



higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NASIENRIGLYN

NASIONALE SERTIFIKAAT

INGENIEURSWETENSKAP N3

30 Julie 2024

Hierdie nasienriglyn bestaan uit 9 bladsye.

VRAAG 1

- 1.1 1.1.1 D
 1.1.2 D
 1.1.3 C
 1.1.4 C
 1.1.5 B
 1.1.6 A

(6 × 1) (6)

- 1.2 Gegee:
 $F_E = 800 \text{ N}$
 $V = 20 \text{ m/s}$
 $D = 0,72 \text{ m}$

1.2.1 $P = F \times V$
 $= 800 \times 20 \checkmark$
 $= 16\,000 \text{ W}$
 $= 16 \text{ kW} \checkmark$

1.2.2 $V = \pi D n$
 $20 = \pi \times 0,72 \times n \checkmark$
 $\therefore n = 8,842 \text{ r/s} \checkmark$

1.2.3 $T_1 = 5 \times 300 \checkmark$
 $= 1\,500 \text{ N} \checkmark$

(3 × 2) (6)

1.3 $M = m \times a$
 $= 450\,000 \times \left(\frac{60\,000}{3\,600}\right) \checkmark$
 $= 750\,000 \text{ kg/ms} \checkmark$

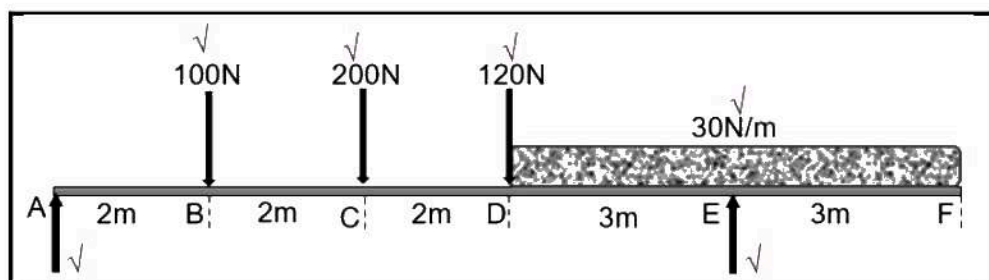
(2)
[14]

VRAAG 2

- 2.1 Volgens die wet van momente is 'n stelsel kragte in ewewig as die som van die linkerkantste momente om die draaipunt $\checkmark$ gelyk is aan die som van die regterkantste momente om dieselfde draaipunt. $\checkmark$

(2)

- 2.2 2.2.1



(3)

2.2.2 Neem momente om A

$$\sum \cup Momente = \sum \cup Momente$$

$$(100 \times 2) + (200 \times 4) + (120 \times 6) + (30 \times 6 \times 9) = E \times 9 \checkmark$$

$$\therefore E = 371,111 N \checkmark$$

Neem momente om E

$$\sum \cup Momente = \sum \cup Momente$$

$$A \times 9 = (100 \times 7) + (200 \times 5) + (120 \times 3) \checkmark$$

$$\therefore A = 228,889 N \checkmark$$

KONTROLEER:

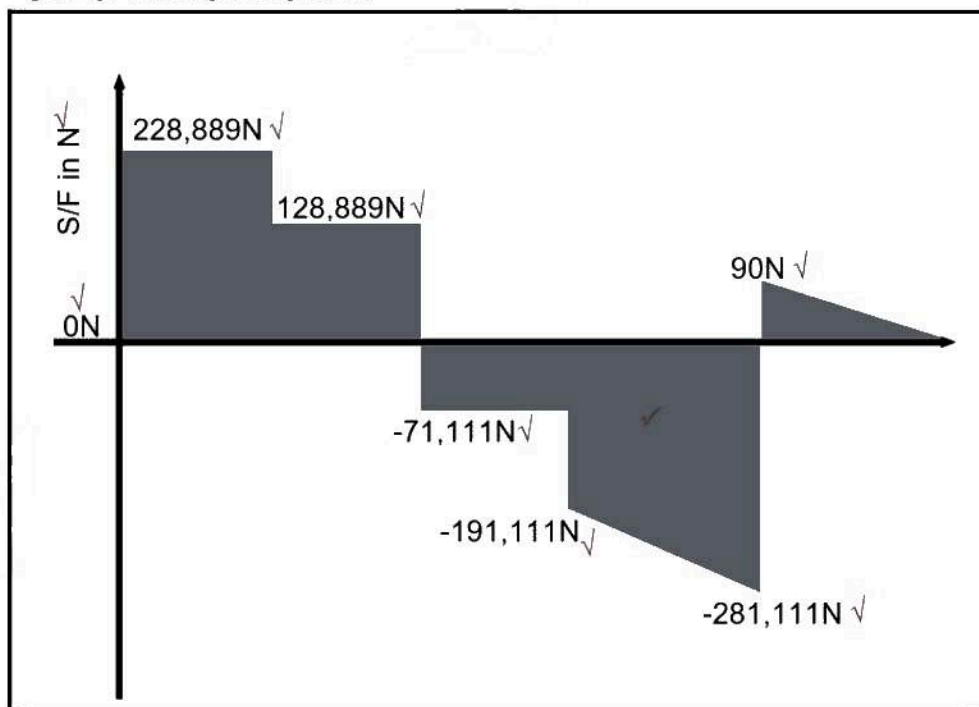
$$\sum \uparrow Kragte = \sum \downarrow Kragte$$

