LF EKSAMEN

FP0001 - BRUKERKURS

V 2016

LF (1)

LF EKSAMEN FY0001 V2016 (31/5-2016)

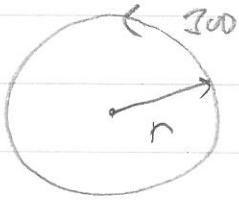
DEL A:

1. VED $t = 2{,}5$ s $\quad \frac{dx}{dt} = 0$; $\frac{dx^2}{dt^2} < 0$

(A)

---

2. $v = 80$ km/h $= \frac{80}{3.6}$ m/s



$2\pi r = 300$ m

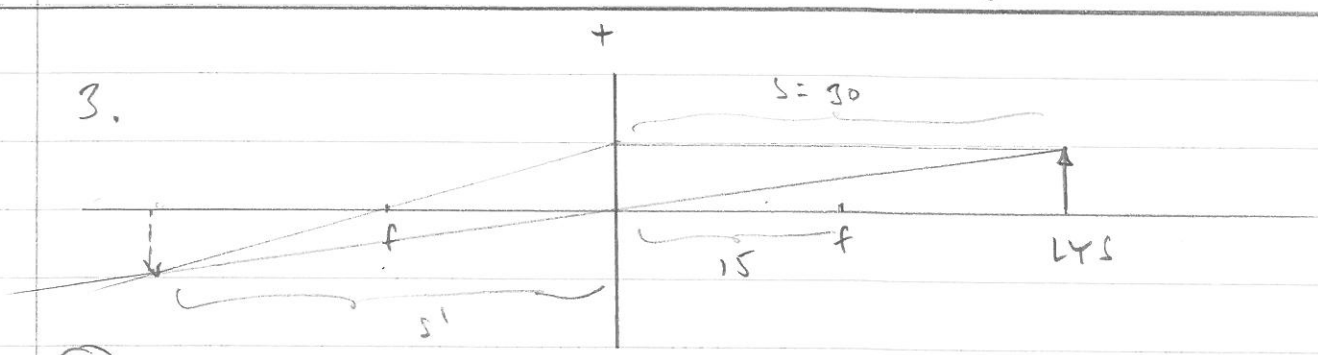
$r = \frac{300}{2\pi} = 47.7$ m

FOR SENTRIPETAL AKS. $a_c = \frac{v^2}{r} = \left(\frac{80}{3.6}\right)^2 \frac{1}{47.7} \simeq 10.4$

(D) N.b. BEVEGELSE KUN I HORISONTALPLANET

=> IKKE AKS. FRA g

3.



(B) INVITERT, UFORSTØRRA

LIGNINGER

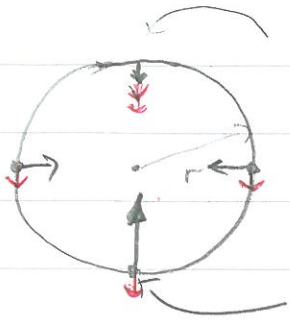
$\frac{1}{30} + \frac{1}{s'} = \frac{1}{15} \Rightarrow \frac{1}{s'} = \frac{1}{15} - \frac{1}{30} = \frac{1}{30} \Rightarrow s' = 30$

$M = -\frac{s'}{s} = -\frac{30}{30} = -1$ OM

LF (2)

4.

$a_c = \frac{v^2}{r}$

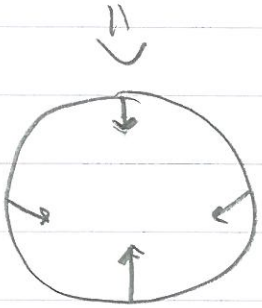


LAV v, LITEN $a_c \sim 0$

MIDDELS v, MIDDELS a_c

HØY v, STOR a_c

ADDERE BIDRAG FRA g



(C)

---

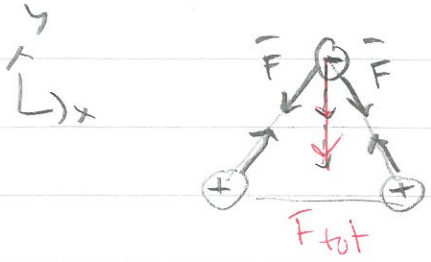
5. HER ER DET LURT Å BRUKE ENERGIPRINSIPPET

$$\cancel{m}gh \rightarrow (4\cancel{m})\frac{v^2}{2} \Rightarrow v^2 = g\frac{h}{2}$$

$$v = \sqrt{g\frac{h}{2}}$$

(B)

6.

