis: dice remaining

x-axis: roll number

WORKSHEET 3

Absolute age

Show your working.

Calculation

Half-life of isotope: _____ Fraction of parent remaining: _____ Age = _____

Two assumptions of radiometric dating and why they matter

FOR THE TEACHER

Assessment checklist

Use during the session. One sheet covers up to eight students; copy as needed.

Student	Applies stratigraphic principles	Analyses decay data	Calculates and evaluates ages

Suggested codes: W = working towards · E = expected · G = greater depth

ABOUT THIS ACTIVITY

Reading the Rocks is a sample activity from the EduTrend Contents W4C Earth Science & Geology programme (high school, level: advanced). Every activity in the programme follows the same format: a practical challenge, a clear session plan, facilitator notes and ready-to-print worksheets, so that teachers, club leaders and parents can run it without extra preparation.

Full 15-, 20- and 32-week programmes are available from EduStore at edutrend.org.

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