higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NASIENRIGLYN

NASIONALE SERTIFIKAAT

INGENIEURSWETENSKAP N2

18 November 2022

Hierdie nasienriglyn bestaan uit 9 bladsye.

Kopiereg voorbehou

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VRAAG 1: DINAMIKA

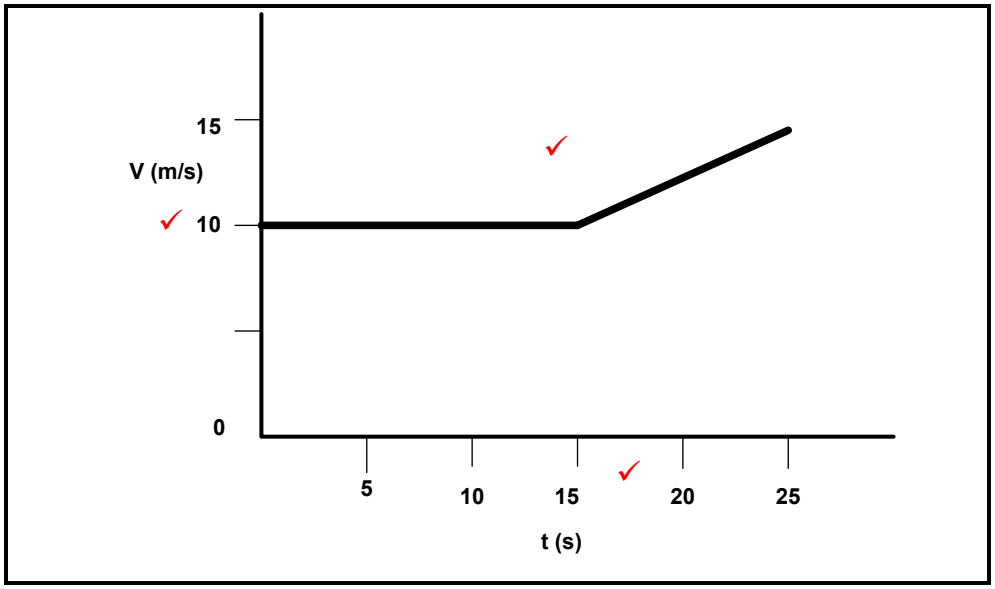
1.1 0,2 cm (1)

1.2 1.2.1 → 6 km oos
← 8 km wes (2)
Verplasing = 8 km – 6 km = 2 km✓ wes✓

1.2.2 $v = \frac{s}{t} = \frac{14}{(\frac{47}{60})}$ ✓ $= 17{,}872$ km/h✓ (2)

1.3 1.3.1 $V = u + at$
$= 10 + (0{,}5)(10)$ ✓
$= 15$ m/s✓ (2)

1.3.2



(3)

1.4 1.4.1 $S = lb + \frac{1}{2}bh$
$= (10 \times 25) + (\frac{1}{2} \times 10 \times 5)$ ✓
$= 250 + 25$ ✓
$= 275$ m✓ (3)

1.4.2 $V = \frac{s}{t} = \frac{275}{25}$ ✓ $= 11$ m/s✓ (2)
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VRAAG 2: STATIKA

2.1 'n Stelsel kragte sal in ewewig wees as die som van die kloksgewyse momente gelyk is aan die som van die antikloksgewyse momente✓ om dieselfde draaipunt.✓ (2)

2.2 2.2.1 Neem momente om B

∑CWM = ∑ACWM
$(A \times 9{,}5) = (168 \times 6) + (245 \times 11)$ ✓
$9{,}5A = 1008 + 2695$ ✓
$9.5A = 3703$
$A = 389{,}789$ N✓

Neem momente om A

∑CWM = ∑ACWM
$(168 \times 3{,}5) + (200 \times 9{,}5) = (245 \times 1{,}5) + (B \times 9{,}5)$ ✓
$588 + 1900 = 367{,}5 + 9{,}5B$ ✓
$B = 223{,}211$ N ✓ (6)