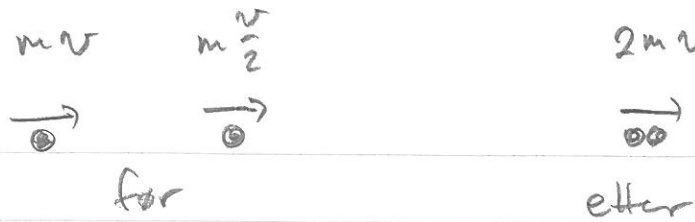


KOMPONENTENE I X-LEDD KANSELLERER

(C)

LF (3)

7:



BEVARING BEVEGELSESMENGDE

$\Rightarrow \quad mv + m\frac{v}{2} = 2mv' \quad \Rightarrow \quad v' = \frac{3v}{4}$

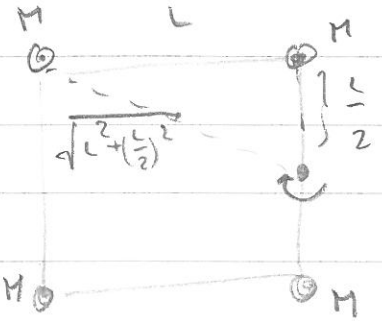
$E_{kin,for} \quad E_f = \frac{4m}{4}\cdot\frac{v^2}{2} + \frac{m}{2}\cdot\left(\frac{v}{2}\right)^2 = \frac{5mv^2}{8} = \frac{10mv^2}{16}$ (A)

$E_{kin,etter} \quad E_e = \frac{2m}{2}\cdot v'^2 = m\cdot\left(\frac{3v}{4}\right)^2 = \frac{9mv^2}{16}$

$E_{tap} \quad \frac{10mv^2}{16} - \frac{9mv^2}{16} = \frac{mv^2}{16}$

$\frac{E_{tap}}{E_f} = \frac{\frac{mv^2}{16}}{\frac{10mv^2}{16}} = \frac{1}{10} = 10\%$

8:



GENERELT HVER PUNKTMASSE GIR $I = M\cdot R^2$

$I_{tot} = 2\times I\left(R=\frac{L}{2}\right) + 2\times I\left(R=\sqrt{L^2+(\frac{L}{2})^2}\right) =$

$= 2M\cdot\left(\frac{L}{2}\right)^2 + 2M\left(L^2+\left(\frac{L}{2}\right)^2\right) = 2ML^2 + 4M\left(\frac{L}{2}\right)^2 =$

$= 3ML^2$ (C)

9:

$m = 15\,kg$

$M = 1000\,kg$

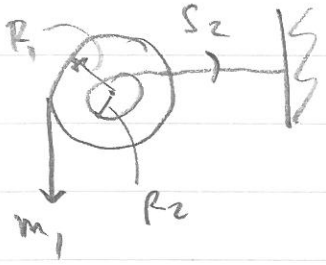
$v = R\cdot\omega \Rightarrow \omega = \frac{v}{R}$

$I = \frac{1}{2}mR^2$ HVERT HJUL

$K_{rot} = \frac{1}{2}I\cdot\omega^2 = \frac{1}{2}\frac{1}{2}mR^2\cdot\omega^2 = \frac{1}{4}mv^2$

$\frac{K_{rot}}{K_{trans}} = \frac{4\times\frac{1}{4}mv^2}{\frac{1}{2}Mv^2} = \frac{2m}{M} = \frac{2\cdot15}{1000} = \frac{30}{1000} = \frac{3}{100}$ (C)

10:



LIKEVEKT FOR DREIEMOMENT F.R

$m_1\cdot g\cdot R_1 = S_2\cdot R_2 \Rightarrow S_2 = m_1 g\cdot\frac{R_1}{R_2}$

(A)

4F (4)

Besvarelsesark del A: No# LF

1: A –

2: D –

3: B –

4: C

5: B

6: C –

7: A

8: C

9: C

10: A

LF (5)

11. $v = 72\ ^{km}/_{h} = \frac{72}{3.6}\ \frac{m}{s} = 20\ \frac{m}{s}$

$\lambda = 0.17\ m$

$v_{luft} = 340\ \frac{m}{s}$ $\quad v = \lambda \cdot f \Rightarrow f = \frac{v}{\lambda} = \frac{340}{0.17} =$

