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:
  1Pa = 1N/m²
• Remember 1 N = 1kg m/sec²
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.
  - Pressure = Force / 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/inch²
  - 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.

1 in x 1 in square column of air weighs 14.7 lbs at sea level

1 atm pressure at surface
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