8.1

(a)

DURANTE LA SALITA DEL SECCHIO:

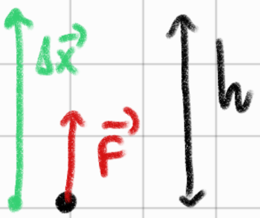
$\vec{v}$ cost $\Rightarrow \vec{F}+\vec{P}=\vec{0}$

$+|\vec{F}|-|\vec{P}|=0$

$\Rightarrow |\vec{F}|=|\vec{P}|= mg = \rho_{H_2O} V g = 10^3 \frac{kg}{m^3} \cdot 15\cdot 10^{-3}\, m^3 \cdot 9{,}81 \frac{m}{s^2} = \boxed{147\, N}$

m ↓ MASSA ACQUA NEL SECCHIO

(b) LAVORO COMPIUTO DA $\vec{F}$:



$L = |\vec{F}|\cdot|\Delta\vec{x}|\cdot\cos\alpha$ ($\vec{F}$ costante) ma $|\Delta\vec{x}|=h$ $\alpha=0°$

$\Rightarrow L = |\vec{F}|\cdot h\cdot\cos 0° = |\vec{F}|\cdot h$

POTENZA $P = \frac{L}{\Delta t} = \frac{|\vec{F}|\cdot h}{\Delta t} = \frac{147\, N\cdot 18\, m}{30\, s} = 88{,}2\, W$

(c) A → cima del pozzo

B → fondo del pozzo

$\Delta E_{AB} = L_{AB}^{(NC)}$

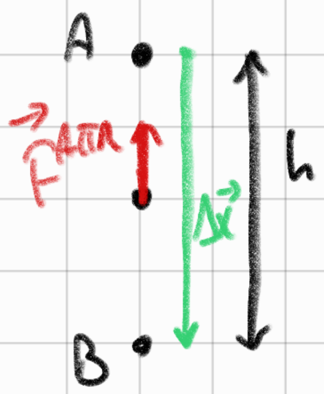
$\Delta K_{AB} + \Delta U_{AB} = L_{AB}^{ATTR}$

$$\frac{1}{2}mv_B^2 - \cancel{\frac{1}{2}mv_A^2} + \cancel{mgh_B} - mgh_A = L_{AB}^{ATTR}$$

(v_A: parte da fermo; $h_B = 0$; $h_A = h$)

$$L_{AB}^{ATTR} = |\vec{F}_{ATTR}| \cdot |\Delta\vec{x}| \cdot \cos\alpha$$

DURANTE LA DISCESA



CON $|\Delta\vec{x}| = h$ $\quad \alpha = 180°$

$$\Rightarrow L_{AB}^{ATTR} = -|\vec{F}_{ATTR}| \cdot h$$

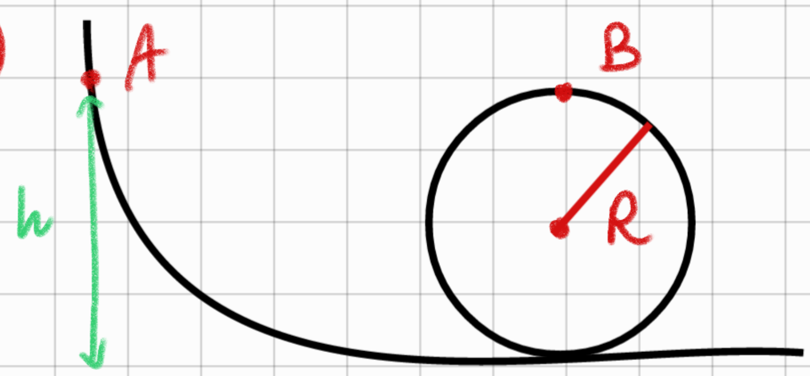
$$\hookrightarrow \frac{1}{2}mv_B^2 - mgh = -|\vec{F}_{ATTR}| \cdot h$$

$$\Rightarrow |\vec{F}_{ATTR}| = \frac{mgh - \frac{1}{2}mv_B^2}{h} = m\left(g - \frac{v_B^2}{2h}\right) =$$

$$= \rho_{H_2O} V \left(g - \frac{v_B^2}{2h}\right) = 10^3 \frac{kg}{m^3} \cdot 15 \cdot 10^{-3} m^3 \left(9{,}81 \frac{m}{s^2} - \frac{(15\ m/s)^2}{2 \cdot 18\ m}\right) =$$

$$= \boxed{53{,}4\ N}$$

#8.2



NO ATTR: $\Delta E_{AB} = 0$

$\Delta K_{AB} + \Delta U_{AB} = 0 \Rightarrow \frac{1}{2} m v_B^2 - \frac{1}{2} m v_A^2 + m g h_B - m g h_A = 0$ ($v_A = 0$)

