

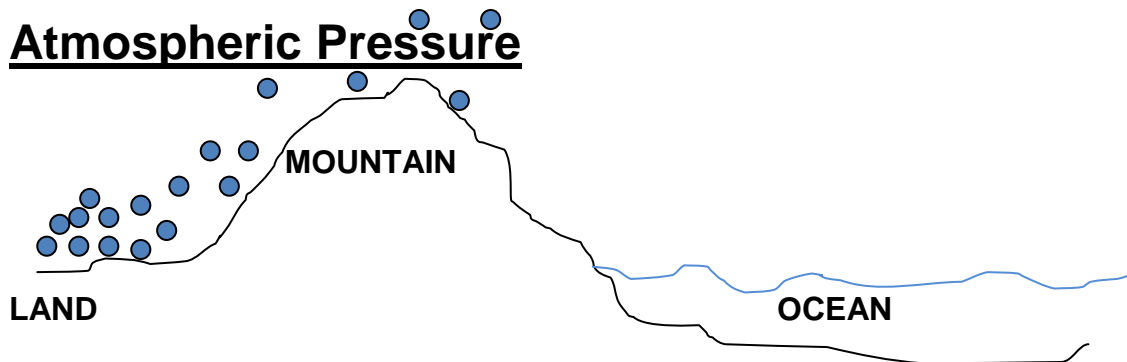
## Chapter 9: PRESSURE

### PRESSURE

- The force acting on a certain area of a surface
- Can produce enough force to operate mechanical devices  
Ex. **Hydraulic systems**: pressure through **liquids**  
**Pneumatic Systems**: pressure through **gases**

NOTE: GASES are COMPRESSABLE but LIQUIDS are NOT.

### Atmospheric Pressure



At HIGHER altitudes,

- ATMOSPHERIC PRESSURE is LESS
- Your body responds to the change in air pressure  
EAR POPPING

### RELATIONSHIP BETWEEN force, area and pressure

- The LARGER the force, the GREATER the pressure
- The SMALLER the area, the GREATER the pressure

REMEMBER **Units**

**FORCE - NEWTONS (N)**

**AREA (lw) - meters squared (m<sup>2</sup>)**

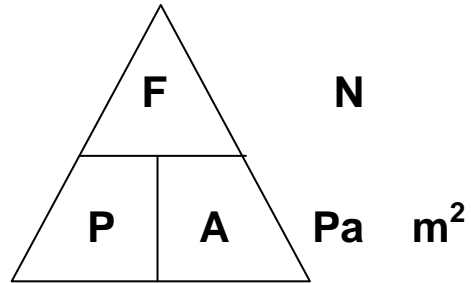
**Pressure - Pascals (Pa) or kilopascals (kPa)**  
**1000 Pa = 1 kPa**

FORMULA

$$P = \frac{F}{A}$$

$$\text{Pressure} = \frac{\text{FORCE}}{\text{AREA}}$$

$$A = lw$$



**Ex1 A book on a desk exert 16N of force. How much pressure is being exerted on the desk/**

$$\begin{aligned} A &= l \times w \\ &= 21 \text{ cm} \times 28 \text{ cm} \\ &= 0.21 \text{ m} \times 0.28 \text{ m} \\ &= 0.0588 \text{ m}^2 \end{aligned}$$

$$P = \frac{F}{A}$$

**NOTE:  $\text{N/m}^2 = \text{Pa}$**

$$\begin{aligned} &= \frac{16\text{N}}{0.0588 \text{ m}^2} \\ &= 272 \text{ Pa} \end{aligned}$$

**Ex 2. Same book from above but it's opened.  
What is the pressure?**

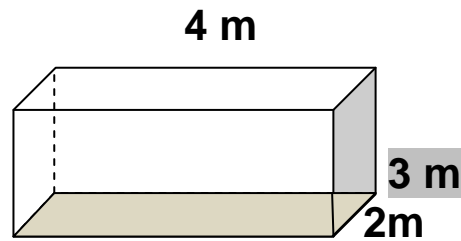
$$\begin{aligned} A &= l \times w \\ &= 21 \text{ cm} \times 44 \text{ cm} \\ &= 0.21 \text{ m} \times 0.44 \text{ m} \\ &= 0.0924 \text{ m}^2 \end{aligned}$$

$$\begin{aligned} P &= \frac{F}{A} \\ &= \frac{16 \text{ N}}{0.0924 \text{ m}^2} \\ &= 173 \text{ Pa} \end{aligned}$$

**??? WHY is open book pressure smaller than closed book?**

**Open book is spread over a larger area.**

### Ex 3



Force/weight = 20 000N

$$\begin{aligned} P &= F/A \\ &= \frac{20\,000\text{N}}{12\text{ m}^2} \\ &= 1667\text{ Pa} \end{aligned}$$

$$\begin{aligned} A &= l \times w \\ &= 2\text{ m} \times 4\text{m} \\ &= 8\text{ m}^2 \end{aligned}$$

## Ex 2 SKATEBOARDING

Weight of skateboard = 1000N

Pressure from one wheel = 0.0001 m<sup>2</sup>

What pressure is exerted on the ground after jumping off a railing and landing on ALL FOUR WHEELS?

$$\begin{aligned} \text{Pressure 4 wheels} &= 4 \times 0.0001\text{ m}^2 \\ &= 0.0004\text{ m}^2 \end{aligned}$$

$$\begin{aligned} P &= \frac{F}{A} \\ &= \frac{1000\text{N}}{0.0004\text{ m}^2} \\ &= 2\,500\,000\text{ Pa} \end{aligned}$$