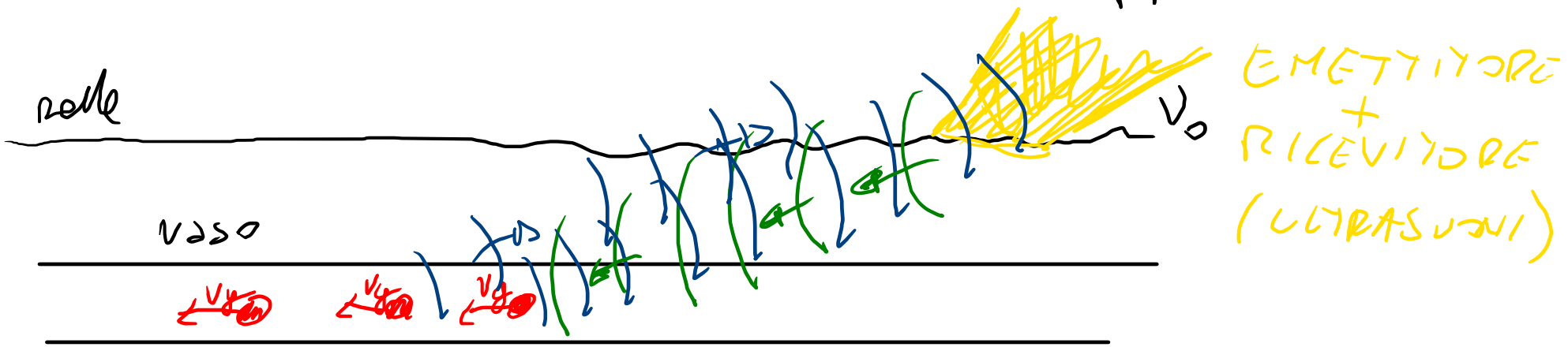
ECODOPPLER → flussimetria Doppler



V_g → velocità media dei globuli rossi

$$V_i = V_0 \left(\frac{V_s - V_g}{V_s} \right)$$ dove V_s è la velocità di propagazione

V_0 → frequenza emessa

V_i → frequenza ricevuta dai globuli rossi (incidente)

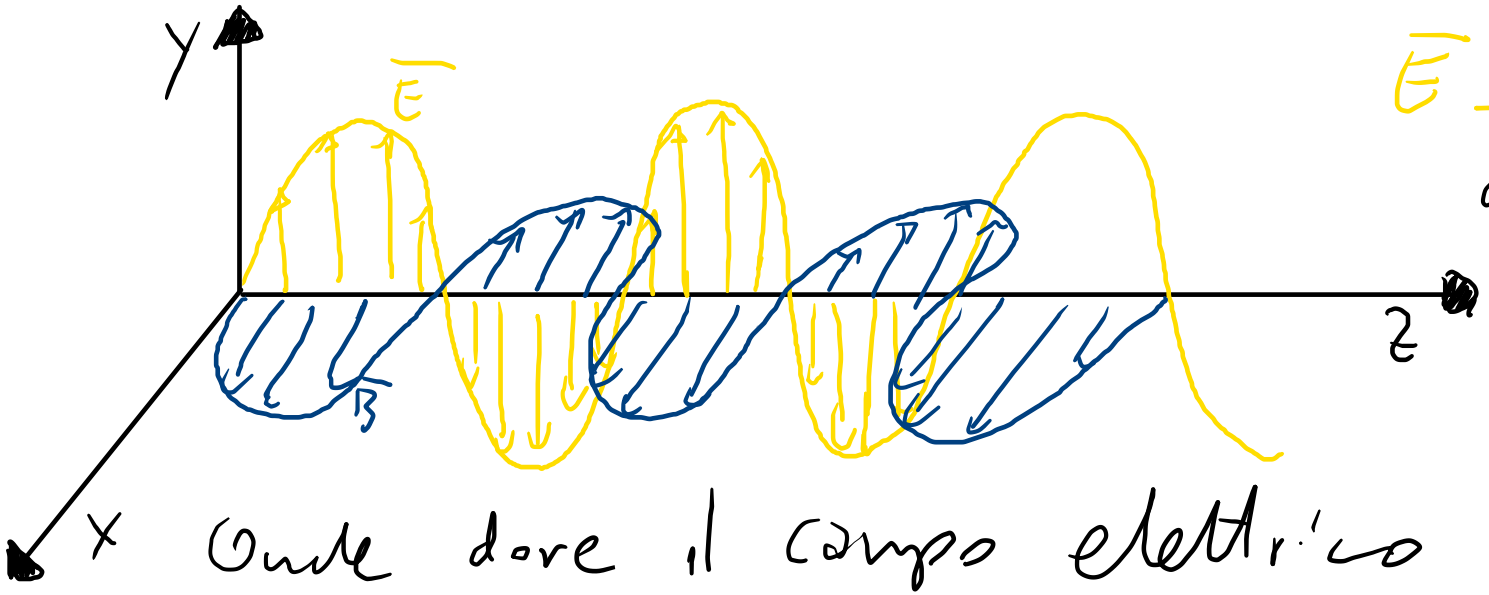
$$V_r = V_i \left(\frac{V_s}{V_s + V_g} \right) = V_0 \left(\frac{V_s - V_g}{V_s} \right) \left(\frac{V_s}{V_s + V_g} \right)$$

