



higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NASIENRIGLYN

NASIONALE SERTIFIKAAT

FLUÏEDMEGANIKA N6

9 April 2026

Hierdie nasienriglyn bestaan uit 11 bladsye.

VRAAG 1

1.1 'n Element van die fluïed, ongeag hoe klein, behou die eienskappe van die fluïed in groot maat (2)

1.2 1.2.1
$$Q_4 = \frac{120}{3\,600}$$
$$= 0,0333 \text{ m}^3/\text{s}$$
$$Q_3 = \frac{1}{3} Q_4$$
$$= \frac{1}{3} \times 0,0333$$
$$= 0,0111 \text{ m}^3/\text{s} \checkmark$$
$$Q_3 = A_3 \times V_3$$
$$0,0111 = \frac{\pi \times 0,06^2}{4} \times V_3 \checkmark$$
$$V_3 = 3,890 \text{ m/s} \checkmark$$
 (3)

1.2.2
$$Q_4 = Q_1 \times Q_2 \times Q_3$$
$$A_1 V_1 + A_2 V_2 + 0,0111 = 0,0333$$
$$\left(\frac{\pi \times 0,04^2}{4} \times V_1 \right) + \left(\frac{\pi \times 0,05^2}{4} \times 5 \right) + 0,011 = 0,0333 \checkmark$$
$$1,257 \times 10^{-3} V_1 + 9,817 \times 10^{-3} + 0,0111 = 0,0333 \checkmark$$
$$V_1 = 9,851 \text{ m/s} \checkmark$$
 (3)

1.2.3
$$Q_4 = A_4 \times V_4$$
$$0,0333 = \frac{\pi \times 0,09^2}{4} \times V_3 \checkmark$$
$$V_4 = 5,234 \text{ m/s} \checkmark$$
 (2)

1.3
$$Q_2 = A_2 \times V_2$$
$$60 \times 10^{-3} = \frac{\pi \times 0,11^2}{4} \times V_2 \checkmark$$
$$V_2 = 6,314 \text{ m/s} \checkmark$$
$$h_L = \frac{0,5 \times 6,314^2}{2 \times 9,81}$$
$$= 1,016 \text{ m} \checkmark$$
 (3)

1.4

$$m = \frac{d}{4}$$
$$= \frac{0,2}{4}$$

$$= 0,05 \text{ m} \checkmark$$

$$A = \frac{\pi \times d^2}{4}$$
$$= \frac{\pi \times 0,2^2}{4}$$
$$= 0,0314 \text{ m}^2 \checkmark$$

$$f = 0,01 \left(1 + \frac{1}{40 \times 0,2} \right)$$
$$= 0,0113 \checkmark$$

$$C = \sqrt{\frac{2g}{f}}$$

$$= \sqrt{\frac{2 \times 9,81}{0,0113}}$$

$$= 41,669 \checkmark$$

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

$$0,07 = 0,0314 \times 41,669 \times \sqrt{0,05 \times i}$$

$$i = 0,0572 \checkmark$$

$$i = \frac{hf}{L}$$
$$0,0572 = \frac{hf}{200}$$

$$hf = 11,44 \text{ m} \checkmark$$

(6)
[19]

VRAAG 2

2.1

$$\tan\theta = \frac{1}{2}$$

$$\theta = 26,565^\circ \checkmark$$

$$\tan 26,565 = \frac{1,2}{x}$$

$$x = 2,4 \text{ m} \checkmark$$

$$\sin 26,565 = \frac{1,2}{z}$$

$$z = 2,683 \text{ m} \checkmark$$

$$A = (B \times D) + (x \times D)$$

$$= (3,6 \times 1,2) + (2,4 \times 1,2) \checkmark$$

$$= 7,2 \text{ m}^2 \checkmark$$

$$P = D + 2z$$

$$= 3,6 \times (2 \times 2,683)$$

$$= 8,966 \text{ m} \checkmark$$

$$m = \frac{A}{P}$$

$$= \frac{7,2}{8,966} \checkmark$$

$$= 0,803 \text{ m} \checkmark$$

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

$$= 7,2 \times 49 \times \sqrt{0,803 \times \frac{1}{1\,600}} \checkmark$$

$$= 7,904$$

$$= 474,24 \text{ m}^3/\text{min} \checkmark$$

(10)

2.2

'n Keep is 'n opening aan die kant van 'n reservoir met enige geometriese vorm.

