CHAPTER

13

Heat Transfer: Conduction, Radiation & Cooling

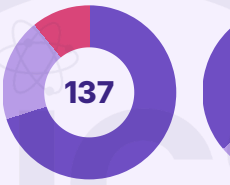
MHT CET · JEE · NEET Physics

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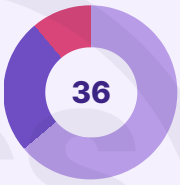
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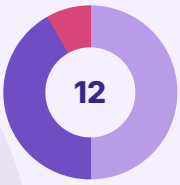
EXAM WEIGHTAGE



MHT CET
2019–2026



JEE Main
2002–2026



NEET
1993–2025

	CET	JEE	NEET
Thermal Radiation: Black Body, Stefan & Wien	96 70%	9 25%	5 42%
Heat Conduction	26 19%	23 64%	6 50%
Newton's Law of Cooling	15 11%	4 11%	1 8%

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CONCEPT

01 Conduction, Thermal Conductivity & Thermal Resistance

IN ONE LINE

Heat flows from hot to cold; in **conduction** it passes from particle to particle while the particles stay in place.

13.1.1 Three ways heat travels

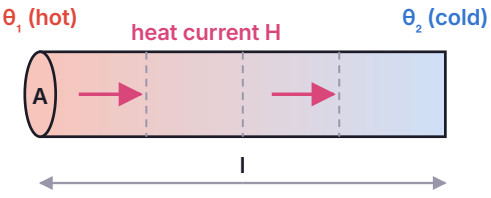
- **Conduction**: particle to particle, no flow of matter. Needs a medium; slow.
- **Convection**: hot fluid itself moves and carries the heat.
- **Radiation**: electromagnetic waves; no medium needed (sun to earth).

Mode	Medium	Where
conduction	needed	mainly solids
convection	needed	liquids, gases
radiation	not needed	even vacuum

13.1.2 How solids pass on heat

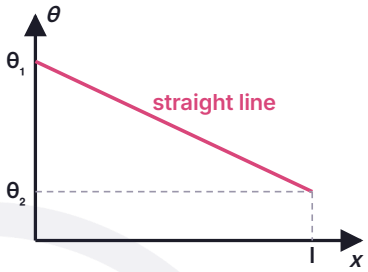
- Metals: free electrons carry heat, so they are good conductors.
- Non-metals and fluids: only vibrations of molecules, so poor conductors.
- Liquids and gases heated from the top transfer heat downward by conduction only.

13.1.3 When temperatures stop changing



Rod of length l and area A between θ_1 and θ_2

- **Variable state**: every section is still getting hotter.
- **Steady state**: temperature of each section stays constant; the rod absorbs no more heat.
- In steady state, for a uniform rod with no side loss, θ falls linearly along the rod.



Steady state: θ falls linearly with x

13.1.4 Temperature gradient

$$\text{temperature gradient} = -\frac{d\theta}{dx} = \frac{\theta_1 - \theta_2}{l}$$

- Unit: K m^{-1} or °C m^{-1}; dimension $[L^{-1}\theta]$.
- Minus sign: θ falls along the direction of heat flow.

13.1.5 Heat through a rod

$$Q = \frac{KA(\theta_1 - \theta_2)t}{l}$$

$$H = \frac{Q}{t} = \frac{KA(\theta_1 - \theta_2)}{l}$$

- H is the **heat current** (rate of flow of heat), in J s^{-1} = W.
- For a cylindrical rod A = πr^2, so $H \propto \frac{r^2}{l}$: double every length ⇒ H doubles.

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13.1.6 Thermal conductivity

- K depends only on the **material**, not on length, area or mass.
- Units: W m^{-1} K^{-1} (SI), cal cm^{-1} s^{-1} $°C^{-1}$; dimension $[MLT^{-3}\theta^{-1}]$.
- Perfect conductor K = ∞; perfect insulator K = 0.
- $K_{Ag} > K_{Cu} > K_{Al}$; $K_{solid} > K_{liquid} > K_{gas}$.
- Air pockets (fur, two blankets, foam, double walls) make poor conductors.

Substance	K (W m^{-1} K^{-1})
silver	420
copper	400
aluminium	240
iron	80
glass	0.9
water	0.6
air	0.024

13.1.7 Heat flow like electric current

$$R = \frac{l}{KA} \cdot H = \frac{\theta_1 - \theta_2}{R}$$

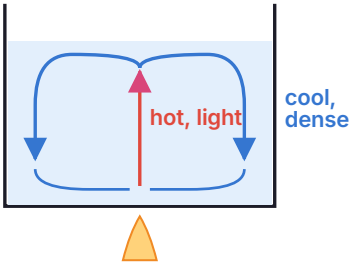
- Like Ohm's law: temperature difference ↔ potential difference, heat current ↔ current.
- Unit: K s J^{-1} (or °C s cal^{-1}); dimension $[M^{-1}L^{-2}T^{3}\theta]$.
- In steady state, θ difference ∝ R: a good conductor (large K) has a small drop across it.

