higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

# NASIENRIGLYN

## NASIONALE SERTIFIKAAT

## INGENIEURSFISIKA N6

## 21 November 2024

**Hierdie nasienriglyn bestaan uit 7 bladsye.**

Kopiereg voorbehou

## VRAAG 1

1.1
1.1.1 Onwaar
1.1.2 Waar
1.1.3 Waar
1.1.4 Waar
1.1.5 Waar
1.1.6 Onwaar
1.1.7 Waar
1.1.8 Onwaar
1.1.9 Waar
1.1.10 Onwaar

(10 × 1) (10)

1.2

$$\gamma = \frac{C_p}{Cv}$$
$$\gamma = \frac{850}{620}$$
$$\gamma = 1{,}371\surd$$

$$R = C_p - C_v$$
$$R = 850 - 620$$
$$R = 230\ J/kg°C\surd$$

$$P_1xV_1 = m.R.T_1$$
$$V_1 = \frac{m.R.T_1}{P_1}$$
$$V_1 = \frac{1{,}5x230x302}{126250}$$
$$V_1 = 0{,}825\ m^3\surd$$

$$(P_1xV_1)1^{\gamma} = (P_2xV_2)1^{\gamma}$$

$$126250x0{,}825x1^{1{,}371} = 958000xV_2x1^{1{,}371}$$
$$V_2x1^{1{,}371} = \frac{126250x0{,}825x1^{1{,}371}}{958000}$$

$$V_2 = \sqrt{0{,}101}$$
$$V_2 = 0{,}187\ m^3\surd$$

$$Arbeid\ verrig = \frac{(P_1xV_1) - (P_2xV_2)}{1{,}371 - 1}$$

$$Arbeid\ verrig = \frac{(126250x0{,}825)-(958000x0{,}187)}{1{,}371-1}\surd$$
$$Arbeid\ verrig = -\ 142579{,}043\ J \text{ or } -\ 142{,}579\ kJ\surd$$ (6)

1.3 1.3.1 $f_o = \frac{f_s(V_a + V_o)}{(V_a + V_s)}$

$f_o = \frac{1\,250(340+0)}{(340-0)}$√
$f_o = 1\,250\ m/s$√ (2)

1.3.2 $f_o = \frac{f_s(V_a + V_o)}{(V_a + V_s)}$

$f_o = \frac{1\,250(340+0)}{(340+16{,}667)}$√√
$f_o = 1\,191{,}588\ m/s$√ (3)

1.4 1.4.1 $V = f\ x\ \lambda_o$
$V\ f\ x\ (2l)$
$334 = 268\ x\ 2l$√
$l = \frac{334}{2\ x\ 268}$
$l = 0{,}623\ m$√

1.4.2 $V = f\ x\ \lambda_o$
$V\ f\ x\ (4l)$
$334 = 268\ x\ 4l$
$l = \frac{334}{4\ x\ 268}$
$l = 0{,}311\ m$√

(2 × 2) (4)
**[25]**

**VRAAG 2**

2.1 2.1.1 Onwaar
2.1.2 Onwaar
2.1.3 Waar
2.1.4 Waar
2.1.5 Waar

(5 × 1) (5)

2.2 Warmteverlies deur stoom teen 100 °C + Warmteverlies deur water teen 100 °C = Warmtewins ✓

(1 kg × X)✓ + 4 200 J/kg.K × 25 K × 1✓ = 4 200 J/kg.K × 30 × 19✓

1 kg × X = 238 650 – 125 610✓

X = 228 900 J/kg **OF** 0,2289 MJ/k✓ (6)

2.3

$$58\ liter = 0{,}058\ m^3 \quad \surd$$
$$R = C_p - C_v$$
$$R = 1{,}006 - 0{,}717$$
$$R = 0{,}289 \frac{kJ}{kg}.K \surd$$

$$Teen\ konstante\ druk$$
$$T_1 = 200 + 273 = 473\ K$$
$$T_2 = 45 + 273 = 723\ K$$
$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$
$$\frac{V_1}{T_1}\ x\ T_2 = V_2$$
$$\frac{0{,}058}{473}\ x\ 723 = V_2 \surd$$
$$V_2 = 0{,}089\ m^3 \surd$$

$$Verandering\ in\ entropie = C_p \text{ x ln } \frac{V_2}{V_1}$$
$$Verandering\ in\ entropie = 1{,}006\ x\ ln \text{ x } \frac{0{,}089}{0{,}058} \surd$$
$$Verandering\ in\ entropie = 0{,}431\ kJ/kg.K \surd$$ (6)

2.4 Warmte-wins deur water (Q) = m x shc × ∆t

Q = 280 × 4200 × (96 – 25)√√

Q = 83,496 MJ√

Warmteverlies deur steenkool = m × HV

$Q_{lost} = Q_{gained}$

m x HV = 8349600 × ŋ√√

$$m = \frac{83{,}496 \times 100}{35 \times 92} \surd$$

m = 2,593 kg√ (8)

**[25]**

## VRAAG 3

3.1 Die elektriese veldintensiteit by 'n punt is die krag wat 'n eenheid positiewe lading✓ by hierdie punt ondergaan.✓ (2)