2.2.2 $\sum\uparrow = \sum\downarrow$

$$223{,}211 + 389{,}789 = 245 + 168 + 200$$
$$613N = 613N \checkmark$$ (1)

2.3
- Tapdraaier
- Vleuelmoer
- Wielsleutel

(Enige EEN) (1)

[10]

VRAAG 3: ENERGIE EN MOMENTUM

3.1 Potensiaalenergie is die energie wat 'n voorwerp het weens die massa✓ en hoogte daarvan.✓ (2)

3.2 3.2.1 m = 3 t = 3 000 kg V = 92 km/h = 25,556 m/s

$$E_k = \frac{1}{2}mv^2$$
$$= \frac{1}{2}(3000)(25{,}556)^2 \checkmark$$
= 979663,704 J OF 979 629,63 J OF $= 979{,}630$ kJ ✓ (2)

3.2.2 $P = mv$
$= 3000 \times 25{,}556$
= 76 668 kg.m/s✓ OF 76666,667 kg.m/s (1)

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3.3 $Ep = mgh$

$h = \frac{E_P}{mg}$

$= \frac{10000}{25 \times 9,8}$ ✓

$= 40,816$ m✓ (2)

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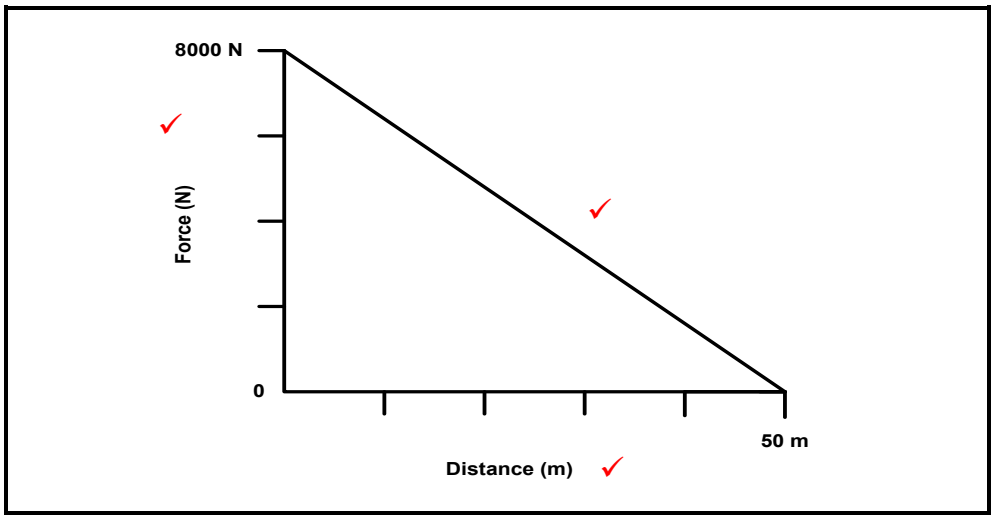
VRAAG 4: ARBEID, DRYWING EN RENDEMENT

4.1 'n Joule is die arbeid verrig wanneer 'n krag van 1 N oor 'n afstand van 1 m in die rigting van 'n krag toegepas word. (1)

4.2 4.2.1



(2)

4.2.2 $W = \frac{1}{2}bh$

$= \frac{1}{2} \times 50 \times 8000$ ✓

= 200 000 J✓ (2)

4.2.3 $P = \frac{W}{t}$ $= \frac{200000}{120}$ ✓ $= 1666,667$ W✓ (2)

4.3 $T = F \times r$

$r = \frac{10,5}{130}$ ✓

$r = 0,081$ m✓

$D = 0,081 \times 2$

$= 0,162$ m✓ OF 161,538 m (3)

[10]

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VRAAG 5: MEGANIESE AANDRYWINGS EN HYSMASJIENE

5.1
- Benodig smering
- Raserig
- Kort afstand tussen asse
- Nie buigsaam nie
- Duur (2)

