Newtons 1. lov

Bevegelse

$$a(t) = \frac{d}{dt} v(t)$$

$$v(t) = \frac{d}{dt} x(t)$$

Kap 5 - Krefter
Newtons lover 1D

Hva er krefter?

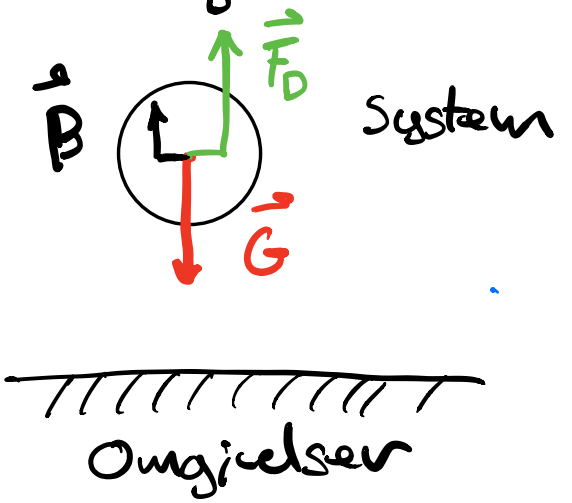
- Sterk kjernekraft
- Svak kjernekraft
- elektromagnetiske krefter
- Gravitasjon.

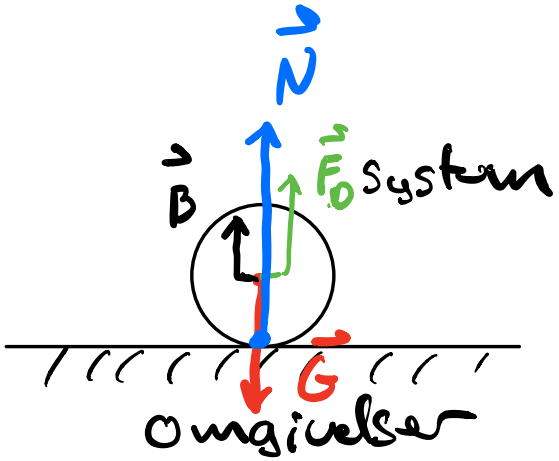
} Moderne Fysikk

Friksjon
Luftmotstand
Oppdrift
Strekk-krefter
} Kontakt krefter

Gravitasjon
Elektromagnetiske
} Avstands-krefter

Analysere krefter:





Newtons 2. lov

$$\vec{F} = m\vec{a}$$

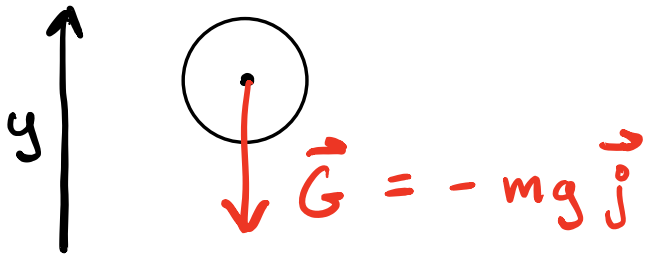
Krefter fører til akselerasjon!

$1\,N = 1\,kg \cdot m/s^2$

Sprettball starter i $y_0 = 57m$

massen, $m = 0{,}10\,kg$ $\quad v_0 = 0\,m/s$

Analyser problemet og sett opp Newtons 2. lov.



