1. $V = 0.40 \times 0.20 \times 0.10 = 8.0 \times 10^{-3}\ m^3$

$m = \rho V = (2200\ \frac{kg}{m^3})(8.0 \times 10^{-3}\ m^3)$
$= 17.6\ kg$

$mg = 172.5\ N$

Want least number in pile.

$P = \frac{F}{A}$, so make the smallest face the bottom side.

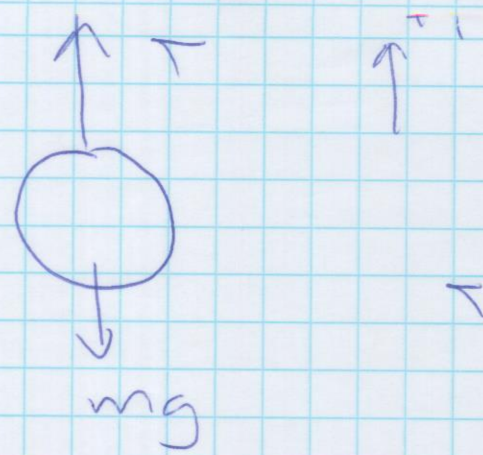
$A = 0.20 \times 0.10 = 0.020\ m^2$

P of N blocks $= \frac{(N)(\text{Weight of each block})}{A}$

$2(1.013 \times 10^5\ \frac{N}{m^2}) = \frac{N(172.5\ N)}{0.020\ m^2} = N(8625\ \frac{N}{m^2})$

$N = 23.5$

→ so 23 blocks is not quite enough.
Need 24.



$$\Sigma F_y = m a_y$$

$$T - mg = 0$$

$$T = mg \qquad m = \rho V$$

$$T = \rho V g$$

$$\text{Sphere: } V = \frac{4}{3}\pi r^3$$

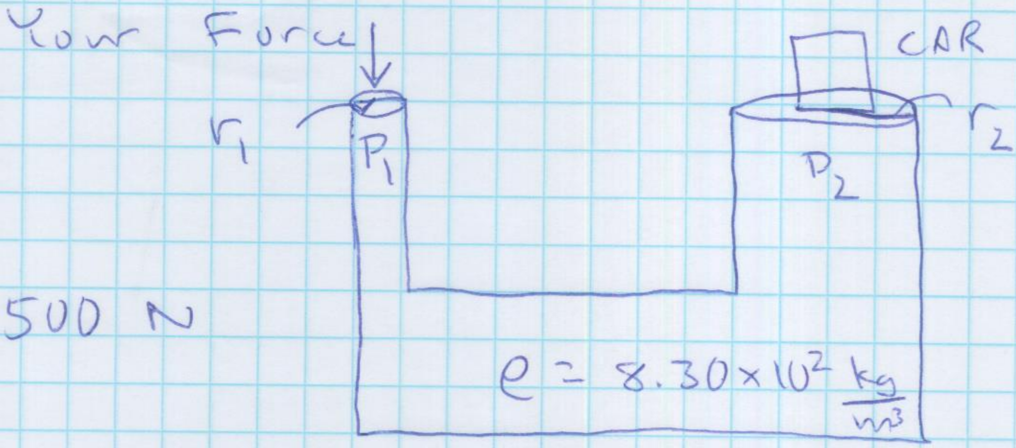
$$V = T/\rho g$$

$$\frac{4}{3}\pi r^3 = T/\rho g$$

$$r^3 = \frac{3T}{4\pi \rho g} = \frac{3(120\ \mathrm{N})}{4\pi(8470\ \mathrm{kg/m^3})(9.8\ \frac{\mathrm{m}}{\mathrm{s^2}})}$$

$$r = 0.070\ \mathrm{m}$$

3.



$r_1 = 7.7 \times 10^{-3}$ m
$r_2 = 0.125$ m

$(mg)_{CAR} = 24,500$ N

Pascal's Principle:
$$P_1 = P_2.$$

What F_2 is needed at output end? Must support car and raise at constant speed.

Output:
$$\Sigma F = ma$$
$$F_{OIL} - mg = 0$$
$$F_{OIL} = mg$$

$$P_1 = P_2$$
$$\frac{F_1}{A_1} = \frac{F_2}{A_2}$$
$$F_1 = \frac{A_1}{A_2} F_2 = \frac{\pi (7.7 \times 10^{-3} \text{ m})^2}{\pi (0.125 \text{ m})^2} (24,500 \text{ N})$$
$$F_1 = 93 \text{ N}$$

Note do not need ρ_{OIL}.