Chapter 13

Fluids

- liquids
- gases

1) Fluids - exert pressure

a) because they're made up of matter and therefore forces are applied to them

b) they are made of matter in constant motion colliding with other matter applying forces (Kinetic-Molecular Th)

Blaise Pascal 1650's

$$P = \frac{F}{A} = \frac{N}{m^2} = Pa$$

Pascal

Apr 18 - 10:26 AM

Pressure

TABLE 13–1

Some Typical Pressures

Location	Pressure (Pascals)
The center of the sun	2×10^{16}
The center of Earth	4×10^{11}
The deepest ocean trench	1.1×10^{8}
An automobile tire	2×10^{5}
Standard atmosphere	1.01325×10^{5}
Blood pressure	1.6×10^{4}
Air pressure on top of Mt Everest	4×10^{4}
Atmospheric pressure on Mars	7×10^{2}
The best vacuum	1×10^{-12}

Atmospheric Pressure is @ 10N/cm 2

Apr 10-7:42 AM

What pressure is exerted when Mr. G does a pushup?

$$P = \frac{F}{A} = \frac{N}{m^2} = Pa$$

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push-up

$$P = \frac{900\ N}{0.02\ m^2} = 45{,}000\ Pa$$

0.1 m x 0.1 m = 0.01 m^2

2 hands ∴ 0.02 m^2

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2 fingertip push ups

$A = \pi r^2 = \pi(.01\ m)^2 = 0.0003\ m^2$

4 fingers (2/hand) ∴ 0.0012 m^2

$$P = \frac{900\ N}{0.0012\ m^2} = 750{,}000\ Pa$$

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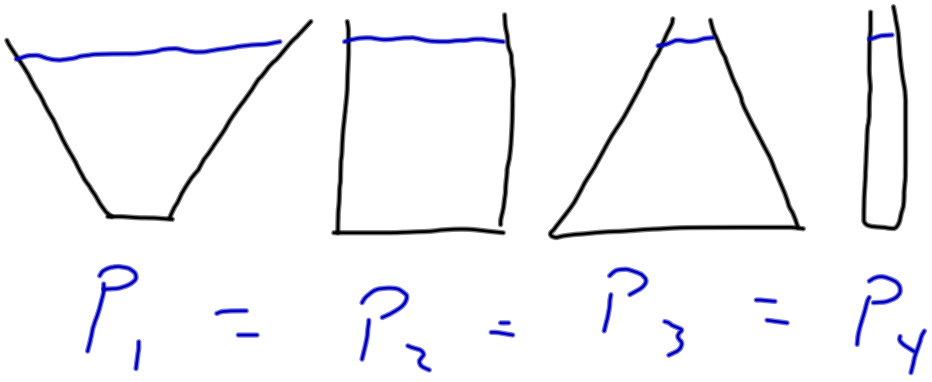
Pascal's Principle



Pressure a fluid exerts is directly proportionate to the depth of the fluid

$P \propto h$

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Pascal's Principle

At a given height the pressure in a fluid is the same everywhere (along that height)

Pressure is exerted throughout the fluid undiminished!

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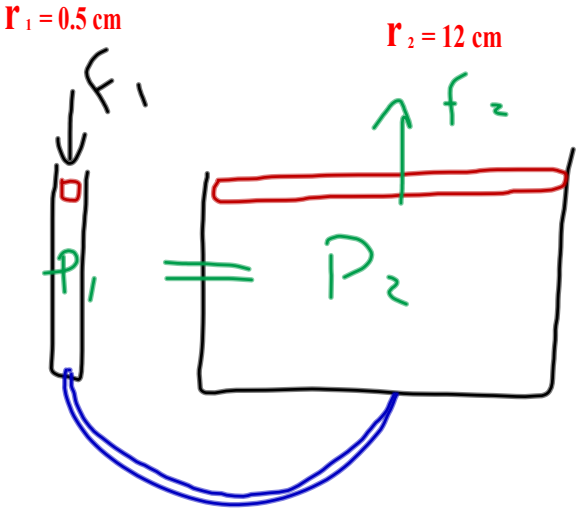

$$P_1 = P_2$$

$$\frac{F_1}{A_1} = \frac{F_2}{A_2}$$

$$\frac{100N}{\pi(.005m)^2} = \frac{F_2}{\pi(.12m)^2}$$

$$F_2 = 57{,}600\ \text{N}$$

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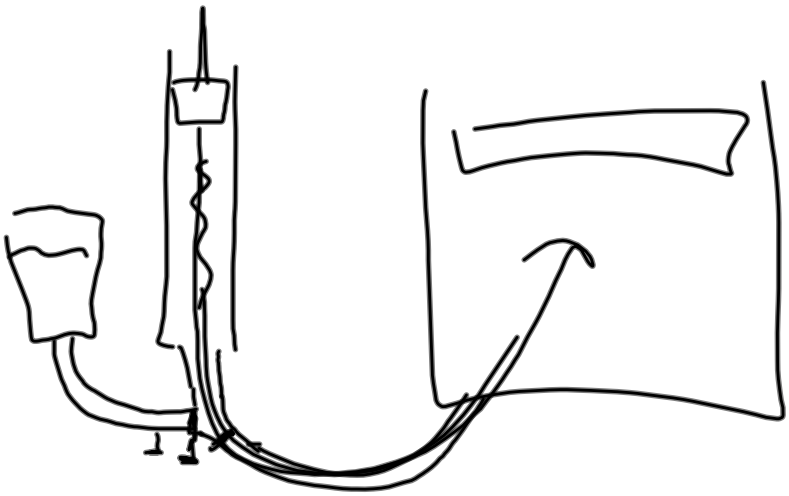
Apr 10-11:11 AM



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Apr 10-11:12 AM

$$P = F/A$$

$$F = mg$$

$$P = mg/A$$

$$P = mg/A$$

$$\rho = m/V$$

$$m = \rho V$$

$$P = \rho Vg/A$$

$$P = \rho Vg/A$$

$$V = Ah$$

$$P = \rho Ahg/A$$

$$P = \rho hg$$

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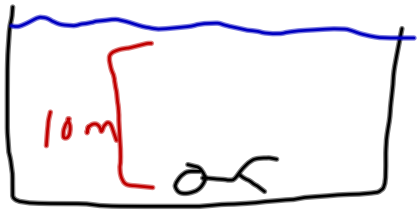
$P = \rho h g$



$P = 1000 kg/m^3 (10 m) 9.8 m/s^2$

$P = 98,000 Pa$

$98 kPa$

Apr 19 - 10:44 AM

What change in pressure do you experience if you're in a jet 30,000 ft above the ground?

30,000 ft (1 m/3.28ft) = 9100 m

$\Delta P = \rho hg = 1.29 \quad (9 \frac{kg}{m^3} \text{ m})9.8 \quad \frac{m}{s^2}$

ΔP = 115,000 Pa

Apr 19 - 1:45 PM