

NEET THERMAL PROPERTIES OF MATTER — HEAT TRANSFER: RADIATION (BLACK BODY, WIEN'S LAW, STEFAN'S LAW) — PYQS

Max. Marks: 72

Questions: 18

Section A (MCQ) — 18 questions

- Q.1** 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.2** 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.3** 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.4** 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.5** 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

Scan or tap for the full solution



- Q.6** 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.7** 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) $\frac{\sigma T^4}{R^2}$ (2) $\frac{\sigma T^4}{4\pi R^2}$ (3) $\frac{\sigma T^4}{R^4}$ (4) $\frac{4\pi \sigma T^4}{R^2}$

Scan or tap for the full solution



- Q.8** Assuming the sun to have a spherical outer surface of radius r , radiating like a black body at temperature $t^\circ\text{C}$, 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.9 A black body at 227°C radiates heat at the rate of $7 \text{ cal/cm}^2 \text{ s}$. 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.10 Assuming the sun to have a spherical outer surface of radius r , radiating like a black body at temperature $t^{\circ}\text{C}$, 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.11 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.12 A black body at 1227°C emits radiations with maximum intensity at a wavelength of $5000 \text{ \AA}$. If the temperature of the body is increased by 1000°C , the maximum intensity will be observed at

[AIPMT 2006]

- (1) $3000 \text{ \AA}$ (2) $4000 \text{ \AA}$ (3) $5000 \text{ \AA}$ (4) $6000 \text{ \AA}$

Scan or tap for the full solution



Q.13 If λ_m denotes the wavelength at which the radiative emission from a black body at a temperature $T \text{ K}$ 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.14 Unit of Stefan's constant is [AIPMT 2002]

- (1) $\text{watt m}^2 \text{ K}^4$ (2) $\text{watt m}^2/\text{K}^4$
 (3) $\text{watt}/\text{m}^2 \text{ K}$ (4) $\text{watt}/\text{m}^2 \text{ K}^4$

Scan or tap for the full solution



Q.15 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.16 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.17 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.

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Q.18 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.	3	3	2	4	4	4	1	3	2	3	1
Ques.	12	13	14	15	16	17	18				
Ans.	1	4	4	2	2	1	2				