



higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NASIENRIGLYN

NASIONALE SERTIFIKAAT

MEGANOTEGNIEK N5

15 April 2026

Hierdie nasienriglyn bestaan uit 10 bladsye.

VRAAG 1: EPISIKLIESE RATAANDRYWING

Voor- waarde	B	C	D	E	Arm A
Maak arm L vas & draai A +1 rew.	+1	$\frac{T_B}{T_C} = \frac{81}{25}$ $= 3,24\checkmark$	$3,24\checkmark$	$\frac{T_B}{T_C} \times \frac{T_D}{-T_E} = \frac{81}{25} \times \frac{41}{-15}$ $= -8,856\checkmark$	0
Maal met X & tel Y by	$x + y$	$3,24x + y\checkmark$	$3,24x + y\checkmark$	$-8,856 + y$	y
$N_E =$ 12 000 $N_B = 0$ $N_A = ?$	$0\checkmark$			$12\,000\checkmark$	$N_A = ?$

$$\begin{aligned}
 x + y &= 0 \dots\dots\dots(1)\checkmark \\
 -8,856 + y &= 12\,000 \dots\dots\dots(2)\checkmark \\
 9,856x + 0 &= -12\,000 \checkmark \quad (\text{Vergelyking 1} - \text{Vergelyking 2}) \\
 x &= \frac{-12\,000}{9,856} \\
 x &= \boxed{-1217,53} \checkmark
 \end{aligned}$$

Vervang x in vergelyking 1

$$\begin{aligned}
 -1\,217,53 + y &= 0\checkmark \\
 y &= \boxed{1\,217,53} \checkmark
 \end{aligned}$$

$$\begin{aligned}
 N_A &= y \\
 N_A &= 1\,217,53 \text{ rpm} \\
 \therefore N_A &= \boxed{1\,217,53 \text{ rpm (kloksgewys)}} \checkmark
 \end{aligned}$$

[10]

VRAAG 2: VERVOERBANDE EN BANDAANDRYWINGS

$$2.1 \quad \theta = \frac{176^\circ}{57,3} = 3,072 \text{ rad};$$

Spoed van die band (v)

$$V = \frac{\pi DN}{60}$$

$$V = \frac{\pi(0,15)(200)}{60} \checkmark$$

$$V = \boxed{1,571 \text{ m/s}} \checkmark$$

Spanningsverhouding

$$\left(\frac{T_1}{T_2}\right)$$

$$\frac{T_1}{T_2} = e^{\mu\theta}$$

$$\frac{T_1}{T_2} = e^{0,37(3,072)} \checkmark$$

$$\frac{T_1}{T_2} = \boxed{3,116} \checkmark$$

Spanning in die slap kant

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

$$25 \times 10^3 = (3,116 T_2 - T_2)1,571 \checkmark$$

$$25 \times 10^3 = (2,116 T_2)1,571 \checkmark$$

$$T_2 = \frac{25 \times 10^3}{2,116 \times 1,571}$$

$$T_2 = \boxed{7\,520,53 \text{ N}} \checkmark$$

Spanning in die stywe kant (T_1)

$$\therefore T_1 = 3,116 T_2$$

$$T_1 = 3,116 (7\,520,53) \checkmark$$

$$T_1 = \boxed{23\,433,96 \text{ N}} \checkmark$$

(9)

2.2 Raakhoek indien oorkruisbandaandrywing

$$\sin \alpha = \frac{R + r}{C}$$

$$\sin \alpha = \frac{100 + 75}{1\,500} \checkmark$$

$$\sin \alpha = 0,1167$$

$$\alpha = \sin^{-1}(0,1167) \checkmark$$

$$\alpha = \boxed{6,699^\circ} \checkmark$$

$$\theta = \theta_1 = \theta_2 = 180^\circ + 2\alpha$$

$$\theta = 180^\circ + 2(6,699)^\circ \checkmark$$

$$\theta = 193,398$$

$$\theta = \boxed{193,4^\circ} \checkmark$$

(5)

2.3 Lengte van die band vir oop aandrywing

$$L = \frac{\pi}{2}(D + d) + \frac{(D - d)^2}{4C} + 2C$$

$$L = \frac{\pi}{2}(200 + 150) + \frac{(200 - 150)^2}{4(1500)} + 2(1\,500) \checkmark$$

$$L = 549,779 + 0,417 + 3\,000 \checkmark$$

$$L = 3\,550,2 \text{ mm}$$

$$L = \boxed{3,55 \text{ m}} \checkmark$$

(3)

