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**Natural Sciences: NATS4**  
**Lesson 8**

**Unit Standard: 7509**

**THEME: Energy and Change**  
**TOPIC: Heat energy and heat transfer**

**At the end of this unit, you should be able to:**

1. Define what is heat energy?
2. Identify and distinguish various forms of energy.
3. State and explain the law of conservation of energy.
4. Illustrate how energy is transferred from one form to another.

**HEAT ENERGY**

**Heat** is the quality of being hot and it is a form of energy. It flows from an area of higher temperature to that of lower temperature. Since heat is a form of energy and energy is the ability to do work.

**How does energy do work?**

By the **Principle of Conservation of Energy** which states that:

***“Energy can neither be created nor destroyed but it can be transferred from one form to another.”***

Heat can be produced from five other forms of energy, namely:

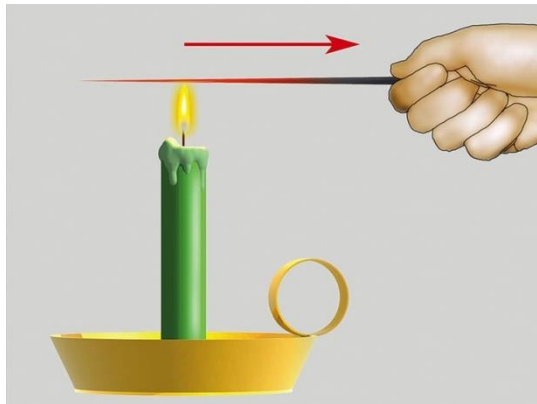
1. **Radiant energy** which comes from sources such Sun, electric lights, fires and lightning.
2. **Chemical energy** released from chemical reactions. It is a form of stored energy.
3. **Mechanical energy** which a sum total of the potential energy and kinetic energy an object has.
4. **Electrical energy** which is the energy of moving charges.
5. **Nuclear energy** which is the energy resulting from the strong forces that exist between the particles in the nucleus of an atom

Therefore, **HEAT or THERMAL ENERGY** is the energy of hot objects, as the result of moving molecules. The greater the movement of molecules in a substance, the more kinetic energy it contains and the hotter it is.

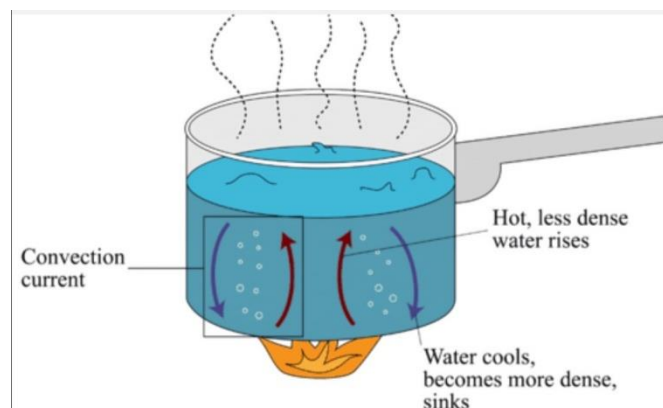
### **TRANSFER OF HEAT ENERGY**

Heat or thermal energy gets transferred by the processes of **conduction, convection and radiation**.

- a) **CONDUCTION** is the transfer of heat between substances that are in direct contact with each other. The better the conductor, the more rapidly heat will be transferred. Metals are conductors of heat. Conduction occurs when a substance is heated and its particles will gain more energy and vibrate more. Then the heat will be transferred to the cooler part of the object.
- **Insulators** are materials that are poor conductors of heat like plastic, rubber, glass etc., hence they are called **thermal insulators**.
  - These substances which trap air internally are good insulators, like wool, fur, cotton etc.



- b) **CONVECTION** is the way in which heat travels through liquids and gases. It occurs when warmer areas of a liquid or gas rise to cooler areas.



***For Example: Heating water***

When water is heated in a pot over a flame, the water molecules directly above the flame start to move faster and further apart as it gets hotter and begins to rise up in the pot. The warmer water near the flame rises to the top of the pot, as it moves from the center it cools down and sinks down the sides of the pot causing continuous circulation of heat energy throughout the pot.

- c) **RADIATION** is heat transferred between objects without contact. Heat is radiated from anything which is warmer than its surroundings.



- **ABSORPTION OF RADIANT HEAT**

Lighter colours do not absorb heat energy as much as darker colours, shiny surfaces do not absorb as much heat as dark surfaces and glass does not absorb heat whereas metal does.

- **HEAT ABSORBERS AND HEAT RADIATORS**

We now know that heat is radiated from any object that is hotter than its surroundings. A surface which absorbs heat well is also a good radiator of heat.

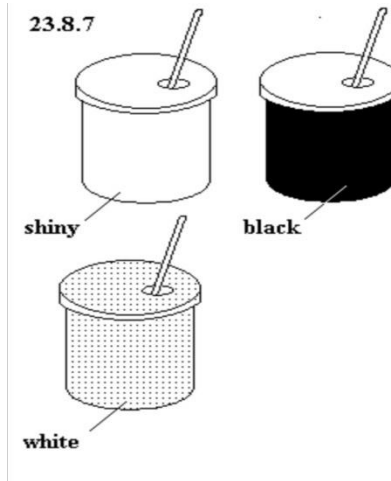
A black surface radiates heat away faster than a light or shiny surface. The best radiating surfaces are black. Shiny surfaces do not lose heat quickly

## ACTIVITY

1. Study the diagram below and answer the question.



- 1.1 Explain what these home appliances are used for.
- 1.2 Identify the form of heat transfer that occurs in each home appliance.
2. Tabulate THREE differences in the forms of heat transfer identified in 1.2 above.
3. Study the diagram showing different colored cans and answer the questions.



- 3.1 Rate the heat absorption of the cans from **hot**, **hotter** and **hottest** should they be filled with boiling water.
- 3.2 Identify the cans as either **heat absorber** or **heat radiator**.