# Experiment 4: Page 53

**Aim:** To see how the temperature changes over time when ice is heated from -5°C until it boils and evaporates.

**Investigative question:**
**How does the temperature change at specific time intervals as ice is heated from -15°C until it boils and evaporates?**

**Hypothesis:**
**Option 1:**
**When ice is heated from -15°C, the temperature will constantly increase with time until it is all vapour.**
**(This statement is false as the temperature does not rise constantly during a state change.)**

**Option 2:**
**When ice is heated from -15°C, the temperature will constantly increase with time, but will remain constant during a state change, until it is all vapour.**
**(This statement is correct.)**

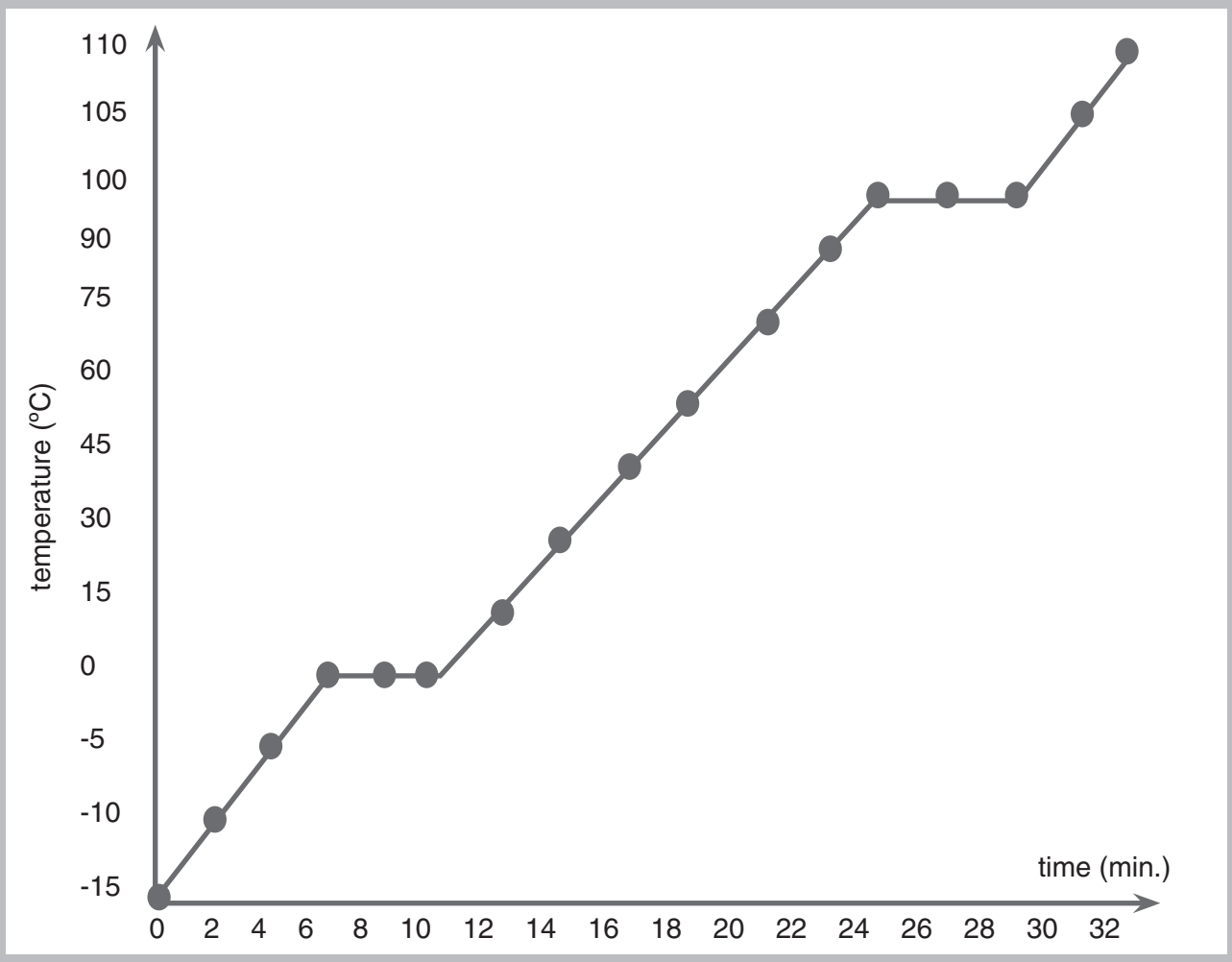
**Variables:**
Fill in the items or quantities that match the headings in the table below.

| **Independent variable** (Which is changed.) | **Dependent variable** (Which is measured.) | **Controlled variable(s)** (Which remain(s) the same.) |
|---|---|---|
| **Time** | **Temperature** | **Mass of ice, size of flame, distance between beaker containing ice and the flame** |

**Observations:**
Complete the table for the following time intervals. (Adjust time intervals if necessary.)

| Time (minutes) | Temperature (°C) | Time (minutes) | Temperature (°C) |
|---|---|---|---|
| 0 | | 16 | |
| 2 | | 18 | |
| 4 | | 20 | |
| 6 | | 22 | |
| 8 | | 24 | |
| 10 | | 26 | |
| 12 | | 28 | |
| 14 | | 30 | |

**Results:**




**Conclusions:**

1. **During the heating of ice from a negative temperature until it is a vapour, energy is transferred constantly. This energy is transformed into different forms during the heating process.**
2. **In the first part of the heating process, the temperature of the ice increases from -15°C to 0°C. The energy transferred is used to change ice at -15°C into ice at 0°C. The heat energy that is transferred from the Bunsen burner is converted into kinetic energy of the ice particles. As the kinetic energy of the particles increases, they vibrate faster and faster, and the temperature increases.**
3. **In the second part of the heating process, the temperature does not change.**
   **The energy transferred is used to change ice at 0°C to water at 0°C.**
   **The ice particles move so fast that they can no longer remain so close together and be held by such strong forces. The heat energy that is transferred from the Bunsen burner is transformed into potential energy of the particles so that the forces between the particles are weakened and the particles can move further apart. This means that there is a state change and no variation in temperature is observed, as the kinetic energy of the particles is not changed. The heat energy that is transferred at this stage is known as latent heat energy.**

4. **In the third part of the heating process, the temperature of the water rises from 0°C to 100°C. The energy transferred is used to change water at 0°C to water at 100°C. The heat energy that is transferred from the Bunsen burner is transformed into kinetic energy of the water particles. As the particles' kinetic energy increases, the particles move faster and faster and the temperature increases.**
5. **In the fourth part of the heating process, the temperature does not increase.**
   **The energy transferred is used to change water at 100°C to vapour at 100°C. The water particles are now moving so fast that they can no longer remain so close together and be held by such relatively strong forces.**
   **The heat energy that is transferred from the Bunsen burner is transformed into potential energy of the particles so that the forces between the particles are completely broken, and the particles can move much further apart.**
   **This means that there is a state change and no variation in temperature is observed, as the kinetic energy of the particles is not changed.**
6. **In the fifth part of the heating process the temperature of the vapour rises from 100°C to 120°C. The energy transferred is used to change vapour at 100°C to vapour at 120°C. The heat energy which is transferred from the Bunsen burner is transformed into kinetic energy of the vapour particles. As the particles' kinetic energy increases, the particles moves faster and faster and the temperature increases.**

Complete the diagram below to consolidate your observations from the investigation.