

CIVE2010: 2013 exam (answers only)

Question 1.

(a) $\rho = \frac{135 \times 10^3}{67.5(2+h)}$, where ρ is density of pontoon (kg/m^3) and h is freeboard (m)

(b) 2.344 m

Question 2.

(a) 0.889 m/s

(b) 31 605 Pa

(c) 1 788 N towards the pipe

Question 3.

0.725 m (approx.)

Question 4.

(a) 0.128 m^3/s

(b) 1 057 s

(c) 1 062 s

Question 5.

(a)

(i) 0.823 m^3/s

(ii) If you assume loss at sudden contraction = $0.5 \frac{V_1^2}{2g} \rightarrow 0.812 \text{ m}^3/\text{s}$

If you assume loss at sudden contraction = $0.5 \frac{V_2^2}{2g} \rightarrow 0.741 \text{ m}^3/\text{s}$

(b) If you assume loss at sudden contraction = $0.5 \frac{V_1^2}{2g} \rightarrow 7.594 \text{ m}$

If you assume loss at sudden contraction = $0.5 \frac{V_2^2}{2g} \rightarrow 9.108 \text{ m}$

The question said to use V_1^2 for minor loss at contraction, but this was actually wrong (should use V_2^2). Students were not penalised either way.

Question 6.

1. $V_2 = 1.507$ m/s
 $V_3 = 0.529$ m/s
 $V_1 = 0.713$ m/s
2. $V_2 = 2.26$ m/s
 $V_3 = 0.882$ m/s
 $V_1 = 1.02$ m/s

Question 6 (continued)3. Pipe 1-2

$$Z_A = Z_B + \frac{0.5V_1^2}{2g} + \frac{0.5V_1^2}{2g} + \frac{V_2^2}{2g} + \frac{\lambda_1 L_1 V_1^2}{2gD_1} + \frac{\lambda_2 L_2 V_2^2}{2gD_2} + \frac{K_2 V_2^2}{2g}$$

Pipe 1-3

$$Z_A = Z_C + \frac{0.5V_1^2}{2g} + \frac{0.5V_1^2}{2g} + \frac{V_3^2}{2g} + \frac{\lambda_1 L_1 V_1^2}{2gD_1} + \frac{\lambda_3 L_3 V_3^2}{2gD_3} + \frac{K_3 V_3^2}{2g}$$

4. $K_2 = 34.5$ (valve in pipe 2); $K_3 = 163.8$ (valve in pipe 3)
5. $K_2 = 11.6$ (valve in pipe 2); $K_3 = 53.7$ (valve in pipe 3)
6. Pipe 2 valve: K_2 between 1.6 – 34.5 so approx. 20-40% closed
 Pipe 3 valve: K_3 between 53.7 – 163.8 so approx. 60-80% closed

Question 7.

True / false part:

- (a) False
- (b) False
- (c) False
- (d) False
- (e) True

Question 8.

- (a) 0.538 m
- (b) 0.323 m
- (c) 0.33 m
- (d) Supercritical

Question 9.

1.32×10^6 N at 23.2° below horizontal

Question 10.

(a) -294.3 Pa

(b) 9.96×10^{-4} m³/s