

# Physical Science

## Chapter 3

### Forces in Fluids

Pressure = Force / Area

- **Pressure: a force pushing on a surface**
- **Pressure = Force / area**
- Unit of measure for Pressure is the Pascal:  
 $1\text{Pa} = 1\text{N}/\text{m}^2$
- Remember  $1\text{ N} = 1\text{kg m}/\text{sec}^2$

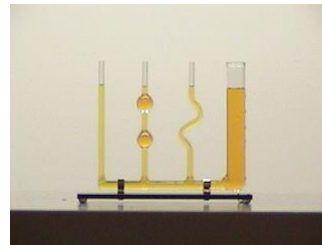


# Fluid Pressure

- Fluid is a substance that can flow easily.
  - Scientifically liquids & gases are considered “fluids”
- In fluids, molecules are constantly moving in all directions
- As a molecule moves and collides w/ a surface, it exerts a force on that surface
- All of the forces exerted by the individual molecules are added together to make up the pressure exerted by the fluid.

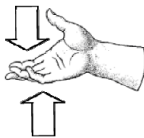
- $\text{Pressure} = \text{Force} / \text{Area}$

*Pascal's Vase - demonstrating that depth, not shape, determines fluid pressure...*

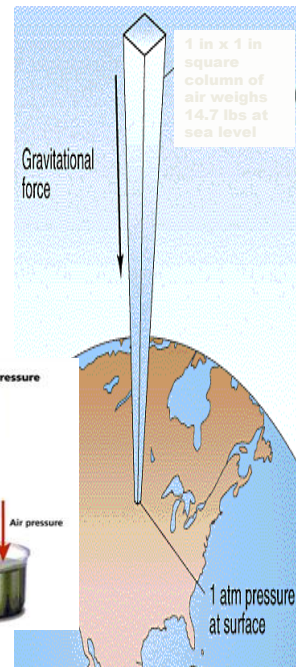
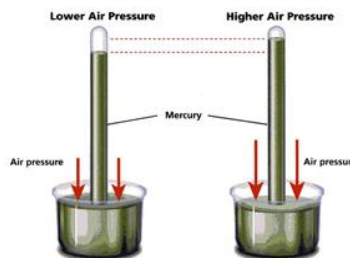


## Air Pressure

- Air pressure is the result of the weight of a column of air pushing down on an area.
  - 14.7 **lbs/inch<sup>2</sup>**
  - 1013.25 **millibars**
  - 1013.25 **hPa (hecto Pascals)**
  - 29.92 **inches of Hg**

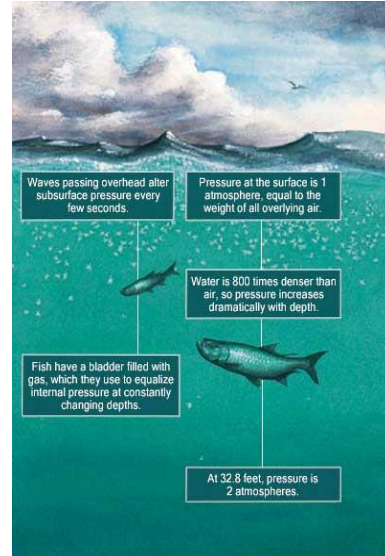
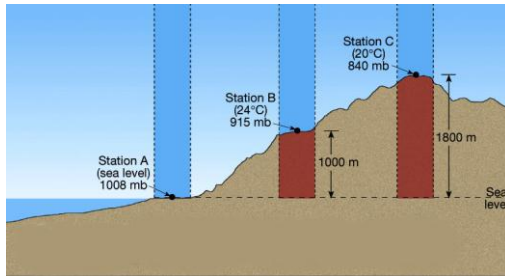


Air exerts a balanced force when fluid is NOT moving; the pressure pushing down on your hand is balanced by the pressure pushing up on your hand



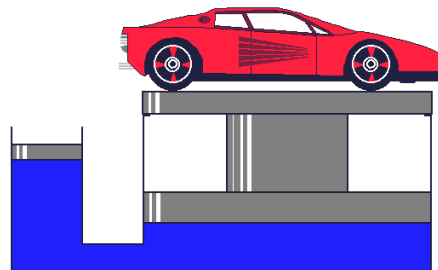
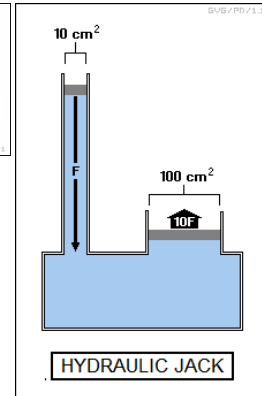
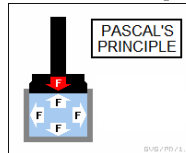
# Variations in Fluid Pressure

- **Elevation** – the distance above sea level.
- As altitude increases → Air pressure decreases
- As air pressure **decreases**, so does **density**.
- As water depth increases → water pressure increases
- Water 800x more dense than air, so pressure increases dramatically w/ depth – every 33 ft in depth adds 1 “atmosphere” of pressure



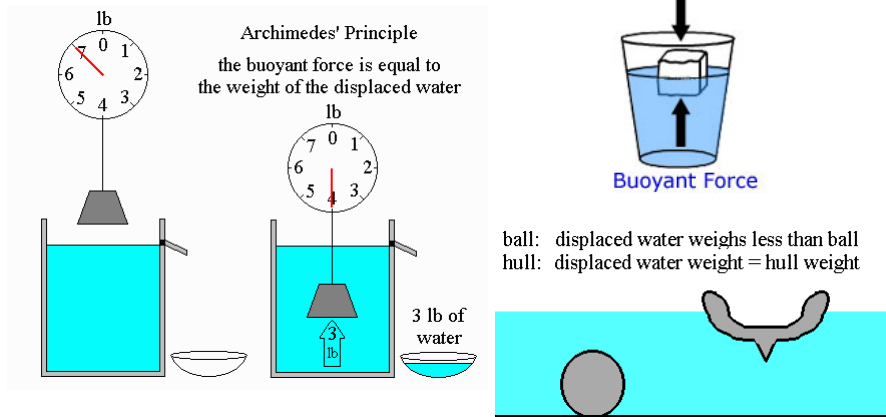
# Pascal's Principle

- When force is applied to a **CONFINED FLUID**, an increase in pressure is transmitted equally to **ALL** parts of the fluid.



# Archimedes Principle

- The buoyant force on an object is equal to the weight of the fluid displaced by the object.
- The buoyant force is opposite (pushes up) to the force of gravity (pulls down)



# Bernoulli's Principle

- The pressure exerted by a moving stream of a fluid is less than the pressure of the surrounding fluid.
- The faster the fluid moves, the less pressure it exerts on the surface of the object

