

Thermal Properties of Matter — Assignment 1

Class 11 Physics · Topic-wise question bank covering every concept of the chapter · Narayan Gurukul Academy

Instructions: (1) Attempt all questions. This worksheet walks through every concept of the chapter, topic by topic.
(2) The interactive MCQ version of these questions (with instant answer reveal) is available on the notes page.
(3) Universal values: $g = 10 \text{ m/s}^2$ unless stated. Give answers with correct SI units.

Temperature and Temperature Scales

MCQ Questions (choose the correct option)

- The boiling point of water in the Fahrenheit scale is —
(A) 212°F
(B) 100°F
(C) 32°F
(D) 180°F
- Absolute zero is approximately —
(A) -273.15°C
(B) 0°C
(C) -100°C
(D) 273.15°C
- A change of 1 kelvin is equal to a change of —
(A) 1°C
(B) $9/5^\circ\text{C}$
(C) $5/9^\circ\text{C}$
(D) 100°C
- Heat always flows from —
(A) a body at higher temperature to one at lower temperature
(B) a body at lower temperature to one at higher temperature
(C) a heavier body to a lighter one
(D) a lighter body to a heavier one

1 Mark Questions

- Distinguish between heat and temperature.
- State the SI units of heat and temperature.
- What is absolute zero?

2 Mark Questions

- Convert 98.6°F (normal body temperature) to the Celsius scale.
- Write the relation between the Celsius, Fahrenheit and Kelvin scales and define each.
- Convert 300 K to the Celsius and Fahrenheit scales.

3 Mark Questions

- Explain the need for an absolute (Kelvin) scale of temperature and write its relation with the Celsius scale.
- At what temperature do the Celsius and Fahrenheit scales read the same numerical value? Derive your answer.

Thermal Expansion of Solids and Liquids

MCQ Questions (choose the correct option)

1. For a solid, the relation between volume (γ) and linear (α) expansion coefficients is —
(A) $\gamma = 3\alpha$
(B) $\gamma = 2\alpha$
(C) $\gamma = \alpha$
(D) $\gamma = \alpha/3$
2. The coefficient of superficial expansion β is related to α by —
(A) $\beta = 2\alpha$
(B) $\beta = 3\alpha$
(C) $\beta = \alpha$
(D) $\beta = 4\alpha$
3. Water has its maximum density at —
(A) 4 °C
(B) 0 °C
(C) 100 °C
(D) 25 °C
4. A bimetallic strip bends on heating because —
(A) its two metals have different expansion coefficients
(B) it expands uniformly
(C) it contracts on heating
(D) of gravity

1 Mark Questions

1. Define the coefficient of linear expansion.
2. Write the relations between α , β and γ for a solid.
3. At what temperature is the density of water maximum?

2 Mark Questions

1. A steel rod of length 1 m and coefficient of linear expansion $1.1 \times 10^{-5} \text{ K}^{-1}$ is heated from 20 °C to 120 °C. Find its increase in length.
2. Why are gaps left between successive sections of railway tracks?
3. Show that for a solid $\beta = 2\alpha$ and $\gamma = 3\alpha$.

3 Mark Questions

1. Define α , β and γ for a solid, and derive the relations $\beta = 2\alpha$ and $\gamma = 3\alpha$.
2. A copper plate has a hole of diameter 1 cm at 20 °C. Find the new diameter of the hole when the plate is heated to 220 °C. ($\alpha = 1.7 \times 10^{-5} \text{ K}^{-1}$.)

Calorimetry and Specific Heat**MCQ Questions (choose the correct option)**

1. The heat needed to raise the temperature of mass m by ΔT with specific heat c is —
(A) $Q = mc\Delta T$
(B) $Q = m\Delta T/c$

- (C) $Q = c\Delta T/m$
(D) $Q = mc/\Delta T$
2. The SI unit of specific heat is —
(A) $\text{J kg}^{-1} \text{K}^{-1}$
(B) J kg
(C) J K
(D) $\text{W m}^{-1} \text{K}^{-1}$
3. The substance with an unusually high specific heat is —
(A) water
(B) iron
(C) copper
(D) mercury
4. In the method of mixtures, the heat lost by the hotter bodies —
(A) equals the heat gained by the colder ones
(B) is always greater
(C) is always less
(D) is independent of the colder bodies

1 Mark Questions

1. Define specific heat capacity. Write its SI unit.
2. Write the expression $Q = mc\Delta T$ and identify each symbol.
3. Why is water used as a coolant?

2 Mark Questions

1. How much heat is required to raise the temperature of 500 g of water from 20°C to 40°C ? ($c = 4200 \text{ J kg}^{-1} \text{K}^{-1}$.)
2. State the principle of the method of mixtures and describe how a calorimeter is used.
3. A block of iron of mass 200 g at 100°C is dropped into 200 g of water at 20°C in a calorimeter. Explain why the final temperature is not 60°C .

3 Mark Questions

1. Define specific heat capacity and heat capacity, and state their SI units. Explain the meaning of the method of mixtures.
2. A piece of metal of mass 100 g at 100°C is placed in 200 g of water at 20°C in a calorimeter of negligible heat capacity. If the final temperature is 25°C , find the specific heat of the metal. ($c_{\text{water}} = 4200 \text{ J kg}^{-1} \text{K}^{-1}$.)

