# Varmafræði - Dæmablað 1 - Andri Kjeilt

* 0.1

- volume $Q$ in $m^3$
- radius $R$ in $m$
- discharge velocity $v$ in $m/s$
- Filling time $t$ in $s$

so we have

$$Q = A \cdot v \cdot t$$

where

$$A = \pi R^2$$

so

$$\boxed{Q = \pi R^2 \cdot v \cdot t}$$

* Q4]

$g_s = 1.1$, $d = 62\,cm$, $P_{atm} = 101\,kPa$

$\rho_w \approx 1000\ \frac{kg}{m^3}$

The fluid density due to specific gravity is:

$$\rho_{fluid} = g_s \cdot \rho_w = 1.1 \cdot 1000 = 1100\ \frac{kg}{m^3}$$

the difference in pressure because of the height is

$$P_{diff} = \rho_{fluid} \cdot g \cdot d = 1100\ \frac{kg}{m^3} \cdot 9.8\ \frac{m}{s^2} \cdot 0,62m$$

$$= 6683,6\ Pa \approx 6,7\ kPa$$

a] Higher

$$P_{abs} = P_{atm} - P_{diff} = 101\,kPa - 6,7\,kPa$$

$$= 94,3\ kPa$$

b] Lower

$$P_{abs} = P_{atm} + P_{diff} = 101\,kPa + 6,7\,kPa$$

$$= 107,7\ kPa$$

* Q.5

$h = 22m$, $P_{atm} = 101\ kPa$, $g_{sea} = 1.03$

$\rho_{sea} = \rho_w \cdot g_{sea} \approx 1030\ \frac{kg}{m^3}$

So the pressure difference because of the depth is.

$$P_{depth} = \rho_{sea} \cdot g \cdot h = 1030\ \frac{kg}{m^3} \cdot 9,8\ \frac{m}{s^2} \cdot 22m$$

$$= 222068\ Pa$$

$$= 222\ kPa$$

The total (absolute) pressure is

$$P_{abs} = P_{atm} + P_{depth} = 101\ kPa + 222\ kPa$$

$$= \underline{323\ kPa}$$

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* Q6

$\dot{m} = 2000\ kg/s$ $h = 73m$

$$\dot{W}_{max} = \dot{m} \cdot g \cdot h = 2000\ \frac{kg}{s} \cdot 9,8\ \frac{m}{s^2} \cdot 73m$$

$$= 1430800$$

$$= \underline{1.43\ MW}$$

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Q.7

$m = 1200\ kg$, $P = 140\ kW$, $v = 27{,}78\ m/s$

$= 140.000\ W$

Kinetic energy at 100 km/h is

$$K = \frac{1}{2} m v^2 = \frac{1}{2} \cdot 1200\ kg \cdot 27{,}78^2\ m/s$$

$$= 463037\ J = 463\ kJ$$

Now we have

$$W_{0\to 100} = K_{100} - K_0$$

$$\Rightarrow W_{0\to 100} = 463\ kJ - 0$$

5C

$$P_{car} = \frac{W_{0\to 100}}{\Delta t} \Rightarrow \Delta t = \frac{W_{0\to 100}}{P_{car}}$$

$$\approx 3.31\ s$$