$= 2000\ Hz$

a) KJØRER MOT ; f ØKER

BRUK $f' = f\left(\frac{1}{1 - \frac{v_E}{v}}\right) = 2000 \cdot \left(\frac{1}{1 - \frac{20}{340}}\right) \simeq 2125\ Hz$

b) KJØRER FRA ; f MINKER

BRUK $f' = f\left(\frac{1}{1 + \frac{v_E}{v}}\right) = 1889\ Hz$

TREKK

FEIL LIANING -10

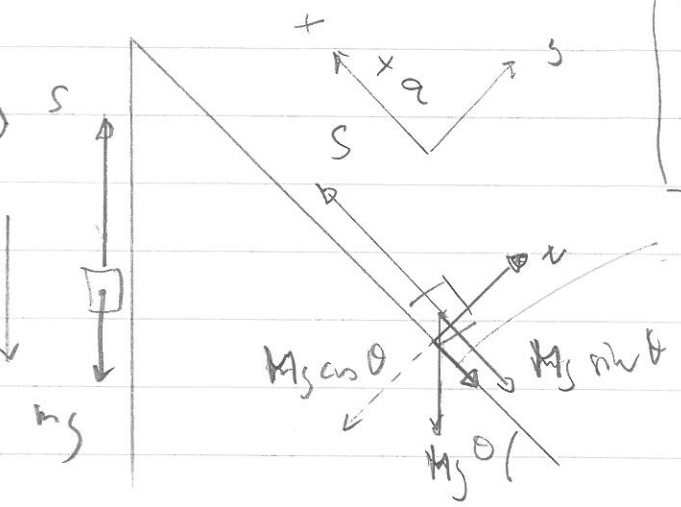
FEIL ~~HØY~~ MOT/LAV FRA -10

FEIL f -10

(LF6)

12)

Hvis ikke FRIKSJON MANNEN VIL SKLI i +x, SOM $mg > M_g \sin\theta$. Friksjon kan kun bremse, ikke trekke



$m = 75\,kg$
$M = 82\,kg$
$\theta = 45°$, $\mu = 0.1$

NEWTON 1&2

S og a ukjente

BØTTA: $\sum \bar{F} = m \cdot a \Rightarrow mg - S = m \cdot a$ (1)

MANN, x: $\sum \bar{F} = M \cdot a \Rightarrow S - F_f - M_g \sin\theta = M \cdot a$ (2)

MANN, y: $N - M_g \cos\theta = 0 \Rightarrow N = M_g \cos\theta$ (3)

(3) ↓

FRIKSJONSVILKÅR $F_f = \mu \cdot N = \mu M_g \cos\theta$ (4)

(4) → (2) $S - \mu M_g \cos\theta - M_g \sin\theta = M \cdot a$ (5)

(1) GIR $S = m(g - a)$ → (5)

$\Rightarrow m(g-a) - \mu M_g \cos\theta - M_g \sin\theta = M \cdot a$

$mg - \mu M_g \cos\theta - M_g \sin\theta = (M+m)\,a$

$\Rightarrow a = \frac{g}{(M+m)} \cdot \left[m - \mu M \cos\theta - M \sin\theta \right]$

→

(LF7)

11.22

12 FORTS

TALL $a = \frac{9.8}{157}\left[75 - 0.1 \cdot 82 \cdot \frac{1}{\sqrt{2}} - \frac{82}{\sqrt{2}}\right]$

5.798 57.98

$\approx 0{,}70 \frac{m}{s^2}$

a)

$S = m(g-a) = 75\,(9.1-0.7) = 682.5\,N$

[KONTROLL:

57.4 56.82 568.2

(5) GIR $S = M \cdot a + \mu M g \cos\theta + M g \sin\theta = 682.5\,N$ OK]

