SNS COLLEGE OF ALLIED HEALTH SCIENCE

Affiliated to The Tamil Nadu Dr MGR Medical University, Chennai

DEPARTMENT OF RADIOGRAPHY TECHNOLOGY

COURSE NAME: GENERAL PHYSICS

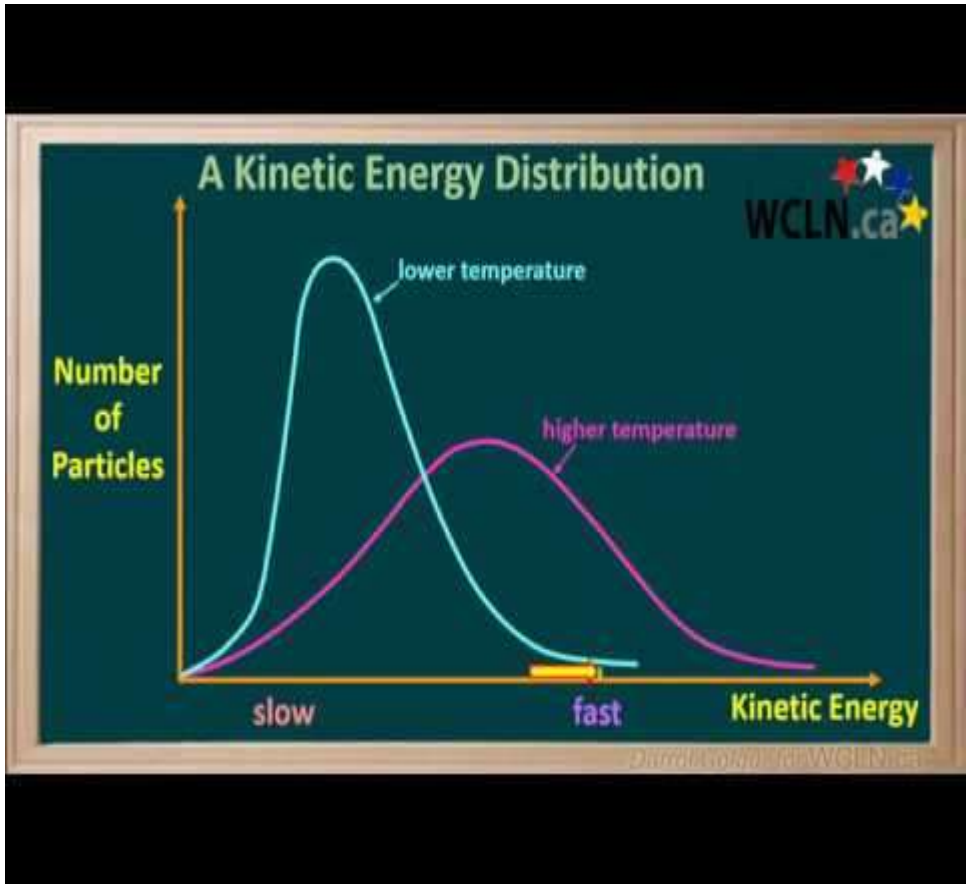
UNIT : 1

TOPIC :TEMPRETURE AND SI UNIT

FACULTY NAME: MS.M.DHANALAKSHMI

TEMPERATURE – DEFINITION

- Temperature is the measure of average kinetic energy of molecules in a substance.
- It determines the direction of heat flow (hot → cold).
- Measured using thermometers (mercury, alcohol, digital).
- SI unit is Kelvin (K); no degree symbol.
- 0 K = absolute zero = all molecular motion stops