$$371,111 + 228,889 = 100 + 200 + 120 + (30 \times 6)$$

$$600 N = 600 N - \text{Dit is gebalanseerd.} \checkmark$$

(5)

2.2.3 SKEURKRAGDIAGRAM

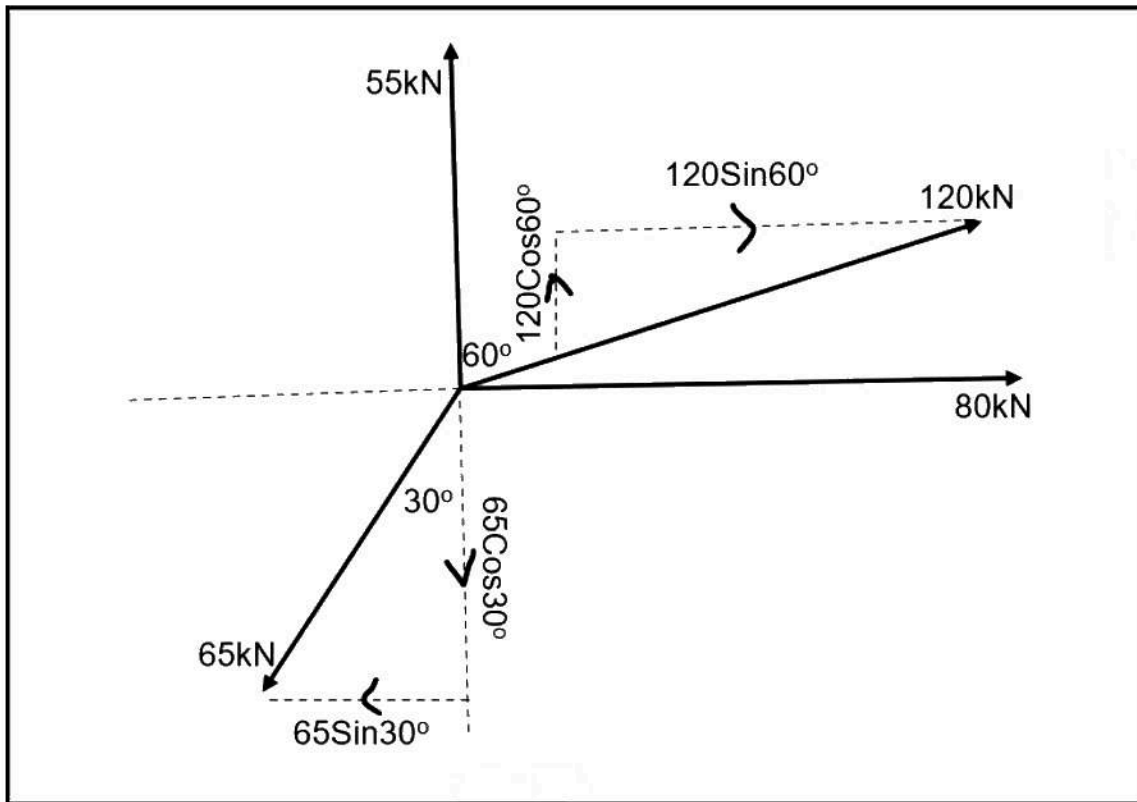


(5)
[15]

VRAAG 3

3.1 'n Ewewigskrag werk in die presiese teenoorgestelde rigting van 'n resultante krag in. (1)