$$= \frac{V_0 \left(\frac{V_s - V_g}{V_s + V_g} \right)}{}$$

$$v_o - v_r = v_o - v_o\left(\frac{v_s - v_g}{v_s + v_g}\right) = v_o\left(\frac{2v_g}{v_s + v_g}\right)$$

$$= v_o\left(\frac{v_s + v_g - (v_s - v_g)}{v_s + v_g}\right) = v_o\left(\frac{2v_g}{v_s + v_g}\right)$$

ONDE ELETTROMAGNETICHE



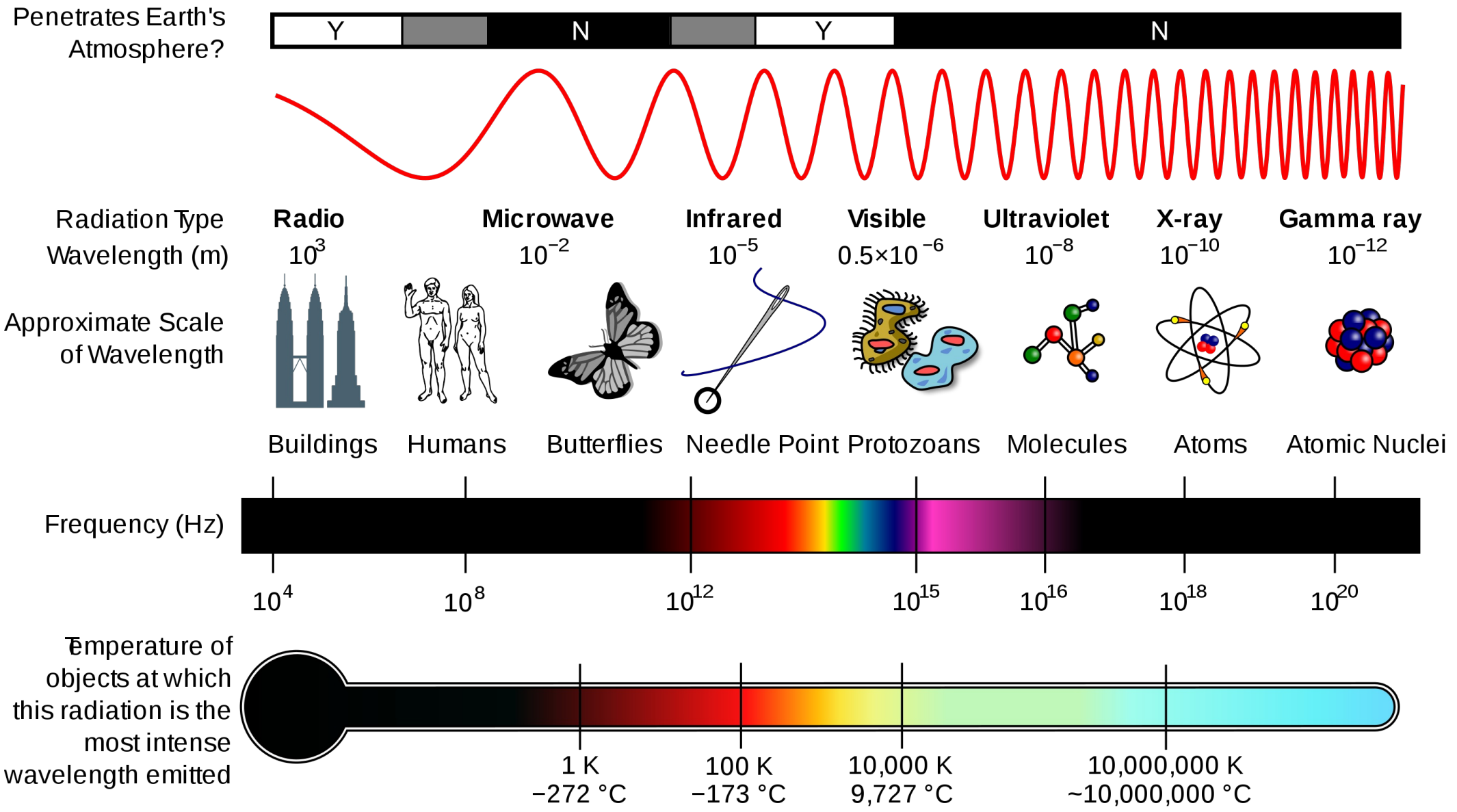
$\bar{E} \perp \bar{B} \perp$ direzione di propagazione

