

## Study Material

**Program Code:** Common to all 1<sup>st</sup> semester

**Semester:** 1

**Course Name:** Basic Science (Physics)

**Course Code:** 22102

**Topic Name:** Heat and optics

**UO3a:** Convert the given temperature in different temperature scales

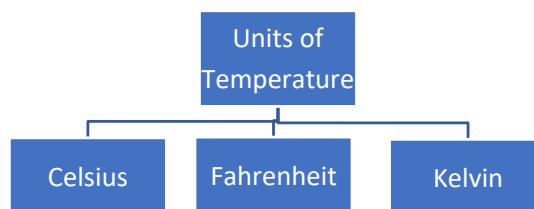
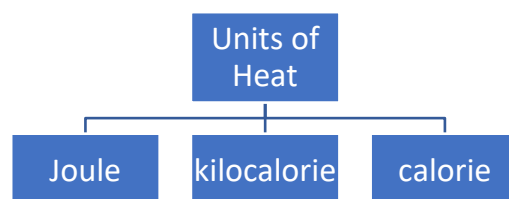
**LO1:**

Students will be able to convert the given temperature in different temperature scales.

**Course Expert:** Mrs. Deepa Gupte

**Date:** 21/9/2020

**Concept Map:**

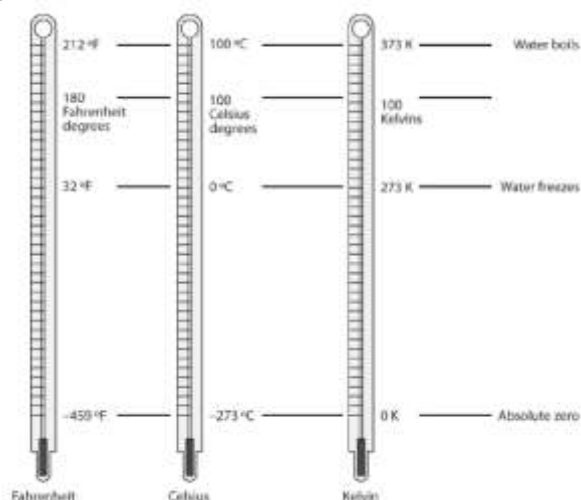


**Key words:** Heat, Temperature, Celsius, Fahrenheit, Kelvin

**Key Questions:** what are different scales of temperatures?

**Key Definition/Formula:** Heat, Temperature, calorie, kilocalorie, Absolute zero temperature

**Diagram /Picture:**



## Notes:

**Heat and Temperature:** When we sit in the sun we feel warm or when milk is poured in a pot placed in fire, it becomes hotter. Thus it is the heat which has been transferred from sun to us and makes us feel warm or makes the milk in the pot hotter.

**Heat** is the form of energy that is transferred from the body which is at high temperature to the body at lower temperature.

We can sense temperature by touch, i.e., we feel the coldness and hotness of the body by touch. A glass tumbler of ice cold water or hot tea in a metal cup makes us to feel upto what extend the coldness or hotness is.

**Temperature** is the measure of degree of hotness or coldness of a body.

## Comparison between heat and temperature

Heat	Temperature
1. Heat is energy which produces sensation of hotness or coldness	1. Temperature is a measure of degree of hotness or coldness of the body.
2. Heat flows from higher temperature to lower temperature	2. Temperature determines the direction of flow of heat
3. Heat is a cause	3. Temperature is effect
4. Symbol of heat is Q	4. Symbol of temperature is T
5. SI unit is Joule	5. SI unit is Kelvin
6. Heat is the sum of energies of all molecules of the body	6. It is average K.E. of the molecules of the body

**Unit of Heat:** When two bodies having different temperatures are brought in contact with each other there is net flow of heat energy from the body at higher temperature to the body at lower temperature. The units in heat is measured are based upon the heat required to raise the temperature of unit mass of water by one degree. Following are the units usually used.

**1 calorie:** It is the amount of heat required to raise the temperature of 1 gram of water by 1°C.

**1 kilocalorie:** It is the amount of heat required to raise the temperature of 1 kilogram of water by 1°C.

## Absolute Zero, units of °C, °F, °K and their conversion:

For any gas, at -273°C pressure and volume of a gas theoretically becomes zero. i.e. -

-273°C is minimum, possible temperature for all gases. The temperature at which the pressure and volume of gas

(theoretically) becomes zero is called **Absolute zero temperature**.

i.e.  $-273^{\circ}\text{C} = 0^{\circ}\text{A} = 0^{\circ}\text{K}$ .

Temperatures are expressed using different temperature measurement scales measured in degrees.

## **Celsius scale ( $^{\circ}\text{C}$ ):**

Celsius scale is a temperature scale where  $0^{\circ}\text{C}$  is the freezing point of water and  $100^{\circ}\text{C}$  is the boiling point of water. The Celsius scale is divided into 100 divisions between these two fixed points and each division is called degree Celsius ( $^{\circ}\text{C}$ ).

## **Fahrenheit scale ( $^{\circ}\text{F}$ ):**

On Fahrenheit scale, the freezing point of liquid water is  $32^{\circ}\text{F}$ , and the boiling point of water is  $212^{\circ}\text{F}$ . The Fahrenheit scale is divided into 180 equal parts between these two fixed points and each part is called degree Fahrenheit ( $^{\circ}\text{F}$ ).

