Cooling of a cup of tea: a short accessible article

Jane Author
Department of Physics, Example University

14 November 2026

Abstract

We measure how a cup of tea cools in a room and compare the result with Newton's law of cooling. This article is also a template: its PDF is tagged, so a screen reader can move through its headings, lists, table, figure and equations.

1 Introduction

A hot drink left on a desk cools quickly at first and slowly later. Newton's law of cooling says that the rate of cooling is proportional to the difference between the drink and the room [1]. We test that with a kettle, a mug and a kitchen thermometer.

The work had three steps:

1. pour 250 ml of boiling water over a tea bag in a ceramic mug;
2. record the temperature every five minutes for half an hour;
3. fit the law to the readings.

2 Method

2.1 Equipment

- A ceramic mug holding 300 ml.
- A digital thermometer that reads to 0.1 °C.
- A room at a steady 21 °C.

2.2 Model

Let $T(t)$ be the temperature of the tea at time t and T_{r} the temperature of the room. Newton's law is

$$\frac{dT}{dt} = -k\left(T - T_{\mathrm{r}}\right), \tag{1}$$

with solution

$$T(t) = T_{\mathrm{r}} + \left(T_0 - T_{\mathrm{r}}\right) e^{-kt}, \tag{2}$$

where T_0 is the temperature at the start and k is a constant of the mug.

3 Results

Table 1 lists the readings and Figure 1 shows them.

Fitting Equation (2) to the readings gives $k \approx 0.036$ min^{-1}.

Table 1: Temperature of the tea over thirty minutes.

Time (min)	Temperature (°C)
0	92.0
5	78.5
10	68.1
15	60.2
20	53.9
25	48.8
30	44.7

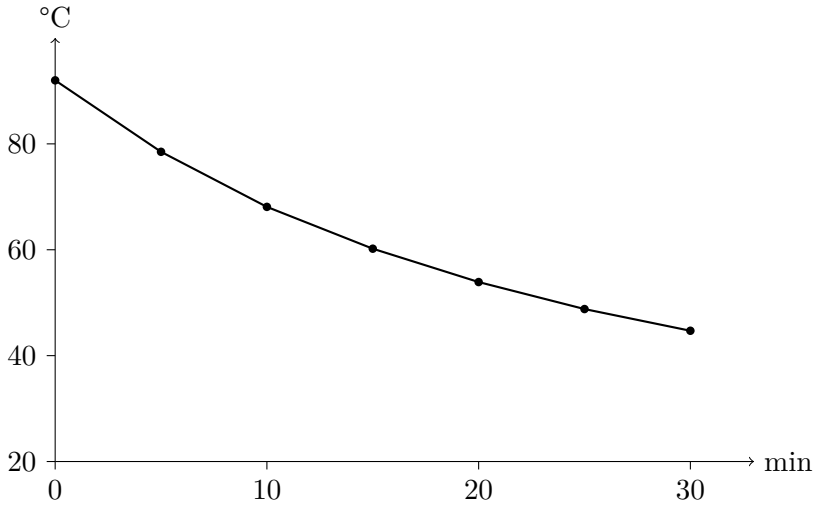


Figure 1: The tea cools quickly at first, then more slowly.

4 Conclusion

The readings follow Newton's law closely over the first half hour. The method and the data are simple enough to repeat in a classroom; a longer run is described by Bergman et al. [2].

References

[1] I. Newton, *Scala graduum caloris*, Philosophical Transactions of the Royal Society 22 (1701), 824–829.

[2] T. L. Bergman, A. S. Lavine, F. P. Incropera and D. P. DeWitt, *Fundamentals of Heat and Mass Transfer*, 8th edition, Wiley, 2017.