O Level Physics Tutorial 9: Thermal Properties of Matter

Syllabus :
(a) describe internal energy as an energy store that is made up of the total kinetic energy associated with the random motion of the particles and the total potential energy between the particles in the system

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1. Explain what is internal energy of a substance in terms of its particles.

(b) define heat capacity and specific heat capacity

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2. (i) Define heat capacity.

   (ii) Define specific heat capacity.

(c) recall and apply the relationship energy transfer (by heating) = mass ×specific heat capacity x change in temperature to new situations or to solve related problems

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3. The specific heat capacity of water is 4,200 Joules per kilogram per degree Celsius (J/kg°C). A kettle with 500 g of water is heated for a short while. The water temperature increases by 10 °C. Find the heat gained by the water.

(d) describe melting/solidification and boiling/condensation as processes of energy transfer without a change in temperature

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4. A small pot of ice at -5 ºC is placed on a hot plate and warmed up slowly until it starts boiling.

   (i) Describe how the ice changes with temperature changes.

   (ii) Sketch a temperature showing how the temperature changes with time.

(e) explain the difference between boiling and evaporation

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5. Explain the difference between boiling and evaporation.

(f) define latent heat and specific latent heat

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6. (i) Define latent heat of fusion.
(ii) Define specific latent heat of fusion.
(iii) Define latent heat of vaporisation.
(iv) Define specific latent heat of vaporisation.

(g) recall and apply the relationship energy transfer (by heating for a change of state) = mass ×specific latent heat to new situations or to solve related problems

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7. The specific latent heat of fusion of water is 333 kJ/kg, and the specific heat of vaporisation is 2257 kJ/kg. A pot of ice of mass 200 g is placed over a hot plate and warmed up slowly. The temperature is measured at regular intervals until the water boils. Find

(i) the heat needed to melt the ice at 0 ºC,

(ii) the heat needed to raise the water temperature to 100 ºC and

(iii) the heat needed to boil the water at 100 ºC.

(h) explain latent heat in terms of behaviour of particles in a body

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8. Explain latent heat of vaporisation in terms of behaviour of particles in a body.

(i) sketch and interpret a cooling curve.

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9. Steam at 110 ºC is cooled down slowly. It condenses into water. It eventually freezes into ice and continues to be cooled until -10 ºC. Sketch a graph of temperature against time and explain the various features.