## **Kelvin scale or Absolute scale ( $^{\circ}\text{A}$ or $^{\circ}\text{K}$ ):**

Lord Kelvin developed absolute scale of temperature. It is also known as ideal gas scale

or Kelvin scale of temperature. On the absolute temperature scale, the absolute zero of temperature is  $0^{\circ}\text{A}$  (absolute) or  $0^{\circ}\text{K}$  (Kelvin) equal to  $-273^{\circ}\text{C}$ .

i.e. In normal  $^{\circ}\text{C}$  scale, the starting point is  $0^{\circ}\text{C}$  but for gases we have seen  $-273^{\circ}\text{C}$  is the minimum possible temperature therefore A new scale starts from  $-273^{\circ}\text{C}$  is called absolute or Kelvin scale of temperature.

## **Conversion of temperature:**

To convert temperature reading from one scale to another, simple relationships between

temperatures in different scales are as follows:

**The temperature conversion formula from Celsius to Kelvin is**

$$\text{K} = \text{C} + 273$$

**The temperature conversion formula from Fahrenheit to Celsius is**

$$\text{C} = (\text{F} - 32) \times 5/9$$

**So The Temperature Conversion Formula from Fahrenheit to Kelvin is:**

$$\text{K} = [(\text{F} - 32) \times 5/9] + 273$$

**Link to YouTube/ OER/ video/e-book:**

**Key Take away: conversion between different scales of temperatures**

## Formative Assessments

<22102>: < Common to all 1st semester>: <Common to all>: <Heat and Optics>: <UO3a: Convert the given temperature in different temperature scales>: <Assessments>: <Formative>

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**Assessment Type: Formative Assessments:**

Set 1: Question No 1	Set 1: Question No 2	Set 1: Question No 3
SI unit of heat is	_____ is a measure of degree of hotness or coldness of the body.	The amount of heat required to raise the temperature of 1 gram of water by 1°C is called _____
a) J	a)Heat	a) 1 calorie
b) J/s	b)Energy	b) 1 kilocalorie
c) Cal	c)Temperature	c) 1 joule
d) J/cal	d)Radiation	d) 1 kJ
Ans: <a>	Ans: <c>	Ans: <a>

Set 2: Question No 1	Set 2: Question No 2	Set 2: Question No 3
-273 °C = _____	Kelvin scale is also called as _____	If we convert 110 °F into Celsius scale of temperature, we get
a) 0 °K	a) Celsius scale	a) 43.3 °C
b) 0 °F	b) Absolute scale	b) 0 °C
c) Both (A) and (B)	c) Fahrenheit scale	c) 150 °C
d) None of the above	d) All of the above	d) 60.5 °C
Ans: <a>	Ans: <b>	Ans: <a>



# VIVEKANAND EDUCATION SOCIETY'S POLYTECHNIC

## Practice Worksheet

<22102> : <Common to all 1<sup>st</sup> Semester> : < Common to all 1<sup>st</sup> Semester>: <Heat and optics>: <UO1a> : <Assessments> :  
<Worksheet>

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Assessment Type: Practice Worksheets:

<p>A) The temperature at which the pressure and volume of gas (theoretically) becomes zero is called _____ temperature</p> <ol style="list-style-type: none"> <li>Absolute zero</li> <li>Celsius zero</li> <li>Fahrenheit zero</li> <li>zero</li> </ol>	<p>B) _____ scale, the freezing point of liquid water is 32°F, and the boiling point of water is 212°F.</p> <ol style="list-style-type: none"> <li>Celsius</li> <li>Fahrenheit</li> <li>Kelvin</li> <li>Absolute</li> </ol>
Ans A: a	Ans B: b
<p>C) If boiling point of water is 100 °C, calculate the temperature of water in Fahrenheit.</p> <ol style="list-style-type: none"> <li>127°F</li> <li>212°F</li> <li>273°F</li> <li>373°F</li> </ol>	<p>D) Scale which is divided into equal 180 parts between the freezing point and boiling point and each division is called _____</p> <ol style="list-style-type: none"> <li>degree Celsius</li> <li>degree Fahrenheit</li> <li>degree Kelvin</li> <li>degree Absolute</li> </ol>
Ans C: b	Ans D: b
<p>E) Temperature of water in a breaker is 40 °C. Its value in Fahrenheit scale is</p> <ol style="list-style-type: none"> <li>104 °F</li> <li>110 °F</li> <li>116 °F</li> <li>130 °F</li> </ol>	<p>F) The amount of heat required to raise the temperature of 1 gram of water by 1°C is called _____</p> <ol style="list-style-type: none"> <li>1 calorie</li> <li>1 kilocalorie</li> <li>1 joule</li> <li>1 kJ</li> </ol>
Ans E: a	Ans F: a
<p>G) _____ scale is a temperature scale where 0°C is the freezing point of water and 100°C is the boiling point of water.</p> <ol style="list-style-type: none"> <li>Celsius</li> <li>Fahrenheit</li> <li>Kelvin</li> <li>d. Absolute</li> </ol>	<p>H) Normal human body's temperature is 98.6 °F. In Celsius scale, it is</p> <ol style="list-style-type: none"> <li>27°C</li> <li>30°C</li> <li>32°C</li> <li>37°C</li> </ol>
Ans G: a	Ans H: a
<p>I) Which is the correct correlation between °C scale and °F scale?</p> <ol style="list-style-type: none"> <li><math>^{\circ}\text{C} = (^{\circ}\text{F} - 32) \times 5/9</math></li> <li><math>^{\circ}\text{F} = (9/5 \times ^{\circ}\text{C}) + 32</math></li> <li>Both (A) and (B)</li> <li>None of the above</li> </ol>	<p>J) The amount of heat required to raise the temperature of 1 kg of water by 1°C is called _____</p> <ol style="list-style-type: none"> <li>1 calorie</li> <li>1 kilocalorie</li> <li>1 joule</li> <li>1 kJ</li> </ol>
Ans I: c	Ans J: b