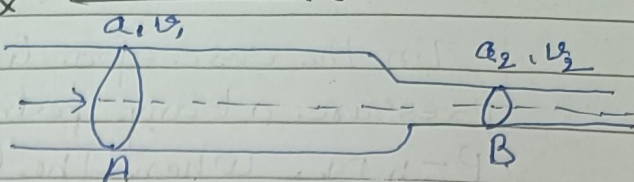


Equation of continuity

Date: ____/____/____

Consider a horizontal pipe. A liquid is flowing through the pipe. The liquid is assumed to be in stream line motion.



Area of cross section at A = a_1

Area of cross section at B = a_2

As there is no accumulation of the liquid at any point, the amount of liquid flowing per second is the same at all cross-sections of the tube.

Amount of liquid flowing per second at A = $a_1 v_1$

Amount of liquid flowing per second at B = $a_2 v_2$

$$\therefore a_1 v_1 = a_2 v_2$$

This eqn is called the equation of continuity

In general $a v = \text{constant}$

Energy of a liquid in Motion:—

A liquid in motion possesses three types of energy

① Kinetic Energy:— The energy is due to the motion of the liquid. It is equal to $\frac{1}{2} m v^2$. The kinetic energy per unit mass of the liquid = $\frac{1}{2} v^2$.

The kinetic energy per unit weight is called the velocity head and is equal to $\frac{v^2}{2g}$.

② Potential energy:— This energy is due to the position of the liquid with respect to the ground level. It is equal to mgh . The potential energy per unit mass of the liquid = gh . The potential energy per unit weight is called the potential head and is equal to h .

③ Pressure energy:— This energy is due to the pressure exerted on the liquid while it is flowing. The energy is equal to PV . Pressure energy per unit mass = $\frac{PV}{m} = \frac{P}{\rho}$. When the flow of the liquid is stream line the total energy per unit mass of the liquid at any point is given by $\left(\frac{v^2}{2} + gh + \frac{P}{\rho} \right)$