5.2
- Tussenrat (1)

5.3 $N_A T_A = N_B T_B$ OF $N_a \times T_a = N_c \times T_c$✓

$10 \times 70 = N_B \times 130$ $N_c = \frac{10 \times 70}{65}$✓ $= 10{,}769\ rev/s$✓

$N_B = 5{,}385$ rev/s✓

$N_B T_B = N_C T_C$

$130 \times 5{,}385 = N_C \times 65$ ✓

$N_C = 10{,}769$ rev/s✓ (3)

5.4 5.4.1
$$V = \pi dn$$
$$= \pi(0{,}13)\left(\frac{625}{60}\right) \checkmark\checkmark$$
$$= 4{,}254 \text{ m/s} \checkmark$$ (3)

5.4.2
$$D = \frac{V}{\pi n}$$
$$= \frac{4{,}254}{\pi \times 15} \checkmark$$
$$= 0{,}090 \text{ m} \checkmark \quad = 90 \text{ mm OF } 90{,}273 \text{ mm}$$ (2)

5.4.3
$$\frac{T_1}{T_2} = 1{,}5$$
$$T_2 = \frac{2300}{1{,}5} = 1533{,}333 \text{ N}$$

$$P = (T_1 - T_2)V$$
$$= (2300 - 1533{,}333) \times 4{,}254 \checkmark$$
$$= 766{,}667 \times 4{,}254 \checkmark$$
$$= 3261{,}401 \text{ W} \checkmark$$ (3)

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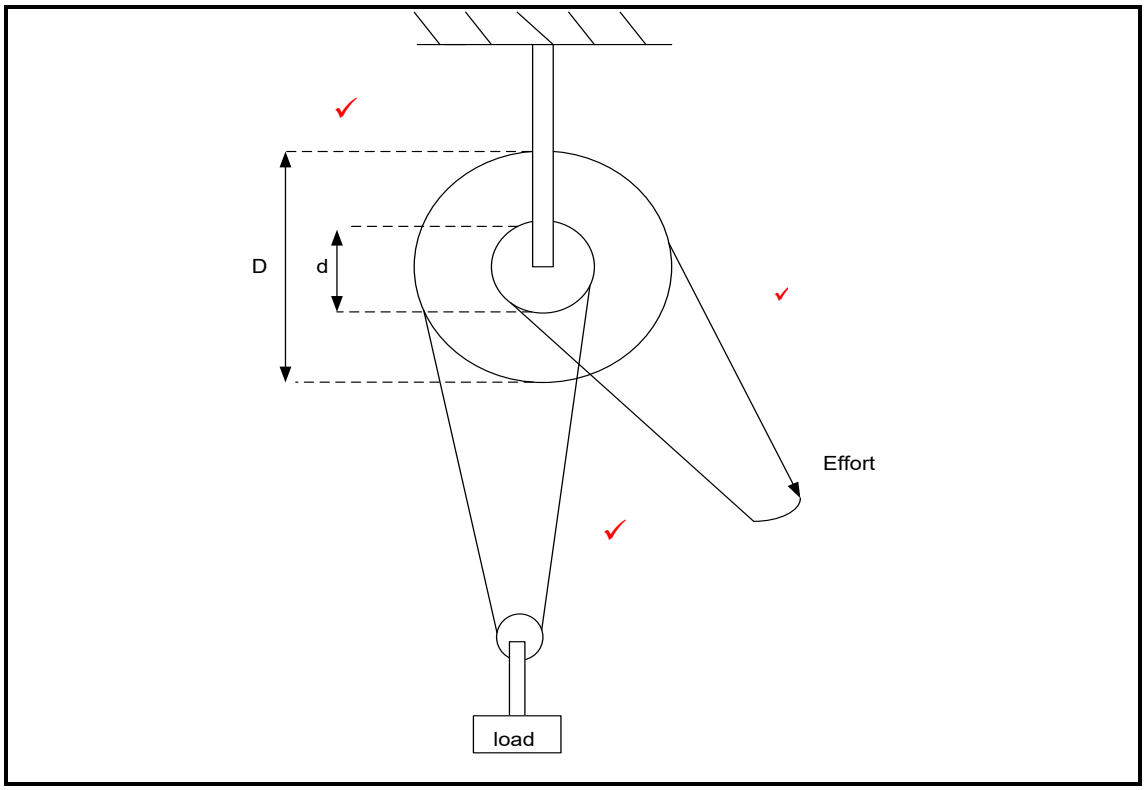
5.5