2.4 Lengte van die band vir kruisaandrywing

$$L = \frac{\pi}{2}(D + d) + \frac{(D + d)^2}{4C} + 2C$$

$$L = \frac{\pi}{2}(200 + 150) + \frac{(200 + 150)^2}{4(1\,500)} + 2(1\,500) \checkmark$$

$$L = 549,779 + 20,417 + 3\,000 \checkmark$$

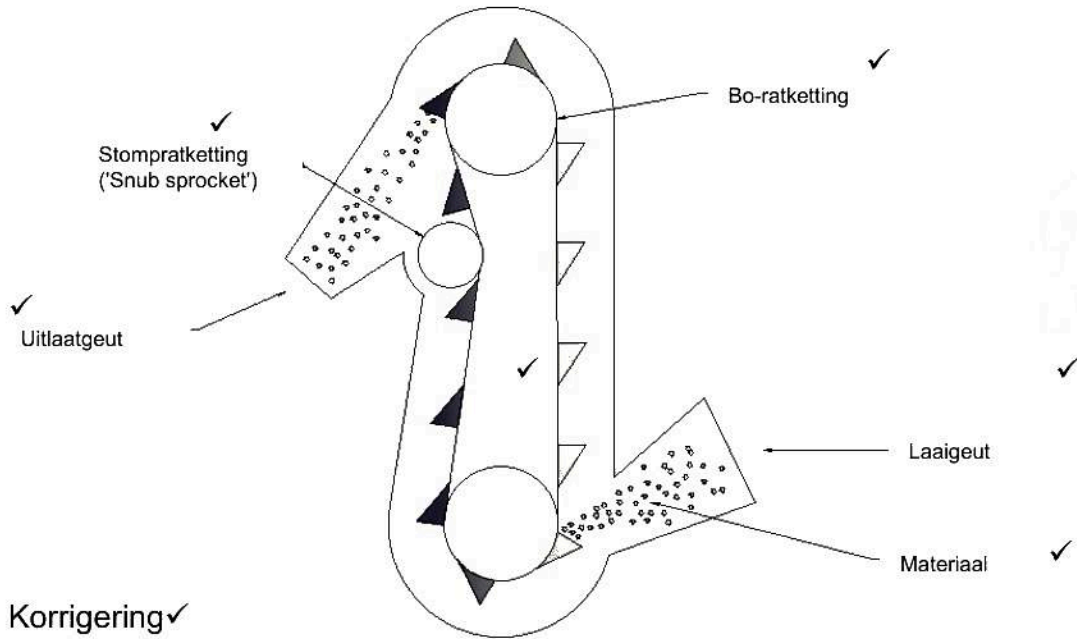
$$L = 3\,570,2 \text{ mm}$$

$$L = \boxed{3,57 \text{ m}} \checkmark$$

(3)
[20]

VRAAG 3: BAKHYSERS

3.1



Korrigerings

Byskrifte

(6)

3.2

$$M_L = 300 \text{ ton/h} = \frac{300 \times 1\,000}{3\,600} = 83,333 \text{ kg/s}$$

$$\text{Volume gelewer} = \frac{83,333}{800}$$

$$\text{Volume gelewer} = 0,104 \text{ m}^3/\text{s}$$

$$\text{Aantal bakke/sek} = \frac{\text{Kettingspoed}}{\text{spasiëring}}$$

$$\text{Aantal bakke/sek.} = \frac{0,45}{1}$$

$$\text{Aantal bakke/sek.} = 0,45 \text{ bak/s}$$

$$\text{Volume/bak} = \frac{\text{Volume van vrag/s}}{\text{Aantal bakke/sek.}}$$

$$\text{Volume/bak} = \frac{0,104}{0,45}$$

$$\text{Volume/bak} = 0,231 \text{ m}^3$$

$$P_g = m \times g \times h$$

$$P_g = 83,333 \times 9,81 \times 58 \checkmark$$

$$P_g = 47\,414,81 \text{ W}$$

$$P_g = \boxed{47,415 \text{ kW}} \checkmark$$

$$\eta = \frac{P_o}{P_i} \times 100$$

$$P_i = \frac{47,415}{0,89}$$

$$P_i = 53\,275,07 \text{ W}$$

$$P_i = \boxed{53,275 \text{ kW}} \checkmark$$

(9)
[15]