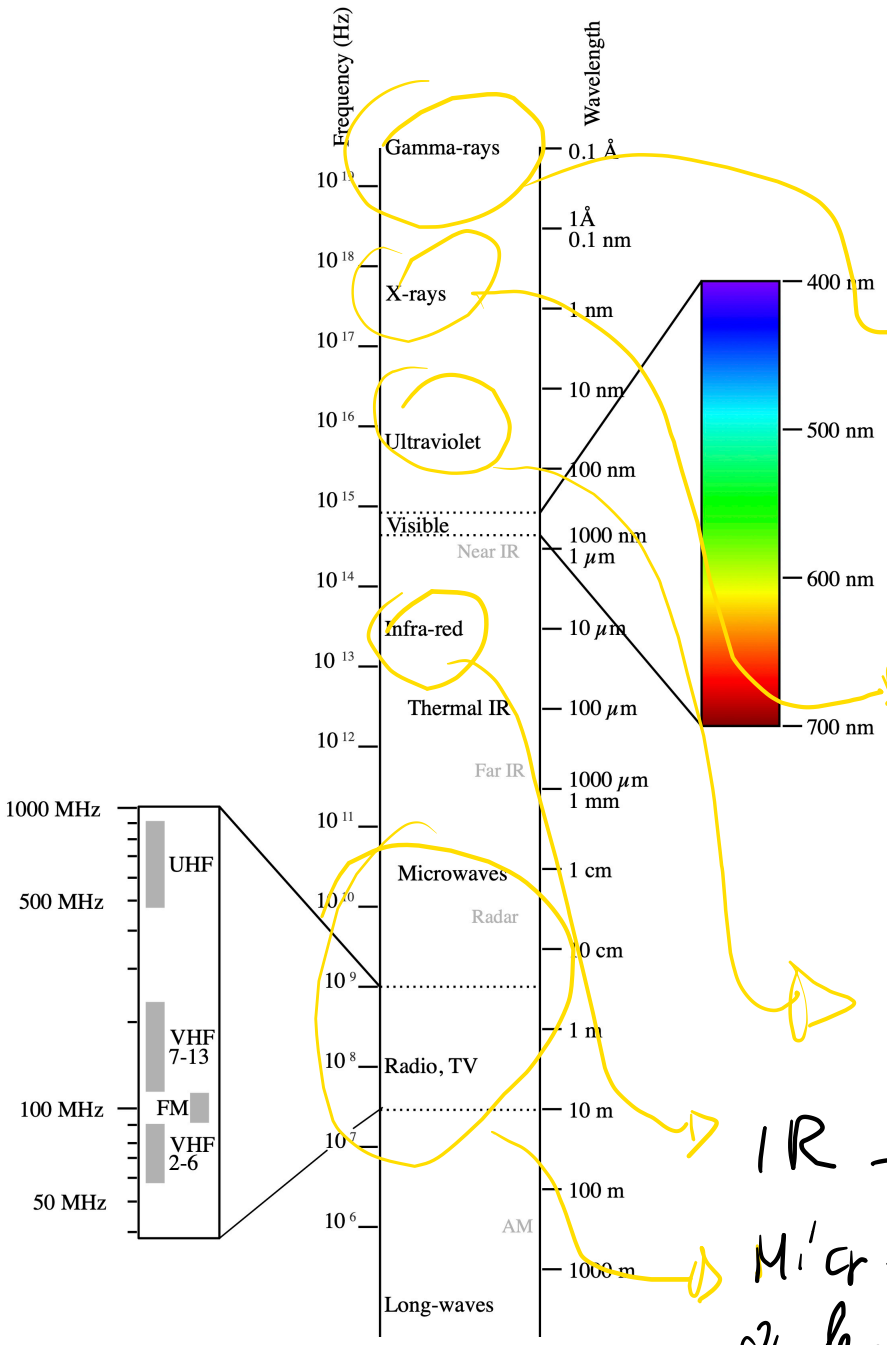
Onde dove il campo elettrico e magnetico oscillano nel tempo e si propagano nello spazio.