13.1.8 Heat conducted into ice

- Heat through the rod in time t melts ice at 0 °C:

$$mL = \frac{KA(\theta_1 - \theta_2)t}{l}$$

13.1.9 Heat carried by moving fluid



Hot fluid rises, cool fluid sinks

- **Natural**: density difference under gravity; heating is done from below. Not possible in a freely falling lift or an orbiting satellite.
- **Forced**: fluid is pushed (fan, pump, blood by the heart).
- Examples: room heater, sea breeze, trade winds, ventilation.

JEE · NEET Corner

Variable state and isothermal surfaces

- Before steady state every section is heating up: part of the heat raises its temperature, part is passed on, part is lost from the sides.
- Isothermal surface: all points at one temperature. Heat flows at right angles to it: plane surfaces in a rod, cylinders around a hot wire, spheres around a point source.

$$\frac{dQ}{dt} = -KA\frac{d\theta}{dx} \text{ (any shape, any state)}$$

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Searle's method and Ingen-Hausz experiment

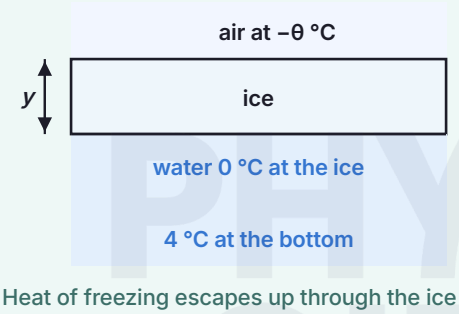
- Searle: heat through the rod in time t warms water flowing past the cold end from θ_3 to θ_4.

$$K = \frac{mc(\theta_4 - \theta_3)l}{A(\theta_1 - \theta_2)t}$$

- Ingen-Hausz: identical rods coated with wax stand in hot water; wax melts to lengths l_1, l_2, ...

$$K_1 : K_2 : K_3 = l_1^2 : l_2^2 : l_3^2$$

Growth of ice on a lake



Heat of freezing escapes up through the ice

- Air at −θ °C; water just below the ice is at 0 °C. Thickness y grows by dy in time dt:

$$\frac{dy}{dt} = \frac{K\theta}{\rho L y}$$

$$t = \frac{\rho L}{2K\theta}(y_2^2 - y_1^2)$$

- Time to reach y, 2y, 3y from zero: 1 : 4 : 9. Time for each next equal layer: 1 : 3 : 5.
- Ice is a poor conductor, so growth slows down.

Heat flow between shells

- Spherical shell, radii $r_1 < r_2$, and cylindrical shell of length L:

$$H = \frac{4\pi K r_1 r_2(\theta_1 - \theta_2)}{r_2 - r_1} \cdot H = \frac{2\pi KL(\theta_1 - \theta_2)}{\ln(r_2 \div r_1)}$$

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Solved Examples 01 Conduction & Thermal Resistance

SOLVED 1 MHT CET 2026 · 13 Apr · Shift 2

The coefficient of thermal conductivity of a metal rod depends on its

(a) area of cross-section
(b) mass
(c) material of the rod
(d) length used

STEP 1 K is a property of the substance
STEP 2 It does not depend on the size or shape of the rod
STEP 3 K depends on the **material of the rod**

Answer: **(c)**

SOLVED 2 MHT CET 2023 · 13 May · Shift 2

Which one of the following is based on convection?

(a) Heating of a copper utensil
(b) Heating a room by a heater
(c) Heating of an iron rod
(d) Heat transferred from the sun to the earth

STEP 1 Utensil and iron rod: conduction. Sun to earth: radiation
STEP 2 A room heater warms air, which rises and circulates
STEP 3 **Heating a room by a heater** is convection

Answer: **(b)**

SOLVED 3 JEE Main 2025 · 29 Jan · Shift 2

A difference of temperature in a material can convert heat energy into electrical energy. To harvest the heat energy, the material should have

(a) low thermal conductivity and high electrical conductivity
(b) low thermal conductivity and low electrical conductivity
(c) high thermal conductivity and high electrical conductivity
(d) high thermal conductivity and low electrical conductivity

