Name _____ Date _____ Class _____

WORKSHEET 43

MATH IN SCIENCE: EARTH SCIENCE

MATH SKILLS USED
Addition
Percentages
Powers of 10

Earthquake Power!

Use the Richter scale to compare the size and magnitude of earthquakes.

Sometimes earthquakes are strong enough to cause a huge amount of damage—highways crumble and buildings fall in an instant. Other times, earthquakes can be so slight that people hardly feel them. Scientists use a mathematical system called the Richter scale to compare the size and magnitude of earthquakes. An earthquake's magnitude depends on the amplitude of seismic waves, which are recorded by a seismograph. The greater the amplitude of the waves is, the higher the reading on the Richter scale is.

Part 1: Richter Readings

Earthquakes per year	Magnitude on the Richter scale*	Severity
1	8.0 and higher	great
18	7.0–7.9	major
120	6.0–6.9	strong
800	5.0–5.9	moderate
6200	4.0–4.9	light
49,000	3.0–3.9	minor

*Earthquakes measuring less than 3.0 are not included because approximately 9000 occur daily.

Use What You Know!

Use the table above to answer the following questions. Remember to show your work.

1. In a given year, how many earthquakes measure 6.0 or greater?

120 + 18 + 1 = 139; In a given year, 139 earthquakes measure 6.0 or greater.

2. In a given year, what percentage of earthquakes measure 3.0 or greater are moderate?

Total number measuring 3.0 or greater = 1 + 18 + 120 + 800 + 6200 + 49,000 = 56,139;

percentage of moderate earthquakes = 800 ÷ 56,139 = 0.014 = 1.4%

3. Calculate the percentage of earthquakes that measure 5.0 or greater that are classified as "major" and "great."

Number of earthquakes measuring 5.0 or greater = 800 + 120 + 18 + 1 = 939. Percentage of these that are "major" and "great" = (18 + 1) ÷ 939 = 0.02 = 2%

Part 2: Richter Math

The Richter scale is based on a mathematical system. Each whole-number increase in magnitude on the Richter scale represents an increase in measured amplitude by a factor of 10. That means that an earthquake measuring 4.0 on the Richter scale is 10 times as strong as an earthquake measuring 3.0.

The Richter scale is also used to estimate the relative energy released by earthquakes. Each whole-number increase on the Richter scale represents an increase in energy release by a factor of 32. Examine the table below, and work the problems that follow. Be sure to show your work.

The Richter Scale

Difference in magnitude	Relative strength	Change of energy released
0.3	2.0 times as strong	3 times as much
0.5	3.2 times as strong	5.5 times as much
1	10 (10^1) times as strong	32 times as much
2	100 (10^2) times as strong	32^2 times as much
3	1000 (10^3) times as strong	32^3 times as much
4	10,000 (10^4) times as strong	32^4 times as much
5	100,000 (10^5) times as strong	32^5 times as much

4. On December 16, 1920, an earthquake measuring 8.6 on the Richter scale hit Gansu, a province in China. Twelve years later, an earthquake measuring 7.6 hit Gansu. How much stronger was the 1920 earthquake?

8.6 − 7.6 = 1; The 1920 earthquake was 10 times stronger.

5. How much more energy did the 1920 earthquake release compared with the second earthquake?

The 1920 earthquake released 32 times as much energy.

6. In 1906, an earthquake occurred in San Francisco that measured 8.3 on the Richter scale. In 1994, an earthquake occurred in Northridge, California, that measured 6.7 on the Richter scale.

a. How much stronger was the San Francisco earthquake?

8.3 − 6.7 = 1.6, or 1 + 0.3 + 0.3; The San Francisco earthquake was 10 × 2 × 2 = 40 times stronger.

b. How much more energy did the San Francisco earthquake release?

32 × 3 × 3 = 288; It released 288 times more energy.