

### Module 3 - Engaging Activities

Evaluate the following. Show your solution.

1. 900 J of heat are added to a system and 200 J of work are done on the system. what is  $\Delta E$  ?
2. Calculate  $w$  for a system that absorbs 260 kJ of heat and for which  $\Delta E$  is 157 kJ. Is the work done on or by the system? Does the system expand or contract?
3. How much energy is needed to raise the temperature of a 75 g sample of aluminum from 22.4 °C to 94.6 °C ? Specific heat of aluminum is 0.900 J/g°C.
4. Energy in the amount of 420 J is added to a 35 g sample of water at a temperature of 10 °C. What is the final temperature of the water?  $C_{H_2O} = 4.186 \text{ J/g}^\circ\text{C}$
5. A piece of unknown metal with a mass of 5.19 g is heated to 100 °C and dropped in 10.0 g of water at 22 °C. The final temperature of the system is 23.83 °C. what is the specific heat of the metal?

### Performance Tasks

**Learning Objective:** To be able to determine the specific heat of the unknown metal sample using coffee cup calorimeter.

### Introduction

Heat is a form of energy that is transferred between objects with different temperatures. Heat always flows from high temperature to low temperature. The amount of heat absorbed or released ( $q$ ) by the object depends on its mass ( $m$ ), specific heat ( $C_s$ ), and the change in temperature ( $\Delta T$ ). Specific heat can be defined as the amount of heat required ( $q$ ) to raise the temperature of one gram of the substance by one degree Celsius. The magnitude of specific heat varies greatly from large values like that of water (4.184 J/g°C) to small values like that of mercury (0.14 J/g°C). When equal masses of objects are heated to absorb an equal amount of heat, the object with smaller the specific heat value would cause the greatest increase in temperature. Heat energy is either absorbed or evolved during nearly all chemical and physical changes. If heat is absorbed or enters the system, the process is endothermic and if heat is evolved or exits the system, the process is exothermic. In the laboratory, heat flow is measured in an apparatus called a calorimeter. A calorimeter is a device used to determine heat flow during a chemical or physical change. A doubled Styrofoam cup fitted with a cover in which a hole is bored to accommodate a thermometer can serve well as a calorimeter.

**Learning Material:** A YouTube link will be uploaded in the Google Classroom to serve as experiment procedure

**Discussion Questions:** After watching the YouTube link, answer the following questions.

1. Write the equation for the heat gained and heat lost using the equation of heat and energy.
2. Which substance lost heat? which substance gained heat? Based from the video.
3. What is the role of the Styrofoam in a coffee cup calorimeter?
4. In your own words, what is thermal equilibrium and how can this be attained?