STEP 1 The temperature difference must be kept, so heat should not leak through: low K
STEP 2 The emf must drive current easily: high electrical conductivity
STEP 3 **Low thermal, high electrical conductivity**

Answer: **(a)**

SOLVED 4 MHT CET 2023 · 13 May · Shift 1

The temperature gradient in a rod of length 75 cm is 40 $\frac{°C}{m}$. If the temperature of the cooler end of the rod is 10 °C, then the temperature of the hotter end is

(a) 50 °C (b) 40 °C
(c) 35 °C (d) 25 °C

STEP 1 $\Delta\theta$ = (gradient) × l
STEP 2 $\Delta\theta = 40 \times 0.75 = 30$ °C
STEP 3 Hot end = 10 + 30 = **40 °C**

Answer: **(b)**

SOLVED 5 MHT CET 2025 · 22 Apr · Shift 2

The two ends of a rod of length x and uniform cross-sectional area A are kept at temperatures T_1 and T_2 ($T_1 > T_2$). If the rate of heat transfer through the rod in steady state is $\frac{Q}{t}$, then the coefficient of thermal conductivity K is

(a) $\frac{AQ}{tx(T_1 - T_2)}$ (b) $\frac{xQ}{tA(T_1 - T_2)}$
(c) $\frac{xAQ}{t(T_1 - T_2)}$ (d) $\frac{Q}{txA(T_1 - T_2)}$

STEP 1 $\frac{Q}{t} = \frac{KA(T_1 - T_2)}{x}$
STEP 2 Solve for K
STEP 3 $K = \frac{\mathbf{xQ}}{\mathbf{tA(T_1 - T_2)}}$

Answer: **(b)**

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Solved Examples 01 Conduction & Thermal Resistance (contd.)

SOLVED 6 MHT CET 2023 · 11 May · Shift 1

The rate of flow of heat through a metal rod with temperature difference 40 °C is 1600 cal/s. The thermal resistance of the metal rod in °C $\frac{s}{cal}$ is

(a) 0.025 (b) 0.25
(c) 2.5 (d) 40

STEP 1 $R = \frac{\Delta\theta}{H}$
STEP 2 $R = \frac{40}{1600}$
STEP 3 $R = \mathbf{0.025\ °C\ \frac{s}{cal}}$

Answer: **(a)**

SOLVED 7 MHT CET 2021 · 24 Sep · Shift 1

The temperature difference between two sides of an iron plate 1.8 cm thick is 9 °C. Heat is transmitted through the plate at 10 $\frac{kcal}{s\ m^2}$ at steady state. The thermal conductivity of iron is

(a) 0.02 $\frac{kcal}{m\ s\ °C}$ (b) 0.04 $\frac{kcal}{m\ s\ °C}$
(c) 0.05 $\frac{kcal}{m\ s\ °C}$ (d) 0.004 $\frac{kcal}{m\ s\ °C}$

STEP 1 $\frac{H}{A} = \frac{K\Delta\theta}{l} \Rightarrow K = \frac{H}{A} \times \frac{l}{\Delta\theta}$
STEP 2 $K = 10 \times \frac{0.018}{9}$
STEP 3 $K = \mathbf{0.02\ \frac{kcal}{m\ s\ °C}}$

Answer: **(a)**

SOLVED 8 MHT CET 2026 · 16 Apr · Shift 1

The rate of flow of heat through a cylindrical rod is H_1. The temperatures at the ends of the rod are T_1 and T_2. If all the dimensions of the rod become double and the temperature difference remains the same, the rate of flow of heat becomes H_2. Then H_2 =

(a) $\frac{H_1}{2}$ (b) $4H_1$
(c) $2H_1$ (d) $\frac{H_1}{4}$

STEP 1 $H = \frac{KA\Delta\theta}{l} \Rightarrow H \propto \frac{r^2}{l}$
STEP 2 $r \to 2r, l \to 2l$: factor = $\frac{4}{2} = 2$
STEP 3 $H_2 = \mathbf{2H_1}$

Answer: **(c)**

SOLVED 9 MHT CET 2021 · 20 Sep · Shift 2

A conducting rod of length 1 m has area of cross-section 10^{-3} m². One end is immersed in boiling water (100 °C) and the other end in ice (0 °C). If the thermal conductivity of the rod is 96 $\frac{cal}{s\ m\ °C}$ and the latent heat of ice is 8×10^4 cal/kg, then the amount of ice which will melt in one minute is

