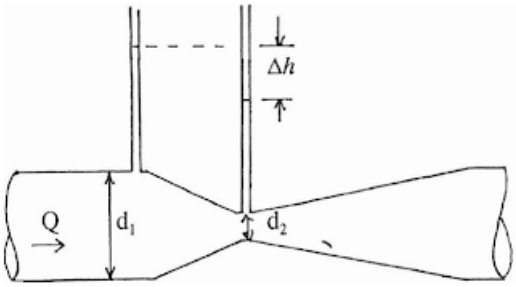
Calibration for Venturi-meter

The main objectives of this experiment is to obtain the coefficient of discharge from experimental data by utilizing Venturi meter, Understand the effect of decrease in area on the velocity and pressure of the flowing fluid and Understand the relationship between velocity and pressure of flowing fluid.

Theory:



Venturimeter

Applying Bernoulli's equation at 2 sections

$$\frac{P_1}{w} + \frac{{V_1}^2}{2g} + Z_1 = \frac{P_2}{w} + \frac{{V_2}^2}{2g} + Z_2$$

Since Z1=Z2

Therefore

H= $\frac{{V_1}^2}{2g}$ + h constant at all sections

Q=AV

$$\rightarrow Q_{th} = \frac{A_1 A_5}{\sqrt{{A_1}^2 - {A_5}^2}} \sqrt{2gH_{1-5}}$$

$$\rightarrow Q_{actual} = \frac{V_2 - V_1}{t}$$

$$\rightarrow C = \frac{Q_{actual}}{Q_{th}}$$

Tables and Calculations:

N	V1(liter)	V2(liter)	t	H1(mm)	H2(mm)
1	1	3	21.6	180	75
2	1	3	20	145	30
3	1	3	19	150	10
4	1	3	14.2	220	20

A1=$\frac{\pi}{4} \times 25^2$ =490.87 $mm^2 \times 10^{-4} = 0.00049087 m^2$

A2=$\frac{\pi}{4} \times 10^2 = 78.54\ mm^2 \times 10^{-4} = 0.00007854 m^2$

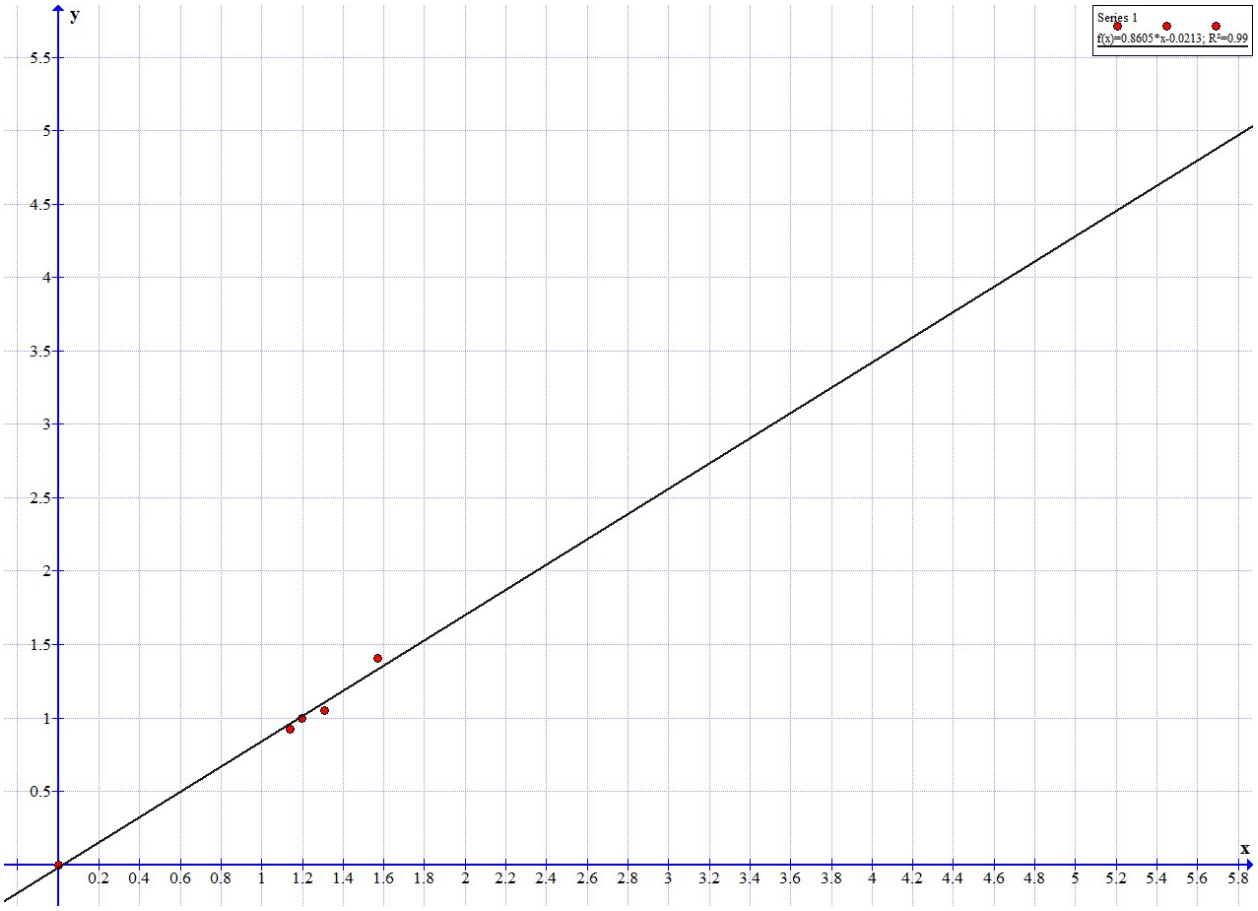
For 1:- $Q_{th} = \frac{0.00049087 \times 0.00007854}{\sqrt{0.00049087^2 - 0.00007854^2}} \times \sqrt{2 \times 9.8 \times (180 - 75) \times 10^{-3}} = 1.14 \times 10^{-4}$

$$Q_{actual} = \frac{3-1}{21.6} = 0.92 \times 10^{-4}$$

$$C_d = \frac{0.92}{1.14} = 0.807$$

N	$Q_{actual}(\frac{m^3}{s})$	$Q_{th}(\frac{m^3}{s})$	C_d
1	0.92×10^{-4}	1.14×10^{-4}	0.807
2	1×10^{-4}	1.195×10^{-4}	0.836
3	1.053×10^{-4}	1.31×10^{-4}	0.804
4	1.408×10^{-4}	1.57×10^{-4}	0.893

Qact vs Qth



Conclusion:

it can be seen clearly that a rise in differential head of two tubes causes the flow rate of the liquid in the tubes to increase and this proves the Venturi effect.