↓

Le onde elettromagnetiche si propagano alla velocità della luce, pari a $c = 3 \cdot 10^8 \ m/s$

$$\lambda \cdot \nu = c$$


Penetrates Earth's Atmosphere?
Y
N
Y
N
Radiation Type
Wavelength (m)
Approximate Scale of Wavelength
Radio
10^{3}
Microwave
10^{-2}
Infrared
10^{-5}
Visible
0.5×10^{-6}
Ultraviolet
10^{-8}
X-ray
10^{-10}
Gamma ray
10^{-12}
Buildings
Humans
Butterflies
Needle Point
Protozoans
Molecules
Atoms
Atomic Nuclei
Frequency (Hz)
10^{4}
10^{8}
10^{12}
10^{15}
10^{16}
10^{18}
10^{20}
Temperature of objects at which this radiation is the most intense wavelength emitted
1 K
−272 °C
100 K
−173 °C
10,000 K
9,727 °C
10,000,000 K
~10,000,000 °C



ALCUNE APPLICAZIONI DELLA RADIAZIONE E.M. IN AMBITO MEDICO

Raggi γ → Radioterapia e medicina nucleare ⇓ PET

Raggi X → Radioterapia e radiodiagnostica ⇓ Radiografia e CT

UV → sterilizzare, polimerizzazione delle resine composite

IR → Pulsossimetro

Microonde → diatermia

Onde radio → MRI, ad esempio contro il cancro

ESERCIZIO 1: orecchio umano 16 Hz - 16 kHz

$$\lambda_1 = \frac{v_s}{\nu_1} = \frac{340\ m/s}{16\ Hz} \simeq 21\ m$$