SCALES OF TEMPERATURE

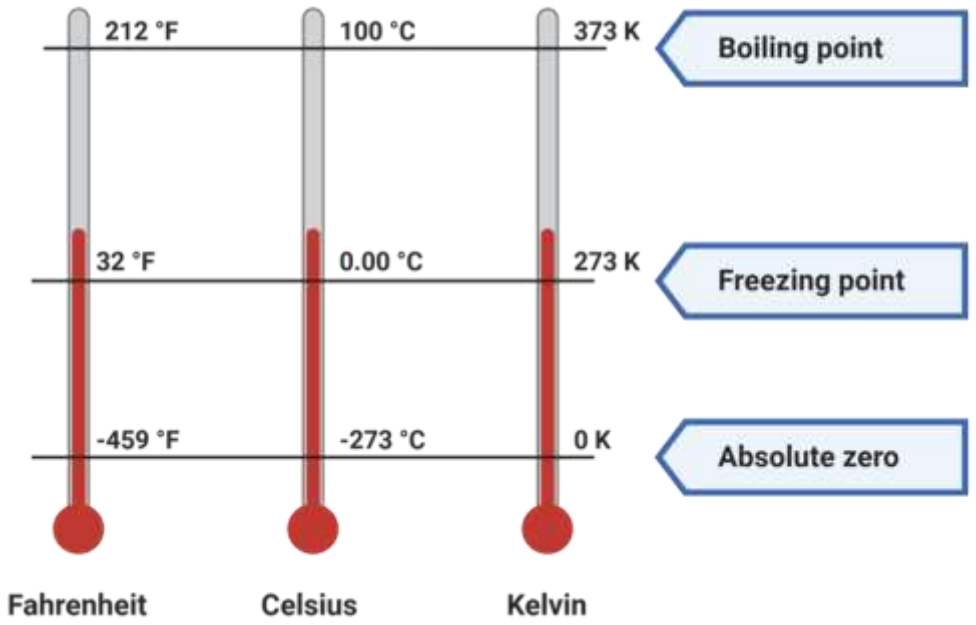
❖Celsius (°C): Water freezes at 0°C, boils at 100°C.

❖Kelvin (K): Absolute scale; 0 K = –273.15°C.

❖Fahrenheit (°F): Water freezes at 32°F, boils at 212°F.

❖Conversion: K = °C + 273.15

❖Conversion: °C = (5/9)(°F – 32)



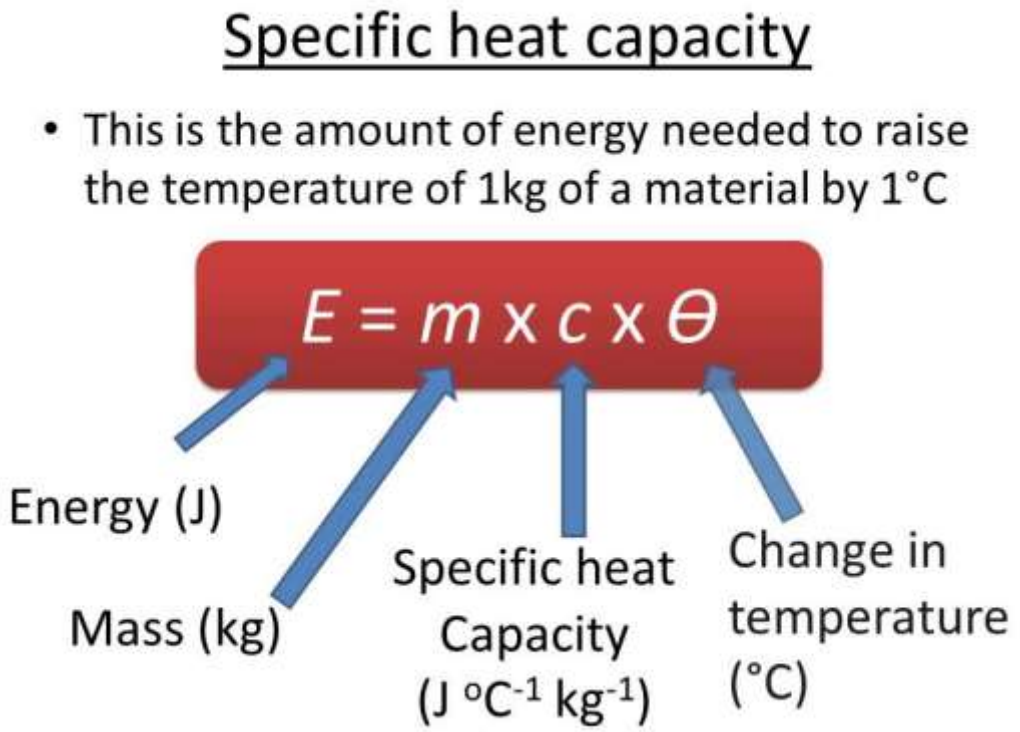
HEAT – DEFINITION & UNIT

- ❖Heat is the form of energy transferred due to temperature difference.
- ❖It flows from higher to lower temperature body.
- ❖SI unit of heat is Joule (J).
- ❖1 calorie = 4.186 J (old unit).
- ❖Heat is a scalar quantity and path-dependent