$\vec{j}$ - enhetsvektor langs y-akse

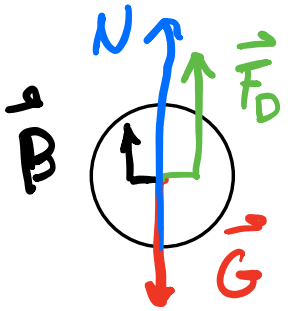
N. 2. lov $\quad \vec{F} = m\vec{a}$

$-mg = ma$ (y-retning)

$$a = -g$$
$$v_0 = 0\,m/s$$
$$y_0 = 57\,m$$

Frilegemediagram

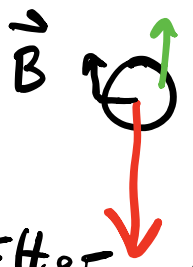
S 88



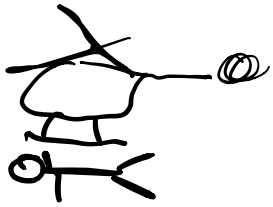
Fallskjermhopper

Tegn frilegemediagram for:

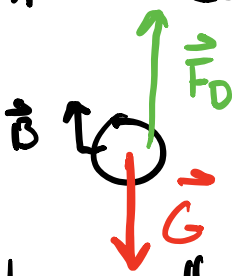
a) I det han hopper ut



$\vec{F} < 0$

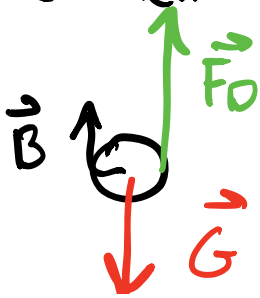


b) Etter ca 30s fritt fall



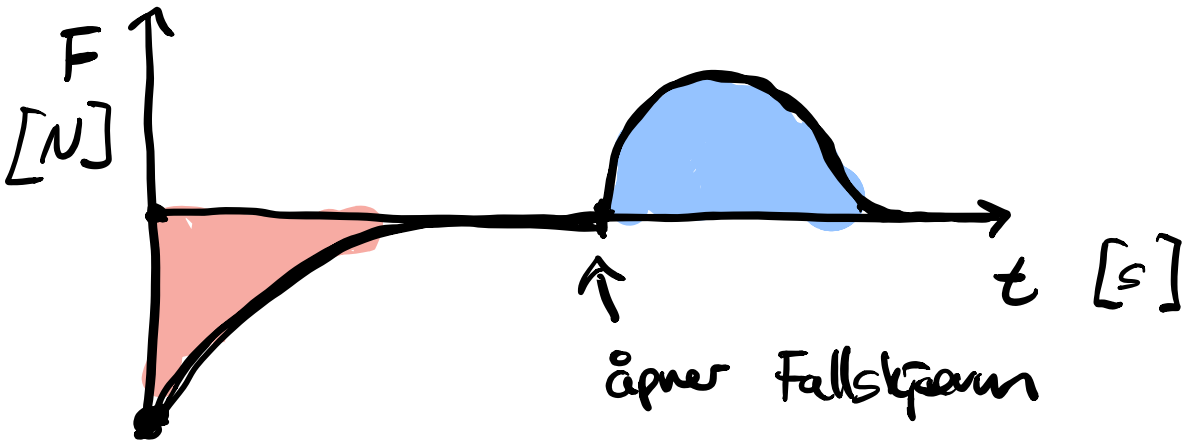
$\vec{F} = \vec{B} + \vec{F}_D + \vec{G} = 0$

c) Like etter Fallskjermen er åpnet.

