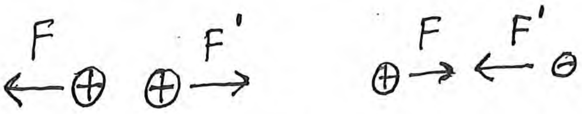
Kap 11.

Rep. 2. Elektrisitet



$e = 1{,}60 \cdot 10^{-19}\,C$
elementærladningen

Metaller har ledningselektroner

$U = \frac{W}{q}$ ← el. arbeid (W), el. ladning (q)
↑ el. spenning (U)

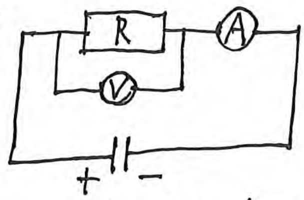
—(V)— voltmeter (U) (R stor)
—(A)— amperemeter (I) (R liten)

Kirchhoffs 2. lov

$\sum U_{opp} = \sum U_{ned}$
(i seriekrets)

strøm: $I = \frac{q}{t}$

Krets:



motstand

likestrøm

(vekselstrøm ~)

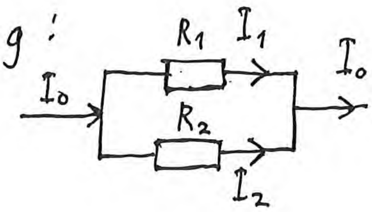
polspenning U_p

Kirchhoffs 1. lov

$I_0 = I_1 + I_2$
(greinstrøm)

Parallellkopling:

$U_{R1} = U_{R2}$



Resistans: $R = \frac{U}{I}$ $\left(\frac{V}{A} = \Omega\right)$
Ohms lov når R er konst.

ledere - halvledere - isolatorer

Serie: $R_s = R_1 + R_2 + \ldots$
Parallell: $R_p = \frac{1}{\left(\frac{1}{R_1} + \frac{1}{R_2} + \ldots\right)}$

dobbeltisolering: ⧈
jording: ⏚
sikring: (I_{max})

12.303
308
311
318
322+
324
325
332

$\mathcal{E} = R_i I + R_y I = R_i I + U_p$
ems (el. motorisk spenning), indre R, ytre R

El. energi

$W = UIt = (RI)It = RI^2 t$
(pga $U = RI$)
UI: til komponent

$W = U \cdot \left(\frac{U}{R}\right) \cdot t$
$= \frac{U^2}{R} \cdot t$

$P = UI$
el. effekt

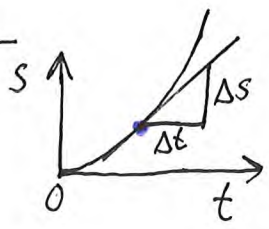
$Wh = W \cdot 60 \cdot 60\,s = 3600\,Ws$
$= 3{,}6\,kJ$

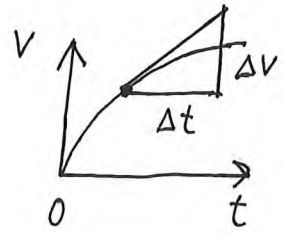
$kWh = 3{,}6 \cdot 10^6\,J$ [11.23, 24, 25, 30]

12. Bevegelse II

$\vec{v}(t) = \vec{s}'(t)$

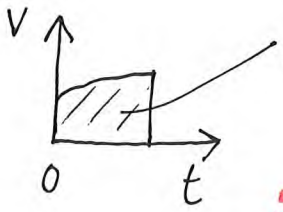
$\vec{a}(t) = \vec{v}'(t)$





$v = \frac{\Delta s}{\Delta t}$

$a = \frac{\Delta v}{\Delta t}$



$A = s = \int v(t)\,dt$

$s = v_0 t + \frac{1}{2} a t^2$ →

Uavhengighetsprinsippet:
x- og y-bevegelser er uavh.

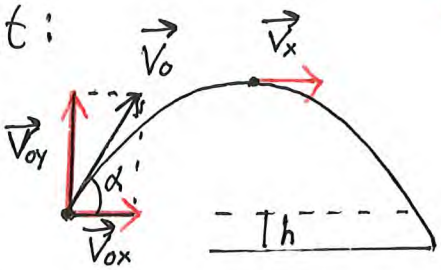
$x = v_{0x} \cdot t + \frac{1}{2} a_x \cdot t^2$ osv.