VRAAG 4: HYSERS

4.1 Vir versnelling

$$T_1 = m_1 g + m_1 a + F\mu$$

$$T_1 = (1\,600)(9,81) + 1\,600(1,8) + 550 \checkmark$$

$$T_1 = \boxed{19\,126 \text{ N}} \checkmark$$

(2)

4.2 $T_2 = m_2 g - m_2 a - F\mu$

$$T_2 = 600(9,81) - 600(1,8) - 550 \checkmark$$

$$T_2 = \boxed{4\,256 \text{ N}} \checkmark$$

(2)

4.3 $T_{vrag} = (T_1 - T_2)r$

$$T_{vrag} = (19\,126 - 4\,256)2,25$$

$$T_{vrag} = \boxed{33\,457,5 \text{ Nm}} \checkmark$$

(1)

4.4 $T_{trom} = I \times \alpha$

$$T_{trom} = I \times \frac{a}{r}$$

$$T_{trom} = 180 \times \frac{1,8}{2,25} \checkmark$$

$$T_{trom} = \boxed{144 \text{ Nm}} \checkmark$$

$$T_{Totaal} = T_{vrag} + T_{trom}$$

$$T_{Totaal} = 33\,457,5 + 144$$

$$T_{Totaal} = \boxed{33\,601,5 \text{ N.m}} \checkmark$$

$$P = T_{Totaal} \times \omega$$

$$T_{motor} = 33\,601,5 \times \left(\frac{2,7}{2,25}\right) \checkmark$$

$$T_{motor} = \boxed{40\,321,8 \text{ Nm}} \checkmark$$

VRAAG 5: SPOOR- EN PADTRAKSIE

$$5.1 \quad u = \frac{27}{3,6} = 7,5 \text{ m/s} \checkmark$$

$$v = \frac{72}{3,6} = 20 \text{ m/s} \checkmark$$

$$v = u + at$$

$$a = \frac{v - u}{t}$$

$$a = \frac{20 - 7,5}{20} \checkmark$$

$$a = \boxed{0,625 \text{ m/s}^2} \checkmark$$

$$F = ma$$

$$F = 2 \times 10^3 (0,625)$$

$$F = \boxed{1\,250 \text{ N}} \checkmark$$

(5)

$$5.2 \quad v^2 = u^2 + 2as$$

$$s = \frac{v^2 - u^2}{2a}$$

$$s = \frac{20^2 - 7,5^2}{2(0,625)} \checkmark$$

$$s = \boxed{275 \text{ m}} \checkmark$$

$$WD = F \times s$$

$$WD = 1\,250 \times 275$$

$$WD = 343\,750 \text{ J}$$

$$WD = \boxed{343,75 \text{ kJ}} \checkmark$$

(3)

$$5.3 \quad P = \frac{WD}{s}$$

$$P = \frac{343\,750}{20} \checkmark$$

$$P = 17\,187,5 \text{ W}$$

$$P = \boxed{17,2 \text{ kW}} \checkmark$$

(2)

[10]

VRAAG 6: Vliegwiele

6.1 $\omega_2 = \omega_1 + \alpha t$
 $\omega_2 = 0 \checkmark + (5,5)(60) \checkmark$
 $\omega_2 = \boxed{330 \text{ rad/s}^2} \checkmark$ (3)

6.2 $\alpha = \frac{\omega_2 - \omega_1}{t}$
 $\alpha = \frac{0 - 330}{70} \checkmark$
 $\alpha = \boxed{-4,714 \text{ rad/s}^2} \checkmark$ (2)
[5]

VRAAG 7: KABELSLEEPWERK EN KABELSWEEFBANE

- 7.1
- Sperrat-en-klink-terughoudingstoestelle: Dis in die dryfrat geïnkorporeer om te keer dat die sleeptrektoerusting trustel.
 - Spilstut-stoptoestelle: Dis op sodanige wyse tussen die spore of aan hul buitekant geïnstalleer dat die trokke dit uit hul pad druk wanneer hulle opwaarts beweeg.
 - Uitskakelspoorstawe: Wanneer 'n trok trubeweeg tydens die opwaartse beweging ontspoor 'n uitskakelspoorstaaf dit en laat dit teen 'n betonblok vasry.
 - Selfsluitende wurmratte: Dis op sodanige wyse ontwerp dat dit nie truggestel kan word deur hysmasjien nie.
 - Ontsporingstoestel: Spoorstawe word met 50 mm tot 75 mm na die buitekant van die spoor verplaas en 'n rangeerbult van bykans dieselfde hoeveelheid word binne die spoorstawe opgestel.
- (Enige 3 × 2) (6)

