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NEET THERMAL PROPERTIES OF MATTER — PYQS

Max. Marks: 192 **Questions:** 48

Section A (MCQ) — 48 questions

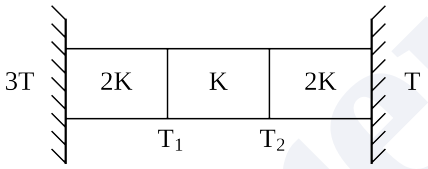
Q.1 The temperature of a metallic sphere of radius R is increased by a small amount ΔT. If the linear coefficient of thermal expansion of the metal is α, the approximate increase in the volume of the sphere is: [RE-NEET (UG) 2026]

(1) $6\pi R^3\alpha\Delta T$ (2) $2\pi R^3\alpha\Delta T$

(3) $3\pi R^3\alpha\Delta T$ (4) $4\pi R^3\alpha\Delta T$

Scan or tap for the full solution

Q.2 Three identical heat conducting rods are connected in series as shown in the figure. The rods on the sides have thermal conductivity 2K while that in the middle has thermal conductivity K. The left end of the combination is maintained at temperature 3T and the right end at T. The rods are thermally insulated from outside. In steady state, temperature at the left junction is T_1 and that at the right junction is T_2. The ratio T_1/T_2 is [NEET (UG) 2025]



(1) $\frac{5}{3}$ (2) $\frac{5}{4}$ (3) $\frac{3}{2}$ (4) $\frac{4}{3}$

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Q.3 A metallic bar of Young's modulus, 0.5×10^{11} N m^{-2} and coefficient of linear thermal expansion 10^{-5} °C^{-1}, length 1 m and area of cross-section 10^{-3} m^2 is heated from 0°C to 100°C without expansion or bending. The compressive force developed in it is : [NEET (UG) 2024]

(1) 5×10^3 N (2) 50×10^3 N

(3) 100×10^3 N (4) 2×10^3 N

Scan or tap for the full solution

Q.4 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. [RE-NEET (UG) 2024]

(1) A is true but R is false.

(2) A is false but R is true.

(3) Both A and R are true and R is the correct explanation of A.

(4) Both A and R are true but R is NOT the correct explanation of A.

Scan or tap for the full solution

Q.5 Two rods one made of copper and other made of steel of same length and same cross sectional area are joined together. The thermal conductivity of copper and steel are 385 J s^{-1} K^{-1} m^{-1} and 50 J s^{-1} K^{-1} m^{-1} respectively. The free ends of copper and steel are held at 100°C and 0°C respectively. The temperature at the junction is, nearly : [NEET (UG) 2022 (Phase 2)]

(1) 88.5°C (2) 12°C (3) 50°C (4) 73°C

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Q.6 A cup of coffee cools from 90°C to 80°C in t minutes, when the room temperature is 20°C. The time taken by a similar cup of coffee to cool from 80°C to 60°C at a room temperature same at 20°C is : [NEET (UG) 2021]

(1) $\frac{5}{13}t$ (2) $\frac{13}{10}t$ (3) $\frac{13}{5}t$ (4) $\frac{10}{13}t$

Scan or tap for the full solution

Q.7 The quantities of heat required to raise the temperature of two solid copper spheres of radii r_1 and r_2 ($r_1 = 1.5r_2$) through 1 K are in the ratio : [NEET (UG) 2020]

(1) $\frac{9}{4}$ (2) $\frac{3}{2}$ (3) $\frac{5}{3}$ (4) $\frac{27}{8}$

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Q.8 A copper rod of 88 cm and an aluminium rod of unknown length have their increase in length independent of increase in temperature. The length of aluminium rod is : ($\alpha_{Cu} = 1.7 \times 10^{-5}\ K^{-1}$ and $\alpha_{Al} = 2.2 \times 10^{-5}\ K^{-1}$) [NEET (UG) 2019]

(1) 119.9 cm (2) 88 cm
(3) 68 cm (4) 6.8 cm

Solution

Q.9 The unit of thermal conductivity is : [NEET (UG) 2019]

(1) $J\ m^{-1}\ K^{-1}$ (2) $W\ m\ K^{-1}$
(3) $J\ m\ K^{-1}$ (4) $W\ m^{-1}\ K^{-1}$