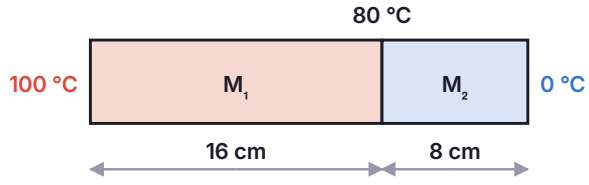
(a) 5.4×10^{-3} kg (b) 7.2×10^{-3} kg
(c) 1.8×10^{-3} kg (d) 3.6×10^{-3} kg

STEP 1 $H = \frac{KA\Delta\theta}{l} = 96 \times 10^{-3} \times 100 = 9.6$ cal/s
STEP 2 In 60 s: Q = 576 cal
STEP 3 $m = \frac{Q}{L} = \frac{576}{8 \times 10^4} = \mathbf{7.2 \times 10^{-3}\ kg}$

Answer: **(b)**

SOLVED 10 JEE Main 2022 · 24 Jun · Shift 1

Two metallic blocks M_1 and M_2 of the same area of cross-section are connected to each other as shown. If the thermal conductivity of M_2 is K, then the thermal conductivity of M_1 will be (assume steady state heat conduction)



(a) 10K (b) 8K
(c) 12.5K (d) 2K

STEP 1 Same heat current through both blocks
STEP 2 $K_1A\ \frac{100 - 80}{16} = KA\ \frac{80 - 0}{8}$
STEP 3 $\frac{20K_1}{16} = 10K \Rightarrow K_1 = \mathbf{8K}$

Answer: **(b)**

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HEAT TRANSFER

CONDUCTION · RADIATION · COOLING

LEVEL 1 · EASY

Topic-wise Previous Year Questions

MHT CET · NEET · JEE Main

54	6	2
questions	concepts	topics

CONTENTS

01	Heat Conduction	Q 1–14	14 Qs
02	Thermal Radiation: Black Body, Stefan & Wien	Q 15–54	40 Qs
	Answer key		

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TOPIC 01

Heat Conduction

14 PYQs · Easy 14 · Medium 0 · Difficult 0 | MHT CET 10 · NEET 1 · JEE 3

Concepts covered: Thermal conductivity & rate of heat flow (10) · Composite rods, slabs & junction temperature (4)

LEVEL 1 · EASY 14 questions

◆ Thermal conductivity & rate of heat flow 10 Qs

1. The coefficient of thermal conductivity of a metal rod depends on its

MHT CET 2026 · 13 APR · SHIFT 2

(a) area of cross section (b) mass
(c) material of the rod (d) length used

2. The two ends of a rod of length ' x ' and uniform cross-sectional area ' A ' are kept at temperatures ' T_1 ' and ' T_2 ' respectively ($T_1 > T_2$). If the rate of heat transfer is ' Q/t ', through the rod in steady state, then the coefficient of thermal conductivity ' K ' is

MHT CET 2025 · 22 APR · SHIFT 2

(a) $\frac{AQ}{tx(T_1-T_2)}$ (b) $\frac{xQ}{tA(T_1-T_2)}$
(c) $\frac{xAQ}{t(T_1-T_2)}$ (d) $\frac{Q}{txA(T_1-T_2)}$

3. Which one of the following is based on convection?

MHT CET 2023 · 13 MAY · SHIFT 2

(a) Heating of a copper utensil
(b) Heating a room by heater
(c) Heating of iron rod
(d) Heat transferred from sun to earth

4. The temperature gradient in a rod of length 75 cm is $40^\circ C/m$. If the temperature of cooler end of the rod is $10^\circ C$, then the temperature of hotter end is

MHT CET 2023 · 13 MAY · SHIFT 1

(a) $50^\circ C$ (b) $40^\circ C$ (c) $35^\circ C$ (d) $25^\circ C$

5. The rate of flow of heat through a metal rod with temperature difference $40^\circ C$ is $1600\ cal/s$. The thermal resistance of metal rod in $^\circ Cs/cal$ is

MHT CET 2023 · 11 MAY · SHIFT 1

(a) 0.025 (b) 0.25 (c) 2.5 (d) 40

6. The temperature difference between two sides of an iron plate, 1.8 cm thick is $9^\circ C$. Heat is transmitted through the plate $10 kcal/sm^2$ at steady state. The thermal conductivity of iron is

MHT CET 2021 · 24 SEP · SHIFT 1

(a) $0.02\frac{kcal}{ms^\circ C}$ (b) $0.04\frac{kcal}{ms^\circ C}$
(c) $0.05\frac{kcal}{ms^\circ C}$ (d) $0.004\frac{kcal}{ms^\circ}$

7. The rate of flow of heat through a copper rod with temperature difference $28^\circ C$ is $1400\ cal\ s^{-1}$. The thermal resistance of copper rod will be

MHT CET 2021 · 22 SEP · SHIFT 2

(a) $0.05\frac{^\circ Cs}{cal}$ (b) $0.02\frac{^\circ Cs}{cal}$ (c) $5\frac{^\circ Cs}{cal}$ (d) $2\frac{^\circ Cs}{cal}$

8. Given below are two statements: One is labelled as Assertion **A** and the other is labelled as Reason **R**.
Assertion A: Houses made of concrete roofs overlaid with foam keep the room hotter during summer.
Reason R: The layer of foam insulation prohibits heat transfer, as it contains air pockets. In the light of the above statements, choose the correct answer from the options given below.

