

# Fluids #3

p 385 Problems 21, 31, ~~41~~, 85  
41

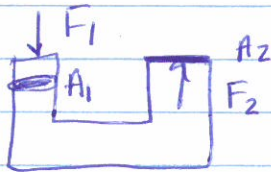
③

## - Problems

21) hydraulic lift

(4)

$m = 1500 \text{ kg}$  a) specifications of piston so smaller piston not exceed 500N



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

↑  
want ratio of  $A_1:A_2$

(1)

$$\frac{A_1}{A_2} = \frac{F_1}{F_2} = \frac{500 \text{ N}}{(1500 \text{ kg})(9.81 \text{ m/s}^2)} = .034$$

b) how far push to lift car 30 cm?

Volume ~~in~~ push = volume lift  
b/c incompressible

$$\begin{aligned} A_1 \Delta y_1 &= A_2 \Delta y_2 & \Delta y_1 &= \left( \frac{A_2}{A_1} \right) \Delta y_2 \\ &= \left( \frac{1}{.034} \right) (.30 \text{ m}) & &= 8.8 \text{ m} \end{aligned}$$

3

31)  $P_{top} = 1.0 \times 10^5 \text{ N/m}^2$   
 $P_{faucet} = ?$   
 $h = 42 \text{ m}$  below reservoir

(1)

$$P = P_{atm} + \rho_{water} g h$$

$$= (1.0 \times 10^5 \text{ N/m}^2) + (1000 \text{ kg/m}^3)(9.8 \text{ m/s}^2)(42 \text{ m})$$

$$P = 5.1 \times 10^5 \text{ N/m}^2$$

~~40~~

41) F on eardrum when change elevation

$$y_0 = 1609 \text{ m}$$

$$y_f = 4301 \text{ m}$$

$$\rho_{air} = 1.2 \text{ kg/m}^3$$

$$A = .5 \text{ cm}^2$$

$$\textcircled{1} P = P_2 - P_1 = \rho_{air} g (\Delta y)$$

$$= (1.2 \text{ kg/m}^3)(9.8 \text{ m/s}^2)(4301 \text{ m} - 1609 \text{ m})$$

$$= 2.11 \times 10^4 \text{ N/m}^2$$

(1)

$$.5 \text{ cm}^2 \left( \frac{1 \text{ m}^2}{(10^2)^2 \text{ cm}^2} \right)$$

$$\textcircled{2} F = PA = (2.11 \times 10^4 \text{ N/m}^2) \left( \frac{.5 \text{ cm}^2}{(10^2)^2 \text{ cm}^2} \right)$$

$$(5 \times 10^{-5} \text{ m}^2)$$

$$F = 1.1 \text{ N}$$

③

85) depth = 10.9 km  
=  $10.9 \times 10^3 \text{ m}$

diameter = 0.10 m

$\rho = 1025 \text{ kg/m}^3$

• submarine explore trench

• F to prevent window  
implode

(1)

$P = P_0 + \rho g h = (1025 \text{ kg/m}^3)(9.8 \text{ m/s}^2)(10.9 \times 10^3 \text{ m})$   
 $= 1.1 \times 10^8 \text{ N/m}^2$

*P<sub>0</sub> so small relative  
doesn't matter*

②  $F = PA = (1.1 \times 10^8 \text{ N/m}^2)(\pi)(.05 \text{ m})^2$   
 $F = P\pi r^2$

$F = 8.6 \times 10^5 \text{ N}$