

Module 5 – Heat, Temperature, and Thermal Equilibrium – Instructions

CAUTION:

Before you start this experiment, understand that you are expected to follow directions **EXPLICITLY!** Take your time and read the directions for each step and for each part of the experiment. You will be required to enter data in a particular format in each table of the Worksheet. You will also be required to enter data in WebAssign in a particular format.

LEARNING OUTCOMES (FROM SYLLABUS)

- Solve a variety of basic problems in particle kinematics (uniform motion and accelerated motion, including “free fall”), dynamics using Newton’s Laws of Motion and the conservation laws of energy and momentum (e.g., collisions), fluid mechanics (including Archimedes’ and Bernoulli’s Principles), thermodynamics, wave motion, basic electricity (Coulomb’s and Ohm’s Laws), and radioactive decay.
- Interpret the results of simple experiments and demonstrations of physical principles.

EXPERIMENT SIMULATION

Use this Experiment Simulation¹ to conduct the first part of the experiment according to the instructions in Part I². Watch the video, Thermal Equilibrium Module 5, in the Canvas Media Gallery to answer the questions in Part II³. Follow all instructions explicitly.

WORKSHEET

Please print the worksheet for this experiment. You will need this sheet to record your data.

PART I: TEMPERATURE AND ABSOLUTE ZERO

Open the States of Matter simulation⁴.

Click on “States” and run the simulation. Select Water from the Atoms & Molecules options. The thermometer will indicate the temperature in Kelvins. Selecting the thermometer’s down arrow will show the temperature in Celsius. Record your observations in Table 1 on the worksheet.

a Observe the motions of the molecules at 157 K (–116°C). Describe what you observe.

¹https://phet.colorado.edu/sims/html/states-of-matter-basics/latest/states-of-matter-basics_en.html

²[manual.html#parti](#)

³[manual.html#partii](#)

⁴https://phet.colorado.edu/sims/html/states-of-matter-basics/latest/states-of-matter-basics_en.html

- b** Drag the slide at the bottom of the screen upward to heat the water. Stop when the temperature reaches 283 K (10°C). Describe what you now observe.
- c** Drag the slide at the bottom of the screen upward to heat the water. Stop when the temperature reaches 700 K (427°C). Describe what you now observe.
- d** Drag the slide at the bottom of the screen upward to heat the water. Stop when the temperature reaches 1,000 K (727°C). Are there any molecules that are not spinning?
- e** Drag the slide at the bottom of the screen downward until you reach 1 K. Describe what you observe.
- f** Drag the slide at the bottom of the screen downward until you reach 0 K. Describe what you now observe.
- g** Referring to (f) above, what is the name of this special point on the temperature scale?

Close the States of Matter simulation.

PART II: THERMAL EQUILIBRIUM

- View the short video in your **Canvas** course: **Modules >> Module 5 – Readings, Videos, and Resources >> Thermal Equilibrium Module 5 (1:29)**

Step 1

Watch the video.

Step 2

Answer the questions.