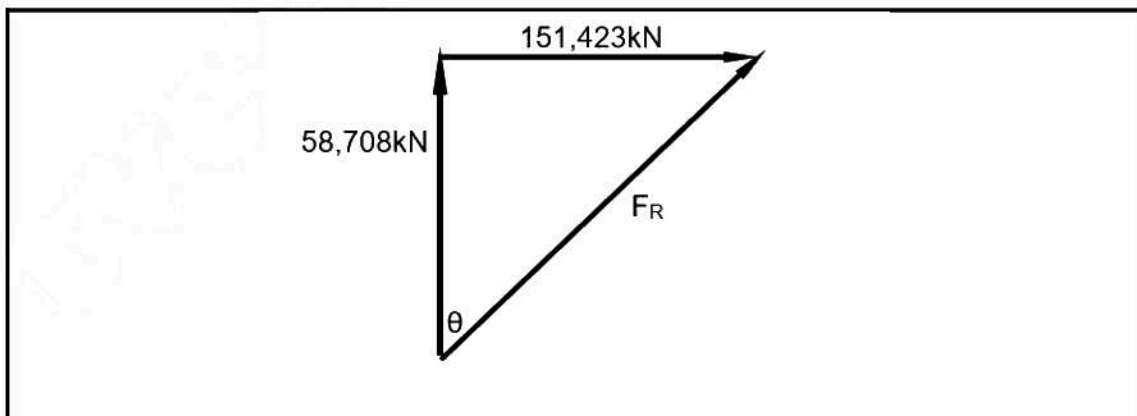
3.2



$$\sum H_{\text{komponente}} = 120 \sin 60^\circ - 65 \sin 30^\circ + 80 = 151,423 \text{ kN (E)} \checkmark \checkmark$$

$$\sum V_{\text{komponente}} = 120 \cos 60^\circ - 65 \cos 30^\circ + 55 = 58,708 \text{ kN (N)} \checkmark \checkmark$$

(4)

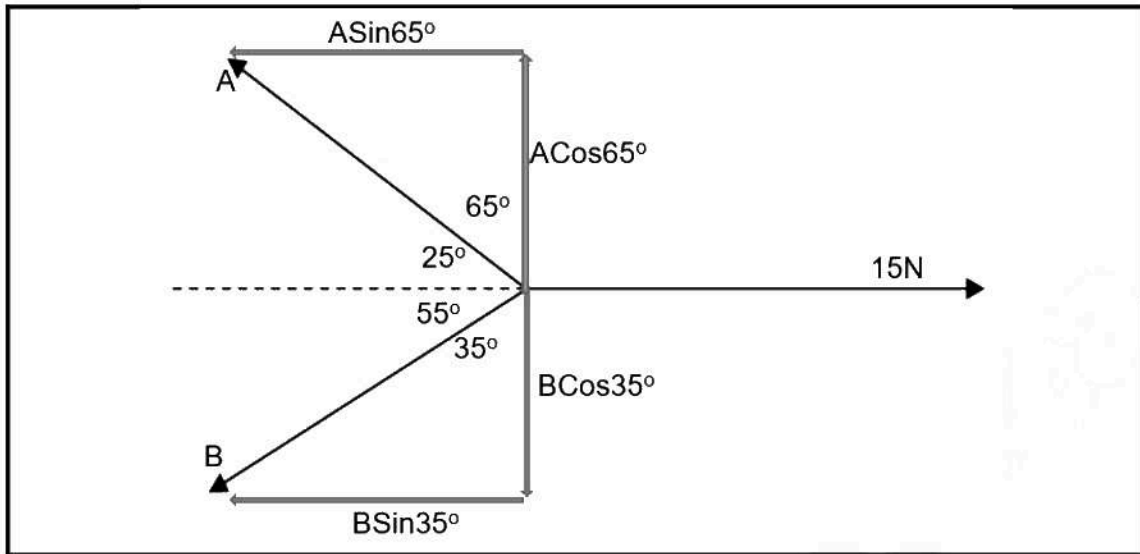


$$F_R = \sqrt{151,423^2 + 58,708^2} \\ = 162,406 \text{ kN} \checkmark$$

$$\theta = \tan^{-1}\left(\frac{151,423}{58,708}\right) \\ = 68,81^\circ \checkmark$$

$$\therefore F_R = 162,406 \text{ kN N}68,8^\circ\text{E} \checkmark$$

3.3



$$\sum H_{\text{komponente}} = 0$$

$$15 - A \sin 65^\circ - B \sin 35^\circ = 0$$

$$A \sin 65^\circ + B \sin 35^\circ = 15 \dots \dots \dots (1) \checkmark$$

$$\sum V_{\text{komponente}} = 0$$

$$A \cos 65^\circ = B \cos 35^\circ$$

$$A = \frac{B \cos 35^\circ}{\cos 65^\circ} \dots \dots \dots (2) \checkmark$$

(2) in (1) $\frac{B \cos 35^\circ}{\cos 65^\circ} \sin 65^\circ + B \sin 35^\circ = 15 \checkmark$

