

Exploring a candle flame

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Introduction

A flame does not show everywhere the same temperature at every region. The characterization of such a flame is possible with a thermocouple (a highly sensitive temperature sensor ranging from -200°C until well over 1000°C). In the following experiment, we are going to explore a candle flame in three characteristic areas labeled with **1**, **2** and **3**:

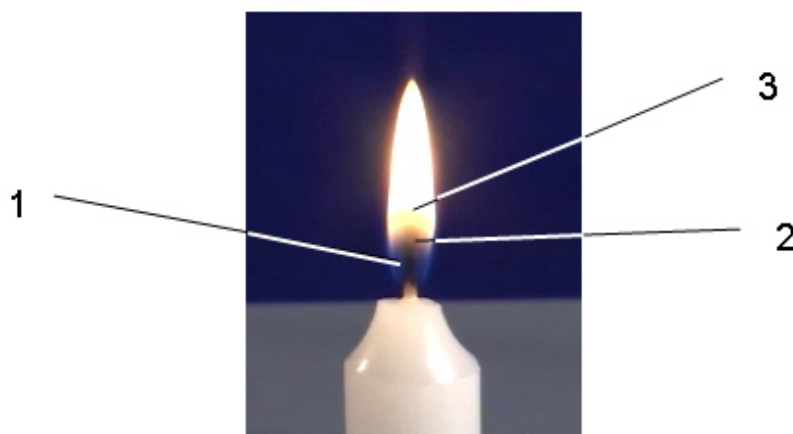


Figure 1



Equipment


A candle

Matches

A Thermocouple type K (-200°C - 1000°C).

A MultiLog

Equipment Setup Procedure

1. Connect the MultiLog to the serial port of the computer and to the power supply.
2. Turn the MultiLog on.
3. Connect the Thermocouple sensor to the I/O 1 port of the MultiLog.
4. Click  on the bottom of the screen. MultiLab will automatically set up the MultiLog Pro.


MultiLog Set Up

Input 1: Temperature (TCK)

Rate: 10/sec.

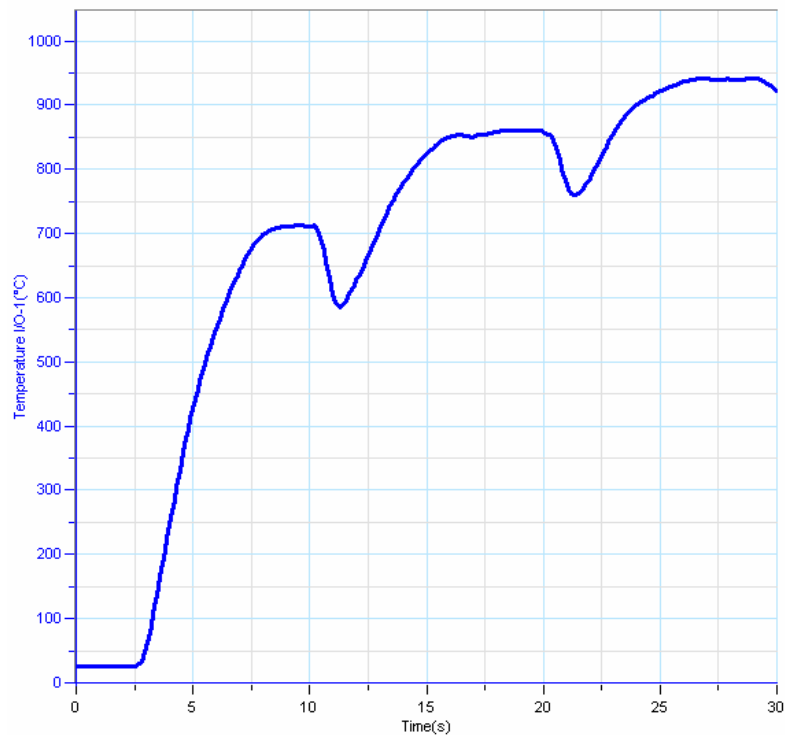
Samples: 1000.

Experimental Procedure

1. Light a candle and let it burn for approx. 2 minutes before starting the experiment.
2. Click the **Run**  button on the left toolbar.
3. Record the room temperature before you approach the sensor to the flame (Note that the Thermocouple is very sensitive and fast responding).
4. Monitor the temperature in three different [areas of the flame \(see Figure 1\)](#):
 - The blue zone at the bottom of the flame – 1
 - The dark zone around the wick – 2
 - The yellow zone at the top – 3

Data Analysis

Plotting temperature versus time shows us that the flame is the hottest in its top part and gets cooler the lower you drag the sensor:



Questions

1. What are the temperatures in each of the flame zones? (1, 2 & 3).
2. Why do you think the hottest part of the flame is at the top?