Change of State and Latent Heat

MCQ Questions (choose the correct option)

1. During a change of state at constant pressure, the temperature of the substance —
(A) remains constant
(B) rises steadily
(C) falls steadily
(D) first rises then falls
2. The heat required to melt unit mass of a solid is its —
(A) latent heat of fusion
(B) latent heat of vaporisation

- (C) specific heat
- (D) heat capacity
- 3. The latent heat of vaporisation of water is approximately —
 - (A) $2.26 \times 10^6 \text{ J kg}^{-1}$
 - (B) $3.34 \times 10^5 \text{ J kg}^{-1}$
 - (C) $4.2 \times 10^3 \text{ J kg}^{-1}$
 - (D) 10^6 J kg^{-1}
- 4. Perspiration cools the body because —
 - (A) sweat evaporates, absorbing latent heat from the skin
 - (B) sweat is cold
 - (C) the skin expands
 - (D) of convection

1 Mark Questions

1. Define latent heat.
2. Write the expression $Q = mL$ and identify each symbol.
3. Why is welding done so that heat is applied during melting and boiling?

2 Mark Questions

1. How much heat is needed to convert 100 g of ice at 0°C to water at 0°C ? ($L_f = 3.34 \times 10^5 \text{ J kg}^{-1}$.)
2. Explain why steam at 100°C causes more severe burns than water at 100°C .
3. State the latent heat of fusion and vaporisation of water.

3 Mark Questions

1. Define latent heat of fusion and vaporisation, and explain why temperature stays constant during a change of state.
2. Find the heat required to convert 200 g of ice at -10°C to steam at 100°C . ($c_{\text{ice}} = 2100$, $c_{\text{water}} = 4200$, $L_f = 3.34 \times 10^5$, $L_v = 2.26 \times 10^6 \text{ J kg}^{-1}$, all in $\text{J kg}^{-1} \text{ K}^{-1}$.)

Heat Transfer: Conduction, Convection and Radiation

MCQ Questions (choose the correct option)

1. The SI unit of thermal conductivity is —
 - (A) $\text{W m}^{-1} \text{ K}^{-1}$
 - (B) $\text{J kg}^{-1} \text{ K}^{-1}$
 - (C) N m^{-2}
 - (D) W s
2. Heat transfer by the bulk motion of a fluid is called —
 - (A) convection
 - (B) conduction
 - (C) radiation
 - (D) insulation
3. The mode of heat transfer that does not require a medium is —
 - (A) radiation
 - (B) conduction
 - (C) convection

- (D) diffusion
4. Heat from the Sun reaches the Earth by —
- (A) radiation
(B) conduction only
(C) convection only
(D) both conduction and convection

1 Mark Questions

1. Define thermal conductivity.
2. Name the three modes of heat transfer.
3. Which mode of heat transfer can operate in a vacuum?

2 Mark Questions

1. A metal rod of length 0.5 m and cross-section 10^{-4} m^2 has a temperature difference of 100°C across its ends. If $k = 200 \text{ W m}^{-1} \text{ K}^{-1}$, find the rate of heat flow.
2. Explain how convection produces a sea breeze.
3. Why are good insulators used in building walls? Distinguish between conductors and insulators.

3 Mark Questions

1. Explain the three modes of heat transfer — conduction, convection and radiation — giving one example of each.
2. A window pane is 1 cm thick, $1 \text{ m} \times 1 \text{ m}$ in area, with a temperature difference of 20°C between its faces. Find the heat conducted per second. ($k_{\text{glass}} = 0.8 \text{ W m}^{-1} \text{ K}^{-1}$.)

Black-Body Radiation and Newton's Law of Cooling

MCQ Questions (choose the correct option)

1. The power radiated by a black body is proportional to —
(A) T^4
(B) T
(C) T^2
(D) $1/T$
2. The value of the Stefan-Boltzmann constant σ is approximately —
(A) $5.67 \times 10^{-8} \text{ W m}^{-2} \text{ K}^{-4}$
(B) $6.67 \times 10^{-11} \text{ N m}^2 \text{ kg}^{-2}$
(C) $8.99 \times 10^9 \text{ N m}^2 \text{ C}^{-2}$
(D) 9.8 m s^{-2}
3. A body that absorbs all incident radiation and emits perfectly is called —
(A) a black body
(B) a perfect conductor
(C) an insulator
(D) a semi-conductor
4. According to Newton's law of cooling, the rate of cooling is proportional to —
(A) the temperature excess over the surroundings
(B) the square of the temperature
(C) the cube of the temperature

(D) the fourth power of the temperature

1 Mark Questions

1. State the Stefan-Boltzmann law.
2. Define a black body.
3. State Newton's law of cooling.

2 Mark Questions

1. A body of surface area 0.1 m^2 at temperature 500 K radiates as a black body. Find the power radiated. ($\sigma = 5.67 \times 10^{-8} \text{ W m}^{-2} \text{ K}^{-4}$.)
2. Why are radiators painted black while vacuum flasks are silvery?
3. A body cools from 80°C to 70°C in 5 minutes when the room is at 20°C . Estimate how long it takes to cool from 70°C to 60°C using Newton's law of cooling.

3 Mark Questions

1. State and explain the Stefan-Boltzmann law and Newton's law of cooling, contrasting their temperature dependences.
2. A black-body sphere of radius 5 cm at 1000 K radiates energy. Find the rate of energy radiated. ($\sigma = 5.67 \times 10^{-8} \text{ W m}^{-2} \text{ K}^{-4}$.)