$\therefore B = 6,437 \text{ N} \checkmark$

(2) $\therefore A = 12,477 \text{ N} \checkmark$

(5)
[14]

VRAAG 4

4.1

STATIESE WRYWING	KINETIESE WRYWING
Staan die aanvanklike beweging teë✓	Staan die krag teë wat die beweging veroorsaak✓
Die krag wat nodig is om die liggaam te beweeg	Die krag wat nodig is om die liggaam aan die beweeg te hou

(Enige van die verskille) (2)

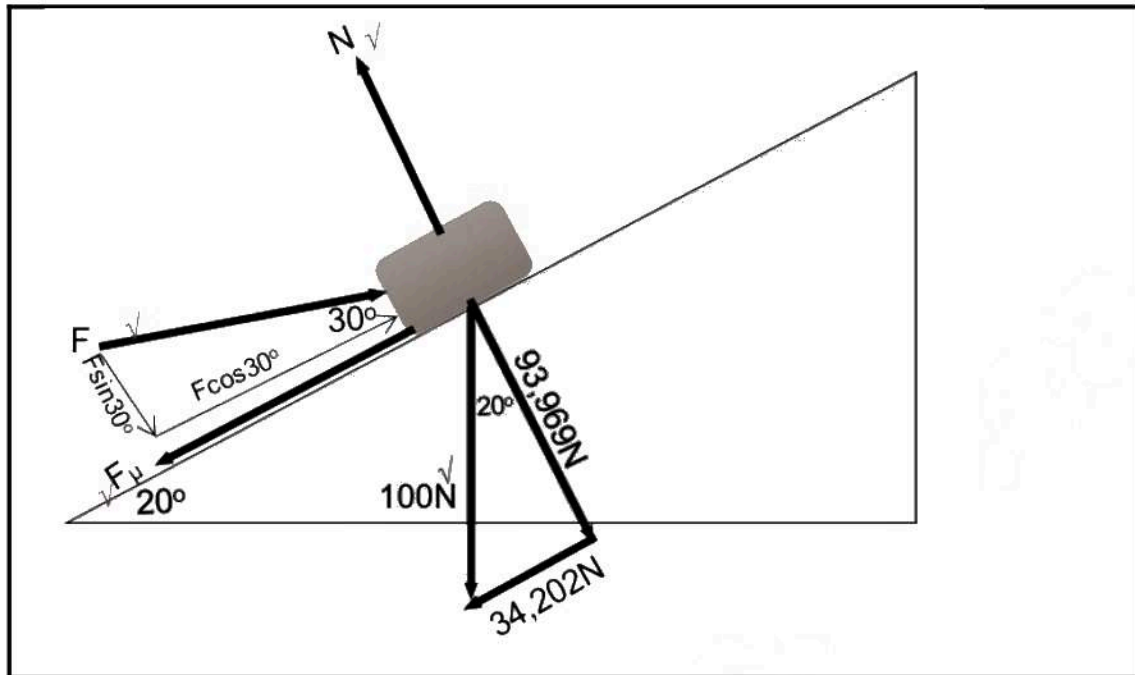
4.2

4.2.1 $100 \sin 20^\circ = 34,202 \text{ N}$

4.2.2 $100 \cos 20^\circ = 93,969 \text{ N}$

(2 × 1) (2)

4.3



(2)

Parallele komponente: $F_\mu = F \cos 30^\circ - 34,202 \dots \dots \dots (1) \checkmark$

Loodregte komponente: $N = F \sin 30^\circ + 93,969 \dots \dots \dots (2) \checkmark$

$$F_\mu = \mu N$$

$$\therefore N = \frac{F_\mu}{\mu}$$

$$\therefore N = \frac{F_\mu}{0,24} = 4,1667 F_\mu \dots \dots \dots (3) \checkmark$$

(3) in (2) $4,1667 F_\mu = F \sin 30^\circ + 93,969$

$$F_\mu = 0,12F + 22,552 \dots \dots \dots (4) \checkmark$$

(1) = (2) $F \cos 30^\circ - 34,202 = 0,12F + 22,552 \checkmark$

$$\therefore F = 76,077N \checkmark$$

(6)

