MŰEGYETEM 1782

# FLUID MECHANICS

## TESTS

Attention: there might be more correct answers to the questions.

## Chapter 10: Hydraulics

**T.10.1.1** Real fluid flows in a pipeline that consist of straight and bent pipes, diffusers etc.

*a, Pressure always decreases in the direction of the flow.*

*b, Pressure might increase in the direction of the flow.*

*c, the Bernoulli-sum always increases in the direction of the flow.*

*d, the Bernoulli-sum always decreases in the direction of the flow.*

The answer is:

**T.10.1.2** Using dimensional analysis

*a, the number of dimensioned physical quantities (n) influencing the problem can be decreased.*

*b, n+r nondimensional groups can be created, where r is the rank of the dimension matrix*

*c, n-r nondimensional groups can be created*

*d, the type of dependence (power or trigonometric function etc.) between the nondimensional variables can be determined*

The answer is:

**T.10.2.1** Assuming a filled rectangular pipe cross-section of the size $a \times b$ the pipe friction loss can be determined using the equivalent diameter, $d_e$ calculated as:

a, $\frac{d_e \pi}{4} = a\,b$

b, $d_e \pi = 2(a+b)$

c, $d_e^2 = a^2 + b^2$

d,$d_e = \frac{4ab}{2(a+b)}$

*e, None of the above are correct.*

The answer is:

**T.10.2.2** In a turbulent pipe flow the pipe friction coefficient $\lambda$ is the same for smooth and rough pipes if

*a, the pipe friction coefficient does not depend on the Reynolds number*

*b, if the wall roughness size is smaller than the viscous sublayer thickness*

*c, if the wall roughness size is greater than the viscous sublayer thickness*

*d, if the Reynolds number is* $Re > 10^5$

*e, None of the above are correct.*

The answer is:

**T.10.3.1**When the flow separates from the diffuser wall

*a, losses are greater than in the non-separated case*

*b, losses are smaller than in the non-separated case*

Separation can be avoided by

*c, decreasing the diffuser angle*

*d, increasing the diffuser angle*

*e, Losses do not depend on the diffuser angle.*

The answer is:

**T.10.3.2** Choose the correct statements!

| | **pressure** | **mean velocity** |
|---|---|---|
| **Diffuser inlet cross section** | $p_{in}$ | $v_{in}$ |
| **Diffuser outlet cross section** | | |
| **— inviscid** | $p_{out}$ | $v_{out}$ |
| **— viscous** | $p_{outv}$ | $v_{outv}$ |

*a,* $p_{in} < p_{out}$ *and* $p_{outv} < p_{out}$

*b,* $p_{in} < p_{out}$ *and* $p_{outv} > p_{out}$

*c,* $v_{in} < v_{out}$ *and* $v_{outv} < v_{out}$

*d,* $v_{in} > v_{out}$ *and* $v_{outv} > v_{out}$

*e, None of the above are correct.*

The answer is:

**T.10.4.1** Which of the following formulae are correct in case of a hydraulically smooth pipe?

*a , If* $\mathrm{Re}=2.3\cdot10^4$ *then* $\lambda = \frac{64}{\mathrm{Re}}$.

*b, If* $\mathrm{Re}=2.3\cdot10^4$ *then* $\lambda = \frac{0.316}{\sqrt[4]{\mathrm{Re}}}$.

*c, If* $\mathrm{Re}>2.3\cdot10^5$ *then* $\lambda = \frac{0.316}{\sqrt[4]{\mathrm{Re}}}$.

*d, If* $\mathrm{Re}<2.3\cdot10^3$ *then* $\lambda = \frac{64}{\mathrm{Re}}$.

*e, If* $\mathrm{Re}=5\cdot10^5$ *then* $\lambda = \frac{0.316}{\sqrt[4]{\mathrm{Re}}}$.

The answer is:

**TZ.10.1** Friction loss in a pipe in case of a turbulent flow

*a, is roughly directly proportional to the mean velocity*

*b, is inversely proportional to the mean velocity squared*

*c, is roughly inversely proportional to the diameter squared*

*d, depends on the position of the pipe*

*e, is roughly proportional to the mean velocity squared*

The answer is:

**TZ.10.2** Hydraulically equivalent diameter

*a, is the ratio of the wetted perimeter over the cross-section*

*b, is the ratio of cross-section over the square root of wetted perimeter*

*c, is the ratio of two times the cross-section over the wetted perimeter*

*d, is the ratio of four times the cross-section over the wetted perimeter*

*e, None of the above are correct.*

The answer is:

**TZ.10.3** Friction loss in a rough pipe is $\Delta p'_r$. In a smooth pipe of the same size, it is $\Delta p'_s$. The flow rate $q_v$, pipe length and the fluid are the same.

*a,* $\Delta p'_r > \Delta p'_s$ *for all* $q_v$

*b,* $\Delta p'_r$ *can be smaller than* $\Delta p'_s$

*c,* $\Delta p'_r$ *can be equal to* $\Delta p'_s$

*d,* $\Delta p'_r$ *can be greater than* $\Delta p'_s$

*e,* $\frac{\Delta p'_r}{\Delta p'_s}$ *is constant for all* $q_v$

The answer is:

**TZ.10.4** Choose the correct statements!

| | **pressure** | **mean velocity** |
|---|---|---|
| **Diffuser inlet cross section** | $p_{in}$ | $v_{in}$ |
| **Diffuser outlet cross section** | | |
| **— inviscid** | $p_{out}$ | $v_{out}$ |
| **— viscous** | $p_{outv}$ | $v_{outv}$ |

Diffuser efficiency $\eta_{diff}$ is calculated as:

*a,* $\frac{p_{outv}-p_{in}}{p_{out}-p_{in}}$

*b,* $\frac{\frac{\rho}{2}(v_{in}^2-v_{outv}^2)}{\frac{\rho}{2}(v_{in}^2-v_{out}^2)}$

*c,* $p_{out} - p_{outv} = (1-\eta_{diff})(p_{outv} - p_{in})$

*d,* $\frac{p_{outv}+\frac{\rho}{2}v_{outv}^2}{p_{in}+\frac{\rho}{2}v_{in}^2}$

*e, None of the above are correct.*