



higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NASIENRIGLYN

NASIONALE SERTIFIKAAT

FLUÏEDMEGANIKA N5

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Hierdie nasienriglyn bestaan uit 5 bladsye.

VRAAG 1

- 1.1 Die verhouding van massa tot volume, kg/m^3 .
- 1.2 Die verhouding van die digtheid van die stof tot die digtheid van die water onder normale toestande. Geen eenheid nie.
- 1.3 Die meting van 'n vloeistof se interne wrywing **OF** 'n vloeistof se weerstand tot vloei, Pa.s.
- 1.4 Die krag waarteen die aarde 'n voorwerp aantrek, Newton (N).

(4 × 2)

[8]

VRAAG 2

- 2.1 In 'n ingeslote houer werk die vloeistofdruk eweredig loodreg op die wande van die houer in.
- 2.2 $P_{atm} = \rho gh \checkmark = 13600 \times 9,81 \times 0,762 = 101,663 \text{ kPa} \checkmark$

(2)

$$P_{ben} = P_{atm} = 1000 \times 0,8757 \times 9,81h \checkmark = 101,6631 \times 10^3 \Rightarrow 11,794 \text{ m} \checkmark$$

(4)

[6]

VRAAG 3

- 3.1
 - Beswaarde akkumulator
 - Veerbelaaide akkumulator
 - Gasakkumulator
 - Blaasakkumulator

(4)

$$3.2 \quad 3.2.1 \quad \frac{\eta \times F_{pl}}{d_{pl}^2} = \frac{F_{ram}}{d_{ram}^2} \checkmark \Rightarrow F_{pl} = 35^2 \times \frac{18,5}{0,88 \times 150^2} \checkmark = 1,145 \text{ kN} \checkmark$$

(3)

$$3.2.2 \quad MA = \frac{F_{pl}}{F_{Lev}} \Rightarrow F_{lev} = \frac{1,145}{30} \checkmark = 38,167 \text{ N} \checkmark$$

(2)

$$3.2.2 \quad V_{pl} = V_{ram}$$

$$n_{str} A_{pl} S L_{plu} = A_r S L_r \checkmark \Rightarrow n_{str} = \frac{150^2 \times 95}{54 \times 35^2} \checkmark = 32,313 \checkmark$$

(3)

[12]

VRAAG 4

$$4.1 \quad P_{ave} = \frac{P_{max} + P_{min}}{2} = \frac{\rho_{oil} g h_{oil}}{2} = \frac{850 \times 9,81 \times 2}{2} \checkmark = 8,339 \text{ kPa} \checkmark \quad (2)$$

$$4.2 \quad F_{average} = A_{aveareg} \times P_{average} = (7 \times 2) \checkmark \times 8,339 = 14 \times 8,339 \checkmark \\ = 116,746 \text{ kN} \checkmark \quad (3)$$

$$4.3 \quad P_{ave} = \frac{P_{max} + P_{min}}{2} = \frac{\rho_{oil} g h_{oil}}{2} = \frac{1000 \times 9,81 \times 2}{2} \checkmark = 9,81 \text{ kPa} \checkmark \quad (2)$$

$$4.4 \quad F_{average} = A_{aveareg} \times P_{average} = 14 \times 9,81 = \checkmark 137,34 \text{ kN} \checkmark \quad (2)$$

[9]

VRAAG 5

$$5.1 \quad W_b = F_b \\ m_{buoy} g \checkmark = \rho_w g V_{dis} \checkmark \\ m_{buoy} = 1000 \times \frac{\pi \times 0,8^2}{4} \times 1,95 \times \frac{52}{100} \checkmark = 509,692 \text{ kg} \checkmark \quad (4)$$

$$5.2 \quad W_{buoy} = F_{bouyancy} \\ m_{buoy} g \checkmark = \rho_{water} g V_{displaced} \checkmark \\ 509,692 = 1026 \times \frac{\pi \times 0,8^2}{4} \times 1,95 \times \frac{\% d}{100} \checkmark \\ \Rightarrow \% d = \frac{470,485 \times 4 \times 100}{1026 \times \pi \times 0,8^2 \times 1,95} \checkmark = 50,68\% \checkmark \quad (5)$$

[9]

VRAAG 6

6.1 6.1.1 Die energie waarom 'n voorwerp weens die gewig daarvan beskik.