Unit	Joules (J)	Calories (cal)	British Thermal Units (BTU)	Kilowatt-hours (kWh)
Joules	1	0.2390	0.000948	2.77778E-07
Calories	4.187	1	0.00397	1.16279E-06
BTUs	1055	252	1	0.000293
Kilowatt-hours	3.6E6	8.6E5	3412	1

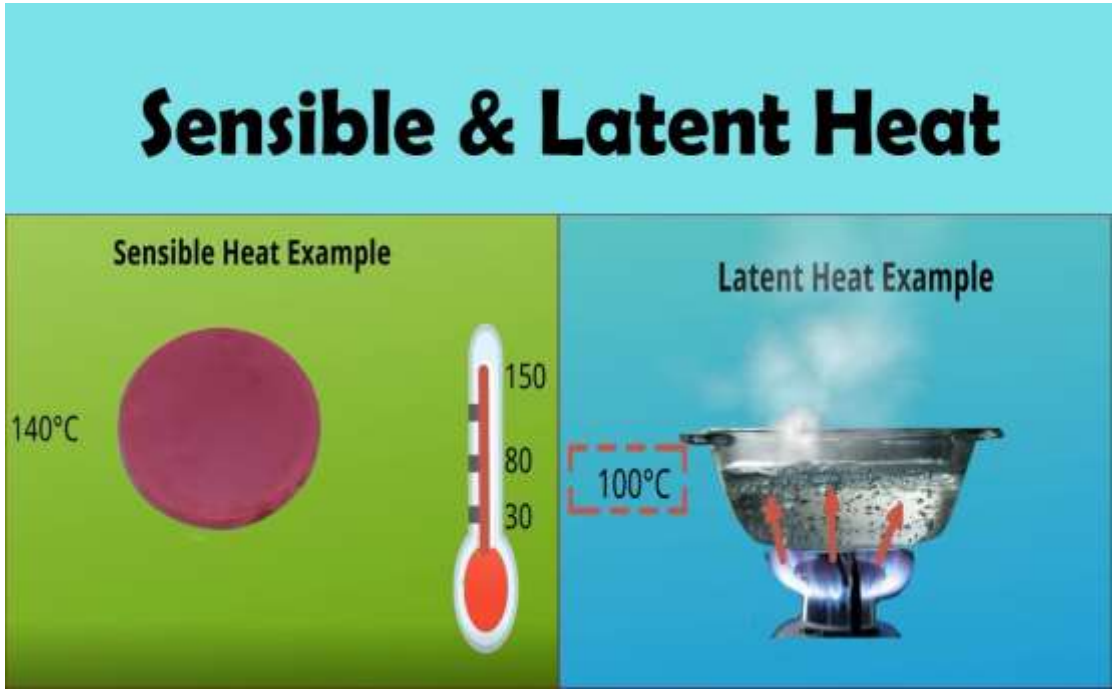
SPECIFIC HEAT CAPACITY

- Specific heat (c) = heat required to raise 1 kg of substance by 1 K.
- Unit: J/kg·K
- Water has high specific heat (4186 J/kg·K).
- Formula: Q = m c ΔT
- Explains why water is used in cooling systems