NEET 2024

(a) A is true but R is false.
(b) A is false but R is true.
(c) Both A and R are true and R is the correct explanation of A.
(d) Both A and R are true but R is NOT the correct explanation of A.

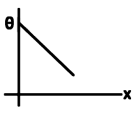
9. The difference of temperature in a material can convert heat energy into electrical energy. To harvest the heat energy, the material should have

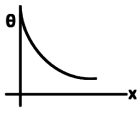
JEE MAIN 2025 · 29 JAN · SHIFT 2

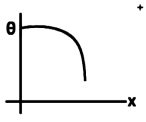
(a) low thermal conductivity and high electrical conductivity
(b) low thermal conductivity and low electrical conductivity
(c) high thermal conductivity and high electrical conductivity
(d) high thermal conductivity and low electrical conductivity

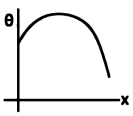
10. A long metallic bar is carrying heat from one of its ends to the other end under steady-state. The variation of temperature θ along the length x of the bar from its hot end is best described by which of the following figures?

AIEEE 2009

(a) 

(b) 

(c) 

(d) 

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◆ Composite rods, slabs & junction temperature 4 Qs

11. Two rods A and B are of equal lengths. Their ends are kept between the same temperatures and their area cross-sections are A_1 and A_2, thermal conductivities are K_1 and K_2. The rate of heat transmission in the two rods will be equal if

MHT CET 2026 · 13 MAY · SHIFT 1

(a) $K_1A_2 = K_2A_1$ (b) $K_1A_1 = K_2A_2$
(c) $K_1A_1^2 = K_2A_2^2$ (d) $K_1 = K_2$

12. The ratio of thermal conductivity of two rods of different materials is $4 : 3$. The two rods have same area of cross-section and same thermal resistance. The lengths of rods are in the ratio

MHT CET 2026 · 18 APR · SHIFT 1

(a) 5 : 4 (b) 4 : 3 (c) 1 : 5 (d) 7 : 1

13. The ratio of the thermal conductivity of two rods of different materials is 6:5. The two rods of same area of cross section and same thermal resistance will have the length in the ratio

MHT CET 2026 · 15 APR · SHIFT 2

(a) 5 : 6 (b) 6 : 5 (c) 1 : 3 (d) 3 : 1

14. A heat source at T = 10^3 K is connected to another heat reservoir at T = 10^2 K by a copper slab which is 1 m thick. Given that the thermal conductivity of copper is 0.1 $WK^{-1}m^{-1}$, the energy flux through it in the steady state is -

JEE MAIN 2019 · 10 JAN · SHIFT 1

(a) 200 Wm^{-2} (b) 65 Wm^{-2}
(c) 120 Wm^{-2} (d) 90 Wm^{-2}

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TOPIC 02

Thermal Radiation: Black Body, Stefan & Wien

40 PYQs · Easy 40 · Medium 0 · Difficult 0 | MHT CET 34 · NEET 3 · JEE 3

Concepts covered: Absorptivity, reflectivity & emissivity (12) · Stefan-Boltzmann law & radiated power (11) · Wien's displacement law (15) · Stefan + Wien combined (2)

LEVEL 1 · EASY 40 questions

◆ Absorptivity, reflectivity & emissivity 12 Qs

15. If 150 J of energy is incident on area $2m^2$ and amount of heat reflected is 15 J, coefficient of absorption is 0.6 the amount of energy transmitted is
MHT CET 2026 · 13 MAY · SHIFT 2
(a) 50 J (b) 45 J (c) 40 J (d) 30 J

16. Heat energy is incident on the surface at the rate of 1000 J/min. If coefficient of absorption is 0.8 and coefficient of reflection is 0.1 then heat energy transmitted by the surface in 5 minute is
MHT CET 2026 · 13 MAY · SHIFT 1
(a) 100 J (b) 500 J (c) 700 J (d) 900 J

