Measuring the Cooling of Hot Water

Your Name

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1 Question

How does the temperature of a cup of hot water change during the first ten minutes after pouring?

2 Prediction

Newton's cooling model suggests that the rate of cooling is approximately proportional to the difference between the water and room temperatures:

$$\frac{dT}{dt} = -k(T - T_{\text{room}}).$$

3 Method

Pour 200 mL of hot water into an uncovered cup. Measure the temperature with the same probe every two minutes, keeping the probe depth and cup position constant. Record room temperature at the start and end.

4 Results

Table 1: Temperature observations.

t (min)	T (°C)	$T - T_{\text{room}}$ (°C)
0	86.0	64.0
2	77.4	55.4
4	70.3	48.3
6	64.2	42.2
8	59.0	37.0
10	54.6	32.6

5 Interpretation

Plot $\ln(T - T_{\text{room}})$ against time, estimate the gradient, and compare the fitted model with the observations. Mention convection, evaporation, probe response time, and any reading that was taken late.

6 Conclusion

The fitted cooling constant is $k =$ _____ per minute. The prediction was _____; the strongest evidence is _____.