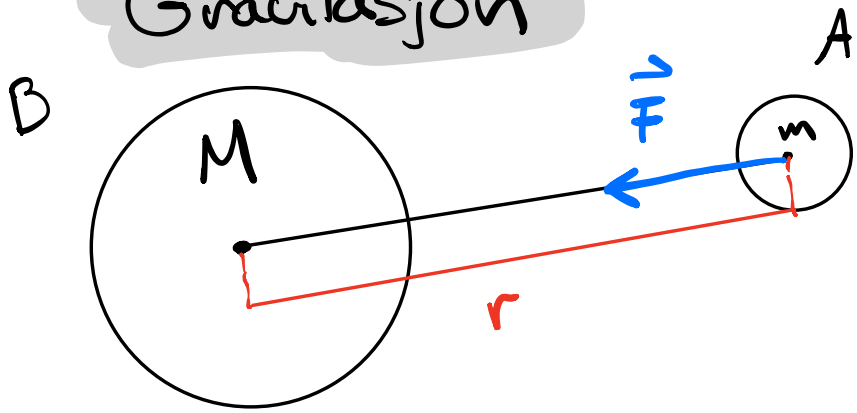


$\vec{F} = \vec{B} + \vec{F}_D + \vec{G} > 0$

Skisser draften på fallskjermhopperen som funksjon av tiden



Gravitasjon



Newtons Gravitasjonslov

$$\vec{F} = \gamma \cdot \frac{M \cdot m}{r^2} \hat{\vec{r}}$$

$$\gamma = 6{,}67428 \pm 0{,}007 \cdot 10^{-11} \ \mathrm{m^3/kgs^2}$$

$$M_\oplus = 5{,}9736 \cdot 10^{24} \ \mathrm{kg}$$

$$R_\oplus = 6371 \ \mathrm{km} = r$$

Finn gravitasjonskraften på en ball med masse $m = 1{,}0 \ \mathrm{kg}$.

$$|\vec{F}| = 9{,}8 \ \mathrm{N}$$

Viskøse krefter

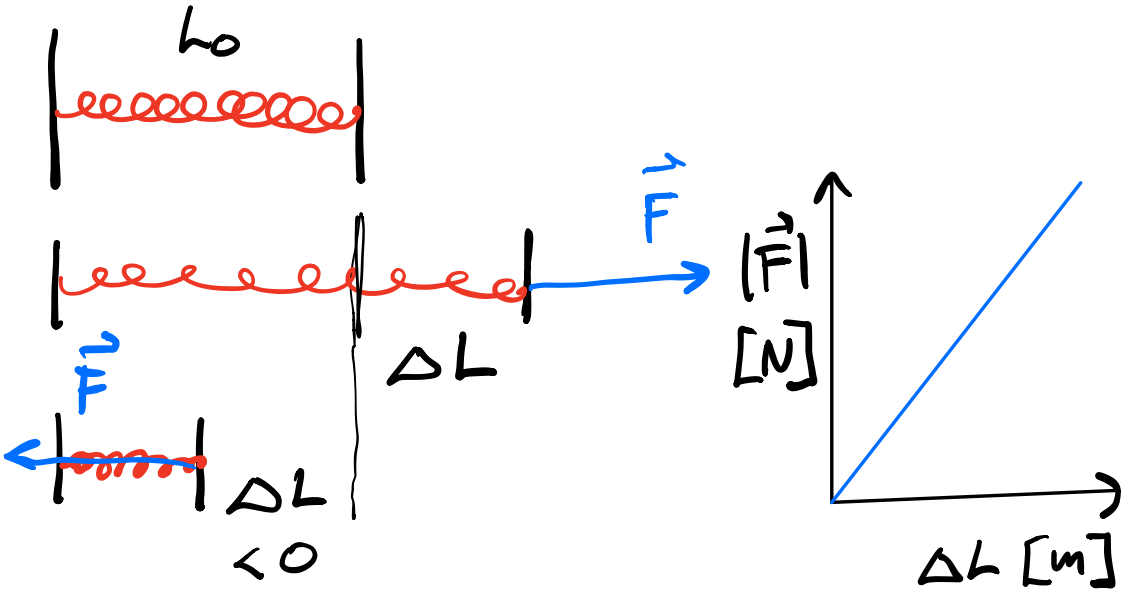
Luftmotstand / vannmotstand.

$F_D = -k_v v$ - lav hastighet

$F_D = -D v^2$ - høy hastighet.