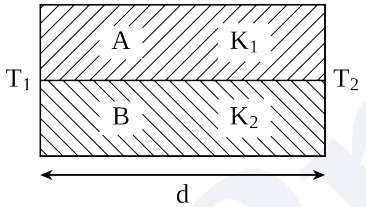
Scan or tap for the full solution

Q.10 The power radiated by a black body is P and it radiates maximum energy at wavelength, λ_0. If the temperature of the black body is now changed so that it radiates maximum energy at wavelength $\frac{3}{4}\lambda_0$, the power radiated by it becomes nP. The value of n is [NEET 2018]

(1) $\frac{3}{4}$ (2) $\frac{4}{3}$ (3) $\frac{256}{81}$ (4) $\frac{81}{256}$

Scan or tap for the full solution

Q.11 Two rods A and B of different materials are welded together as shown in figure. Their thermal conductivities are K_1 and K_2. The thermal conductivity of the composite will be [NEET 2017]



(1) $\frac{3(K_1 + K_2)}{2}$ (2) $K_1 + K_2$
(3) $2\ (K_1 + K_2)$ (4) $\frac{K_1 + K_2}{2}$

Scan or tap for the full solution

Q.12 A spherical black body with a radius of 12 cm radiates 450 watt power at 500 K. If the radius were halved and the temperature doubled, the power radiated in watt would be [NEET 2017]

(1) 450 (2) 1000 (3) 1800 (4) 225

Scan or tap for the full solution

Q.13 Coefficient of linear expansion of brass and steel rods are α_1 and α_2. Lengths of brass and steel rods are l_1 and l_2 respectively. If $(l_2 - l_1)$ is maintained same at all temperatures, which one of the following relations holds good? [NEET 2016 (Phase 1)]

(1) $\alpha_1^2 l_2 = \alpha_2^2 l_1$ (2) $\alpha_1 l_1 = \alpha_2 l_2$
(3) $\alpha_1 l_2 = \alpha_2 l_1$ (4) $\alpha_1 l_2^2 = \alpha_2 l_1^2$

Scan or tap for the full solution

Q.14 A piece of ice falls from a height h so that it melts completely. Only one-quarter of the heat produced is absorbed by the ice and all energy of ice gets converted into heat during its fall. The value of h [Latent heat of ice is 3.4×10^5 J/kg and g = 10 N/kg] [NEET 2016 (Phase 1)]

(1) 136 km (2) 68 km (3) 34 km (4) 544 km

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Q.15 A black body is at a temperature of 5760 K. The energy of radiation emitted by the body at wavelength 250 nm is U_1, at wavelength 500 nm is U_2 and that at 1000 nm is U_3. Wien's constant, $b = 2.88 \times 10^6$ nm K. Which of the following is correct? [NEET 2016 (Phase 1)]

(1) $U_1 > U_2$ (2) $U_2 > U_1$
(3) $U_1 = 0$ (4) $U_3 = 0$

Scan or tap for the full solution

Q.16 Two identical bodies are made of a material for which the heat capacity increases with temperature. One of these is at 100 °C, while the other one is at 0 °C. If the two bodies are brought into contact, then, assuming no heat loss, the final common temperature is [NEET 2016 (Phase 2)]

(1) 50 °C
(2) more than 50 °C
(3) less than 50 °C but greater than 0 °C
(4) 0 °C

Scan or tap for the full solution

Q.17 A body cools from a temperature 3T to 2T in 10 minutes. The room temperature is T. Assume that Newton's law of cooling is applicable. The temperature of the body at the end of next 10 minutes will be [NEET 2016 (Phase 2)]

(1) $\frac{7}{4}T$ (2) $\frac{3}{2}T$ (3) $\frac{4}{3}T$ (4) T

Scan or tap for the full solution

Q.18 The value of coefficient of volume expansion of glycerin is 5×10^{-4} K^{-1}. The fractional change in the density of glycerin for a rise of 40°C in its temperature, is [AIPMT 2015]

(1) 0.025 (2) 0.010 (3) 0.015 (4) 0.020

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Q.19 The two ends of a metal rod are maintained at temperatures 100°C and 110°C. The rate of heat flow in the rod is found to be 4.0 J/s. If the ends are maintained at temperatures 200°C and 210°C, the rate of heat flow will be [AIPMT 2015 (Cancelled)]

