

# PhysicsByAaryan

CSIR NET . GATE . JEST . BARC - Physics

## Black Body Radiations - CSIR NET Physics PYQs

Statistical Mechanics . All PYQs (2015-2025) with answer key

**6 questions . Answer key included**

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**Q1. [June 2018] . 5.0 marks**

Statistical Mechanics &gt; Black Body Radiations

CSIR NET	2018 June	5M
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The maximum intensity of solar radiation is at the wavelength of  $\lambda_{\text{sun}} \sim 5000\text{\AA}$  and corresponds to its surface temperature  $T_{\text{sun}} \sim 10^4 \text{ K}$ . If the wavelength of the maximum intensity of an *X*-ray star is  $5\text{\AA}$ , its surface temperature is of the order of

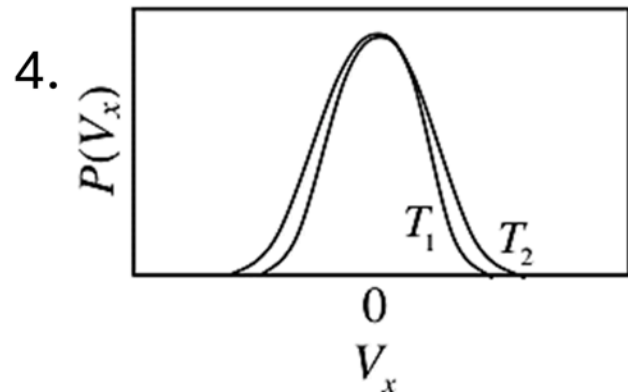
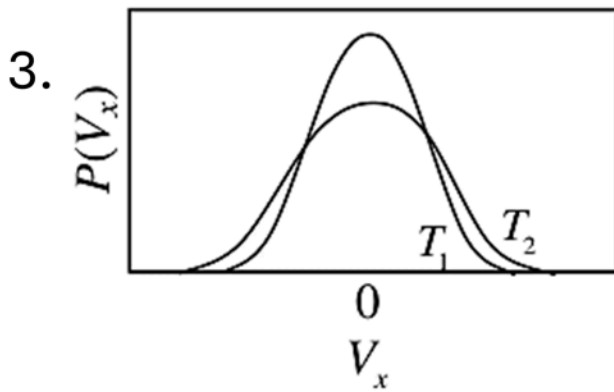
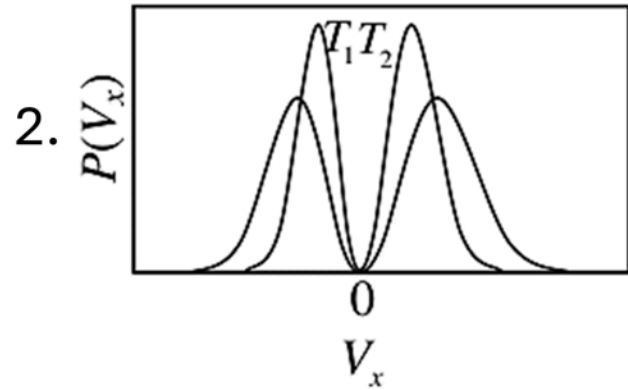
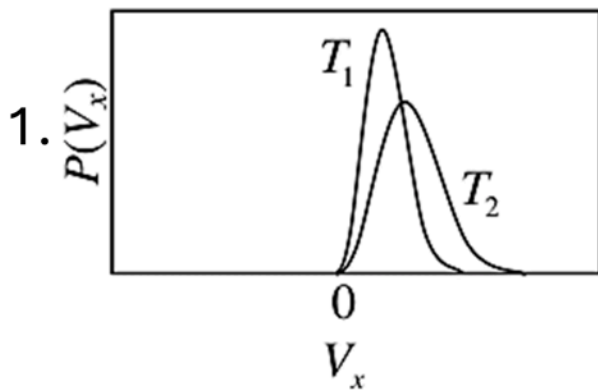
1.  $10^{16} \text{ K}$
2.  $10^{14} \text{ K}$
3.  $10^{10} \text{ K}$
4.  $10^7 \text{ K}$

**Q2. [June 2019] . 3.5 marks**

Statistical Mechanics > Black Body Radiations

CSIR NET	2019 June	3.5M
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Consider a classical gas in thermal equilibrium at temperatures  $T_1$  and  $T_2$  where  $T_1 < T_2$ . Which of the following graphs correctly represents the qualitative behavior of the probability density function of the  $x$ -component of the velocity?



