



**higher education  
& training**

Department:  
Higher Education and Training  
**REPUBLIC OF SOUTH AFRICA**

# **NASIENRIGLYN**

**NASIONALE SERTIFIKAAT**

**FLUÏEDMEGANIKA N6**

**6 APRIL 2018**

**Hierdie nasienriglyn bestaan uit 7 bladsye.**

**VRAAG 1**

- 1.1 Egalige vloeï> Die deursneeoppervlakte en die snelheid van die vloeistof is dieselfde by elke agtereenvolgende dwarsnit.✓  
Bestendige vloeï> Die deursneeoppervlakte en die snelheid van die vloeistof wissel van dwarsnit to dwarsnit.✓ (2)
- 1.2. 1.2.1 Dieselfde, ✓ omdat dit parallel loop.✓ (2)
- 1.2.2 Dieselfde, ✓ omdat die hoeveelheid afhanklik is van die deursneeoppervlakte en die stelsel van ① tot ③ aaneenlopend is/Die pype is in serie gekoppel.✓ (2)
- 1.2.3 Verskil, ✓ omdat die deursneeoppervlakte/deursneeë verskill.✓ (2)
- 1.2.4 
$$V = \frac{Q}{A}$$

$$= \frac{0,1254 \times 4}{\pi \times (0,9)^2} \checkmark$$

$$= 0,197 \text{ m/s} \checkmark$$
 (2)
- 1.2.5 
$$V = \frac{Q}{A}$$

$$= \frac{0,1254 \times 4}{\pi \times (0,22)^2} \checkmark$$

$$= 3,299 \text{ m/s} \checkmark$$
 (2)
- 1.2.6 
$$f = 0,005 \left( 1 + \frac{1}{40d} \right) = 0,005 \left( 1 + \frac{1}{40(0,22)} \right) = 0,0056 \checkmark$$
- $$h_f = \frac{f l Q^2}{3 d^5} \quad \text{OF} \quad h_f = \frac{4 f l v^2}{2 g d}$$
- $$= \frac{0,0056 \times 11 \times (0,1254)^2}{3(0,22)^5} \checkmark \quad = \frac{4 \times 0,0056 \times 11 \times (3,299)^2}{2 \times 9,81 \times 0,22} \checkmark$$
- $$= 0,623 \text{ m} \checkmark \quad = 0,618 \text{ m} \checkmark$$
- (3)
- 1.3 1.3.1 
$$C = \sqrt{\frac{2g}{f}}$$

$$= \sqrt{\frac{2 \times 9,81}{0,007}} \checkmark$$

$$= 52,942 \text{ m}^{1/2}/\text{s} \checkmark$$
 (2)

1.3.2  $m = \frac{d}{4} = \frac{0,5}{4} \checkmark = 0,125 \text{ m} \checkmark$

$$Q = AC\sqrt{mi}$$

$$i = \frac{Q^2}{A^2 \times C^2 \times m}$$

$$= \frac{(1,249)^2}{\left[\frac{\pi}{4} \times (0,5)^2\right]^2 \times (52,942)^2 \times 0,125}$$

$$= 0,115 \checkmark$$

$$h_f = i \times L$$

$$= 0,115 \times 1450 \checkmark$$

$$= 167,464 \text{ m} \checkmark$$

NB: Merk verkeerd indien Darcy se formule gebruik is. (6)

1.4  $V_1A_1 = V_2A_2$

$$V_1 = \frac{0,084^2}{0,154^2} V_2 \Rightarrow V_1 = 0,298 V_2 \dots\dots\dots(1) \checkmark$$

$$hf_1 = \frac{4flv^2}{2gd}$$

$$= \frac{4 \times 0,008 \times 30 \times v^2}{2 \times 9,81 \times 0,154} \checkmark$$

$$= 0,318v_1^2 \checkmark$$

$$hf_2 = \frac{4flv^2}{2gd}$$

$$= \frac{4 \times 0,008 \times 40 \times v^2}{2 \times 9,81 \times 0,084} \checkmark$$

$$= 0,777v_2^2 \checkmark$$

$$hf_T = hf_1 + hf_2$$

$$11 = 0,318v_1^2 + 0,777v_2^2 \dots\dots\dots(2) \checkmark$$

Vervang (1) in (2)

$$11 = 0,318 (0,298v_2)^2 + 0,777v_2^2$$

$$V_2 = 3,697 \text{ m/s} \checkmark$$

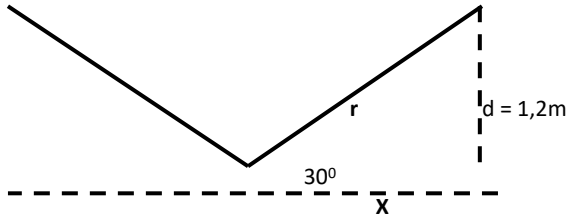
$$Q_2 = 3,697 \times \frac{\pi}{4}(0,084^2) = 0,021 \text{ m}^3/\text{s} \quad (8)$$

