



higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NASIENRIGLYN

NASIONALE SERTIFIKAAT

INGENIEURSWETENSKAP N3

25 November 2025

Hierdie nasienriglyn bestaan uit 8 bladsye.

VRAAG 1: BEWEGING, VERMOË EN ENERGIE

1.1 D✓ (1)

1.2 A✓ (1)

- 1.3
- Veroorsaak nie 'n verandering in die beweging van 'n voorwerp nie, wat beteken dat 'n stilstaande voorwerp bewegingloos bly, en 'n bewegende voorwerp hou aan om in dieselfde rigting teen 'n konstante snelheid te beweeg✓
 - Die som van alle kragte wat lynlangs op die voorwerp uitgeoefen word, is altyd gelyk aan nul✓

OF

- Dit hou die liggaam in rus.
- Dit hou die liggaam teen 'n konstante snelheid. (1)

1.4 1.4.1 $s = 10t + 2\frac{1}{2}t^2$

$$= 10 \times \frac{7}{2} + \frac{5}{2} \times \left(\frac{7}{2}\right)^2 \checkmark$$

$$= 65,625 \text{ m} \checkmark \quad (2)$$

1.4.2 $\frac{1}{2}a = 2,5$

$$a = 5 \text{ m/s}^2 \checkmark \quad (1)$$

1.4.3 $10 \text{ m/s} \checkmark \quad (1)$

1.4.4 $8,5 = 10t + 2,5t^2$

$$2,5t^2 + 10t - 8,5 = 0 \checkmark$$

$$5t^2 + 20t - 17 = 0$$

$$t = \frac{-(20) \pm \sqrt{(20)^2 + 4 \times 5 \times 17}}{2 \times 5} \checkmark$$

$$= 0,72 \text{ s} \checkmark \quad (3)$$

1.5 $m_1u_1 + m_2u_2 = v(m_1 + m_2)$

$$4 \times 3 + (6)(-6) = v(4 + 6) \checkmark \checkmark$$

$$v = -2,4 \text{ m/s} \checkmark$$

OF

$$v = 2,4 \frac{\text{m}}{\text{s}} \text{ na links of in die oorspronklike rigting van } 6 \text{ kg massa}$$

1.6 $T_1:T_2 = 7:1$

$$T_2 = \frac{550}{7} = 78,571 \text{ N} \checkmark$$

$$P = (T_1 - T_2)v$$

$$= (550 - 78,571) \times 0,025 \checkmark$$

$$= 11,786 \text{ W} = 0,012 \text{ kW} \checkmark$$

(3)
[16]

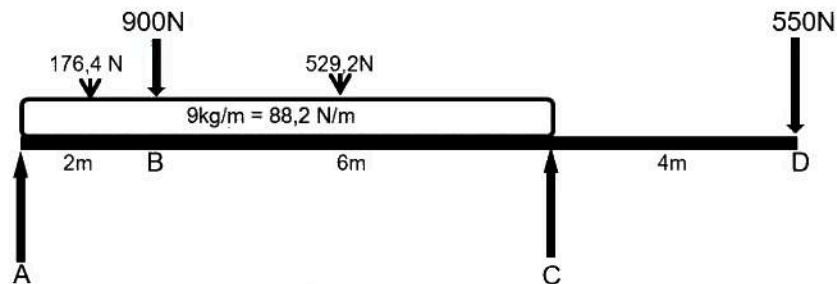
VRAAG 2: MOMENTE

2.1 2.1.1 Waar ✓

2.1.2 Onwaar ✓

(1)
(1)

2.2 2.2.1



$\frac{1}{2}$ punt vir elke waarde: 900 N ✓, 550 N ✓, 9 kg/m ✓; en reaksies op korrekte plekke. ✓

Ignoreer die waardes 176,4 N en 529,2 N want dit word in VRAAG 2.2.2 en 2.2.3 gebruik.