**Q3. [June 2020] . 3.5 marks**

Statistical Mechanics &gt; Black Body Radiations

CSIR NET	2020 June	3.5M
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The temperatures of two perfect black bodies A and B are 400K and 200K, respectively. If the surface area of A is twice that of B, the ratio of total power emitted by A to that by B is

1. 4
2. 2
3. 32
4. 16

**Q4. [June 2020] . 5.0 marks**

Statistical Mechanics &gt; Black Body Radiations

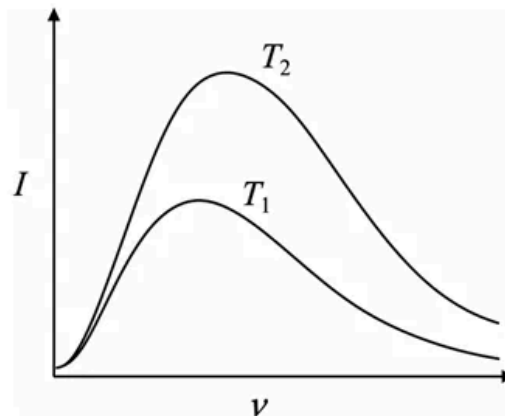
CSIR NET	2020 June	5M
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The energy density  $I$  of a black body radiation at temperature  $T$  is given by the Planck's distribution

$$\text{function } I(\nu, T) = \frac{8\pi\nu^2}{c^3} \frac{h\nu}{\left(e^{\frac{h\nu}{k_B T}} - 1\right)}, \text{ where } \nu \text{ is the}$$

frequency. The function  $I(\nu, T)$  for two different temperatures  $T_1$  and  $T_2$  are shown below. If the two curves coincide when  $I(\nu, T)\nu^a$  is plotted against  $\nu^b/T$ , then the values of  $a$  and  $b$  are, respectively,

1. 2 and 1
2. -2 and 2
3. 3 and -1
4. -3 and 1



**Q5. [June 2021] . 3.5 marks**

Statistical Mechanics &gt; Black Body Radiations

CSIR NET	2021 June	3.5M
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The volume and temperature of a spherical cavity filled with black body radiation are  $V$  and 300 K, respectively. If it expands adiabatically to a volume  $2V$ , its temperature will be closest to

1. 150 K
2. 300 K
3. 250 K
4. 240 K

**Q6. [Dec 2024] . 3.5 marks**

Statistical Mechanics &gt; Black Body Radiations

CSIR NET	2024 Dec	3.5M
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A spherical cavity of volume  $V$  is filled with thermal radiation at temperature  $T$ . The cavity expands adiabatically to 8 times its initial volume. If  $\sigma$  is Stefan's constant and  $c$  is the speed of light in vacuum, what is the closest value of the work done in the process?

1.  $8 \left( \frac{\sigma T^4 V}{c} \right)$

2.  $4 \left( \frac{\sigma T^4 V}{c} \right)$

3.  $\frac{1}{2} \left( \frac{\sigma T^4 V}{c} \right)$

4.  $2 \left( \frac{\sigma T^4 V}{c} \right)$

## Answer Key

6 questions . Subject and topic for quick revision

Q. No	Subject	Topic	Answer
Q1	Statistical Mechanics	Black Body Radiations	4
Q2	Statistical Mechanics	Black Body Radiations	3
Q3	Statistical Mechanics	Black Body Radiations	3
Q4	Statistical Mechanics	Black Body Radiations	4
Q5	Statistical Mechanics	Black Body Radiations	4
Q6	Statistical Mechanics	Black Body Radiations	4

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