Fjær-krefter

$F = -k\,\Delta L$ Hookes lov



k - fjærkonstant [N/m]

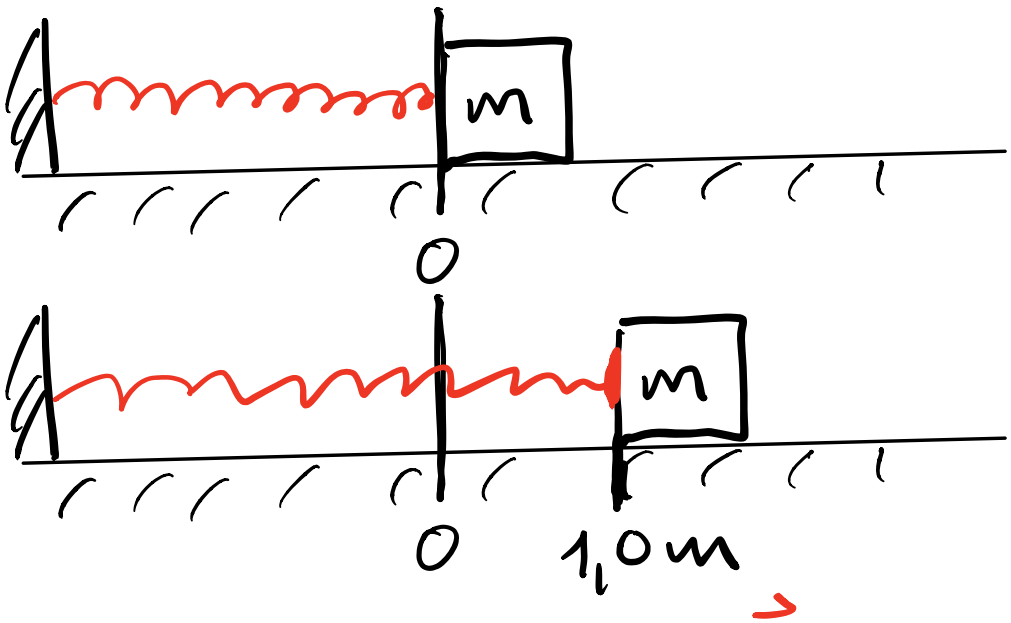
Masse - fjærkraft.

Kloss med masse 1,0 kg

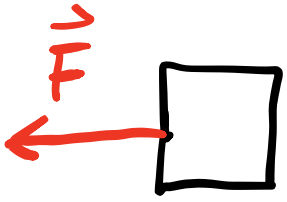
fjær med fjærkonstant 10 N/m

Trekke klossen 1,0 m fra

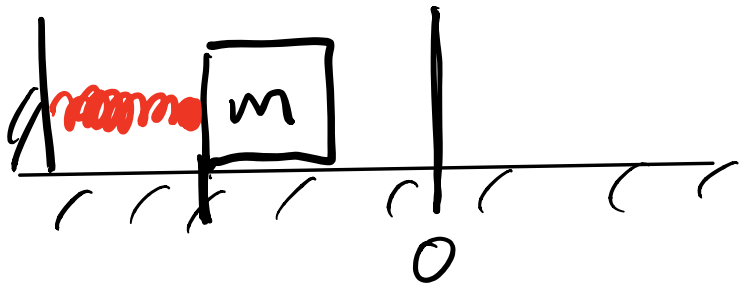
Likevekt og slipper. Hva skjer?

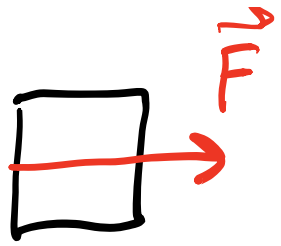


Frilegemediagram:



$F = -kx$





$F = -kx$

Newtons 2. lov $F = ma$

$$-kx = ma \quad \Big| \quad a = \ddot{x} = x''$$

$$-kx = m\ddot{x} \quad \Big| \quad \frac{d^2}{dt^2}x$$

$$m\ddot{x} + kx = 0$$

$x(0) = 1{,}0\ m$

$v(0) = 0\ m/s$