Background Information:

Life requires energy and the body’s cells are the energy transformers. When you eat, your food is broken down into its needed molecular components. When you breathe, your blood cells carry the oxygen to the body cells for cellular respiration. When you exercise, your body’s cells convert the potential chemical energy into useful kinetic energy.

Energy is defined as the capacity to do work and work is defined as movement against an opposing force. Biologically speaking, the work your cells are doing is chemically changing matter from one form to another. Chemical potential energy is the type of energy for life.

Energy is governed by the laws of thermodynamics. The First Law of Thermodynamics states that the total amount of energy in the universe is constant and it cannot be created or destroyed, just transformed. The Second Law of Thermodynamics states that energy conversions increase the universe’s entropy. The amount of disorder in a system is called entropy.

There are two types of reactions that occur in the cells, endergonic (energy in) and exergonic (energy out). An endergonic reaction takes in energy and an exergonic reaction releases energy. Photosynthesis needs the sun’s energy to make the chemical reactions of converting CO2 and H2O into glucose and O2 happen, which makes this an endergonic reaction. On the other hand, cellular respiration is an exergonic reaction, where glucose is converted to the chemical energy of ATP.

Our cells perform many chemical transformations. The total sum of the reactions is called cellular metabolism.

Energy coupling is the cell’s ability to use the energy released from exergonic reactions is to drive endergonic reactions. The ATP molecule is the key to energy coupling.

In this lab, you will create an endothermic and an exothermic reaction. The cellular processes of energy intake and output are called endergonic or exergonic. The specific chemical reactions are called endothermic and exothermic reactions.

You will also be taking qualitative and quantitative observations. Make sure to label the observations as such.

PART 1

Materials:
- Flask and dish
- Thermometer
- 50ml room temperature water
- 2 g sodium hydroxide (NaOH)
- Spoon or scoop

Procedure:
Read directions first. Create a data table.
1. Fill flask with 50ml water
2. Place thermometer in beaker. Record temperature (C)
3. Feel outside of flask. Record your observations.
4. Stir in NaOH.
5. Feel the outside of the flask. Record your observations.
6. Every minute for 5 minutes, take the temperature of the water/NaOH solution. Record the temperature.

Conclusion: Explain what happened in terms of energy.
PART 2

Materials:
✓ ___ Flask and dish
✓ ___ Thermometer
✓ ___ 50ml room temperature water
✓ ___ 2 g citric acid
✓ ___ 2 g baking soda
✓ ___ spoon or scoop

Procedure:
Read directions first. Create a data table.
1. Fill the flask with 50 ml water.
2. Place thermometer in beaker. Record temperature (°C)
3. Feel outside of flask. Record your observations.
4. Stir in Citric Acid
5. Record the temperature. Feel the beaker and record your observations.
6. Stir in the baking soda.
7. Take the temperature of the Citric acid/baking soda solution. Record the temperature every minute for 5 minutes.
8. Record any other observations.

Conclusion: Explain what happened in terms of energy.

Analysis:
1. a. For each reaction, what was the potential energy?
   b. For each reaction what was the kinetic energy?
2. If an exothermic reaction releases heat, why is it inaccurate to say that an endothermic reaction releases cold?
3. Explain why the energy that is stored in the chemical bonds of a molecule is not destroyed when that molecule is broken down into smaller molecules.
4. Explain which type of bond you think releases more energy when broken, an ionic bond or a covalent bond.
5. When atoms or molecules are forming to make bonds, such as in monomers to polymers, explain whether there is endergonic or exergonic reaction taking place.
6. How are energy and matter related?

!!! Caution !!!
Citric Acid is a strong acid.
Do not ingest. Avoid skin/eye contact.
If contact occurs, flush affected area with water for 15 minutes, rinse mouth with water. Call teacher.