

# AMOUNT OF WATER FOR THE CRYSTALIZATION OF CANDY



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## INTRODUCTION

Caramelization is the process of heating sugar until its molecules begin to break down. The heat transforms sucrose, colourless, odourless and with a sweet taste, into several different molecules. Some acquire a bitter taste, others an intense aroma or a dark brown colour. The caramelization of sucrose, over 170 °C, generates odours of dairy, fruit, sherry, vinegar, nuts, solvent or toasted cereal. As the heat increases and these reactions take place, the structure of the original sugar is destroyed, so that the more the sugar is cooked, the more viscous and less sweet is the result. The reaction changes from caramelisation to carbonisation. To make these reactions more homogeneous and slower, water is used. Instead of boiling the sugar by itself, it is mixed with a little water, which evaporates as the sucrose caramelises, slowing down the process. This reduces the chance of burning the sugar: as caramelisation begins, the reactions give off heat that increases the temperature of the mixture.

Viscosity is the property of fluids to offer resistance to the relative movement of their molecules, thus, the volume of water used in making the candy will influence its viscosity and, therefore, its culinary properties and flavour. The colour of the caramel will contribute to the appetizing or not the same appearance and also to the flavour, since once the charring has started, it would take on a bitter taste. Determining the optimal amount of water and the time at which carbonization begins will help to prepare sweet recipes with softer textures and will allow us to enhance the flavour of these foods.

## OBJECTIVE

- The main objective is to observe the effect of the amount of water on the crystallization of the caramel and therefore on its viscosity.
- Another important objective is to determine the moment in which the intensity and tone of the color change during the cooking process.

**Variables :** Dependents: Viscosity and colour  
Independent: Water  
Controlled: Sugar, lemon, temperature and time (15 min)

### Ingredients by each realization

- Sugar (100g)
- Water (variable)
- Lemon (10ml)

## Method

1. The sugar is poured , with the water and the lemon to heat in the saucepan.
2. Take samples every 2 min and place them on a white surface to take the colour
3. Take a sample after approximately 15 min and put it on the consistometer to take measurements of the distance travelled by the candy.

## Materials

### 1º SESSION



-Beaker: to measure the amount of water.



Scale: to measure quantity of sugar.



Saucepan: container to make the caramel.

Palette: to stir the candy in the saucepan.