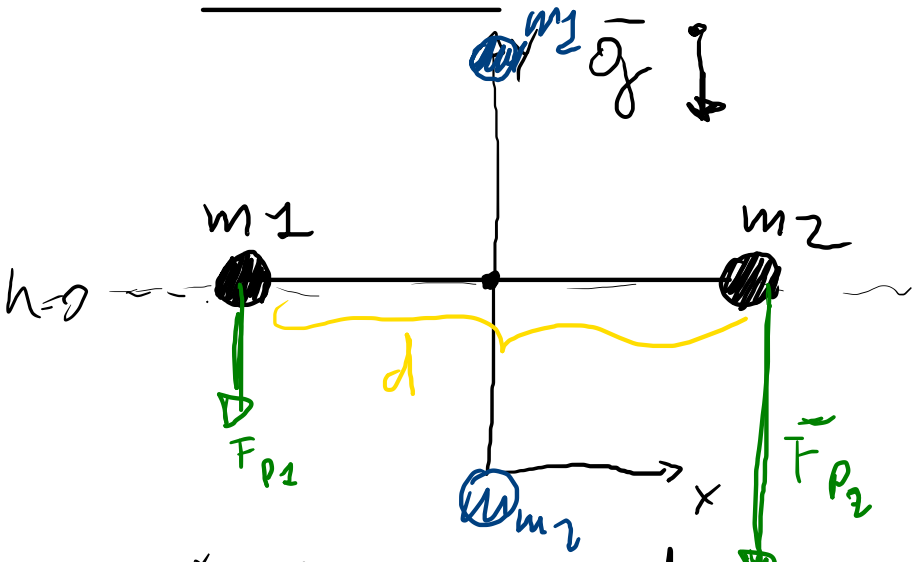
$$1\ Hz = 1\ s^{-1}$$

$$\lambda_2 = \frac{340\ m/s}{16 \cdot 10^3\ Hz} = 2.1\ 10^{-2}\ m = 2.1\ cm$$

pipistrelli e ultrasuoni $\Rightarrow \lambda = 3.3\ mm$

$$\nu = \frac{340\ m/s}{3.3\ mm} = \frac{340\ m/s}{3.3\ 10^{-3}\ m} \simeq 10^5\ Hz$$

ESERCIZIO



$m_1 = 0.1$ kg $\quad m_2 = 0.2$ kg

calcolare la velocità angolare quando la sbarra è verticale

$$(U = mgh)$$

$$\Delta U = m_1 g \frac{d}{2} + m_2 g\left(-\frac{d}{2}\right) = g\frac{d}{2}(m_1 - m_2) < 0$$

$$\Delta K = \frac{1}{2} m_1 v_1^2 + \frac{1}{2} m v_2^2 = \frac{1}{2}(m_1 + m_2) v^2$$

$$v_1 = v_2 \qquad v_1 = \omega \cdot r = \omega \frac{d}{2}$$

$$v_2 = \omega \frac{d}{2}$$

$\vec{v} \rightarrow K = \frac{1}{2} m v^2$

$K = \frac{1}{2} I \omega^2$

$$\Delta U = g\frac{d}{2}(m_1 - m_2) < 0$$

$$\Delta K = \frac{1}{2}(m_1+m_2)v^2 = \frac{1}{2}(m_1+m_2)u^2\left(\frac{d}{2}\right)^2$$

$$\Delta E = 0 \Rightarrow \Delta E + \Delta K = 0$$

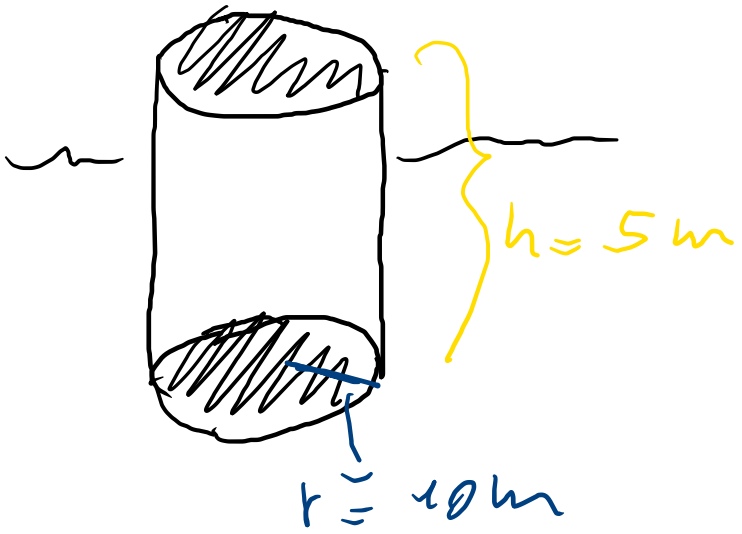
$$\Delta K = -\Delta U \Rightarrow g\frac{d}{2}(m_2 - m_1) = \frac{1}{2}(m_1+m_2)u^2$$

$$= \frac{1}{2}(m_1+m_2)u^2\frac{d}{4}$$

$$4\,\frac{g\,d(m_2-m_1)}{(m_1+m_2)d^2} = u^2 \Rightarrow u^2 = \frac{4g(m_2-m_1)}{(m_1+m_2)d}$$

$$u = 2\sqrt{\frac{g(m_2-m_1)}{(m_1+m_2)d}}$$

ESERCIZIO: Un cilindro di ghiaccio immerso in acqua



Volume della parte emersa?

$\rho_{acqua} = 1020 \ kg/m^3$

$\rho_{ghiaccio} = 920 \ kg/m^3$

$$F_A = \rho_{H_2O} V_i g \qquad F_P = \rho_{ghiaccio} V g$$

$$F_A = F_P \Rightarrow \rho_{H_2O} V_i g = \rho_g \cdot V \cdot g$$

$$V_i = \frac{\rho_g V}{\rho_{H_2O}} = \frac{\rho_g}{\rho_{H_2O}} \cdot \pi r^2 h = \frac{920}{1020} \cdot 3.14 \cdot 100 \cdot 5 \ m^3$$

$$= 1.4 \cdot 10^3 \ m^3$$

$$V_e = V - V_i = 3.14 \cdot 10^2 \cdot 5\ m^3 - 1.4 \cdot 10^3\ m^3$$

$$= 1570\ m^3 - 1402\ m^3 = 168\ m^3$$

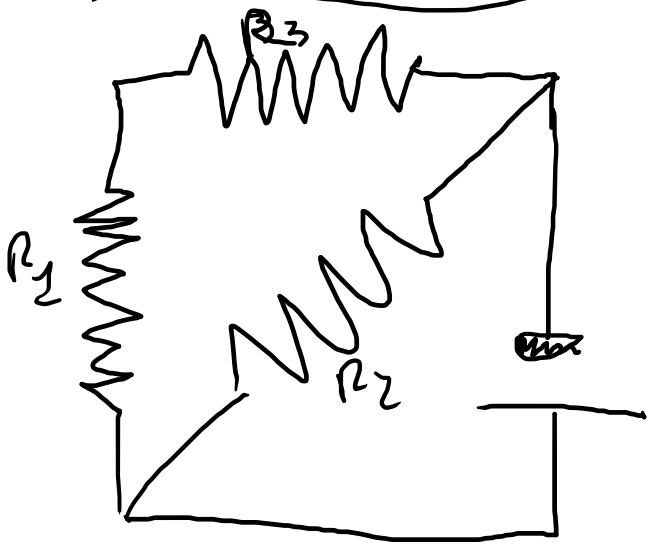
$$\frac{V_e}{V} = \frac{168}{1570} \simeq 11\%$$

ESERCIZIO:

$R_1 = 2\,\Omega$ Resistenza totale?

$R_2 = 4\,\Omega$

$R_3 = 1\,\Omega$



$$R_{13} = R_1 + R_3 = 3\,\Omega$$

$$\frac{1}{R_{123}} = \frac{1}{R_{13}} + \frac{1}{R_2} = \frac{1}{3\,\Omega} + \frac{1}{4\,\Omega}$$

$$R_{123} = \left(0.33 + 0.25\right)^{-1}\,\Omega = 1.7\,\Omega$$