17. When 170 J of energy is incident on a surface of a body, 17 J of energy is reflected by it. If the coefficient of absorption is 0.7, then the amount of energy transmitted will be
MHT CET 2026 · 19 APR · SHIFT 1
(a) 3.4 J (b) 11.9 J (c) 34.0 J (d) 119.0 J

18. 'x' joule of heat is incident on a body. Out of it, the total heat reflected and transmitted by it is 'y' joule. The absorption coefficient of the body is
MHT CET 2026 · 17 APR · SHIFT 1
(a) $\frac{x}{y}$ (b) $\frac{x-y}{x}$ (c) $\frac{y}{x-y}$ (d) $\frac{x}{y-x}$

19. If 120 J of thermal energy is incident on area 3 m^2, the amount of heat transmitted is 12 J, coefficient of absorption is 0.6, then the amount of heat reflected is
MHT CET 2025 · 22 APR · SHIFT 1
(a) 24 J (b) 30 J (c) 36 J (d) 40 J

20. For a perfectly black body, coefficient of emission is
MHT CET 2025 · 20 APR · SHIFT 1
(a) zero.
(b) unity.
(c) less than one (non-zero).
(d) infinity.

21. The co-efficient of absorption and the coefficient of reflection of a thin uniform plate are 0.77 and 0.17 respectively. If 250 kcal of heat is incident on the surface of the plate, the quantity of heat transmitted is
MHT CET 2025 · 19 APR · SHIFT 2
(a) 7 kcal (b) 12 kcal (c) 15 kcal (d) 22 kcal

22. Three identical metal spheres (of same surface area) have red, black and white colors and they are heated up to same temperature. They are allowed to cool. Arrange them from maximum rate of cooling to minimum rate of cooling
MHT CET 2024 · 9 MAY · SHIFT 1
(a) black, red, white (b) white, red, black
(c) red, black, white (d) red, white, black

23. Given that ' x ' joule of heat is incident on a body. Out of that, total heat reflected and transmitted is ' y ' joule. The absorption coefficient of body is
MHT CET 2024 · 3 MAY · SHIFT 1
(a) $\frac{x}{y}$ (b) $\frac{y}{x}$ (c) $\frac{x-y}{x}$ (d) $\frac{y-x}{x}$

24. A body is said to be opaque to the radiation if (a, r and t are coefficient of absorption, reflection and transmission respectively)
MHT CET 2023 · 14 MAY · SHIFT 1
(a) $t = 0$ and $a + r = 1$ (b) $a = r = t$
(c) $t \neq 0$ (d) $a = 0, r = 1, t = 1$

25. Heat energy is incident on the surface at the rate of X J/min. If 'a' and 'r' represent coefficient of absorption and reflection respectively then the heat energy transmitted by the surface in 't' minutes is
MHT CET 2023 · 10 MAY · SHIFT 1
(a) $(a + r)xt$ (b) $\frac{(a+r)}{xt}$
(c) $-(a + r)xt$ (d) $\frac{xt}{(a+r)}$

26. For a perfectly black body, coefficient of emission is
MHT CET 2021 · 23 SEP · SHIFT 1
(a) zero
(b) infinity
(c) unity
(d) less than one (non-zero)

◆ Stefan-Boltzmann law & radiated power 11 Qs

27. A perfectly black body radiates power at temperature T_1 K. If it is to radiate 16 times this power, its temperature should be increased by
MHT CET 2026 · 19 MAY · SHIFT 1
(a) $(16T_1)K$ (b) $(4T_1)K$ (c) $(2T_1)K$ (d) $(T_1)K$

28. The temperature of a black body is increased by 50% then the percentage increase of radiation is nearly
MHT CET 2026 · 15 MAY · SHIFT 1
(a) 100% (b) 25% (c) 400% (d) 500%

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29. A black body is at temperature $827^{\circ}C$. The rate at which it emits energy is proportional to
MHT CET 2026 · 19 APR · SHIFT 1
(a) $(827)^4$ (b) $(827)^2$ (c) $(1100)^4$ (d) $(1100)^2$

30. Black sphere of radius R radiates power P at certain temperature T. If the temperature is doubled, the radius gets doubled. Now the power radiated would be
MHT CET 2025 · 19 APR · SHIFT 1
(a) 4 P (b) 8 P (c) 16 P (d) 64 P

31. If the temperature of a hot body is increased by 50%, then the increase in the quantity of emitted heat radiation will be approximately
MHT CET 2023 · 11 MAY · SHIFT 1
(a) 125% (b) 200% (c) 300% (d) 400%