- Stove: to heat the mixture

### 2º SESSION

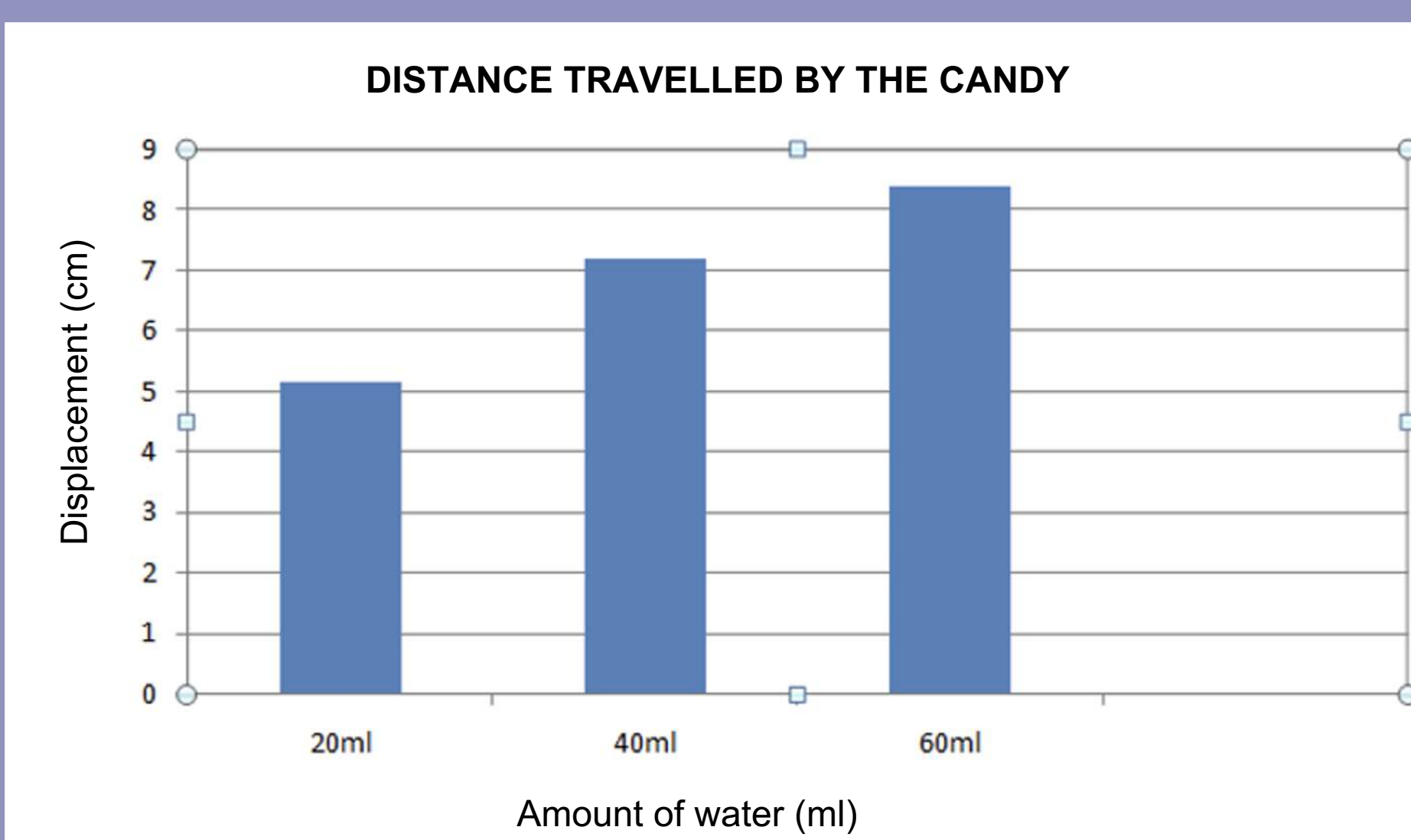
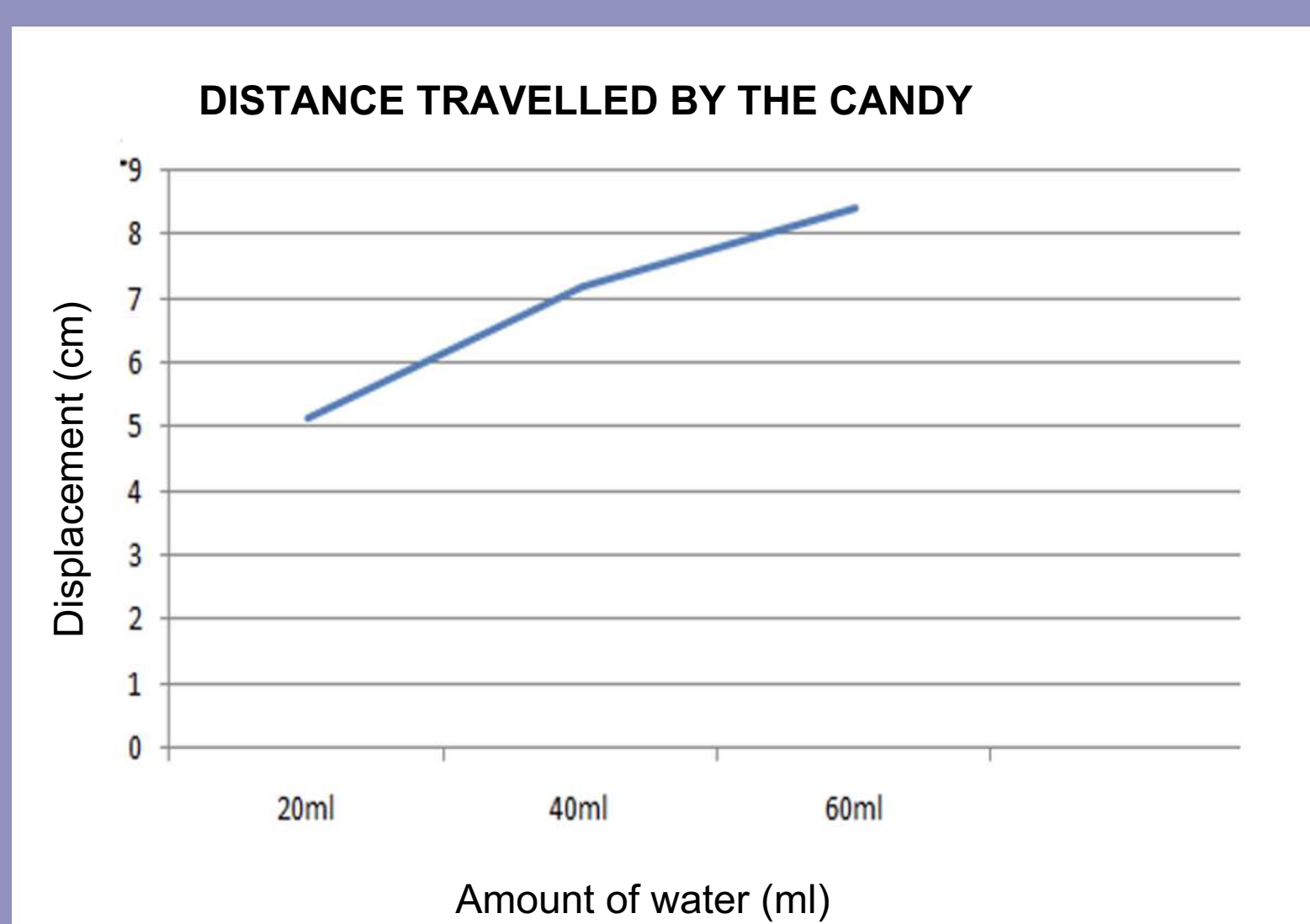