3.2 3.2.1

$$E = \frac{Q}{4\pi\varepsilon_o r^2}$$
$$= \frac{1x10^{-7}\ x9x10^9}{(0{,}1)^2}$$
$$= 900x10^2 = 90000 N/C$$

3.2.2 $$V = \frac{Q}{4\pi\varepsilon_o a}$$
$$= \frac{1x10^{-7}\,x9x10^{9}}{0{,}1}$$
$$= 9000V$$

(2 × 3) (6)

3.3 $$Indien\ die\ 15\ \mu C - lading\ vas\ is.$$
$$Potensiaalverskil = \frac{Q}{4\pi\varepsilon_0}\left(\frac{1}{a} - \frac{1}{b}\right)$$
$$Potensiaalverskil = 15\ x\ 10^{-6}\ x\ 9\ x\ 10^{9}\left(\frac{1}{0{,}04} - \frac{1}{0{,}08}\right)\ \checkmark$$
$$Potensiaalverskil = 1{,}6875\ MV\ \checkmark$$
$$WD\ om\ 10\ \mu C\ na\ 4\ cm\ te\ beweeg$$
$$WD = 10\ x\ 10^{-6}\ x\ 1{,}6875\ x\ 10^{6}$$
$$WD = 16{,}875\ J\ \checkmark$$

(3)

3.4 3.4.1 V = E × d
V = 1150 × 1 × $10^{-3}$
V = 115 Volt

3.4.2 F = E × Q
F 1,15 × $10^{4}$ × 2 × $10^{-9}$
F = 2,3 × $10^{-5}$ N

3.4.3 W = V × Q
W = 115 × 1 × $10^{-9}$
W = 1,15 × $10^{7}$

(3 × 2) (6)

3.5 3.5.1 $$\vartheta = \frac{\varepsilon_o\ x\ V}{r}$$

$$\vartheta = \frac{8{,}85\ x\ 10^{-12}\ x\ 30\ 000}{1\ x\ 10^{-2}}\ \checkmark$$

$$\vartheta = 2{,}655\ x\ 10^{-6}\ Coulum/m2\checkmark$$

3.5.2 $$E = \frac{\vartheta}{\varepsilon_o}$$
$$E = \frac{30\ 000}{10^{-12}}\checkmark$$
$$E = 3\ x\ 10^{6}\ V/m\checkmark$$

(2 × 2) (4)

3.6 3.6.1 Coulomb se wet
3.6.2 Gauss se wet
3.6.3 Diëlektriese konstante
3.6.4 Kapasitansie

(4 × 1) (4)
**[25]**

**VRAAG 4**

4.1 $C = \frac{kEoA}{d}$

$C = \frac{1,2 \times}{} \frac{10^6 \times 8.9 \times 10^{-12} \times 25}{2,72}$✓

$= 9,11 \times 10^{-7}$ F

Energie = ½ CV²

= ½ × 9,11 × $10^{-7}$ × (1,2 × $10^6$)²✓

= 4 555 Joule✓ (4)

4.2 4.2.1 $I = \frac{Q}{T} = \frac{63 \times 10^{-19}}{1,6 \times 10^{-14}}$ ✓✓

$I = 39,375 \times 10^{-5}$ A✓ (3)

4.2.2 $V = \frac{W}{Q} = \frac{8,4 \times 10^{-16}}{1,6 \times 10^{-14}}$✓

V = 5 250 V✓ (2)

4.3 4.3.1 Aangesien die frekwensie van $c = f \times \lambda$

Dus, $f = c/\lambda = \frac{3 \times 10^8 \text{ m/s}}{5 \times 10^{-7} \text{ m}}$✓

$f = 6 \times 10^{14}$ Hz✓ (2)

4.3.2 Die energie van elke proton is

$E = h \times f$

$= 6,630 \times 10^{-34}$ J.s × 6 × $10^{14}$ Hz

$E = 3,98 \times 10^{-19}$ J✓

Maar 1 eV = 1,60 × $10^{-19}$ J

Dus $E = \frac{3,98 \times 10^{-19} \text{ J}}{1.6 \times 10^{-19} \text{ J}}$ ✓

E = 2,49 eV✓ (3)

4.4 4.4.1 Aantal disintegrerings per sekonde

$$No = \frac{1\,012 \times 0{,}693}{30 \times 24 \times 60 \times 60}$$

$No = 2{,}7 \times 10^5$ (3)

4.4.2 Tyd vir $N = 10^4$ om oor te bly

$N = 10^4$

$10^4 = 10^{12}\, e^{-\lambda t}$

Neem logs tot die basis van 10

$- 8 = - \lambda.t \log e$

$t = \frac{8\lambda \times 1}{\log e}$

t = 64 dae (2)

4.4.3 Aantal disintegrerings per uur $= \frac{0.693 \times 10^4}{30 \times 24}$

= 9,6 (2)

4.5 4.5.1 Elektron (- lading)
4.5.2 Neutron (geen lading nie)
4.5.3 Kern (geen lading nie)
4.5.4 Proton (+ lading)

LET WEL: 4.5.2 en 4.5.4 mag afgewissel word

(4 × 1) (4)
**[25]**

**TOTAAL: 100**

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