32. The temperature of a black body is increased by 50%, then the percentage increase in the rate of radiation by the body is approximated
MHT CET 2021 · 23 SEP · SHIFT 1
(a) 50% (b) 100% (c) 400% (d) 150%

33. The emissive power of sphere of area $0.04\,m^2$ is $0.7\,k\,cal\,s^{-1}\,m^{-2}$. The amount of heat radiated in 20 second is
MHT CET 2021 · 22 SEP · SHIFT 2
(a) $2.8\,k\,cal\,s^{-1}\,m^{-2}$ (b) $0.28\,k\,cal\,s^{-1}\,m^{-2}$
(c) $5.6\,k\,cal\,s^{-1}\,m^{-2}$ (d) $0.56\,k\,cal\,s^{-1}\,m^{-2}$

34. A perfectly black body emits a radiation at temperature 'T_1' K. If it is to radiate at 16 times this power, its temperature 'T_2' K should be
MHT CET 2021 · 20 SEP · SHIFT 1
(a) $8T_1$ (b) $4T_1$ (c) $2T_1$ (d) $16T_1$

35. The SI unit and dimensions of Stefan's constant σ in case of Stefan's law of radiation is
MHT CET 2019 · 3 MAY · SHIFT 1
(a) $\frac{J}{m^3\,s^4}, \left[M^1L^0T^{-3}K^{-4}\right]$
(b) $\frac{J}{m^2\,s^4\,K}, \left[M^1L^0T^{-3}K^3\right]$
(c) $\frac{J}{m^3\,s\,K^4}, \left[M^1L^0\,T^{-3}\,K^4\right]$
(d) $\frac{J}{m^2\,s\,K^4}, \left[M^1\,L^0\,T^{-3}\,K^{-4}\right]$

36. A black body is at a temperature of 500 K. It emits energy at a rate which is proportional to
AIPMT 1997
(a) $(500)^3$ (b) $(500)^4$ (c) 500 (d) $(500)^2$

37. If the temperature of the sun is doubled, the rate of energy received on earth will be increased by a factor of
AIPMT 1993
(a) 2 (b) 4 (c) 8 (d) 16

◆ Wien's displacement law 15 Qs

38. Temperature of two stars are in the ratio 3 : 2. If wavelength of maximum intensity of first star is 4200 Å, the corresponding wavelength for second star is
MHT CET 2026 · 20 MAY · SHIFT 1
(a) 2100 Å (b) 3000 Å (c) 6300 Å (d) 7000 Å

39. Identify the INCORRECT statement about the black body radiation
MHT CET 2026 · 20 MAY · SHIFT 1
(a) Intensity is same for all wavelengths.
(b) Intensity is maximum for a particular wavelength.
(c) Intensity is less for longer wavelengths.
(d) A black body emits all wavelengths.

40. Two stars A and B radiate maximum energy at wavelength 3.9×10^{-7} m and 5.2×10^{-7} m respectively. The ratio of the temperature of star A to that of star B will be
MHT CET 2026 · 20 APR · SHIFT 2
(a) 2 : 3 (b) 3 : 2 (c) 3 : 4 (d) 4 : 3

41. Out of the following, which statement is NOT true about black body radiation?
MHT CET 2026 · 19 APR · SHIFT 2
(a) Intensity is more for shorter wavelengths (λ).
(b) Intensity is same for all wavelengths (λ).
(c) Intensity is less for longer wavelengths (λ).
(d) A black body emits all wavelengths (λ).

42. A black body emits radiation of maximum intensity of wavelength 'λ' at temperature 'T' K. Its corresponding wavelength at temperature $(2.5T)$ K will be
MHT CET 2026 · 17 APR · SHIFT 2
(a) $\frac{2\lambda}{3}$ (b) $\frac{2\lambda}{5}$ (c) $\frac{4\lambda}{5}$ (d) $\frac{16\lambda}{81}$

43. A black body has maximum wavelength 'λ_m' at temperature 2000 K. Its maximum wavelength at 3000 K will be
MHT CET 2025 · 5 MAY · SHIFT 2
(a) $\frac{3}{2}\lambda_m$ (b) $\frac{16}{81}\lambda_m$ (c) $\frac{81}{16}\lambda_m$ (d) $\frac{2}{3}\lambda_m$

44. A black body emits radiation of maximum intensity at wavelength 'λ' at temperature T K. Its corresponding wavelength at temperature 1.5 T K will be
MHT CET 2025 · 25 APR · SHIFT 2
(a) $\frac{2\lambda}{3}$ (b) $\frac{4\lambda}{3}$ (c) $\frac{16\lambda}{81}$ (d) $\frac{81\lambda}{16}$

45. About black body radiation, which of the following is the wrong statement?
MHT CET 2023 · 12 MAY · SHIFT 1
(a) For all wavelengths, intensity is same.
(b) For shorter wavelengths, intensity is more.
(c) For longer wavelengths, intensity is less.
(d) All wavelengths are emitted by a black body.