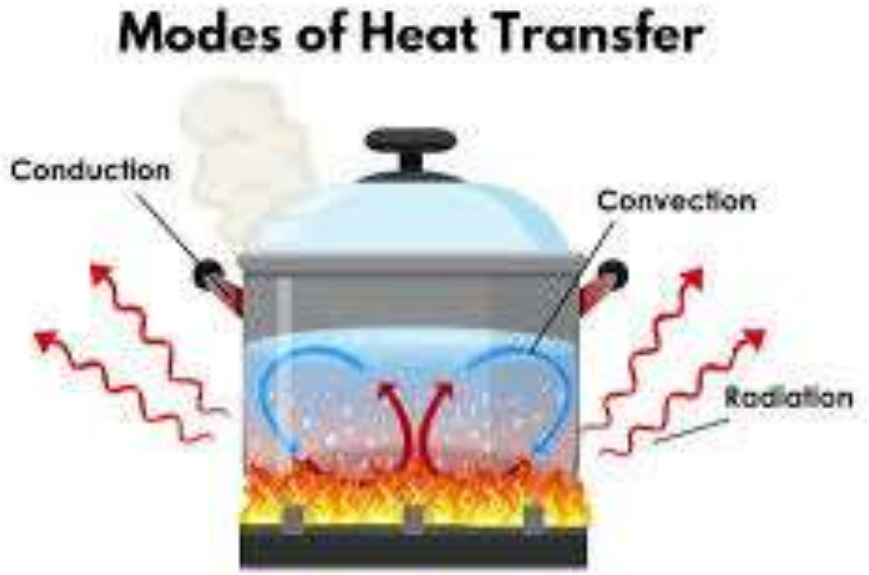
LATENT HEAT

- Latent heat = heat absorbed/released during phase change at constant temperature.
- Latent heat of fusion (L_f): solid ↔ liquid.
- Latent heat of vaporization (L_v): liquid ↔ gas.
- Formula: $Q = m L$ Water: $L_f = 334$ kJ/kg, $L_v = 2260$ kJ/kg.



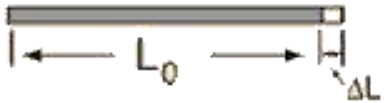
MODES OF HEAT TRANSFER

- Conduction: Through direct molecular contact (solids).
- Convection: Through fluid motion (liquids/gases).
- Radiation: Through electromagnetic waves (no medium).
- All bodies above 0 K emit thermal radiation.
- Black body = perfect absorber and emitter.



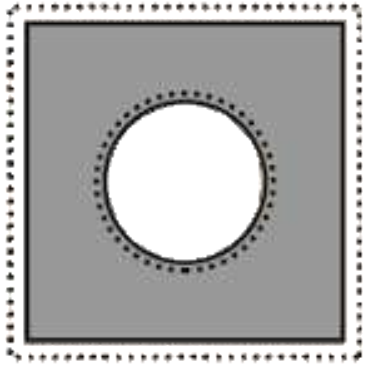
THERMAL EXPANSION

- Most solids expand on heating, contract on cooling.
- Linear expansion: $\Delta L = L_0 \alpha \Delta T$
- Volume expansion: $\Delta V = V_0 \gamma \Delta T$
- $\gamma = 3\alpha$ (for isotropic materials).
- Bimetallic strip used in thermostats



