The Earth’s Shape

Introduction: Pictures of the earth taken from space show that the earth appears to be perfectly round and smooth. However, to us, the earth appears to have a highly irregular surface. In addition, accurate measurements of the earth’s shape show that the equatorial diameter is slightly different than the polar diameter.

Objective: After you complete this lab you will better understand the true roundness and smoothness of the earth.

Vocabulary:

Relief: ________________________________

Model: ________________________________

Oblate Spheroid: ________________________

Sphere: ________________________________

Procedure:

Part A. Roundness

The ratio of the polar diameter to the equatorial diameter of a sphere is a measure of its roundness. Dividing the polar diameter by the equatorial diameter would give a value of one since both diameters of a perfect sphere are equal. The farther from 1 the actual computed ratio is, the less spherical a globe is.

1. Use the values given for the equatorial and polar diameters of the earth in the Data Chart on the Report Sheet to calculate the roundness-ratio of the earth. Record this value on the Data Chart.

2. Measure the equatorial and polar diameters of the “globe” represented by the diagram with your ruler to the nearest 0.1 cm (page 3). Record these measurements on the Report Sheet.

3. Calculate the roundness ratio for the “globe” using the data from step 2. Record this value on the report sheet.
Part B. Smoothness

A relief globe shows the relative height of its surface features, such as mountains. It is a scale model of the earth. The following procedures will show you whether or not these features are constructed to scale on such a globe. To calculate, you must use the proportion shown below.

\[
\frac{\text{Actual height of Surface Features (km)}}{\text{Earth Diameter (km)}} = \frac{\text{Relief Globe height of Surface Feature (cm)}}{\text{Relief Globe Diameter (cm)}}
\]

When you place your data into the equation shown above, you have one unknown value (Relief Globe height of Surface Feature). You then apply the mathematical rules for cross-multiplying ratios, and solve for the unknown value.

RECORD THE FOLLOWING INFORMATION ON THE DATA CHART UNDER “SMOOTHNESS” ON YOUR REPORT SHEET.

1. The actual height of Mt. Everest = 8.8 km
2. The average diameter of the Earth can be found in your ESRT on page 15.
3. Measure the Relief Globe Diameter (equatorial) in cm (nearest 0.1).
4. Using the values obtained above, and the equation shown above, solve for the relief globe height of the surface feature (Mt. Everest) to correct scale for this globe.
5. Measure the actual Relief Globe Height of Mt. Everest in cm using the diagram on page 3.
6. Determine the % Deviation (Error) between the height of Mt. Everest on the diagram (#5) and the height it should have been if drawn to the correct scale (#4).
Relief Globe

North Pole

Mt. Everest

Equator

South Pole
REPORT SHEET

A. ROUNDENESS

<table>
<thead>
<tr>
<th></th>
<th>Polar Diameter</th>
<th>Equatorial Diameter</th>
<th>Roundness Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earth</td>
<td>12,714 km</td>
<td>12,756 km</td>
<td></td>
</tr>
<tr>
<td>Relief Globe</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

B. SMOOTHNESS

Actual Height of Mt. Everest (in km)  

Average Diameter of the Earth (in km)  

Average Diameter of Relief Globe (Equator in cm)  

Correct Scale for Relief Globe Height of Mt. Everest (in cm) (Accepted)  

Height of Mt. Everest on the diagram (page 3 in cm) (Measured)  

Percent Deviation Calculation (SHOW ALL WORK)!

Questions: (Answer in complete sentences)
1. Using the roundness ratio you calculated, which is more nearly a perfect sphere, the earth or the average classroom globe?

2. How does the earth’s polar diameter compare with its equatorial diameter?

3. Is the earth a perfect sphere? How does your data confirm your answer?

4. Using your calculations under Procedure B, explain why you think the earth is, or is not, smoother than the average classroom relief globe.

5. A 0.1 cm deep scratch was made in the surface of a globe with a diameter of 40 cm. Calculate the actual depth of the surface feature (represented by the scratch on the real earth). SHOW ALL WORK!

6. From the information derived from this lab, describe the roundness and smoothness of Earth.