(2)

[12]

VRAAG 3

$$\begin{aligned}
 3.1 \quad C_c &= \frac{d_a^2}{d_t^2} \\
 0,62 &= \frac{d_a^2}{0,05^2} \checkmark \\
 d_a &= 39,37 \text{ mm} \checkmark
 \end{aligned}
 \tag{2}$$

$$\begin{aligned}
 3.2 \quad V_t &= \sqrt{2 \times 9,81 \times h} \\
 &= \sqrt{2 \times 9,81 \times 4,8} \\
 &= 9,704 \text{ m/s} \checkmark \\
 C_v &= \frac{V_a}{V_t} \\
 0,98 &= \frac{V_a}{9,704} \\
 &= 9,5099 \text{ m/s} \checkmark
 \end{aligned}
 \tag{2}$$

$$\begin{aligned}
 3.3 \quad Q_a &= A_a \times V_a \\
 &= \frac{\pi \times 0,0394^2}{4} \times 9,5099 \checkmark \\
 &= 0,0116 \text{ m}^3/\text{s} \checkmark
 \end{aligned}
 \tag{2}$$

$$\begin{aligned}
 3.4 \quad F &= \rho g Q_a V_a \\
 &= 1\,000 \times 0,0116 \times 9,5099 \checkmark \\
 &= 110,315 \text{ N} \checkmark
 \end{aligned}
 \tag{2}$$

$$\begin{aligned}
 3.5 \quad t &= \sqrt{\frac{2y}{g}} \\
 &= \sqrt{\frac{2 \times 2}{9,81}} \checkmark \\
 &= 0,6 \text{ sec} \checkmark
 \end{aligned}
 \tag{2}$$

[10]

VRAAG 4

- 4.1
- Lug wat in die pomp glip
 - Water wat uit die pomp glip
 - Verslyte pompkomponente
- (3 × 1) (3)

4.2 4.2.1

$$Q = ALSE \frac{N}{60}$$

$$= \frac{\pi \times 0,15^2}{4} \times 0,3 \times 1 \times 2 \times \frac{20}{60} \checkmark$$

$$= 3,534 \text{ d/s} \checkmark$$

(2)

4.2.2

$$P = \rho g H a_t$$

$$100 \times 10^3 = 1\,000 \times 9,81 \times H a_t$$

$$H a_t = 10,194 \text{ m} \checkmark$$

$$H a_s = \frac{l \times D^2}{g \times d^2} \times w^2 \times r$$

$$= \frac{7 \times 0,15^2}{9,81 \times 0,075^2} \times \left(\frac{2 \times \pi \times 20}{60}\right)^2 \times \frac{0,3}{2} \checkmark \text{ C C}$$

$$= 1,878 \text{ m} \checkmark$$

$$\text{Begin} = H a_t - h_s - H a_s \checkmark$$

$$= 10,194 - 4 - 1,878$$

$$= 4,316 \text{ m} \checkmark$$

(5)

4.2.3

$$H f_s = \frac{4 \times f \times l}{2 \times g \times d} \left[\frac{D^2}{d^2} \times w \times r \right]^2$$

$$= \frac{4 \times 0,01 \times 7}{2 \times 9,81 \times 0,075} \left[\frac{0,15^2}{0,075^2} \times \frac{2 \times \pi \times 20}{60} \times \frac{0,3}{2} \right]^2 \checkmark$$

$$= 0,300 \text{ m} \checkmark$$

$$\text{Middel} = H a_t - (h_s + H f_s) \checkmark$$

$$= 10,194 - 4 - 0,3$$

$$= 5,894 \text{ m} \checkmark$$

(4)

4.2.4

$$\text{Einde} = H a_t - (h_s - H a_s) \checkmark$$

$$= 10,194 - 4 + 1,878$$

$$= 8,072 \text{ m} \checkmark$$

(2)

4.3

$$U_o = \frac{\pi DN}{60}$$
$$= \frac{\pi \times 0,38 \times 1\,200}{60}$$
$$= 23,876 \text{ m/s} \checkmark$$

$$\eta = \frac{gH}{U_o V_{wo}}$$
$$0,75 = \frac{9,81 \times 26}{23,876 \times V_{wo}}$$
$$V_{wo} = 14,244 \text{ m/s} \checkmark$$

$$U_o = V_{wo} + x$$
$$23,876 = 14,244 + x$$
$$x = 9,632 \text{ m/s} \checkmark$$

$$Q = a \times V_{fo}$$
$$\frac{1\,400}{60 \times 1\,000} = \pi \times 0,38 \times 0,012 \times V_{fo} \checkmark$$
$$V_{fo} = 1,629 \text{ m/s} \checkmark$$

$$\tan \phi = \frac{V_{fo}}{x}$$
$$= \frac{1,629}{9,632}$$
$$\phi = 9,6^\circ \checkmark$$

(6)
[22]

