Measurement of Diffusion flame height for different gases with different diameters

Introduction:

Diffusion flames are those in which the fuel and oxidizer diffuse and mix only at the flame zone. Reaction rates are much larger in comparison with premixed flames. Such flames are therefore diffusion limited. It is also good to recognize that diffusion flames occur more often in nature, when flames/ fires are caused nature makes sure fuel and oxidizer elements are separate to increase the stability of life. When fire is caused, oxidizer (usually air) gets to the fuel vapours at the flame and this result in the diffusion flame.

Experimental setup and Procedure:

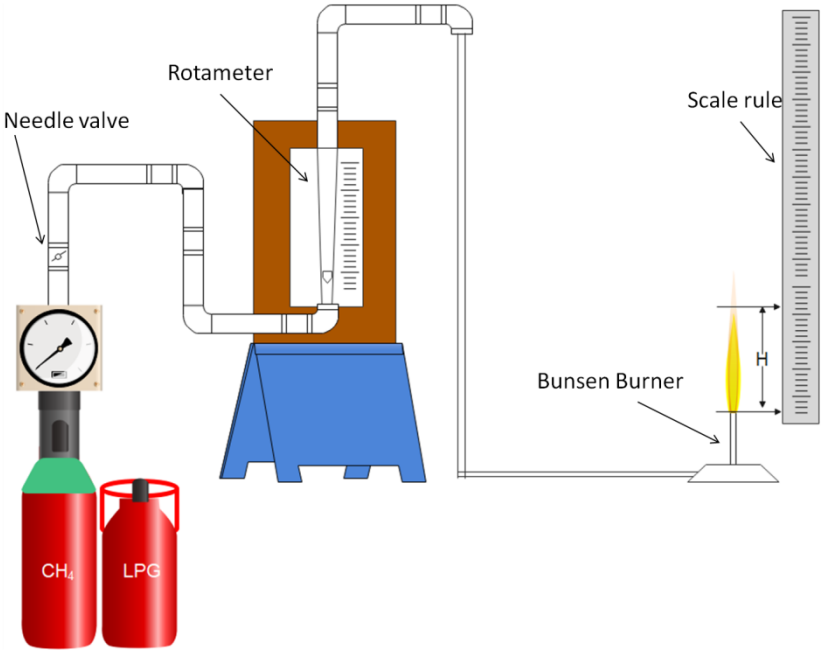

Figure 1: Schematic of Experimental Setup

The experimental setup used is show in Fig. 1. It consists of a gaseous fuel (LPG or Methane) Cylinder connected to a Bunsen burner through a Rotameter. The rotameter connected to the cylinder indicates the volumetric flow reading of fuel, during the experiment. A needle valve is also kept in between the gas cylinder and the rotameter to adjust the flow rates.

The gas emanating from the burner is ignited with a pilot flame and the volumetric flow rate reading of the cylinder was recorded from the rotameter, while the corresponding flame height is measured using the scale rule. In this experiment oxygen calibrated rotameter is used, hence the flow rates are corrected for LPG and CH_4 by a correction factor.

In order to obtain the correction factor following steps are followed:

Specific gravity (SG): $$SG = \frac{Molecular\ weight\ of\ gas}{Molecular\ weight\ of\ O_2}$$

$$SG = \frac{(\%A \times Molecular\ weight\ of\ A) + (\%B \times Molecular\ weight\ of\ B)}{Molecular\ weight\ of\ O_2}$$

Correction factor (CF): $$CF = \sqrt{\frac{1}{SG}}$$

CF = 0.722 for LPG

CF = 0.84 for CH_4

In the present experiment three cases are considered.

Case 1: LPG gas with 10 mm diameter tube

Case 2: CH_4 gas with 5 mm diameter tube

Case 3: CH_4 gas with 10 mm diameter tube

The diffusion flame heights are measured from the experiment video by noting the height of the flame from the scale adjacent to the burner. The corresponding flow rate readings are also need to be recorded and should be corrected for the fuel used.

Sl. No.	Flow rate (LPM)	Corrected flow of LPG/Methane	Flame height (H) (in cm)
1.			
2.			
3.			
4.			
5.			
6.			

The measured diffusion flame heights (H) are to be plotted on y-axis along with the corrected mass flow rate of fuel consumed on x-axis.

What are the conclusions you can draw?