

Logarithms Application - Richter Scale

Earthquake Research Project

Introduction

The Richter scale is used to measure the magnitude of an earthquake. The magnitude of an earthquake describes the intensity or amount of energy released during the earthquake.

- The magnitude of an earthquake is measured by a seismograph.
- The Richter scale is a logarithmic scale in which each unit of increase magnitude signifies an increase of intensity by a factor of 10.
- Earthquakes having magnitudes greater than 6.0 are considered dangerous.

Formulas:

- The intensities of two earthquakes can be compared using the formula $\frac{I_1}{I_2} = 10^{M_1 - M_2}$, where I refers to the intensity and M refers to the magnitude of the earthquakes.
- The amount of energy, E , an earthquake releases is related to its magnitude, M using the formula: $\log E = 11.8 + 1.5M$ and is measured in **ergs**.

Examples:

(i) How much more intense is an earthquake with magnitude 7.5 than an earthquake with magnitude 6.4 ? Round your answer to the nearest whole number	(ii) Calculate the amount of energy released by an earthquake measuring 7.6 on the Richter scale.
$10^{7.5-6.4} = 10^{1.1} \approx 12.6$ The earthquake with magnitude 7.5 was approximately 13 times more intense than the earthquake with magnitude 6.4.	Amount of Energy: $\log E = 11.8 + 1.5M$ $M = 7.6$

$$\log E = 11.8 + 1.5(7.6)$$

$$\log E = 23.2$$

$$E = 10^{23.2}$$

The amount of **energy released** by an earthquake measuring 7.6 on the Richter scale is $10^{23.2}$ **ergs**.

Project Objectives

Objective 1: Research two(2) famous earthquakes. They should have different magnitudes. Record or calculate the values listed below.

- Magnitude
- Energy Released

Objective 2: Calculate how much more intense the larger earthquake was than the smaller one.

Objective 3: Write a brief description of the impact of the earthquakes on the communities where they happened. Include the impact on life and property.

Objective 4: Organize your research on a poster, Google slides presentation, PowerPoint presentation, or as a written paper. Include pictures. Ensure your name is included on your work.

Note:

- For slides: no more than four(4)
- Poster: no larger than an A3 size-paper. If using online poster creation sites like Canva ensure that the teacher can access your work and be able to print/download the file.
- Written paper: No more than two(2) pages on A4 paper.

Grading Rubric

Objective 1		Objective 2	Objective 3	Objective 4
Magnitude of earthquake 1 1 point: Included 0 points: Not included	Magnitude of earthquake 2 1 point: Included 0 points: Not included	3 points: All calculations are correct and have a written statement describing the difference in intensity. 2 points: All calculations are correct, but missing statement describing the difference in intensity. 1 point: There are minor errors in calculations or statements. 0 points: Incorrect and/or blank.	3 points: Descriptions are excellent, including descriptions on life and property. 2 points: Descriptions are good, including descriptions on life and property. May be missing a small amount of information. 1 point: Descriptions are minimal. 0 points: Descriptions not included.	3 points: Presentation is neat, accurate, and portrays the impact in a visually compelling manner. 2 points: Presentation is neat, mostly accurate, and portrays the impact. Missing a couple components. 1 point: Presentation is incomplete, unorganized, or difficult to follow. 0 points: Presentation is not done.
Energy released by earthquake 1 3 points: Calculated correctly. All work shown. 2 points: Calculated correctly. Missing some work. 1 point: Correct answer, with no work. 0 points: Incorrect	Energy released by earthquake 2 3 points: Calculated correctly. All work shown. 2 points: Calculated correctly. Missing some work. 1 point: Correct answer, with no work. 0 points: Incorrect			