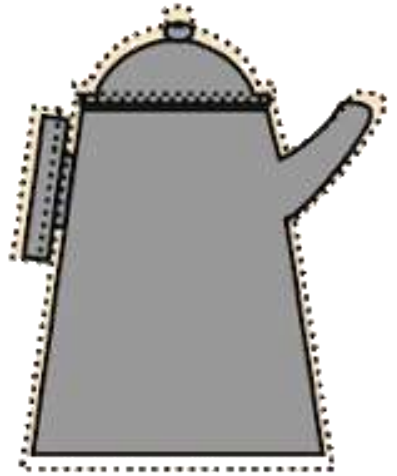
Linear expansion

$$\frac{\Delta L}{L_0} = \alpha \Delta T$$



Area expansion

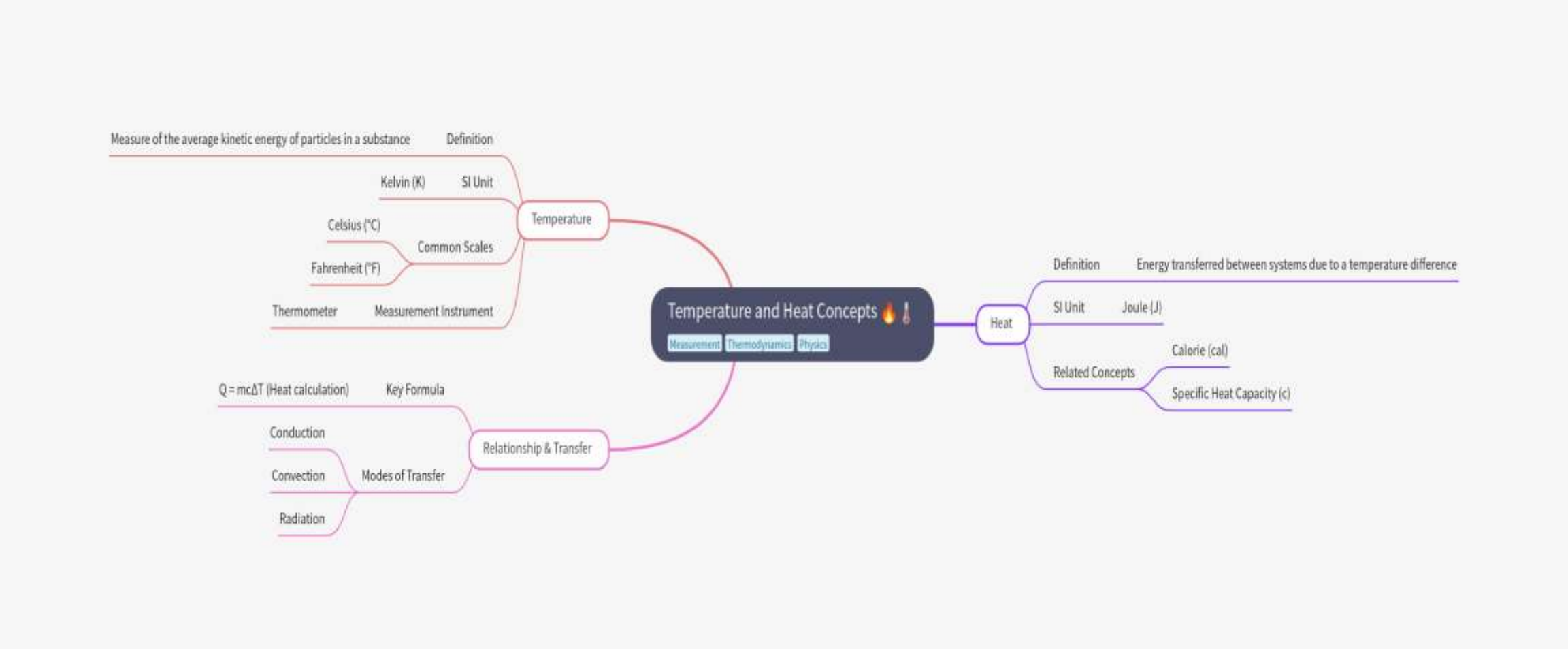
$$\frac{\Delta A}{A_0} = 2\alpha \Delta T$$



Volume expansion

$$\frac{\Delta V}{V_0} = 3\alpha \Delta T$$

SUMMARY


Temperature and Heat Concepts
Measurement
Thermodynamics
Physics
Temperature
Definition
Measure of the average kinetic energy of particles in a substance
SI Unit
Kelvin (K)
Common Scales
Celsius (°C)
Fahrenheit (°F)
Measurement Instrument
Thermometer
Heat
Definition
Energy transferred between systems due to a temperature difference
SI Unit
Joule (J)
Related Concepts
Calorie (cal)
Specific Heat Capacity (c)
Relationship & Transfer
Key Formula
Q = mcΔT (Heat calculation)
Modes of Transfer
Conduction
Convection
Radiation

REFERENCE

- **The Essential Physics of Medical Imaging**
- **Authors:** Jerrold T. Bushberg, J. Anthony Seibert, Edwin M. Leidholdt Jr., John M. Boone
- **Publisher:** Lippincott Williams & Wilkins (3rd Edition, 2011)

The Physics of Radiology and Imaging

- **Author:** K. Thayalan
- **Publisher:** Jaypee Brothers Medical Publishers (2nd Edition, 2014)
- **Physics of Thermal Therapy: Fundamentals and Clinical Applications**
- **Editors:** Eduardo G. Moros
- **Publisher:** CRC Press (2013)