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46. Assume that for solar radiation, surface temperature of the sun is $6000\,\mathrm{K}$. If Wien's constant 'b' is $2.897 \times 10^{-3}\,\mathrm{mK}$, the value of maximum wavelength will be

MHT CET 2021 · 24 SEP · SHIFT 2

(a) $4828\,\overset{o}{A}$ (b) $3648\,\overset{o}{A}$ (c) $6400\,\overset{o}{A}$ (d) $5890\,\overset{o}{A}$

47. A black body has maximum wavelength 'λ_m' at temperature $2000\,\mathrm{K}$. Its corresponding wavelength at temperature $3000\,\mathrm{K}$ will be

MHT CET 2021 · 21 SEP · SHIFT 1

(a) $\frac{4\lambda_m}{9}$ (b) $\frac{2\lambda_m}{3}$ (c) $\frac{3\lambda_m}{2}$ (d) $\frac{9}{4}\lambda_m$

48. Two stars 'P' and 'Q' emit yellow and blue light respectively. The relation between their temperatures (T_P and T_Q) is

MHT CET 2021 · 20 SEP · SHIFT 2

(a) $T_P = T_Q$ (b) $T_P = \frac{T_Q}{2}$
(c) $T_P > T_Q$ (d) $T_P < T_Q$

49. Three stars A, B, C have surface temperatures T_A, T_B, T_C respectively. Star A appears bluish, star B appears reddish and star C yellowish. Hence,

NEET 2020 · PHASE 2

(a) $T_A > T_C > T_B$ (b) $T_A > T_B > T_C$
(c) $T_B > T_C > T_A$ (d) $T_C > T_B > T_A$

50. The earth radiates in the infra-red region of the spectrum. The spectrum is correctly given by

AIEEE 2003

(a) Rayleigh Jeans law
(b) Planck's law of radiation
(c) Stefan's law of radiation
(d) Wien's law

51. Infrared radiation is detected by

AIEEE 2002

(a) spectrometer (b) pyrometer
(c) nanometer (d) photometer

52. Which of the following is more close to a black body?

AIEEE 2002

(a) black board paint (b) green leaves
(c) black holes (d) red roses

◆ Stefan + Wien combined 2 Qs

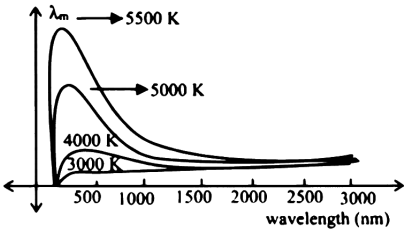
53. About black body radiation, which one of the following is a WRONG statement?

MHT CET 2026 · 15 APR · SHIFT 1

(a) For all wavelengths, power radiated is same
(b) For shorter wavelengths, radiated power is more
(c) for longer wavelengths, radiated power is less
(d) All wavelengths are emitted by the black body

54. The following graph represents the radiant power versus wavelength of the black body. The area under the curve represents

MHT CET 2025 · 20 APR · SHIFT 2



(a) the maximum wavelength emitted by the object.
(b) the minimum wavelength emitted by the object.
(c) the total energy emitted per unit time by the black body at some particular wavelength
(d) the total energy emitted per unit time per unit area by the black body at all wavelengths.

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ANSWER KEY

Shaded by level: **Easy**

01 Heat Conduction

1. (c)	2. (b)	3. (b)	4. (b)	5. (a)	6. (a)	7. (b)	8. (b)	9. (a)	10. (a)
11. (b)	12. (b)	13. (b)	14. (d)						

02 Thermal Radiation: Black Body, Stefan & Wien

15. (b)	16. (b)	17. (c)	18. (b)	19. (c)	20. (b)	21. (c)	22. (a)	23. (c)	24. (a)
25. (a)	26. (c)	27. (d)	28. (c)	29. (c)	30. (d)	31. (d)	32. (c)	33. (d)	34. (c)
35. (d)	36. (b)	37. (d)	38. (c)	39. (a)	40. (d)	41. (b)	42. (b)	43. (d)	44. (a)
45. (a)	46. (a)	47. (b)	48. (d)	49. (a)	50. (d)	51. (b)	52. (a)	53. (a)	54. (d)

Note: *"Bonus" = no option is correct as the question is printed (dropped in the official key). Numerical questions show the numerical answer.*

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