(2)

2.2.2 *Neem momente om A*

$$\sum \text{Kloksgewyse momente} = \sum \text{Antikloksgewyse momente}$$

$$(176,4 \times 1) + (900 \times 2) + (529,2 \times 5) + (550 \times 12) = C \times 8 \checkmark$$

$$C = 1\,402,8 \text{ N} \checkmark$$

Neem momente om C

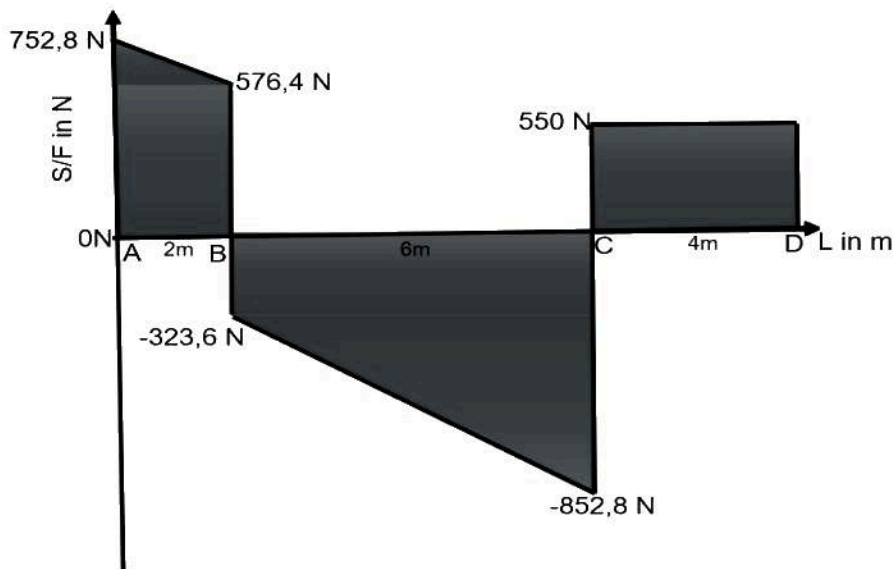
$$\sum \text{Kloksgewyse momente} = \sum \text{Antikloksgewyse momente}$$

$$(A \times 8) + (550 \times 4) = (529,2 \times 3) + (900 \times 6) + (176,4 \times 7) \checkmark$$

$$A = 752,8 \text{ N} \checkmark$$

(4)

2.2.3



½ punt vir elk van die volgende:
752,8 N✓; 576,4 N✓; -323,6 N✓; -852,8 N✓; 550 N✓; 0 N✓; vorm van die grafiek✓; byskrifte vir die asse.✓

(4)
[12]

VRAAG 3: KRAGTE

- 3.1
- Vektorkragte vorm 'n geslote driehoek.✓
 - Die algebraïese som van die komponente van kragte in enige rigting is gelyk aan nul.✓
 - Die algebraïese som van die momente van die kragte om enige punt is gelyk aan nul.
 - Aksielyn van die kragte ontmoet op 'n punt.
 - Die kragte van vektors is saamvlakkig.
 - Die resultante krag is 0 N.
 - Som van die vertikale komponente is 0 N.
 - Som van horisontale komponente is 0 N.
- (Enige 2) (2)
- 3.2 C✓ (1)
- 3.3
- 3.3.1 $\sum H_c: A - 180\cos 50^\circ - B\cos 60^\circ = 0$ ✓ (1)
- 3.3.2 $\sum V_c: 180\sin 50^\circ - B\sin 60^\circ + 250 = 0$ ✓ (1)
- 3.3.3 $\sum V_c: 180\sin 50^\circ - B\sin 60^\circ + 250 = 0$ ✓
 $\therefore B = 447,894 \text{ N}$ ✓
- $\sum H_c: A - 180\cos 50^\circ - B\cos 60^\circ = 0$
 $A - 180\cos 50^\circ - 447,894 \times \cos 60^\circ = 0$ ✓
 $\therefore A = 339,649 \text{ N}$ ✓ (4)
- 3.3.4 Resultant is 0 N✓

3.4 3.4.1 Die diagram is simmetries

$$L = R = \frac{30+10+10}{2} = 25 \text{ kN} \checkmark \checkmark \quad (2)$$

3.4.2 Neem punt by L

$$\begin{aligned} \sum V_c: AF \sin 30 &= 25 \text{ kN} \checkmark \\ \therefore AF &= 50 \text{ kN (Stut)} \checkmark \checkmark \end{aligned}$$

$$\begin{aligned} \sum H_c: AF \cos 30 &= EF \\ \therefore EF &= 50 \cos 30 \checkmark \\ &= 43,301 \text{ kN (Bind)} \checkmark \checkmark \end{aligned}$$