$y = v_{0y} \cdot t + \frac{1}{2} a_y \cdot t^2$

$a_x = 0$

$g = a_y = -9{,}81 \frac{m}{s^2}$ i fritt fall og kast

Skrått kast:



$v_{0y} = v_0 \cdot \sin\alpha$

$g = 9{,}81 \frac{m}{s^2}$

a) v i toppen: $v = v_{0x} = v_0 \cdot \cos\alpha$

b) t til toppen: $v_y = 0$ og $v_y = v_{0y} + a_y t \rightarrow 0 = v_{0y} - gt$ ⇑+

$t = \frac{v_{0y}}{g}$

c) h i toppen: $(2as = v^2 - v_0^2)$ $2gy = v_y^2 - v_{0y}^2$ eller $y = v_{0y} t - \frac{1}{2} g t^2$

d) kastlengde x: $y = -h$ og $y = v_{0y} \cdot t - \frac{1}{2} g t^2$

$-h = v_{0y} \cdot t - \frac{1}{2} g t^2$

$\underbrace{\frac{1}{2} g}_{A} t^2 \underbrace{- v_{0y}}_{B} \cdot t \underbrace{- h}_{C} = 0$

Finn t først → y: +⇑

$t =$

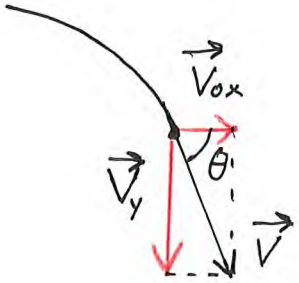
$x = v_{0x} \cdot t =$

e) $\vec{v}$ i nedslaget: $v = v_0 + at$

+⇑ $v_y = v_{0y} - gt$ ← t for kastlengde

$v = \sqrt{v_{0x}^2 + v_y^2} =$

$\tan\theta = \frac{|v_y|}{|v_{0x}|}$



$\theta = \tan^{-1}\left(\frac{|v_y|}{|v_{0x}|}\right)$

$a = \frac{v^2}{r}$ mot sentrum

$v = \frac{2\pi r}{T}$ ved konst. banefart

20

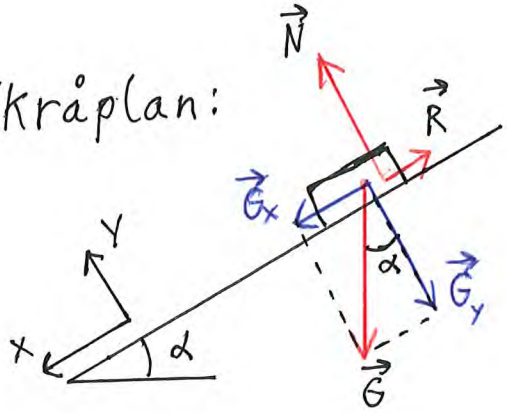
12.303 (311) 316, 336, 342
12.10 (12.12, 13, 16)

13. Kraft og bevegelse II

Newtons 1., 2. og 3. lov $\sum \vec{F} = m\vec{a}$ $\sum F_x = ma_x$ $\sum F_y = ma_y$

uavhengighetsprinsippet

Skråplan:



$\sum F_x = ma_x$ $\quad a_x = ?$

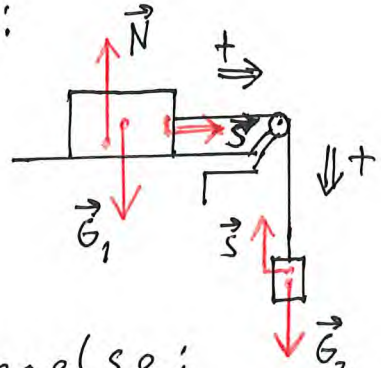
$G_x - R = ma$

$mg\sin\alpha - \mu mg\cos\alpha = ma$

$\mu = \frac{R}{N}$

$U = \sqrt{N^2 + R^2}$

Snordrag:



$\sum F_1 = m_1 a$ $\quad S = m_1 a$

$\sum F_2 = m_2 a$ $\quad G_2 - S = m_2 a$

$m_2 g - m_1 a = m_2 a$

$m_2 g = (m_1 + m_2) a$

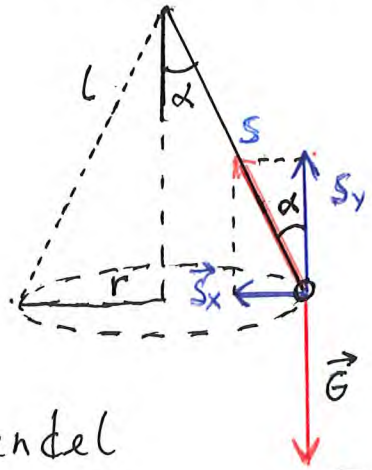
Sirkelbevegelse:

$\sum F = ma = \frac{mv^2}{r}$

↑ sentripetalkraft

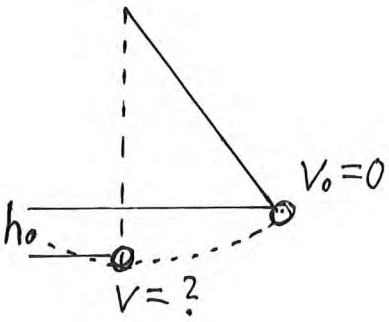
$\sum F_x = ma_x$	$\sum F_y = 0$
$S \cdot \sin\alpha = m\frac{v^2}{r}$	$S \cdot \cos\alpha = G$