(3)
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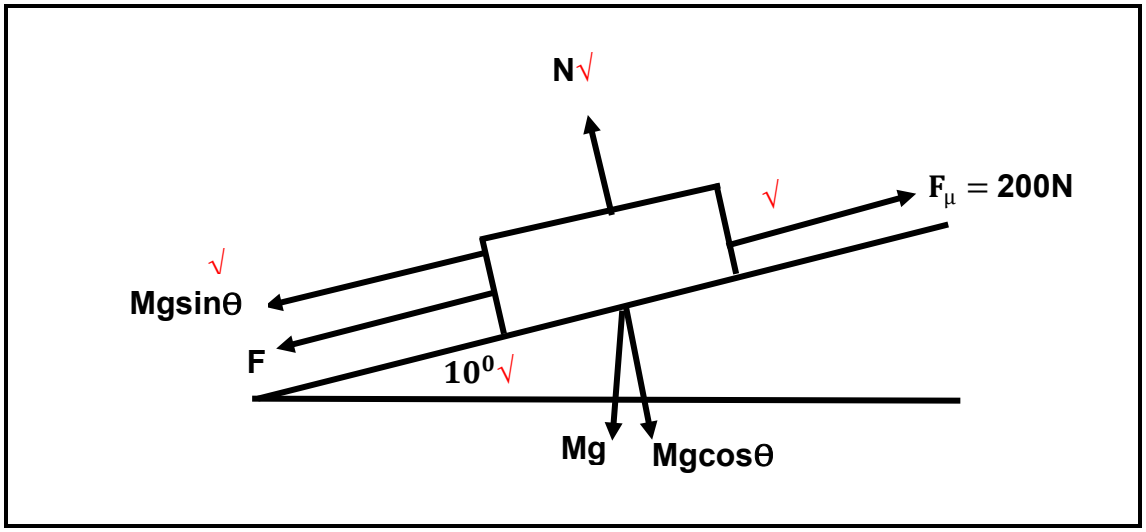
VRAAG 6: WRYWING

6.1
- Wrywing kan lineêre en draaibeweging tot stilstand bring.
- Wrywing word gebruik om toestelle, komponente en masjiene aan te dryf.
- Wrywing word gebruik om 'n werkstuk vas te klamp. (Enige EEN) (1)

6.2



(½ punt vir korrekte diagram)
(½ punt vir loodregte kragte)
(½ punt vir afwaartse kragte)
(½ punt vir teenkragte) (2)

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6.3 6.3.1 $\mu = \frac{F_\mu}{W}$ (2)

$= \frac{200}{70 \times 9{,}8\ cos\ 10^0}$✓

$= 0{,}296$✓

6.3.2 $F_S = w \sin\theta$ (2)

$= 686\ sin\ 1\ 0^0$✓

$= 119{,}123$N✓

6.3.3 $F_d = F_\mu - w \sin\theta$ (2)

$= 200 - 119{,}123$✓

$= 80{,}877$N✓

[9]

VRAAG 7: WARMTE

7.1 Die warmtekapasiteit van 'n stof is die hoeveelheid hitte wat benodig word om die temperatuur van die stof met 1 kelvin of 1 ºC te laat styg. (1)

7.2
- Vaste brandstof – hout, steenkool, ens.
- Vloeibare brandstof – petrol, paraffien, ens.
- Gasbrandstof – metaan, butaan, ens. (3)

7.3
- Massa
- Spesifieke warmtekapasiteit
- Verandering in temperatuur (3)

7.4 $m = \frac{Q}{c\Delta t}$

$= \frac{\div 93730}{4187 \times (-10-15)}$✓ **NB:** Hitte verwerp is negatief.

