University of Al-Mustaqbal
College of Science
Department of Medical Physics

BIOPHYSICS

first stage

(Types of heat in Biothermal physics)

Lecture Five

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What is Heat?

Heat is the form of energy that is transferred between two materials of different temperature. This transfer of energy occurs because of differences in the average. translational kinetic energy per molecule in the two materials Heat flows from the material with higher temperature to the material with lower temperature

The SI unit of heat is the joule, where 1 joule = 1 newton × meter

What is Temperature?

Temperature is a measure of average translational kinetic energy per molecule in a substance.

Temperature scales are **Fahrenheit, Celsius and Kelvin**

In Fahrenheit scale, water freezes at 32^{o} and boils at 212^{o}.

On the Celsius scale, water freezes at $0^{o}$and boils at 100^{o}.

The scientific standard, is the Kelvin scale. 0 Kelvin is equal to -273.15^{o} Celsius.

Converting Between Celsius, Kelvin, and Fahrenheit Scales

To Convert From…	Use This Equation
Celsius to Fahrenheit	$T_{°F} = 9/5\ T_{°C} + 32$
Fahrenheit to Celsius	$T_{°C} = 5/9\ (T_{°F} - 32)$
Celsius to Kelvin	$T_K = T_{°C} + 273.15$
Kelvin to Celsius	$T_{°C} = T_K - 273.15$
Fahrenheit to Kelvin	$T_K = 5/9\ (T_{°F} - 32) + 273.15$
Kelvin to Fahrenheit	$T_{°F} = 9/5\ (T_K - 273.15) + 32$

Types of heat:-

There are three types of heat:

1. Perceptible heat is the heat that can cause a change and a difference in the temperature of a substance

2. Latent heat, a specific amount of energy is required to change the solid form of a particular substances into a liquid or the liquid into a gas. It is energy required for change of state

3. Specific heat is the quantity of heat required to raise the temperature of one gram of a substance by one Celsius degree. The units of specific heat are usually calories or joules per gram per Celsius degree. example, the specific heat of water is 1 calorie (or 4.186 joules) per gram per Celsius degree.

$$c = \frac{\Delta E}{m\Delta\theta}$$

$$\Delta E = mc\Delta\theta$$

m = mass (kg)
c = specific heat capacity (J/kg°C)
ΔE = change in thermal energy (J)
$\Delta\theta$= change in temperature (°C)

Example

A 250g copper pipe is heated from 10°C to 31°C. What is the energy needed to heat the pipe? The specific heat capacity of copper is 390 $J/kg^{-1}°C^{-1}$.

$$\Delta E = mc\Delta\theta$$

$m = 250g \times 10^{-3} = 0.25$ kg, $\Delta\theta = 31 - 10 = 21°C$

$\Delta E = 0.25\ kg \times 390\ J/kg^{-1}°C^{-1} \times 21°C = 2048J$

Q: 1. What is 12.0 °C in kelvins?

2. What is 32.0 °C in degrees Fahrenheit?

3. What is used to measure temperature?

4. what the difference between heat and temperature?