Kjeglependel



Loop

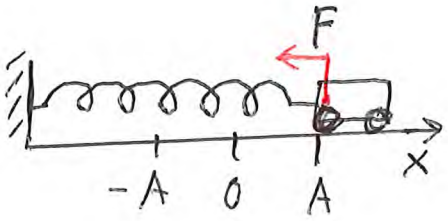
Planpendel



$E = E_0$

$mgh + \frac{1}{2}mv^2 = mgh_0 + \frac{1}{2}mv_0^2$

Elastisk pendel



A = amplitude

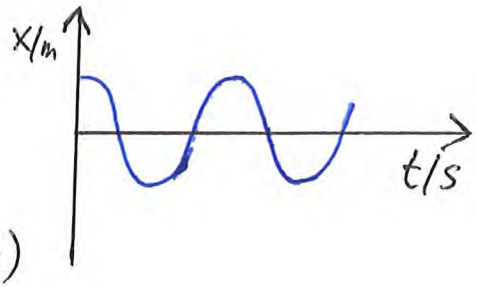
f = frekvens

$\sum F = mx''$

$-kx = mx''$

$x'' + \frac{k}{m}x = 0$ svingelikninga

gir $x(t) = A \cdot \cos(2\pi f t)$



med $v(t) = x'(t)$ og $a(t) = x''(t)$

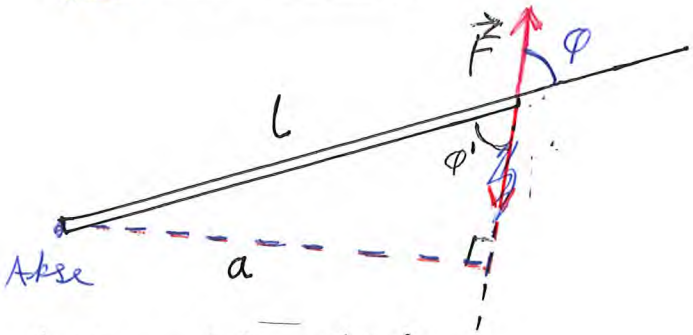
$f = \frac{1}{2\pi}\sqrt{\frac{k}{m}}$ og $T = \frac{1}{f}$

Generelt:

* Bruk Newtons lover
* Bruk $E_k + E_p$ bevart
* Bruk $\sum mv$ bevart
* Få oversikt
* Stor figur med all info, symboler, fortegn
* Prøve og feile

[13.304, 311, 319, 320, 327, 338
13.342, 345, 347]

14. Statikk



$a = l \cdot \sin\varphi = l \cdot \sin\varphi'$

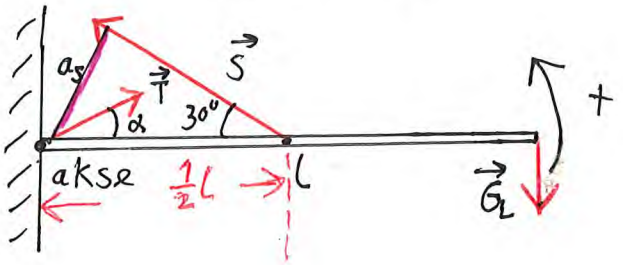
$M = aF = l \cdot F \cdot \sin\varphi$ [Nm]

↑ kraftmoment

Likevektsvilkår

$\sum \vec{F} = 0$ og $\sum M = 0$ om en akse

Eks.



a) $\sum M = 0$ $\quad S = ?$

$M_S - M_L = 0 \quad (M_T = 0)$

$a_S \cdot S = a_L \cdot mg$

$\frac{1}{2}l \cdot (\sin 30°) \cdot S = l \cdot mg$

$S = \frac{2mg}{\sin 30°}$

b) $\vec{T} = ?$

$\sum F_x = 0$ og $\sum F_y = 0$

$T_x = S_x$ $\quad T_y + S_y = G_L$

$T_x = S \cdot \cos 30°$ $\quad T_y = mg - S \cdot \sin 30°$

$T = \sqrt{T_x^2 + T_y^2}$

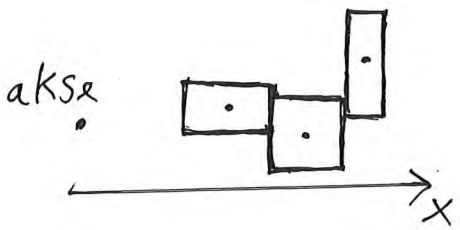
og $\tan\alpha = \frac{T_y}{T_x}$

$\alpha = \tan^{-1}\left(\frac{T_y}{T_x}\right)$

Tyngdepunkt: $x_T = \frac{\sum x_i G_i}{G}$

G_i : deltyngde

G : hele tyngden



[14.05,06,10,306(307),315]