$\Rightarrow \frac{1}{2} v_B^2 + gh - 2gR = 0 \Rightarrow v_B^2 - 2gh - 4gR = 0$

$\Rightarrow v_B = \sqrt{2gh - 4gR}$

(a) CORPO VINCOLATO: BASTA CHE ARRIVI IN CIMA CON VELOCITÀ

$v_B > 0 \Rightarrow 2gh - 4gR = 0 \Rightarrow \boxed{h = 2R}$

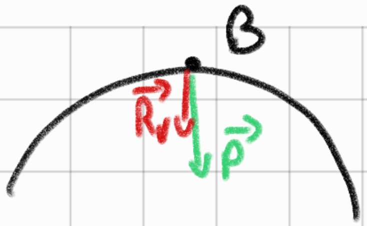
(b) CORPO NON VINCOLATO: IN B DEVE AVERE VELOCITÀ SUFFICIENTE PER CONTINUARE IL MOTO CIRCOLARE (ALTRIMENTI CADE)

QUESTO É VERO SE: $\sum \vec{F} = m\vec{a}$

CON $|\vec{a}| = \frac{v^2}{R}$ ACC. CENTRIPETA

DURANTE IL MOTO, SUL CORPO AGISCONO:
- FORZA PESO
- REAZIONE DELLA PISTA $\Rightarrow \vec{P} + \vec{R_v} = m\vec{a}$

IN B:



$\Rightarrow mg + |\vec{R_V}| = \frac{m v_B^2}{R}$

AFFINCHÉ NON SI STACCHI DALLA PISTA: $|\vec{R_V}| > 0$

$\Rightarrow \frac{m v_B^2}{R} - mg > 0 \Rightarrow v_B > \sqrt{gR}$

MA $v_B = \sqrt{2gh - 4gR} \Rightarrow 2gh - 4gR = gR \Rightarrow$ $\boxed{h = \frac{5}{2}R}$

#83

(a) $p = p_0 + \rho g h$ con $p_0 = 1$ atm ($1{,}013 \cdot 10^5$ Pa) PRESSIONE ATMOSFERICA

$\Rightarrow h = \frac{p - p_0}{\rho g} = \frac{(3{,}05 - 1{,}013) \cdot 10^5 \text{ Pa}}{1023 \text{ Kg/m}^3 \cdot 9{,}81 \text{ m/s}^2} = \boxed{20{,}2 \text{ m}}$

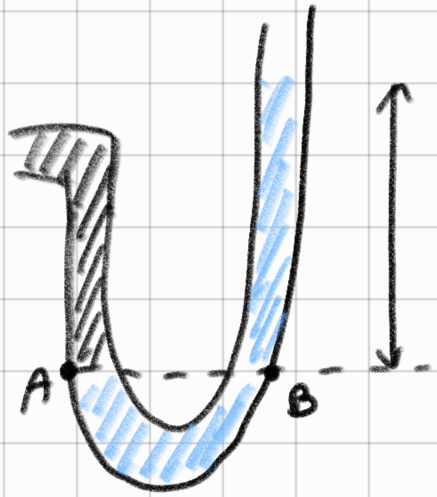
NB: 1 bar = 10^5 Pa

(b) $p = \frac{F}{A} \Rightarrow F = p \cdot A = p \cdot \pi r^2 = p \cdot \pi \frac{d^2}{4} =$

$= \frac{\pi}{4} \cdot 3{,}05 \cdot 10^5 \text{ Pa} \cdot (2{,}20 \cdot 10^{-2})^2 = \boxed{116 \text{ N}}$

#8.4

(a)



IN A → P_A É LA PRESSIONE ALL'INTERNO DEL SERBATOIO (EQUILIBRIO)

IN B → $P_B = P_0 + \rho_{H_2O}\, g\, h$ (STEVINO)

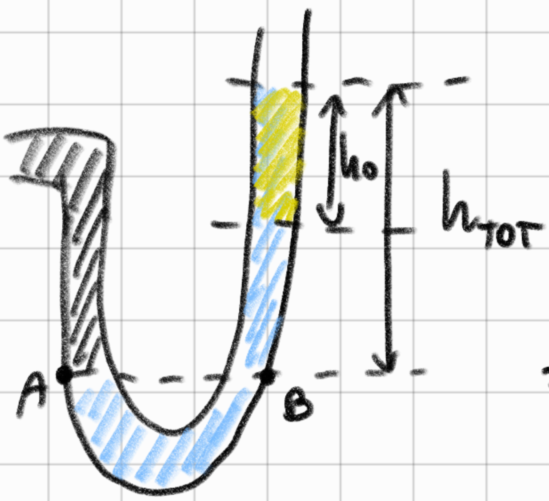
P_0 ↓ (P ESTERNA)

MA $P_A = P_B$ (STESSA QUOTA)

$\Rightarrow P_A = P_0 + \rho_{H_2O}\, g\, h$ A NOI INTERESSA $\Delta p = P_A - P_0$

$$\Rightarrow \Delta p = \rho_{H_2O}\, g\, h = 1000\,\frac{kg}{m^3} \cdot 9{,}81\,\frac{m}{s^2} \cdot 0{,}4\,m = \boxed{3{,}92 \cdot 10^3\ Pa}$$