[12]

VRAAG 5

5.1 Die wet van die behoud van hitte-energie lui dat as twee liggame van verskillende temperature bymekaar gebring word, sal die een met die hoër temperatuur hitte afstaan aan die een met die laer temperatuur totdat die twee liggame dieselfde temperatuur of ewewig bereik. $\checkmark$

(2)

- 5.2
- Stoom kan weer gebruik word.
 - Stoom word uit water gevorm, wat gereedelik beskikbaar en goedkoop is.
 - Stoominstallasies het 'n lang lewensduur. (Enige 2×1)

(2)

$$5.3 \quad 5.3.1 \quad \beta = 2\alpha = 2 \times 12 \times 10^{-6} = 24 \times 10^{-6}/^{\circ}\text{C} \quad (1)$$

$$5.3.2 \quad A_f = A_o + \Delta A \\ = (0,34 \times 0,25) + (0,34 \times 0,25 \times 24 \times 10^{-6} \times (60 - 100)) \check{\check{\check{}}} \\ = 84,918 \times 10^{-3} \text{m}^2 \check{\check{}} \quad (4)$$

$$5.4 \quad 5.4.1 \quad h_{nat} = 0,85h_{fg} + h_f \\ = 0,85 \times 2014 + 762 \\ = 2\,473,9 \text{ kJ/kg} \check{\check{}} \\ \\ h_g = 2\,777 \text{ kJ/kg} \check{\check{}} \\ \\ h_{benodig} = h_g - h_{nat} \\ = 2\,777 - 2\,473,9 \\ = 303,1 \text{ kJ/kg} \check{\check{}} \quad (3)$$

$$5.4.2 \quad h_{benodig} = h_{sup} - h_g \\ = 3\,158 - 2\,777 \check{\check{}} \\ = 381 \text{ kJ/kg} \check{\check{}} \quad (2) \\ [14]$$

VRAAG 6

$$6.1 \quad 6.1.1 \quad V = \frac{\pi}{4} \times D^2 \times L_s \\ = \frac{\pi}{4} \times 0,12^2 \times 0,075 \\ = 848,230 \times 10^{-6} \text{m}^3 \check{\check{}} \\ = 848,230 \times \text{cm}^3 \check{\check{}} \quad (2)$$

$$6.1.2 \quad m = \rho \times V \\ = 1\,000 \times 848,230 \times 10^{-6} \\ = 848,230 \times 10^{-3} \text{kg} \\ = 0,848 \text{ kg} \check{\check{}} \quad (1)$$

$$6.1.3 \quad W = \rho \times g \times h \times V \\ = 1\,000 \times 9,81 \times 25 \times 848,230 \times 10^{-6} \check{\check{}} \\ = 208,028 \text{ J} \check{\check{}} \quad (2)$$

$$6.2 \quad 6.2.1 \quad \frac{F}{D^2} = \frac{f}{d^2} \\ \frac{F}{0,3^2} = \frac{260}{0,02^2} \check{\check{}} \\ \therefore F = 58\,500 \text{ N} \check{\check{}} \\ \\ \therefore F = 58\,500/9,8 \\ = 5\,969,388 \text{ kg} \check{\check{}}$$

$$\begin{aligned}
 6.2.2 \quad d^2 \times H \times \text{getal slae} &= D^2 \times h \\
 0,02^2 \times 0,035 \times 90 &= 0,3^2 \times h \quad \checkmark \\
 \therefore h &= 0,014 \text{ m} \quad \checkmark
 \end{aligned}
 \tag{2}$$

$$\begin{aligned}
 6.2.3 \quad V &= \frac{\pi}{4} \times d^2 \times H \times \text{getal slae} \\
 &= \frac{\pi}{4} \times 0,02^2 \times 0,035 \times 150 \quad \checkmark \\
 &= 1,649 \times 10^{-3} \text{ m}^3 \quad \checkmark
 \end{aligned}
 \tag{2}$$

[12]