6.1.2 Die energie waarom 'n voorwerp weens die snelheid daarvan beskik.

(2 × 2) (4)

$$6.2 \quad 6.2.1 \quad Z_1 + \frac{P_1}{\rho g} + \frac{v_1^2}{2g} = Z_2 + \frac{P_2}{\rho g} + \frac{v_2^2}{2g} \checkmark \\ 0 + \frac{P_1}{\rho g} + \frac{20^2}{19,62} \checkmark = 15 + \frac{P_2}{\rho g} + \frac{v_2^2}{19,62} \checkmark \\ v_2 = \sqrt{15 \times 19,62} \checkmark = 17,155 \text{ m/s} \checkmark \quad (5)$$

$$6.2.2 \quad Q_1 = A_1 v_1 = 1000 \times 17,155 \times \frac{\pi \times 0,3^2}{4} = 1212,615 \text{ l/s}$$

VRAAG 7

$$7.1 \quad H_{av} = \frac{h_1 + h_2 + h_3}{n} = \frac{105 + 98 + 94}{3} \checkmark = 99 \text{ mm} \checkmark \quad (3)$$

$$7.2 \quad H_{vel} = h_{Hg} \left(\frac{\rho_{Hg}}{\rho_{oil}} - 1 \right) = 0,099 \left(\frac{13600}{910} - 1 \right) \checkmark = 1,381 \text{ m} \checkmark \quad (2)$$

$$7.3 \quad H_{vel} = \frac{v_{ave}^2}{2g} \Rightarrow v_{ave} = \sqrt{19,62 \times 1,381} \checkmark = 5,205 \text{ m/s} \checkmark \quad (2)$$

$$7.4 \quad Q_{ave} = A \times v_{ave} = \frac{\pi \times 0,25^2}{4} \times 5,205 \times 1000 \checkmark \checkmark = 255,5 \text{ l/s} \checkmark \quad (3)$$

[10]

VRAAG 8

$$8.1 \quad \frac{P_A}{P_B} = \frac{L_A d_B^4}{L_B d_A^4} \checkmark = \frac{0,6 \times 0,22^4}{0,58 \checkmark \times 0,28^4} = 0,3943 \checkmark \quad (4)$$

$$8.2 \quad \frac{H_1}{H_2} = 0,3943 \checkmark \Rightarrow H_1 = 0,3943 H_2 \checkmark \quad \text{and } H_1 + H_2 = 0,2 \checkmark$$

$$\therefore H_2 = 0,1434 \text{ m} \checkmark \quad \text{and} \quad H_1 = 0,05654 \checkmark \text{ m} \checkmark \quad (6)$$

[10]

VRAAG 9

$$9.1 \quad Q_{actual} = \frac{81\,612 \times 10^{-3}}{3600} \checkmark = 22,67 \times 10^{-3} \text{ m}^3/\text{s} \checkmark$$

$$9.2 \quad v_t = \sqrt{2gH} = \sqrt{19,62 \times 8} \checkmark = 12,528 \text{ m/s} \checkmark$$

$$9.3 \quad Q_t = A \times v_t = \frac{\pi \times 0,06^2 \times 12,528}{4} \checkmark = 35,422 \times 10^{-3} \text{ m}^3/\text{s} \checkmark$$

$$9.4 \quad C_Q = \frac{Q_{actual}}{Q_{theoretical}} = \frac{22,67 \times 10^{-3}}{35,422 \times 10^{-3}} \checkmark = 0,64 \checkmark$$

(4 × 2) **[8]**

VRAAG 10

$$10.1 \quad F_{jet} = \rho A (v_{jet} - u_{plate})^2 \\ = 1000 \times \frac{\pi \times 0,025^2}{4} \checkmark (8 - 0 \checkmark)^2 = 31,416 \text{ N} \checkmark \quad (3)$$

$$10.2 \quad \times y_1 = F_{jet} \times \cos \beta \times y_2 \checkmark \\ 10 \times 9,81 \times 0,35 \times \sin \beta \checkmark = 31,416 \times \cos \beta \times \frac{0,35}{\cos \beta} \checkmark \\ \Rightarrow \beta = \sin^{-1} \left(\frac{31,416}{9,81 \times 10} \right) \checkmark = 18,678^\circ \checkmark \quad (5) \\ [8]$$

VRAAG 11

$$11.1 \quad Q_{th} = \frac{LANK}{60} = \frac{0,255 \times \pi \times 0,115^2 \times 2400 \times 3 \times 1}{4 \times 60} \checkmark = 317,839 \times 10^{-3} \text{ m}^3/\text{s} \checkmark \quad (2)$$

$$11.2 \quad C_Q = \frac{Q_{act}}{Q_{th}} \times 100\% = \frac{310}{317,839} \checkmark = 97,534\% \checkmark \\ \Rightarrow \%Slip = 100\% - 97,534\% = 2,466\% \checkmark \quad (3)$$

$$11.3 \quad H_{total} = H_s + H_f + H_{vd} = 56 + (3,15 + 11,2) + 0,9 = 71,25 \text{ m} \checkmark \quad (1)$$

$$11.4 \quad P_p = \rho g Q H_{tot} = 9810 \times 317,839 \times 10^{-3} \times 71,25 \checkmark = 222,156 \text{ kW} \checkmark \quad (2) \\ [8]$$

TOTAAL: 100