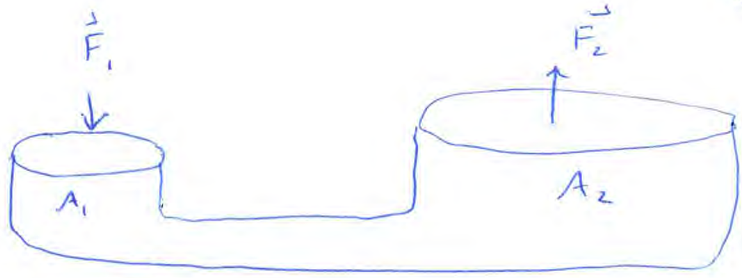
OBLIG 5

1) $\frac{F_2}{F_1} = 100$



output force $= 100 \times$ input force

a) $F_2 = F_1 \left(\frac{A_2}{A_1}\right)$ $\qquad \frac{F_2}{F_1} = \frac{A_2}{A_1} = 100$

$A_1 = \frac{\pi}{4} D_1^2 \quad , \quad A_2 = \frac{\pi}{4} D_2^2 \qquad \frac{A_1}{A_2} = \frac{D_1^2}{D_2^2} = 100$

$\frac{D_1}{D_2} = \sqrt{100} = 10$

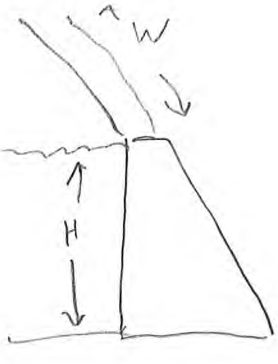
b) Volume of fluid moved by Piston 1
= Volume of fluid moved by piston 2

Volume 1 $= d_1 \cdot A_1 \quad = \quad$ Volume 2 $= d_2 \cdot A_2$

$\frac{d_2}{d_1} = \frac{A_1}{A_2} = \frac{1}{100}$

Have to move piston 1 100 cm to lift piston 2
by 1 cm

2.



$H = 12.0\,m$

$W = 10.0\,m$

$h_0 = 0$

$\rho_w = 1000 kg/m^3$

$g = 9.8\,m/s^2$

a) $P = \rho g h$ $\quad P_{av} = \frac{\rho g h_0 + \rho g H}{2} = \frac{1000 kg/m^3 \cdot 9.8 m/s^2 \cdot 12.0 m}{2}$

$P_{av} = 58.8\,kPa$

$F = P \cdot A = 12.0m \times 10.0m \times 58.8\,kPa = 7.06 \times 10^6 N$

or $\quad F = P \cdot A \qquad dF = P \cdot dA \qquad dA = w \cdot dh$

$$\int_0^H dF = \int \rho g h \cdot w\,dh = \rho g w \int_0^H h\,dh$$

$$F = \rho g w \left.\frac{h^2}{2}\right|_0^H = \rho g \frac{w H^2}{2} = 7.06 \times 10^6 N$$

b) The pressure increases with depth so the Force on the dam from the water $F = P \cdot A$ increases with depth and is maximum at the bottom

Oblig 5 #3

3. man in air

$m_m = 80.0\ \text{Kg}$

$\rho_m = 955\ \text{Kg/m}^3$ density

$P = 100.0\ \text{kPa}$

$T = 20°C = 293.15\ \text{K}$

$\rho_{air} = 1.204\ \text{Kg/m}^3$ density

$g = 9.8\ \text{m/s}^2$ gravity

a) Volume of the man

$m = \rho \cdot V$ mass = density · Volume

$$V_m = \frac{m_m}{\rho_m} = \frac{80.0\ \text{kg}}{955\ \text{kg/m}^3} = 0.0838\ \text{m}^3$$

b) Buoyant force = weight of fluid displaced
= weight of air displaced by the man

$F_B = w_{Fl} = m_{air} \cdot g$ = weight of air

$m_{air} = \rho_{air} \cdot V_{air} = 1.204\ \text{kg/m}^3 \cdot 0.084\ \text{m}^3 = 0.101\ \text{kg}$

$F_B = m_{air} \cdot g = 0.101\ \text{kg} \cdot 9.8\ \text{m/s}^2 = 0.99$ Newtons

c) weight of the man: $F_g = w_m = m_m \cdot g = 80.0\ \text{kg} \cdot 9.8\ \text{m/s}^2$
$F_g = 784\text{N}$. ratio of Buoyant force to weight

$$\frac{F_B}{F_g} = \frac{0.99\ \text{N}}{784\ \text{N}} = 0.00126 \quad \text{or} \quad \frac{m_{air}}{m_{man}} = \frac{0.101\ \text{kg}}{80\ \text{kg}} = 0.00126$$