VRAAG 7

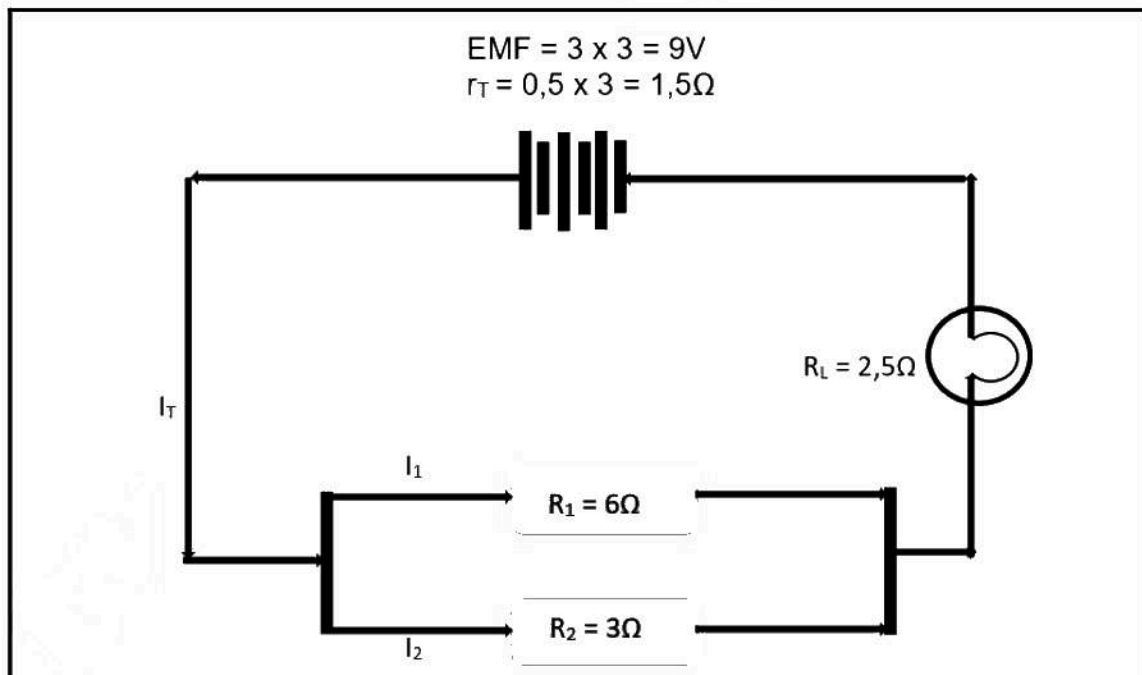
7.1 Die massa van 'n gegewe stof wat by 'n elektrode van 'n sel vrygemaak word, ✓
is direk eweredig aan die hoeveelheid energie wat deur die sel vloei. ✓

OR

In elektrolise is die massa van materiaal wat vrygemaak word direk eweredig
aan die lading.

(Enige 1 × 2) (2)

7.2



$$\begin{aligned}
 7.2.1 \quad R_T &= R_P + R_L + r_T \\
 &= \frac{1}{\frac{1}{6} + \frac{1}{3}} + 2,5 + 1,5 \quad \checkmark \checkmark \checkmark \\
 &= 6 \, \Omega \quad \checkmark
 \end{aligned}$$

(4)

$$\begin{aligned}
 7.2.2 \quad I_T &= \frac{EMF}{R_T} \\
 &= \frac{9}{6} \checkmark \\
 &= 1,5A \checkmark
 \end{aligned}
 \tag{2}$$

$$\begin{aligned}
 7.2.3 \quad V_{3\Omega} &= I_T \times R_P \\
 &= 1,5 \times 2 \\
 &= 3V \checkmark \\
 I_{3\Omega} &= \frac{3}{3} \\
 &= 1A \checkmark
 \end{aligned}
 \tag{2}$$

7.3 Gegee:
 $V = 210\text{ V}$
 $P = 3\text{ kW}$
 $t = 90\text{ minute}$
 Koste = R2,45 per kWh

$$\begin{aligned}
 E &= P \times t \\
 &= 3\,000 \times 90 \times 60 \checkmark \\
 &= 16,2\text{ MJ} \checkmark
 \end{aligned}$$

$$\begin{aligned}
 Koste &= \frac{16,2}{3,6} \times R2,45 \checkmark \\
 &= R11,03 \checkmark
 \end{aligned}
 \tag{4}$$

[14]

VRAAG 8

8.1 Oksidasie is die wins in suurstof✓ en reduksie is die verlies aan suurstof.✓
 OF
 Oksidasie is die verlies aan elektrone en reduksie is die wins in elektrone.
 (Enige 1 × 2) (2)

8.2

8.2.1	NaCl				
8.2.2	CaCO ₃				
8.2.3	H ₂ SO ₄				

(3 × 1) (3)

[5]

TOTAAL: 100