(b)



VALE SEMPRE $P_A = P_B$

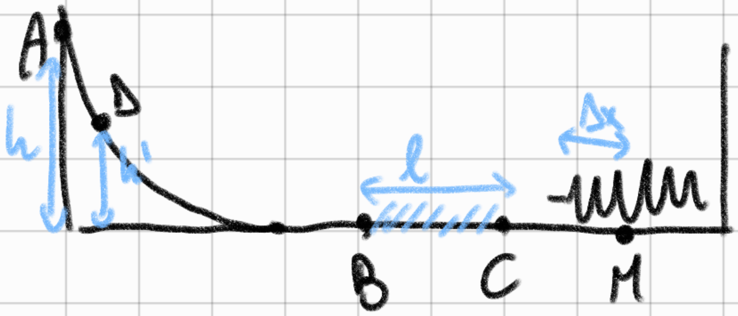
$$P_A = p_0 + \rho_{olio}\, g\, h_0 + \rho_{H_2O}\, g\, (h_{TOT} - h_0)$$

$$\Rightarrow \Delta p = \rho_{olio}\, g\, h_0 + \rho_{H_2O}\, g\, h_{TOT} - \rho_{H_2O}\, g\, h_0$$

$$\Rightarrow h_{TOT} = \frac{\Delta p + (\rho_{H_2O} - \rho_{olio})\, h_0\, g}{\rho_{H_2O}\, g} = \frac{3{,}92 \cdot 10^3\,Pa + (1000 - 900)\,kg/m^3 \cdot 9{,}81\,m/s^2 \cdot 0{,}25\,m}{1000\,kg/m^3 \cdot 9{,}81\,m/s^2} =$$

$= \boxed{0{,}42\ m}$

#8.5



(a) $\Delta E_{AB} = 0$

$\Rightarrow \Delta K_{AB} + \Delta U_{AB} = 0$

$\frac{1}{2} m v_B^2 - \frac{1}{2} m v_A^2 + mgh_B - mgh_A = 0$ ($v_A = 0$, $h_B = 0$, $h_A = h$)

$\Rightarrow v_B = \sqrt{2gh} = 7{,}7\ m/s$

(b) M PUNTO DI MASSIMA COMPRESSIONE DELLA MOLLA

$\Delta E_{BM} = L_{BM}^{(ATTR)}$ → $\vec{F}_{ATTR}$ AGISCE SOLO NEL TRATTO l ED È OPPOSTA AL MOTO ($\alpha = 180°$)

$\Delta K_{BM} + \Delta U_{BM} = -|\vec{F}_{ATTR}| \cdot l$ NB: $|\vec{F}_{ATTR}| = |\vec{N}| \mu$ IN QUESTO CASO $|\vec{N}| = mg$

$\frac{1}{2} m v_M^2 - \frac{1}{2} m v_B^2 + \frac{1}{2} k x_M^2 - \frac{1}{2} k x_B^2 = -mg\mu l$

($v_M = 0$; $x_M = \Delta x$; x_B: MOLLA NON COMPRESSA QUANDO MI TROVO IN B)

$\Rightarrow \mu = \frac{-k\Delta x^2 + m v_B^2}{2mgl} = 0{,}225$

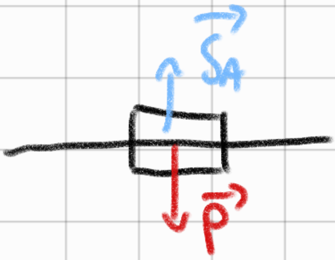
c) $\Delta E_{MD} = L^{ATTR}_{MD}$

$$\Delta K_{MD} + \Delta U_{MD} = -|\vec{F}^{ATTR}|\,\ell$$

$$\frac{1}{2} m v_D^2 - \frac{1}{2} m v_M^2 + \frac{1}{2} k x_D^2 + mgh_D - \frac{1}{2} k x_M^2 - mgh_M = -mg\mu\ell$$

$$\Rightarrow h' = \frac{k\Delta x^2 - 2mg\ell\mu}{2mg} = \frac{k\Delta x^2}{2mg} - \ell\mu = 0{,}35$$

EX PER CASA – TAPPO DI SUGHERO



$$|\vec{S}_A| = |\vec{P}|$$

$$\rho_{H_2O}\, g\, V_{imm} = \rho\, g\, V_{TOT}$$

VOLUME CHE EMERGE

$$V_{em} = V_{TOT} - V_{imm}$$

$$\Rightarrow \rho_{H_2O} V_{TOT} - \rho_{H_2O} V_{em} = \rho V_{TOT}$$

$$\Rightarrow \rho_{H_2O} V_{em} = (\rho_{H_2O} - \rho) V_{TOT}$$

$$\Rightarrow \frac{V_{em}}{V_{TOT}} = \frac{\rho_{H_2O} - \rho}{\rho_{H_2O}} = 1 - \frac{\rho}{\rho_{H_2O}} \simeq 78\%$$