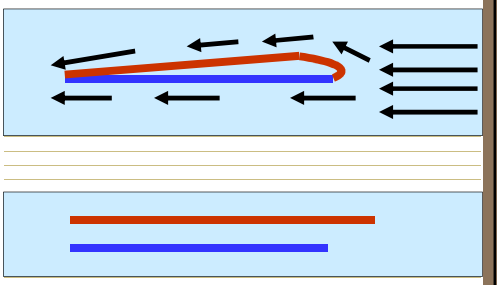
Bernoulli's, Pascal's, & Archimedes' Principles

Principles of Fluids

Bernoulli's Principle

- As the **Velocity** (speed) of a fluid increases, the **Pressure exerted by** the fluid decreases
- Why?

Bernoulli's Example



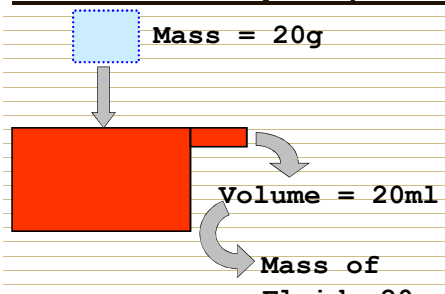
Buoyant Force

- The **upward** force of a **Fluid** exerted on an object.
- What is the downward Force exerted on an object? Gravity

Archimedes' Principle

- The **buoyant force** on an object in a fluid is **equal** to the **weight of the fluid displaced** by the object

Archimedes (Example #1)



Archimedes (Example #1)

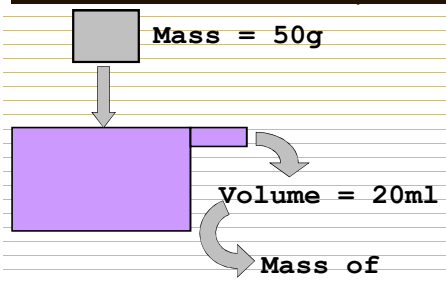
Gravity = 20

Object is in

Liquid

Buoyant Force = 20

Archimedes' (Example #2)



Archimedes (Example #2)

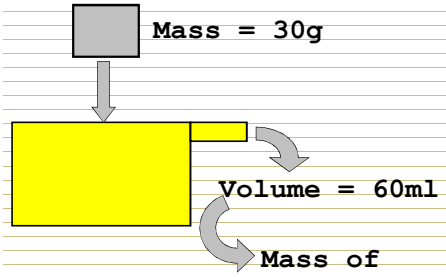
Gravity = 50

Object

SINKS

Buoyant Force = 20

Archimedes' (Example #3)



Archimedes (Example #3)

Gravity = 30

Object

Floats

Buoyant Force = 60

Pascal's Principle

- Pressure applied to one place of a fluid is transmitted **unchanged throughout** the fluid.

Pascal's Principle

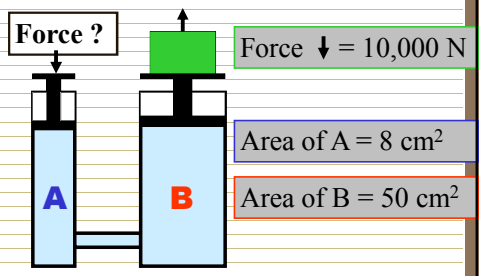
What is pressure?

$$P = \frac{\text{Force}}{\text{Area}}$$

What type of fluid works best for this principle?
Explain your answer.

Liquid

Pascal's example

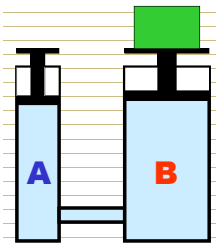


Force ↓ = 10,000 N

Area of A = 8 cm^2

Area of B = 50 cm^2

Break down the problem:



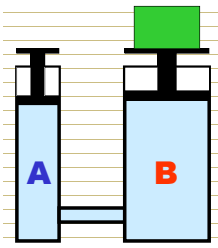
1st solve for P in B

$$\mathbf{P = \frac{Force}{Area}}$$

$$P = \frac{10{,}000\ N}{50\ cm^2}$$

$$P = \frac{200\ N}{cm^2}$$

Break down the problem:



2nd solve for F on A

$$\mathbf{P = \frac{Force}{Area}}$$

F = P x A

$$F = \frac{200\ N}{cm^2} \times 8\ cm^2$$

F = 1600 N