

Pressure

Pressure is the force per unit area. The smaller the area on which a force is exerted, the greater the pressure is. This explains why sharp or pointy objects cut into things easily compared to dull objects. Pressure can be calculated with the following equation based on the definition.

$$\text{Pressure} = \frac{\text{Force}}{\text{Area}} \text{ or } P = \frac{F}{A}$$

The units of pressure are *pascals* (Pa). Since force is measured in newtons (N), and area is measured in meters squared (m²), a pascal is defined as one newton per meter squared ($1\text{Pa} = 1\frac{\text{N}}{\text{m}^2}$).

<u>Sample Problems</u>	
<p>EXAMPLE 1: A U.S. quarter has a surface area of 0.000462 m² and a weight of 0.0556 N. Calculate the pressure exerted by a quarter on the surface where it is resting.</p> <p>Step 1: List the variables $F = 0.0556\text{ N}$ $A = 0.000462\text{ m}^2$</p> <p>Step 2: Substitute values into the equation $P = \frac{F}{A} = \frac{0.0556\text{ N}}{0.000462\text{ m}^2} = 120\text{ Pa}$</p>	<p>EXAMPLE 2: (Determining pressure when you know the mass instead of the weight) An olympic plate with a mass of 20.4 kg has a surface area of 0.156 m². Calculate the pressure it exerts on the surface where it is resting.</p> <p>Step 1: Determine the weight in Newtons $(20.4\text{ kg}) \times (9.8\text{ m/s}^2) = 200\text{ N}$</p> <p>Step 2: Substitute values into the equation $P = \frac{F}{A} = \frac{200\text{ N}}{0.156\text{ m}^2} = 1282\text{ Pa} \approx 1280\text{ Pa}$</p>

Answer the questions below based on your reading above and your knowledge of physics.

1. What double meaning is used in the cartoon to the right?
- _____
- _____
- _____
- _____
- _____



2. An 80 kg man is wearing a shoe with a 0.010 m² heel. A 55 kg woman wearing high heels has a 0.00050 m² heel. Which one exerts more pressure? Show your work to support your conclusion. (NOTE: Since you are comparing the pressures, the relative result will be the correct even if you assume each individual's total weight is on one heel.)
3. A 5.0 kg computer monitor stands on a base with an area of 0.0315 m². How much pressure does it exert?