



## Lab. (3) Temperature and Thermometers



### Heat Verses Temperature

We have all noticed that when you hear something up, its temperature rises. Often, we think that heat and temperature is the same thing. However, this is not the case. Heat and temperature are related to each other, but are different concepts.



**HEAT**



**TEMPERATURE**

**Heat:** is the total energy of molecular motion in a substance.

**Temperature:** is a measure of the average energy of molecular motion in a substance, we can measure the temperature body by devise called “thermometers”.

### Detecting Heat

There are many ways to detect heat. The method chosen often depends on what heat source we are trying to measure. For example, the way we

detect the heat in the air is different from how we detect heat from a fire or heat from objects in deep space.

We have all felt various levels of heat. Our skin is a good detector of heat and we interpret the average molecular motion within an object as a feeling that the object is hot or cold. However, our skin does not always give us consistent measurements of heat energy.

## Thermometers

Thermometers can be used for measuring the temperature in various applications (clinical, food and outdoor thermometer), which are either mechanically or electrically (digital thermometer).

**A-mechanical thermometers** are based on the ability of a substance to expand when heated or contract when cooled. One type of mechanical thermometer, the liquid-in-glass thermometer, includes: -

- maximum thermometer: usually are liquid-in-glass thermometers, such as mercury, that record maximum observed temperature
- minimum thermometers, which contain a liquid of low density, such as alcohol. that record minimum observed temperatures.

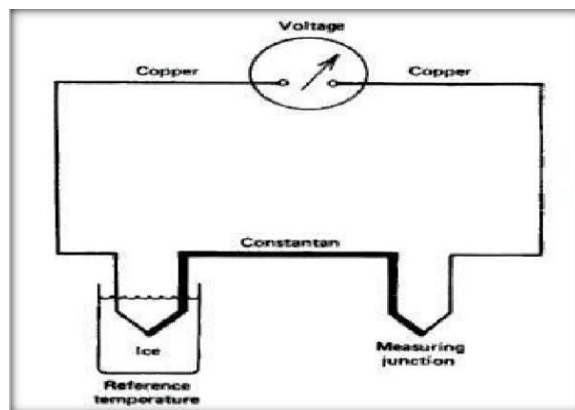


## B-Digital thermometers

Digital thermometers use thermocouples or thermostats to sense the change in temperature and display the temperature on a digital display. Infrared thermometers use the infrared sensors to determine the temperature and have a digital display.



## Thermocouple



Infrared ear thermometer which measure the infrared energy emitted from the patient's eardrum



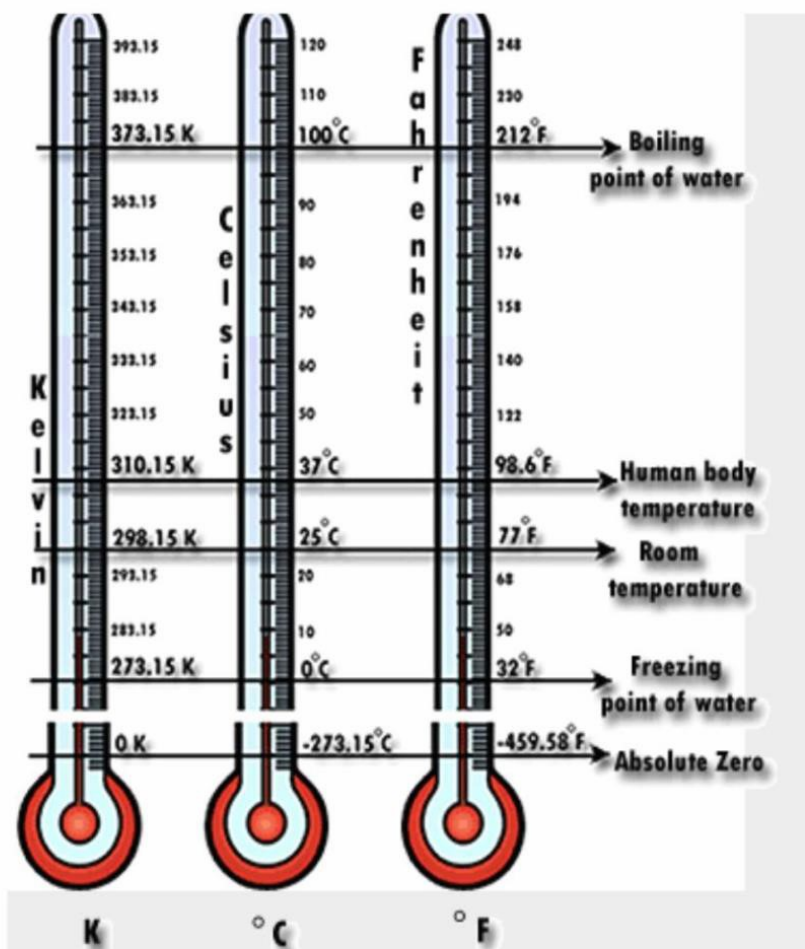
### Temperature Scales

The three common temperature scales used to measure temperature are:

A-The **Fahrenheit scale**, which is defined by using the ice point ( $32^{\circ}$ ) and steam point ( $212^{\circ}$ ).