7.2 7.2.1 For $\frac{6}{7}$ konstruksiekabeloppervlak = $0,36 D^2$

$$Spanning_{Breek} = \frac{Sterkte_{Breek}}{A_{kabel}}$$

$$Spanning_{Breek} = \frac{Sterkte_{Breek}}{0,36 D^2}$$

$$D^2 = \frac{Sterkte_{Breek}}{0,36 \times Spanning_{Breek}}$$

$$D^2 = \frac{640 \times 10^3}{0,36 \times 1\,400 \times 10^6}$$

$$D^2 = 0,001269841$$

$$D = 0,03563 \text{ m}$$

$$D = 0,03563 \text{ m}$$

$$D = \boxed{35,63 \text{ mm}}$$

$$\begin{aligned}
 7.2.2 \quad \text{Kabelmassa per meter} &= \frac{d^2}{250} \\
 \text{Kabelmassa per meter} &= \frac{(35,63)^2}{250} \\
 \text{Kabelmassa per meter} &= \boxed{5,078 \text{ kg/m}} \quad (2)
 \end{aligned}$$

$$\begin{aligned}
 7.2.3 \quad \text{Spanning weens selfgewig} (T_{sw}) &= \frac{m_1 \times g \times s^2}{8h} \\
 T_{sw} &= \frac{5,078 \times 9,81 \times (98)^2}{8(2)} \\
 T_{sw} &= \boxed{29\,901,56 \text{ N}} \quad (2)
 \end{aligned}$$

$$\begin{aligned}
 7.2.4 \quad \text{Spanning weens een vrag} (T_L) &= \frac{m_2 \times g \times s}{4h} \\
 T_L &= \frac{520 \times 9,81 \times (98)}{4(2)} \\
 T_L &= \boxed{62\,489,7 \text{ N}} \quad (2)
 \end{aligned}$$

$$\begin{aligned}
 7.2.4 \quad \text{Veiligheidsfaktor} &= \frac{\text{Breeksterkte}}{T_{sw} + T_L} \\
 &= \frac{640 \times 10^3}{29\,901,56 + 62\,489,7} \\
 \text{Veiligheidsfaktor} &= \boxed{6,927} \quad (4) \\
 &\quad \mathbf{[20]}
 \end{aligned}$$

VRAAG 8: REDUKSIERATKAS

$$\begin{aligned}
 8.1 \quad X &= \frac{m}{2}(T_B + T_C) \quad C = 32, \quad B = 18, \quad D = 28, \quad F = 18, \quad G = 36 \\
 100 &= \frac{4}{2}(T_B + 32) \checkmark \\
 50 &= T_B + 32 \checkmark \\
 T_B &= \boxed{18 \text{ tande}} \checkmark \quad (3)
 \end{aligned}$$

$$\begin{aligned}
 8.2 \quad \frac{N_{in}}{N_{uit}} &= \frac{\text{produk van gedrewe ratte}}{\text{produk van dryfratte}} \\
 \frac{N_A}{N_G} &= \frac{T_C \times T_D \times T_G}{T_B \times T_E \times T_F} \\
 \frac{42}{6,4} &= \frac{32 \times 28 \times 36}{18 \times T_E \times 18} \checkmark \\
 T_E &= \frac{32 \times 28 \times 36 \times 6,4}{18 \times 42 \times 18} \checkmark
 \end{aligned}$$

8.3
$$\text{Snelheidsverhouding} = \frac{N_A}{N_G} = \frac{T_C \times T_D \times T_G}{T_B \times T_E \times T_F} \checkmark$$

$$\text{Snelheidsverhouding} = \frac{42}{6,4} \checkmark$$

$$\text{Snelheidsverhouding} = 6,5625 \checkmark$$

$\therefore$ Verhouding is 1:6,6525 ✓

(4)

[10]

TOTAAL:

100