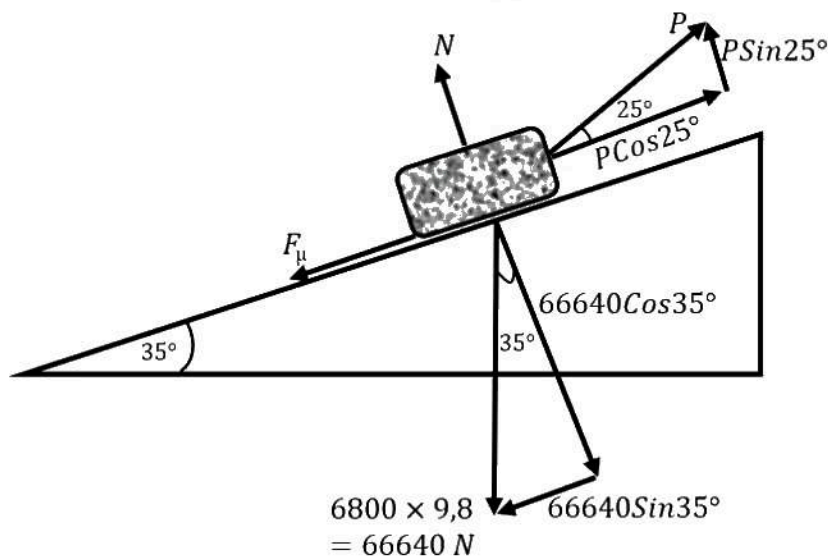
(3)
[15]

VRAAG 4: WRYWING

- 4.1
- Voorkom gly tussen twee kontakoppervlakke ✓
 - Verwyder materiaal ✓
 - Dra beweging/krag oor deur middel van bande ✓
 - Bring beweging tot stilstand

(Enige 3) (3)

4.2



$$\begin{aligned} \mu &= 0,3 \\ F_\mu &= \mu N \\ \therefore F_\mu &= 0,3N \end{aligned}$$

$$\begin{aligned} \sum \text{Parallel aan die vlakkomponente} &= 0 \\ F_\mu + 66640 \sin 35^\circ &= P \cos 25^\circ \checkmark \\ F_\mu &= P \cos 25^\circ - 66640 \sin 35^\circ \checkmark \end{aligned}$$

Σ Loodreg op die vlakkomponente = 0

$$N + P\sin 25^\circ = 66640\cos 35^\circ \checkmark$$

$$\frac{F_\mu}{0,3} + P\sin 25^\circ = 66640\cos 35^\circ$$

$$F_\mu = 0,3(66640\cos 35^\circ - P\sin 25^\circ) \checkmark$$

Gelykstelling van (1) en (2)

$$P\cos 25^\circ - 66640\sin 35^\circ = 0,3(66640\cos 35^\circ - P\sin 25^\circ) \checkmark$$

$$P\cos 25^\circ + 0,3P\sin 25^\circ = 0,3 \times 66640\cos 35^\circ + 66640\sin 35^\circ \checkmark$$

$$\therefore P = 52850,622\text{N} \checkmark$$

(7)
[10]

VRAAG 5: HITTE

5.1 5.1.1 $h_{sup} = 2\,948\text{ kJ/kg} \checkmark$ (1)

5.1.2 $h_{wet} = h_f + xh_{fg}$
 $2500 = 962 + x \times 1839 \checkmark \checkmark$
 $\therefore x = 0,836 \checkmark$ (3)

5.1.3 $h_g = 2\,745\text{ kJ/kg} \checkmark$ (1)

5.2 5.2.1 $A_o = 0,8 \times 1,98 = 1,584\text{ m}^2 \checkmark$ (1)

5.2.2 $\Delta A = 2A_o \propto \Delta t$
 $\Delta A = 2 \times (0,795 \times 1,975) \times 25 \times 12 \times 10^{-5} \checkmark$
 $= 9,421 \times 10^{-3}\text{ m}^2 \checkmark$ (2)

5.2.3 $A_f = (0,795 \times 1,975) + 9,421 \times 10^{-3}$
 $= 1,580\text{ m}^2 \checkmark$

Ja, dit sal pas want die nuwe oppervlak is steeds kleiner as die oppervlak van die kosyn. $\checkmark$

(2)