$= 0{,}895$ kg✓

(2)

7.5 $\Delta L = L_O \alpha \Delta t$

$= 2{,}3 \times 0{,}000017 \times (33-12)$

$= 8{,}211 \times 10^{-4}$ m✓

$L_f = \Delta L + L_O$

$= 8{,}211 \times 10^{-4} + 2{,}3$

$= 2{,}3008$ m✓

(2)

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VRAAG 8: DEELTJIESTRUKTUUR VAN MATERIE

8.1 'n Ioon is 'n atoom wat 'n elektron bygekry of verloor het. (1)

8.2
- Protone – positief
- Neutrone – neutraal
- Elektrone – negatief (3)

8.3 Daar is geen gelaaide ione in suiwer water om elektrisiteit te gelei nie, dus is suiwer water 'n goeie isolator. (2)

8.4
- Elektroplatering
- Raffinering van materiale
- Voorbereiding van chemikalieë
- Korrosie
- Ontginning van materiale uit erts (Enige 2 × 1) (2)

[8]

VRAAG 9: ELEKTRISITEIT

9.1
- Vaste resistors
- Verstelbare resistors (2)

9.2 Die stroom wat in 'n kring vloei, is direk eweredig aan die spanning✓ en omgekeerd eweredig aan die weerstand.✓ (2)

9.3
$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$$
$$\frac{1}{R_1} = \frac{1}{2} - \frac{1}{3}\checkmark$$
$$\frac{1}{R_1} = \frac{1}{6}\checkmark$$
$$R_1 = 6\ \Omega\checkmark$$
(3)

9.4
$$R = \frac{\rho l}{A} \qquad A = \frac{\pi d^2}{4} = \frac{\pi \times (1{,}3 \times 10^{-3})^2}{4} = 1{,}327 \times 10^{-6}\ \text{m}^2\checkmark$$
$$l = \frac{3 \times 1.327 \times 10^{-6}}{0{,}000000018}\checkmark$$
$$= 221{,}167\ \text{m}\checkmark$$
(3)

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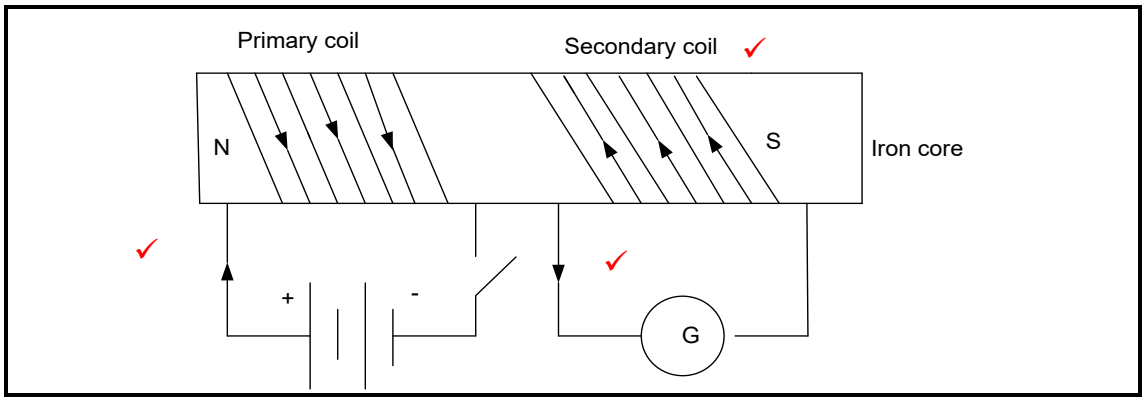
9.5



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TOTAAL: 100

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