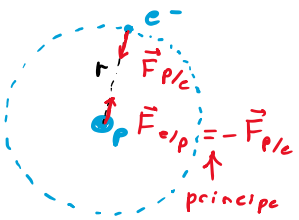
4.14

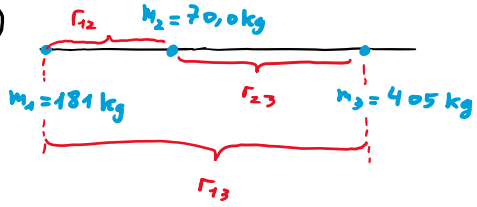


(a). $F_{p/e} = G \cdot \frac{m_p \cdot m_e}{r^2} = 6{,}67 \cdot 10^{-11} \cdot \frac{1{,}67 \cdot 10^{-27} \cdot 9{,}11 \cdot 10^{-31}}{(5{,}29 \cdot 10^{-11})^2}$

$\simeq 3{,}63 \cdot 10^{-47}\ N$

(b). idem (a) !

4.15



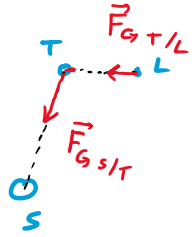
$F_1 = F_{2/1} + F_{3/1} = G\frac{m_1 m_2}{r_{12}^2} + G\frac{m_1 m_3}{r_{13}^2}$

$= G m_1 \cdot \left(\frac{m_2}{r_{12}^2} + \frac{m_3}{r_{13}^2} \right)$

$= 6{,}67 \cdot 10^{-11} \cdot 181 \cdot \left(\frac{70}{0{,}31^2} + \frac{405}{0{,}77^2} \right) \simeq 1{,}70 \cdot 10^{5}\ N$

vers la droite !

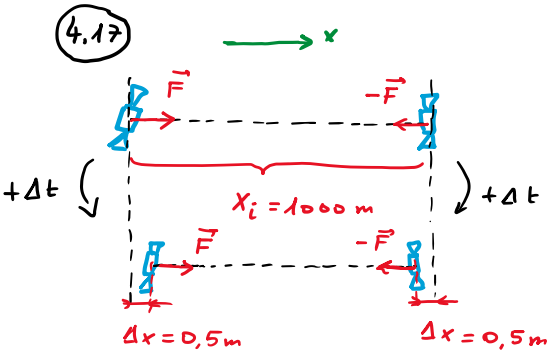
4.16



$\frac{F_{G\ S/T}}{F_{G\ T/L}} = \frac{G \cdot \frac{m_T \cdot m_S}{r_{TS}^2}}{G \cdot \frac{m_T \cdot m_L}{r_{TL}^2}} = \frac{m_S}{r_{TS}^2} \cdot \frac{r_{TL}^2}{m_L} = \frac{1{,}99 \cdot 10^{30}}{(1{,}5 \cdot 10^{11})^2} \cdot \frac{(3{,}85 \cdot 10^{8})^2}{7{,}35 \cdot 10^{22}}$

$\simeq 178$

4.17



Démarche :

- De $F = ma$ on en tire a (dynamique)
- On trouve Δt à l'aide de $\Delta x = \frac{1}{2} a (\Delta t)^2$

$\Rightarrow \Delta t = \sqrt{\frac{2\Delta x}{a}}$ (cinématique)

$F = F_G = G \cdot \frac{M \cdot m}{x_i^2} = M a$

$\Rightarrow a = G\frac{m}{x_i^2} = 6{,}67 \cdot 10^{-11} \cdot \frac{2 \cdot 10^4}{1000^2} \simeq 1{,}33 \cdot 10^{-12}\ m/s^2$

et donc $\Delta t = \left(\frac{2 \cdot 0{,}5}{a} \right)^{1/2} = 8{,}65 \cdot 10^{5}\ s \mapsto 2{,}4 \cdot 10^2\ h$

4.18

$F_p = mg = 2{,}27 \cdot 9{,}81 = 22{,}3\ N$

4.19

$g_{Terre} = 9{,}81\ N/kg$

$g_{Lune} = 1{,}6\ N/kg$

(a). $F_p = m\, g_{Terre} = 40\ kg \cdot 9{,}81\ N/kg = 3{,}9 \cdot 10^2\ N$

(b). $F_p = m\, g_{Lune} = 40\ kg \cdot 1{,}6\ N/kg = 64\ N$