**[31]**

**VRAAG 2**

2.1 'n Klein opening aan die kant van die reservoir. (1)

2.2



$$x = \frac{1,2}{\tan 30} = 2,078 \text{ m} \checkmark$$

$$r = \frac{1,2}{\sin 30} = 2,4 \text{ m} \checkmark$$

$$A = \frac{1}{2} \times (2 \times 2,078) \times 1,2 \checkmark = 2,494 \text{ m}^2 \checkmark \quad \text{OR} \quad A = L \times B = 2,078 \times 1,2 \checkmark$$

$$= 2,494 \text{ m}^2 \checkmark$$

$$P = 2(2,4) = 4,8 \text{ m} \checkmark$$

$$m = \frac{A}{P} = \frac{2,494}{4,8} \checkmark = 0,520 \text{ m} \checkmark$$

$$C = \frac{87}{1 + \frac{k}{\sqrt{m}}}$$

$$= \frac{87}{1 + \frac{0,276}{\sqrt{0,52}}} \checkmark = 62,912 \checkmark$$

$$Q = AC \sqrt{mi}$$

$$i = \frac{Q^2}{A^2 \times C^2 \times m}$$

$$= \frac{5,783^2}{2,494^2 \times 62,912^2 \times 0,52} \checkmark$$

$$= 0,00261 \checkmark$$

$$= 1 : 382,506 \checkmark \text{ OF } 1 \text{ in } 382,506$$

(12)

2.3

$$Q = Cd \times \frac{8}{15} \times \sqrt{2g} \times \tan \frac{\theta}{2} \times H^{2,5} \checkmark$$

$$0,145 = 0,6 \times \frac{8}{15} \sqrt{2 \times 9,81} \times \tan \frac{90}{2} \times H^{2,5} \checkmark$$

$$H^{2,5} = 0,1023 \checkmark$$

$$H = 0,402 \text{ m}$$

$$= 401,742 \text{ mm} \checkmark$$

(4)

2.4

$$\begin{aligned}
 VA &= gx22y & \text{OF} & \quad VA = Cv2gh \sqrt{\quad} \sqrt{\quad} \\
 &= \sqrt{\frac{9,81 \times (5,3)^2}{2 \times 2,1}} \sqrt{\frac{gx^2}{2y}} = Cv\sqrt{2gh} \\
 &= 8,1 \text{ m/s} \sqrt{\frac{9,81 \times 5,3^2}{2 \times 2,1}} = 0,89\sqrt{2 \times 9,81 \times h} \\
 V_{th} &= \frac{VA}{Cv} & h &= 4,222 \text{ m} \\
 V_{th} &= \frac{8,1}{0,89} \\
 &= 9,101 \text{ m/s} \\
 V_{th} &= \sqrt{2gh} \\
 9,101 &= \sqrt{2 \times 9,81 \times h} \\
 h &= 4,222 \text{ m}
 \end{aligned} \tag{6}$$

2.5 Dit is 'n opening aan die kant van die reservoir wat bokant die vryoppervlak uitstaan en enige geskikte geometriese vorm het. (2)  
[25]

**VRAAG 3**

3.1 3.1.1 Vir 1 pomp

$$\begin{aligned}
 Q &= \frac{22500}{1000 \times 3600} = 0,00625 \text{ m}^3/\text{s} \\
 P &= \frac{\rho g Q H}{\eta} \\
 &= \frac{10^3 \times 9,81 \times 0,00625 \times 335}{0,86} \\
 &= 23,88 \text{ kW}
 \end{aligned} \tag{4}$$

3.1.2

$$\begin{aligned}
 H_{f1} &= 335 - 320 = 15 \text{ m} \\
 \frac{H_{f2}}{H_{f1}} &= \left(\frac{Q_2}{Q_1}\right)^2 \\
 H_{f2} &= 15 \left(\frac{0,0125}{0,00625}\right)^2 = 60 \\
 H &= 320 + 60 = 380 \\
 P &= \frac{103 \times 9,81 \times 0,0125 \times 380}{0,86} \\
 &= 54,183 \text{ kW}
 \end{aligned} \tag{6}$$

3.2 3.2.1

$$\begin{aligned}
 H_m &= \frac{P}{\rho g} \\
 &= \frac{285 \times 10^3}{10^3 \times 9,81} \\
 &= 29,052 \text{ m}
 \end{aligned}$$