VRAAG 5

5.1

$$\begin{aligned} a_1 &= \frac{\pi \times d_1^2}{4} \\ &= \frac{\pi \times 1,2^2}{4} \\ &= 1,131 \text{ m}^2 \checkmark \end{aligned}$$

$$\begin{aligned} S_1 &= \pi \times d_1 \times L_1 \\ &= \pi \times 1,2 \times 100 \\ &= 376,991 \text{ m}^2 \checkmark \end{aligned}$$

$$\begin{aligned} a_2 &= \frac{\pi \times d_2^2}{4} \\ \frac{376,991 \times V_1^2}{1,131} &= \frac{226,195 \times V_2^2}{0,636} \checkmark \\ V_2 &= 0,937 V_1 \checkmark \end{aligned}$$

$$\begin{aligned} Q_T &= Q_1 + Q_2 \\ 30 &= (1,131 \times V_1) + (0,636 \times 0,937 V_1) \checkmark \\ V_1 &= 17,37 \text{ m/s} \checkmark \end{aligned}$$

$$\begin{aligned} Q_1 &= A_1 V_1 \\ &= 1,131 \times 17,37 \checkmark \\ &= 19,501 \text{ m}^3/\text{s} \checkmark \end{aligned}$$

(8)

5.2

$$\begin{aligned} V_2 &= 0,937 \times 17,37 \\ &= 16,276 \text{ m/s} \checkmark \end{aligned}$$

$$\begin{aligned} Q_2 &= A_2 V_2 \\ &= 0,636 \times 16,276 \\ &= 10,352 \text{ m}^3/\text{s} \checkmark \end{aligned}$$

(2)
[10]

VRAAG 6

$$6.1 \quad Q = A_o \times V_o$$

$$\frac{25}{60} = \frac{\pi \times 0,9^2}{4} \times V_o \checkmark$$

$$V_o = 0,655 \text{ m/s} \checkmark$$

$$\frac{P_i}{\rho g} + \frac{V_i^2}{2g} + Z_i = \frac{P_o}{\rho g} + \frac{V_o^2}{2g} + Z_o + h_E$$

$$\frac{160}{9,81} + \frac{V_i^2}{2 \times 9,81} + 2 \checkmark = \frac{-22}{9,81} + \frac{0,655^2}{2 \times 9,81} + 0 + 22 \checkmark$$

$$16,310 + \frac{V_i^2}{19,62} + 2 = -2,243 + 0,0219 + 22 \checkmark$$

$$V_i = 5,368 \text{ m/s} \checkmark$$

$$Q = A_i \times V_i$$

$$\frac{25}{60} = \frac{\pi \times d_i^2}{4} \times 5,368 \checkmark$$

$$d_i = 314,372 \text{ m} \checkmark$$

(8)

$$6.2 \quad P = \rho g Q H_E$$

$$= 1\,000 \times 9,81 \times \frac{25}{60} \times 22 \checkmark$$

$$= 89,925 \text{ kW} \checkmark$$

(2)

[10]

VRAAG 7

- 7.1 Die werwelende massa fluïed, veral 'n vloeistof, met 'n werwelende of kringbeweging wat geneig is om 'n holte of vakuum in die middel van die sirkel te vorm

(2)

7.2

$$\omega = \frac{2\pi N}{60}$$
$$= \frac{2\pi \times 300}{60} \checkmark$$
$$= 31,42 \text{ rad/s} \checkmark$$

$$y = \frac{\omega^2 r^2}{2g}$$
$$= \frac{31,42^2 \times 0,15^2}{2 \times 9,81} \checkmark$$
$$= 1,132 \text{ m} = 1\,132 \text{ mm} \checkmark$$

(4)
[6]

VRAAG 8

$$\begin{aligned}
 8.1 \quad V &= Cv\sqrt{2gh} \\
 &= 0,98 \times \sqrt{2 \times 9,81 \times (400 \times 0,84)} \checkmark \\
 &= 79,569 \text{ m/s} \checkmark
 \end{aligned}
 \tag{2}$$

$$\begin{aligned}
 8.2 \quad U &= 0,5V \\
 &= 0,5 \times 79,569 \\
 &= 39,785 \text{ m/s} \checkmark \\
 U &= \frac{\pi DN}{60} \\
 39,785 &= \frac{\pi \times D \times 500}{60} \\
 D &= 1,519 \text{ m} \checkmark
 \end{aligned}
 \tag{2}$$

$$\begin{aligned}
 8.3 \quad \eta &= \frac{P_{out}}{P_{in}} \\
 0,9 &= \frac{4,5}{P_{in}} \\
 P_{in} &= 5 \text{ mW} \checkmark \\
 P_{in} &= \rho g Q h \\
 5 \times 10^6 &= 1\,000 \times 9,81 \times Q \times 336 \checkmark \\
 Q &= 1,517 \text{ m}^3/\text{s} \checkmark \\
 Q &= a_i \times V \\
 \frac{1,512}{2} &= \frac{\pi \times d_j^2}{4} \times 79,569 \checkmark \\
 d_j &= 109,988 \text{ mm} \checkmark
 \end{aligned}
 \tag{5}$$

$$\begin{aligned}
 8.4 \quad hf &= \frac{f l Q^2}{3d^5} \\
 (400 - 336) &= \frac{0,006 \times 2\,000 \times 1,517^2}{3 \times d^5} \checkmark \\
 d &= 678,532 \text{ mm} \checkmark
 \end{aligned}
 \tag{2}$$

[11]

TOTAAL: 100