Title: Oh, My Aching Feet!

Content Standard A (Grades 5-8): Mathematics is important in all aspects of scientific inquiry.

Standard 5:

Indicator 5.5.1 Make precise and varied measurements and specify the appropriate units.

Indicator 5.5.5 Demonstrate that areas of irregular shapes can be found by dividing them into squares and triangles.

Background:

Elephants are the largest of the land mammals and the African bulls (males) can weigh between 9,000-13,000 pounds while the cows (females) can weigh between 4,500-7,000 pounds. With this much weight, the elephant's foot must be designed to withstand tremendous pressure.

Purpose: To calculate the amount of pressure exerted on an elephant's foot and compare this pressure with the pressure exerted on a human foot.

Materials:

- Elephant foot mold (Indianapolis Zoo's Elephant Resource Kit)
- Graph paper

Activity:

1. Moisten the bottom of the elephant foot mold.
2. Press the mold on a sheet of graph paper.
3. Count the number of squares on the graph paper contained within the footprint. (the area)
4. Divide the elephant's weight by the area using the formula:

$$\text{Pressure} = \frac{\text{Force}}{\text{Area}} \qquad P\ (\text{lb}/\text{in}^2) = \frac{F\ (\text{lb})}{A\ (\text{in}^2)}$$

This is the average pressure the elephant exerts on the ground when standing on one foot.

5. Calculate the pressure exerted by the elephant when standing on four feet.
6. Have the student moisten one foot and repeat items #2-# 4.
7. Calculate the pressure exerted by the student when standing on two feet.
8. Compare the pressure exerted on an elephant's foot to the pressure exerted on the student's foot.

Extensions:

1. Find the pressure exerted on the feet of other animals.
2. Compare the pressures exerted on the feet of the different animals.
3. Calculate the pressure exerted on the feet of a female wearing high heels.

Assessment:

1. Calculations on finding pressure.
2. Discussion on how the area of the feet of animals relates to the pressure exerted on the feet of humans.

Resources/teacher notes:

1. Have the graph paper marked off in squares that are one inch by one inch.
2. Pressure is in units of lb/in and not the metric unit of Pascal's because of common usage of lb/in^2.