(1) 8.0 J/s (2) 4.0 J/s (3) 44.0 J/s (4) 16.8 J/s

Scan or tap for the full solution

Q.20 On observing light from three different stars P, Q and R, it was found that intensity of violet colour is maximum in the spectrum of P, the intensity of green colour is maximum in the spectrum of R and the intensity of red colour is maximum in the spectrum of Q. If T_P, T_Q and T_R are the respective absolute temperatures of P, Q and R, then it can be concluded from the above observations that [AIPMT 2015 (Cancelled)]

(1) $T_P < T_R < T_Q$ (2) $T_P < T_Q < T_R$

(3) $T_P > T_Q > T_R$ (4) $T_P > T_R > T_Q$

Scan or tap for the full solution

Q.21 Steam at 100°C is passed into 20 g of water at 10°C. When water acquires a temperature of 80°C, the mass of water present will be

[Take specific heat of water = 1 cal g^{-1} $°C^{-1}$ and latent heat of steam = 540 cal g^{-1}] [AIPMT 2014]

(1) 24 g (2) 31.5 g (3) 42.5 g (4) 22.5 g

Scan or tap for the full solution

Q.22 Certain quantity of water cools from 70°C to 60°C in the first 5 minutes and to 54°C in the next 5 minutes. The temperature of the surroundings is [AIPMT 2014]

(1) 45°C (2) 20°C (3) 42°C (4) 10°C

Scan or tap for the full solution

Q.23 A piece of iron is heated in a flame. It first becomes dull red then becomes reddish yellow and finally turns to white hot. The correct explanation for the above observation is possible by using [NEET 2013]

(1) Kirchhoff's Law

(2) Newton's Law of cooling

(3) Stefan's Law

(4) Wien's displacement Law

Solution

Q.24 Two metal rods 1 and 2 of same lengths have same temperature difference between their ends. Their thermal conductivities are K_1 and K_2 and cross sectional areas A_1 and A_2, respectively. If the rate of heat conduction in 1 is four times that in 2, then [NEET 2013 (Karnataka)]

(1) $K_1A_1 = 4K_2A_2$ (2) $K_1A_1 = 2K_2A_2$

(3) $4K_1A_1 = K_2A_2$ (4) $K_1A_1 = K_2A_2$

Scan or tap for the full solution

Q.25 The density of water at 20°C is 998 kg/m^3 and at 40°C is 992 kg/m^3. The coefficient of volume expansion of water is [NEET 2013 (Karnataka)]

(1) 3×10^{-4}/°C (2) 2×10^{-4}/°C

(3) 6×10^{-4}/°C (4) 10×10^{-4}/°C

Scan or tap for the full solution

Q.26 A slab of stone of area 0.36 m^2 and thickness 0.1 m is exposed on the lower surface to steam at 100 °C. A block of ice at 0 °C rests on the upper surface of the slab. In one hour 4.8 kg of ice is melted. The thermal conductivity of slab is

(Given latent heat of fusion of ice = 3.36×10^5 J kg^{-1}) [AIPMT 2012 (Mains)]

(1) 1.24 J/m/s/°C (2) 1.29 J/m/s/°C

(3) 2.05 J/m/s/°C (4) 1.02 J/m/s/°C

Scan or tap for the full solution

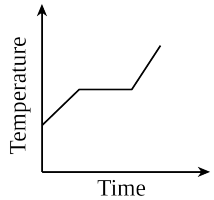
Q.27 If the radius of a star is R and it acts as a black body, what would be the temperature of the star, in which the rate of energy production is Q? [AIPMT 2012 (Prelims)]

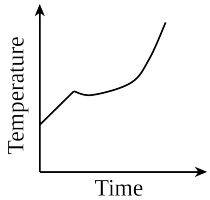
(1) $\frac{Q}{4\pi R^2\sigma}$ (2) $\left(\frac{Q}{4\pi R^2\sigma}\right)^{-1/2}$

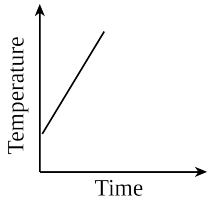
(3) $\left(\frac{4\pi R^2 Q}{\sigma}\right)^{1/4}$ (4) $\left(\frac{Q}{4\pi R^2\sigma}\right)^{1/4}$

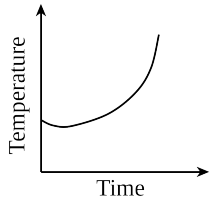
Scan or tap for the full solution

Q.28 Liquid oxygen at 50 K is heated to 300 K at constant pressure of 1 atm. The rate of heating is constant. Which one of the following graphs represents the variation of temperature with time ? [AIPMT 2012 (Prelims)]

(1)


(2)


(3) 

(4) 

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Q.29 A cylindrical metallic rod in thermal contact with two reservoirs of heat at its two ends conducts an amount of heat Q in time t. The metallic rod is melted and the material is formed into a rod of half the radius of the original rod. What is the amount of heat conducted by the new rod, when placed in thermal contact with the two reservoirs in time t?