b) BRUK $x = \frac{v^2 - v_0^2}{2a}$ ($v_0 = 0$) $\Rightarrow v = \sqrt{2ax}$

$= \sqrt{2 \cdot 0.7 \cdot 7} = 3.1 \frac{m}{s}$

SENSUR

+10 (max) FOR GOD FIGUR MED ALLE KREFTER RETT

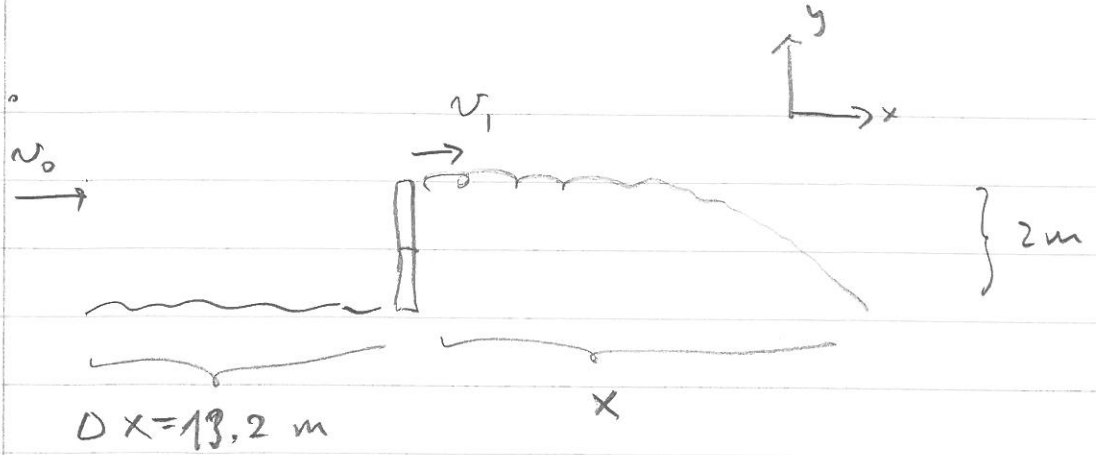
+5 BEREGNET S HELT RIKTIG

+5 -"- v HELT RIKTIG

trekk for små avvik

LF8

13.



GITT $v_1 = 60$ km/h $\simeq 16.67 \frac{m}{s}$; $\mu = 0.6$; $g = 9.8$

$\Delta x = 13.2$ m

a) TIDEN DET TAR ER DEN SAMME SOM Å FALLE 2 m ↓

$x = x_0 + v_x \cdot t + \frac{1}{2} a_x t^2$ → tilpasse y-koord → $y = y_0 + v_y t - \frac{1}{2} g t^2$ ($v_y = 0$)

$y_0 = 2 \Rightarrow y = 0$ (bakken)

$\Rightarrow 0 = 2 - \frac{1}{2} g t^2 \Rightarrow \frac{4}{g} = t^2 \Rightarrow t = \frac{2}{\sqrt{g}} \simeq 0.639$ s

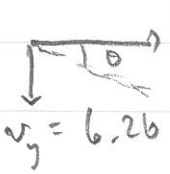
FINN NÅ x $\quad x = v_x \cdot t = 16.67 \frac{m}{s} \cdot 0.639\,s \simeq 10.65$ m

ans. 11 m

b) NÅR MAN FALLT 2 m ER HASTIGHETEN

$v_y = v_{0y} + a \cdot t \Rightarrow v_y = 0 - g \cdot t = -9.8 \cdot 0.639 \simeq -6.26 \frac{m}{s}$

∴ VED NEDSLAGSPUNKTET



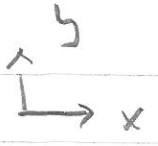
$\tan\theta = \frac{v_y}{v_x} \Rightarrow \theta = 20.6°$

ans. 21°

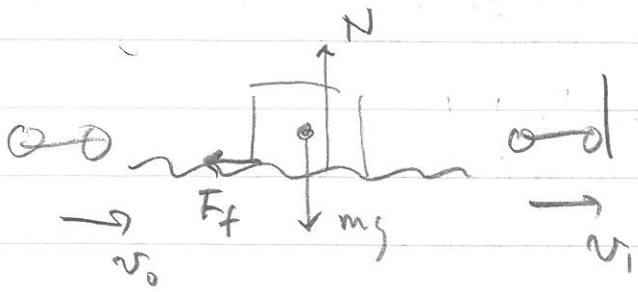
0.375 57

(LFG)

13. FORTS



c)



NEWTON x: $-F_f = m \cdot a_x$

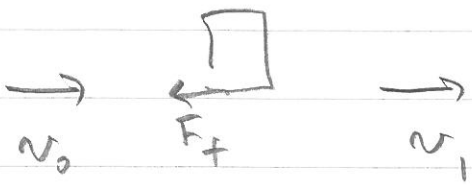
F_f gir AV FRIKSJON $F_f = \mu \cdot N$

NEWTON y: $-mg + N = 0 \quad \Rightarrow N = -mg$

$\Rightarrow F_f = -\mu mg \quad \Rightarrow -\mu m g = m \cdot a_x \Rightarrow a = -\mu g$

QED

d) ENERGIBETRAKTNING (ALLE GÅR LUKE GREIT / BONUS FOR ENERGI-RETT)



W_f = FRIKSJONSARBEID $= -F_f \cdot x = -\mu mgx$

$K_0 = \frac{1}{2} m v_0^2$

$K_1 = \frac{1}{2} m v_1^2$

$\Big\} \; K_1 - K_2 = W_f \Rightarrow \frac{1}{2} m (v_1^2 - v_0^2) = -\mu m g x$

$\Rightarrow x = \frac{v_0^2 - v_1^2}{2\mu g}$; $v_0 = \sqrt{v_1^2 + 2\mu g x} \simeq 20.8 \frac{m}{s}$

Ans. $\sim$ 75 km/h