Cronometer: to check the time



- Homemade consistometer: to measure displacement of the candy

## RESULTS



Graph 1 and 2: Distance travelled by the caramel as a function of the amount of water used in its processing.

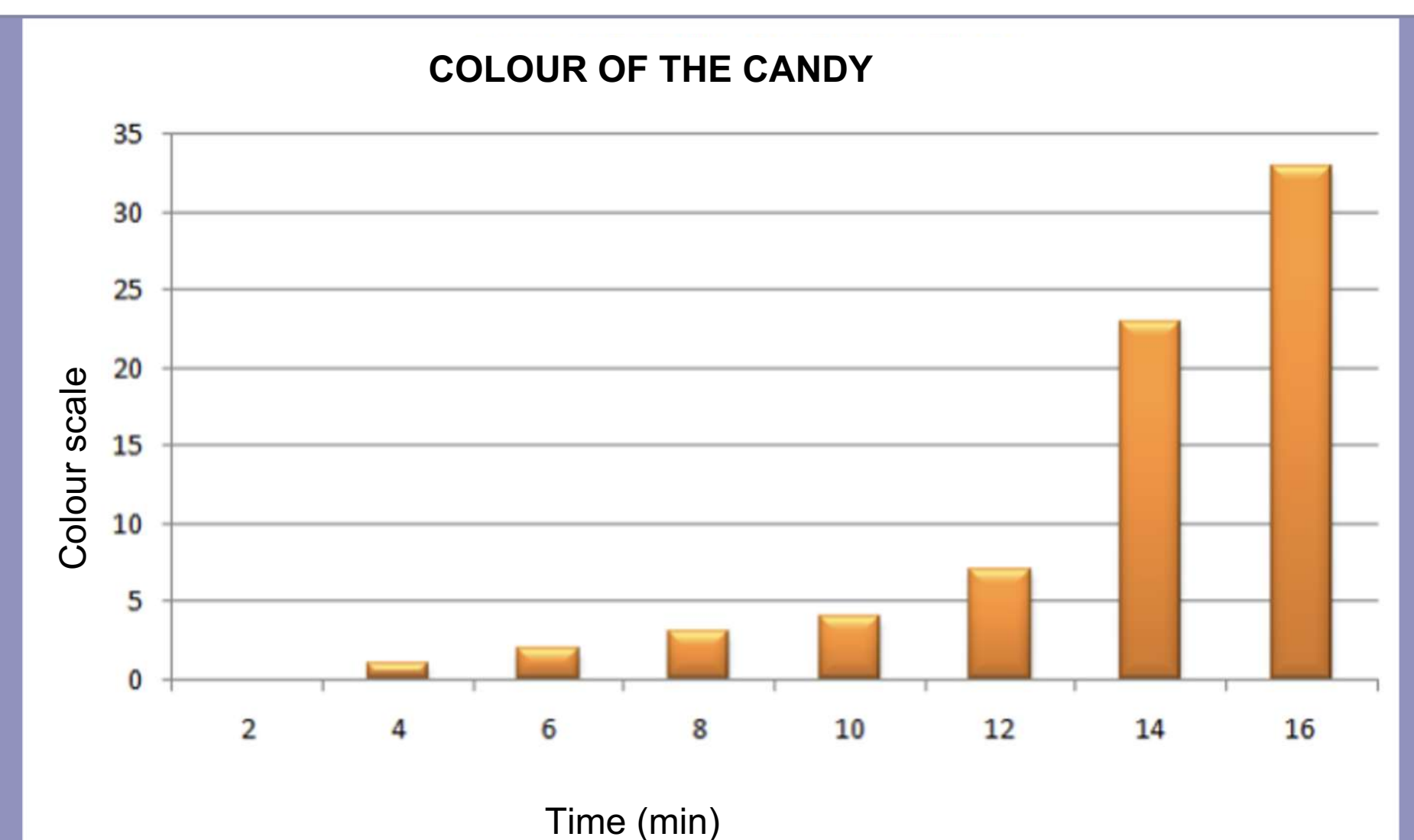
To obtain this data series represented in the graph we have used a homemade consistometer with an inclination of 80 °.

Viscosity is a property of fluids that causes friction, this causes the loss of energy in the fluid flow, so the ease with which a liquid runs off is a guideline of its viscosity. The ability to travel more distance on an inclined plane in a given time is indicative of lower viscosity.

You can clearly see the difference in viscosity when making the caramel with different amounts of water. The viscosity is higher the less water is used, however the more water is used, the lower the viscosity.



Table 1. EBC color scale (x 1000 units)  
Color measurement reference



Graph 3: Caramel colors

To represent this graph, in which you can see the different shades of the caramel every 2 minutes, we have started from a numbered colour scale that has been used as a pattern. It can be seen that in the first minutes the colour remains more or less constant. However, after 12 minutes the colour is more intense and begins to darken faster and faster. At 145°C caramelization begins (light brown tones), at 165°C the correct caramelization occurs (soft brown tones), however at 165°C carbonization begins (intense brown tones). It is therefore a very narrow interval, since in a very few seconds the formation of bitter substances that would spoil the flavour of the caramel begins. It does not seem advisable to exceed 12 minutes of heating when making homemade caramel.

## CONCLUSIONS

1. It has been observed that the greater the amount of water, the lower the viscosity, which is why they are two inversely proportional variables.
- 2.- By increasing the heating time of the caramel, the intensity and colour tone increase slowly, after 12 minutes this increase is abrupt due to the beginning of charring.



Image 1: Candy colour change

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