[AIPMT 2010 (Prelims)]

(1) $\frac{Q}{4}$ (2) $\frac{Q}{16}$ (3) 2Q (4) $\frac{Q}{2}$

Scan or tap for the full solution

Q.30 The total radiant energy per unit area, normal to the direction of incidence, received at a distance R from the centre of a star of radius r, whose outer surface radiates as a black body at a temperature T K is given by [AIPMT 2010 (Prelims)]

(1) $\frac{\sigma r^2 T^4}{R^2}$ (2) $\frac{\sigma r^2 T^4}{4\pi R^2}$ (3) $\frac{\sigma r^2 T^4}{R^4}$ (4) $\frac{4\pi\sigma r^2 T^4}{R^2}$

Scan or tap for the full solution

Q.31 Assuming the sun to have a spherical outer surface of radius r, radiating like a black body at temperature t°C, the power received by a unit surface, (normal to the incident rays) at a distance R from the centre of the sun is
where σ is the Stefan's constant.

[AIPMT 2010 (Prelims)]

(1) $\frac{r^2\sigma(t+273)^4}{4\pi R^2}$ (2) $\frac{16\pi^2 r^2\sigma t^4}{R^2}$

(3) $\frac{r^2\sigma(t+273)^4}{R^2}$ (4) $\frac{4\pi r^2\sigma t^4}{R^2}$

Scan or tap for the full solution

Q.32 A black body is at 727°C. It emits energy at a rate which is proportional to [AIPMT 2007]

(1) $(1000)^4$ (2) $(1000)^2$ (3) $(727)^4$ (4) $(727)^2$

Scan or tap for the full solution

Q.33 A black body at 227°C radiates heat at the rate of 7 cal/cm^2 s. At a temperature of 727°C, the rate of heat radiated in the same units will be

[AIPMT 2009]

(1) 50 (2) 112 (3) 80 (4) 60

Scan or tap for the full solution

Q.34 The two ends of a rod of length L and a uniform cross-sectional area A are kept at two temperatures T_1 and T_2 ($T_1 > T_2$). The rate of heat transfer, $\frac{dQ}{dt}$ through the rod in a steady state is given by :

[AIPMT 2009]

(1) $\frac{dQ}{dt} = \frac{k(T_1 - T_2)}{LA}$ (2) $\frac{dQ}{dt} = kLA(T_1 - T_2)$

(3) $\frac{dQ}{dt} = \frac{kA(T_1 - T_2)}{L}$ (4) $\frac{dQ}{dt} = \frac{kL(T_1 - T_2)}{A}$

Scan or tap for the full solution

Q.35 On a new scale of temperature (which is linear) and called the W scale, the freezing and boiling points of water are 39°W and 239°W respectively. What will be the temperature on the new scale, corresponding to a temperature of 39°C on the Celsius scale ?

[AIPMT 2008]

(1) 200°W (2) 139°W (3) 78°W (4) 117°W

Scan or tap for the full solution

Q.36 Assuming the sun to have a spherical outer surface of radius r, radiating like a black body at temperature t°C, the power received by a unit surface, (normal to the incident rays) at a distance R from the centre of the sun is
where σ is the Stefan's constant. [AIPMT 2007]

(1) $\frac{r^2\sigma(t+273)^4}{4\pi R^2}$ (2) $\frac{16\pi^2 r^2\sigma t^4}{R^2}$

(3) $\frac{r^2\sigma(t+273)^4}{R^2}$ (4) $\frac{4\pi r^2\sigma t^4}{R^2}$

Scan or tap for the full solution

Q.37 A black body at 1227°C emits radiations with maximum intensity at a wavelength of 5000 Å. If the temperature of the body is increased by 1000°C, the maximum intensity will be observed at

[AIPMT 2006]