B-The **Celsius scale**, a decimal scale on which the melting point of ice is set at 0 and the boiling point of water at  $100^{\circ}$ .

he **Kelvin** or **absolute scale**, where the zero point represents the temperature at which all molecular motion is presumed to cease (called **absolute zero**), the ice point is set at 273, and the steam point at 373.



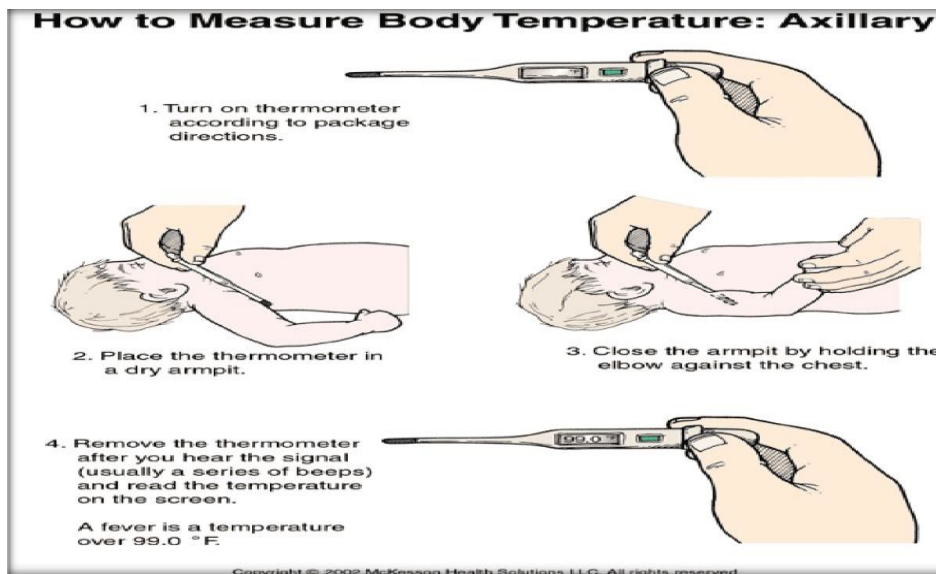
## The Ways of Measuring the Temperature

1. Orally.
2. Rectally
3. Axially.
4. By ear

1- Oral temperature can be taken by mouth using classic glass mercury-filled or digital thermometers (Normal body temperature = 37°C).



2- Axillary temperatures can be taken under the arm. Temperatures taken by this route tend to be (0.5°C) lower than those temperatures taken by mouth.



3- Rectally temperatures taken rectally (using a mercury or digital thermometer) tend to be 0.5°C higher than when taken by mouth.

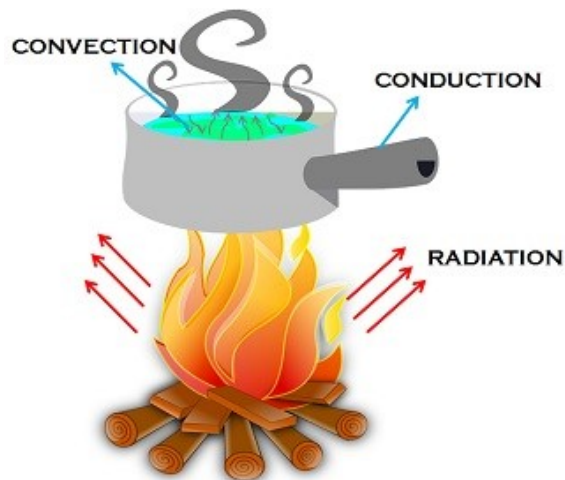
4- By ear a special thermometer can quickly measure the temperature of the ear drum, which reflects the body's core temperature.



### How does Heat Travel?

Heat can be transferred from one place to another by four methods: -

1. Conduction.
2. Convection.
3. Evaporation.
4. Radiation.



The method used to transfer heat is usually the one that is the most efficient. If there is a temperature difference in a system, heat will always move from higher to lower temperatures.

The skin temperature, in contrast to the core temperature, rises and falls with the temperature of the surroundings. This is the temperature that is important when we refer to the ability of the skin to lose heat to the surroundings.