3.2.2

$$\begin{aligned}
 H_T &= \frac{H_m}{\eta} \\
 &= \frac{29,052}{0,65} \\
 &= 44,695 \text{ m}
 \end{aligned}$$

$$\begin{aligned}
 3.2.3 \quad U_o &= \frac{\pi D N}{60} \\
 &= \frac{\pi \times 0,365 \times 1100}{60} \checkmark \\
 &= 21,022 \text{ m/s} \checkmark
 \end{aligned}$$

$$\begin{aligned}
 3.2.4 \quad a &= \pi D \text{ Width} \\
 &= \pi \times 0,365 \times 0,014 \checkmark \\
 &= 0,0161 \text{ m}^2 \checkmark
 \end{aligned}$$

$$\begin{aligned}
 3.2.5 \quad V_{fo} &= \frac{Q}{a} \\
 &= \frac{0,0208}{0,0161} \checkmark \\
 &= 1,298 \text{ m/s} \checkmark
 \end{aligned}$$

$$\begin{aligned}
 3.2.6 \quad V_{wo} &= \frac{g H}{U_o \times \eta_m} \\
 &= \frac{9,81 \times 29,052}{21,022 \times 0,65} \checkmark \\
 &= 20,857 \text{ m/s} \checkmark
 \end{aligned}$$

(6 × 2) (12)

$$\begin{aligned}
 3.3 \quad 3.3.1 \quad P_{in} &= \frac{\rho g Q w.g}{\eta} \\
 &= \frac{1 \times 9,81 \times 550 \times 0,0484}{60 \times 0,78} \checkmark \\
 &= 5,58 \text{ W} \checkmark
 \end{aligned} \tag{2}$$

$$\begin{aligned}
 3.3.2 \quad \frac{P_2}{P_1} &= \left( \frac{N_2}{N_1} \right)^3 \\
 P_2 &= \left( \frac{350}{500} \right)^3 \times 5,579 \checkmark \\
 &= 1,914 \text{ W} \checkmark
 \end{aligned} \tag{2}$$

3.3.3 Indien die waaierspoed verminder, verminder die krag ook. (1)  
[27]

**VRAAG 4**

$$\begin{aligned}
 4.1 \quad 4.1.1 \quad V &= \sqrt{2gh} \\
 &= \sqrt{2 \times 9,81 \times 40,5} \checkmark \\
 &= 28,189 \text{ m/s} \checkmark
 \end{aligned} \tag{2}$$

$$\begin{aligned}
 4.1.2 \quad U &= \frac{\pi D N}{60} \\
 &= \frac{\pi \times 2,3 \times 145}{60} \checkmark \\
 &= 17,462 \text{ m/s} \checkmark
 \end{aligned} \tag{2}$$

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$$\begin{aligned}
 4.1.3 \quad E &= \frac{U_i \times (V_{wi} - V_{wo})}{g} \\
 &= \frac{17,462 \times (20 - 5)}{9,81} \checkmark \\
 &= 26,7 \text{ m} \checkmark
 \end{aligned}$$

$$\begin{aligned}
 H &= \frac{E}{H} \\
 &= \frac{26,7}{45} \times 100 \% \checkmark \\
 &= 59,334 \% \checkmark
 \end{aligned} \tag{4}$$

$$\begin{aligned}
 4.2 \quad 4.2.1 \quad V &= C_v \sqrt{2gh} \\
 &= 0,98 \sqrt{2 \times 9,81 \times 289} \checkmark \\
 &= 73,795 \text{ m/s} \checkmark
 \end{aligned} \tag{2}$$

$$\begin{aligned}
 4.2.2 \quad Q &= V A \\
 A &= \left( \frac{7660}{3600} \div 3 \right) \div 73,795 = 0,00961 \text{ m}^2 \checkmark \\
 \frac{\pi D^2}{4} &= 0,00961 \\
 D &= 110,623 \text{ mm} \checkmark
 \end{aligned} \tag{2}$$

$$\begin{aligned}
 4.2.3 \quad H_f &= \frac{f l Q^2}{3 d^5} \\
 d &= \sqrt[5]{\frac{0,007 \times 1500 \times 2,128^2}{3 \times 51}} \checkmark \\
 &= 791,535 \text{ mm} \checkmark
 \end{aligned} \tag{2}$$

$$\begin{aligned}
 4.2.4 \quad \eta &= \frac{U}{gh} (V - U) [1 + n \cos (180^\circ - y)] \times 100\% \\
 U &= \frac{\pi D N}{60} \quad n = \frac{100 - 9}{100} = 0,91 \\
 &= \frac{\pi \times 1,8 \times 350}{60} \\
 &= 32,987 \text{ m/s} \checkmark \\
 &= \frac{32,897}{9,81 \times 289} (73,795 - 32,987) [1 + 0,91 \cos (180^\circ - 162)] \times 100\% \checkmark \\
 &= 88,573 \% \checkmark
 \end{aligned} \tag{3}$$

[17]

**TOTAAL: 100**