

Icebergs: A Thermodynamic Problem

Life Savers: A Solution

Recent reports in the news have drawn attention to the reduced levels of ozone over the South Pole, as well as the warming trend leading to the breakup of some of the continental ice-sheet covering Antarctica. Massive quantities of ice have broken off into the ocean, and concerns have been raised regarding the possible hazards to shipping as the country-sized icebergs move north. All one needs is a source of thermal energy to melt the icebergs and the problem would be solved.

Energy is released when sugar undergoes combustion. In this experiment you will determine how much heat is released by the combustion of Life Savers, and thus, the mass of Life Savers required to melt an iceberg of given dimension.

If you were given an unlimited supply of Life Savers, what mass of Life Savers would be sufficient to melt an iceberg with the following dimensions:

$$77 \text{ km} \times 32 \text{ km} \times 200 \text{ m}$$

Assume Life Savers to be pure sucrose, $\text{C}_{12}\text{H}_{22}\text{O}_{11}$, molar mass 324 g/mol.

Mass of one Life Saver: 2.36 g

Density of Ice: 0.917 g/cm^3

? $H^{\circ}_{\text{fusion}}$ of ice: 6.0 kJ/mol

? H°_{c} (sucrose): + 44.53 kJ mol⁻¹

1. From the Introduction, formulate a problem statement.
2. Formulate a hypothesis (prediction) related to the research question, explaining quantitatively.
3. Write a suitable procedure for the determination of the stated problem that allows for:
 - a) appropriate apparatus and materials
 - b) the control of the variables
 - c) the collection of sufficient relevant data
4. From the Procedure
 - a) state the manipulated and responding variables
 - b) list some controlled variables
5. Prepare data tables for your observations and measurements.

You will be marked on Planning (a), Planning (b), and Data Evaluation.