Type - 01

1. A swimmer is swimming in a swimming pool at 6m below the surface of the water. Calculate the pressure on the swimmer due to water above.

(Density of water =1000 kg/m^3, g=9.8 m/s^2)

Given :-

$h = 6m$

$P = ?$

$\rho = 1000 kg/m^3$

$g = 9.8 m/s^2$

Solution :-

$$P = \rho h g$$

$P = 1000 \times 6 \times 9.8$

$P = 10^3 \times 6 \times 9.8$

$P = 58.8 \times 10^3$

$$P = 5.88 \times 10^4 N/m^2$$

calculation

$9.8 \times 6 = 58.8$

2. In a hydraulic lift, the input piston had surface area $30cm^2$ and the output piston has surface area of $1500\ cm^2$. If a force of 25N is applied to the input piston, calculate weight on output piston.

Given :-

$A_1 = 30cm^2$

$A_1 = 30 \times 10^{-4} m^2$

$A_2 = 1500\ cm^2$

$A_2 = 1500 \times 10^{-4} m^2$

$F_1 = 25\ N$

$F_2 = ?$

Solution :-

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

$$\frac{F_2}{1500 \times 10^{-4}} = \frac{25}{30 \times 10^{-4}}$$

$$F_2 \times 30 \times 10^{-4} = 25 \times 1500 \times 10^{-4}$$

$$F_2 = \frac{25 \times 1500 \times 10^{-4}}{30 \times 10^{-4}}$$

$$F_2 = \frac{25 \times 150}{3} \quad 50$$

$$F_2 = 25 \times 50$$

$$\boxed{F_2 = 1250\ N}$$

3. In a hydraulic lift, the input piston had surface area 20 cm^2. The output piston has surface area of 1000 cm^2. If a force of 50N is applied to the input piston, it raises the output piston by 2m. Calculate weight of support on output piston and its work done.

Given:-

$A_1 = 20 cm^2$

$A_1 = 20 \times 10^{-4} m^2$

$A_2 = 1000 cm^2$

$A_2 = 1000 \times 10^{-4} m^2$

$F_1 = 50 N$

$h = 2m$

(1) $F_2 = ?$

(2) $k = ?$

Solution:-

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

$$\frac{F_2}{1000 \times 10^{-4}} = \frac{50}{20 \times 10^{-4}}$$

$$F_2 \times 20 \times 10^{-4} = 50 \times 1000 \times 10^{-4}$$

$$F_2 = \frac{50 \times 1000 \times 10^{-4}}{20 \times 10^{-4}}$$

$$F_2 = \frac{5000}{2}$$

$$\boxed{F_2 = 2500 N}$$

(2) Work done = Force x displacement

$W.D. = F_2 \times h$

$W.D. = 2500 \times 2$

$W.D. = 5000\ N\text{-}m$

$\boxed{W.D. = 5000\ J}$