(1) 3000 Å (2) 4000 Å

(3) 5000 Å (4) 6000 Å

Scan or tap for the full solution

Q.38 Which of the following rods, (given radius r and length l) each made of the same material and whose ends are maintained at the same temperature will conduct most heat? [AIPMT 2005]

(1) $r = r_0, l = l_0$ (2) $r = 2r_0, l = l_0$
(3) $r = r_0, l = 2l_0$ (4) $r = 2r_0, l = 2l_0$

Scan or tap for the full solution

Q.39 If λ_m denotes the wavelength at which the radiative emission from a black body at a temperature T K is maximum, then [AIPMT 2004]
(1) $\lambda_m \propto T^4$ (2) λ_m is independent of T
(3) $\lambda_m \propto T$ (4) $\lambda_m \propto T^{-1}$

Scan or tap for the full solution

Q.40 Consider a compound slab consisting of two different materials having equal thicknesses and thermal conductivities K and 2K, respectively. The equivalent thermal conductivity of the slab is [AIPMT 2003]
(1) $\frac{2}{3}K$ (2) $\sqrt{2}K$ (3) 3K (4) $\frac{4}{3}K$

Scan or tap for the full solution

Q.41 Unit of Stefan's constant is [AIPMT 2002]
(1) watt $m^2 K^4$ (2) watt m^2/K^4
(3) watt/m^2 K (4) watt/m^2K^4

Scan or tap for the full solution

Q.42 Consider two rods of same length and different specific heats (S_1, S_2), conductivities (K_1, K_2) and area of cross-sections (A_1, A_2) and both having temperatures T_1 and T_2 at their ends. If rate of loss of heat due to conduction is equal, then [AIPMT 2002]
(1) $K_1A_1 = K_2A_2$ (2) $\frac{K_1A_1}{S_1} = \frac{K_2A_2}{S_2}$
(3) $K_2A_1 = K_1A_2$ (4) $\frac{K_2A_1}{S_2} = \frac{K_1A_2}{S_1}$

Scan or tap for the full solution

Q.43 For a black body at temperature 727°C, its radiating power is 60 watt and temperature of surrounding is 227°C. If temperature of black body is changed to 1227°C then its radiating power will be [AIPMT 2002]
(1) 304 W (2) 320 W (3) 240 W (4) 120 W

Scan or tap for the full solution

Q.44 Which of the following is closest to an ideal black body? [AIPMT 2002]
(1) lamp black
(2) cavity maintained at constant temperature
(3) platinum black
(4) a lump of charcoal heated to high temperature.

Scan or tap for the full solution

Q.45 The Wien's displacement law expresses relation between [AIPMT 2002]
(1) wavelength corresponding to maximum energy and temperature
(2) radiation energy and wavelength
(3) temperature and wavelength
(4) colour of light and temperature.

Solution

Q.46 A cylindrical rod has temperatures T_1 and T_2 at its ends. The rate of flow of heat is Q_1 cal/s. If all the linear dimensions are doubled keeping the temperatures constant, then the rate of flow of heat Q_2 will be [AIPMT 2001]
(1) $4Q_1$ (2) $2Q_1$ (3) $\frac{Q_1}{4}$ (4) $\frac{Q_1}{2}$

Scan or tap for the full solution

Q.47 Gravitational force is required for [AIPMT 2000]
(1) stirring of liquid (2) convection
(3) conduction (4) radiation

Scan or tap for the full solution

Q.48 A black body emits maximum energy at wavelength λ_m at 2000 K. Its corresponding wavelength at 3000 K will be [AIPMT 2000]
(1) $\frac{3}{2}\lambda_m$ (2) $\frac{2}{3}\lambda_m$ (3) $\frac{16}{81}\lambda_m$ (4) $\frac{81}{16}\lambda_m$

Scan or tap for the full solution

ANSWER KEY

Ques.	1	2	3	4	5	6	7	8	9	10	11
Ans.	4	1	2	2	1	3	4	3	4	3	4
Ques.	12	13	14	15	16	17	18	19	20	21	22
Ans.	3	2	1	2	2	2	4	2	4	4	1
Ques.	23	24	25	26	27	28	29	30	31	32	33
Ans.	4	1	1	1	4	1	2	1	3	1	2
Ques.	34	35	36	37	38	39	40	41	42	43	44
Ans.	3	4	3	1	2	4	4	4	1	2	2
Ques.	45	46	47	48							
Ans.	1	2	2	2							