5.3 Gegewe

$$m_s = 45 \times 0,75 = 33,75\text{ kg}$$

$$t_{1\text{ staal}} = 180^\circ\text{C}$$

$$c_{\text{staal}} = 500\text{ J/kg}^\circ\text{C}$$

$$m_{\text{olie}} = 0,005 \times 920 = 4,6\text{ kg}$$

$$t_{1\text{ olie}} = 20^\circ\text{C}$$

$$c_{\text{olie}} = 2000\text{ J/kg}^\circ\text{C}$$

$$(mc\Delta t)_{\text{staal}} = (mc\Delta t)_{\text{olie}}$$

$$33,75 \times 500 \times (180 - t_2) = 4,6 \times 2\,000 \times (t_2 - 20) \checkmark \checkmark$$

$$180 - t_2 = 0,545185(t_2 - 20) \checkmark$$

$$\therefore t_2 = 123,547^\circ\text{C} \checkmark$$

VRAAG 6: HIDROULIKA

$$\begin{aligned}
 6.1 \quad 6.1.1 \quad P &= \rho \times g \times h \\
 &= 1\,000 \times 9,8 \times 20 \checkmark \\
 &= 196\,kPa \checkmark
 \end{aligned} \tag{2}$$

$$\begin{aligned}
 6.1.2 \quad WD &= P \times V \\
 &= 196 \times 80 \checkmark \\
 Wd &= 15,680\,MJ \checkmark
 \end{aligned} \tag{2}$$

$$\begin{aligned}
 6.1.3 \quad P_{out} &= \frac{\text{Werk verrig}}{\text{tyd}} \\
 &= \frac{15\,680\,kJ}{3\,600\,s} \checkmark \\
 &= 4,355556\,kW \checkmark \\
 \eta &= \frac{P_{uit}}{P_{in}} \times 100\% \\
 &= \frac{4,355556}{5} \times 100\% \checkmark \\
 &= 87,111\% \checkmark
 \end{aligned} \tag{4}$$

$$\begin{aligned}
 6.2 \quad 6.2.1 \quad \frac{F}{D^2} &= \frac{f}{d^2} \\
 \therefore F &= \frac{310 \times 0,2^2}{0,05^2} \checkmark \\
 &= 4960\,kN \checkmark
 \end{aligned} \tag{2}$$

$$\begin{aligned}
 6.2.2 \quad V_R &= V_P \\
 \frac{\pi D^2 h}{4} &= \frac{\pi d^2 H}{4} \times n \\
 D^2 h &= d^2 H n \\
 \therefore h &= \frac{0,05^2 \times 0,7}{0,2^2} \checkmark \\
 &= 0,04375\,m = 43,750\,mm \checkmark
 \end{aligned} \tag{2}$$

$$\begin{aligned}
 6.2.3 \quad D^2 h &= d^2 H n \\
 0,2^2 \times 46 &= 0,05^2 \times 0,7 \times n \\
 \therefore n &= 1051,1429\,slae \checkmark \\
 &\approx 1\,052\,slae \checkmark
 \end{aligned} \tag{2}$$

(3 × 2)

VRAAG 7: ELEKTRISITEIT

$$\begin{aligned}
 7.1 \quad 7.1.1 \quad R_T &= r_T + R_P \\
 R_P &= \frac{1}{\frac{1}{6} + \frac{1}{3}} = 2 \, \Omega \checkmark \\
 r_T &= 0,15 \times 6 = 0,9 \, \Omega \checkmark \\
 \therefore R_T &= 2 + 0,9 = 2,9 \, \Omega \checkmark \quad (3)
 \end{aligned}$$

$$\begin{aligned}
 7.1.2 \quad I_T &= \frac{EMK}{R_T} \\
 &= \frac{1,5 \times 6}{2,9} \checkmark \\
 &= 3,103 \, A \checkmark \quad (2)
 \end{aligned}$$

$$\begin{aligned}
 7.1.3 \quad V &= I_T r_T \\
 &= 3,103 \times 0,9 \checkmark \\
 &= 2,793 \, \text{volt} \checkmark \quad (2)
 \end{aligned}$$

$$\begin{aligned}
 7.2 \quad Q \text{ per dag} &= (10 \times 0,06 \times 4) + (5 \times 0,1 \times 0,6) + (2 \times 1) + (2 \times 0,075 \times 3) \\
 &= 5,15 \, \text{kWh} \checkmark \\
 \text{Vir 7 dae} &= 5,15 \times 7 = 36,05 \, \text{kWh} \checkmark \\
 \therefore \text{Totale koste} &= 36,05 \times 1,63 = R58,76 \checkmark \quad (4)
 \end{aligned}$$

$$\begin{aligned}
 7.3 \quad m &= zIt \\
 &= 3,294 \times 10^{-4} \times 100 \times (2 \times 3\,600) \checkmark \\
 &= 237,168 \, \text{gram} \checkmark \quad (2)
 \end{aligned}$$

[13]

VRAAG 8: CHEMIE

- 8.1 D✓
- 8.2 F✓
- 8.3 A✓
- 8.4 C✓
- 8.5 B✓
- 8.6 E✓

(6 × 1) [6]

TOTAAL: