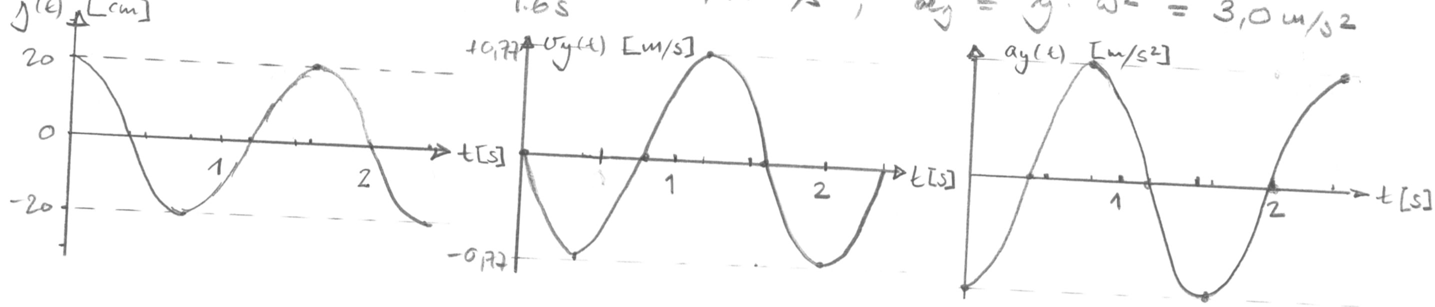
# Simple Harmonic Motion

11. $T = 2\pi \cdot \sqrt{m/k} = 2\pi \cdot \sqrt{0{,}55\,kg / 8{,}2\,N/m} = 1{,}6\,s$

$\hat{v}_y = \hat{y} \cdot \omega = 0{,}2\,m \cdot \frac{2\pi}{1{,}6\,s} = 0{,}77\,m/s$, $\quad \hat{a}_y = \hat{y} \cdot \omega^2 = 3{,}0\,m/s^2$




12. $T = 0{,}4\,s$, $\omega = \frac{2\pi}{T} = 15{,}7\,rad/s$, $f = \frac{1}{T} = 2{,}5\,Hz$

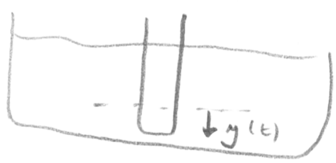
$y_{max} = 3\,cm$, $E = \frac{1}{2} m \cdot \hat{v}_y^2 = \frac{1}{2} m \cdot (\omega \cdot y_{max})^2 = \frac{1}{2} \cdot 0{,}4\,kg \cdot (15{,}7\,rad/s \cdot 0{,}03\,m)^2$

$E = \frac{1}{2} k \cdot y_{max}^2 \longrightarrow k = \frac{2 \cdot E}{y_{max}^2}$ $\qquad = \underline{52\,mJ}$

$= \frac{2 \cdot 52 \cdot 10^{-3}\,J}{(0{,}03\,m)^2} = \underline{116\,N/m}$

13. a)


equilibrium:
$F_G = F_B$ (buoyancy)




resultant force: $F_y(t) = -\rho_W \cdot A \cdot y(t) \cdot g$

$\Rightarrow a_y(t) = -\frac{\rho_W \cdot A \cdot g}{m}\, y(t) = -\omega^2 \cdot y(t)$

$\Rightarrow$ SHM with $\omega = \sqrt{\frac{\rho_W \cdot A \cdot g}{m}} \rightarrow T = 2\pi \sqrt{\frac{m}{\rho_W \cdot A \cdot g}}$

b) $T = 2\pi \cdot \sqrt{\frac{0{,}065\,kg}{10^3\,kg/m^3 \cdot \pi \cdot (1{,}25 \cdot 10^{-2}\,m)^2 \cdot 9{,}81\,m/s^2}} = \underline{0{,}73\,s}$