

PHYSICS · JEE MAIN

Kinetic Theory of Gases

Chapter-wise previous year questions, with answer key

107

PYQS

2020–2025

PAPERS

7

TOPICS

Ideal Gas Equation

Kinetic Theory Assumptions

RMS Speed and Distribution

Degrees of Freedom

Mean Free Path

Degrees of Freedom and Equipartition

RMS, Average and Most Probable Speed

- 1 Attempt each question on paper first — they're grouped by topic, newest papers first.
- 2 Check yourself against the answer key at the end.
- 3 Got one wrong? Tap “Step-by-step solution” under it for the full working.

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Ideal Gas Equation · 18 PYQs

Q1 JEE Main 2025 · 3 Apr · Shift 2

Pressure of an ideal gas, contained in a closed vessel, is increased by 0.4% when heated by 1°C . Its initial temperature must be:

- (A) 2500 K (B) 25°C
(C) 250°C (D) 250 K

[Step-by-step solution ► prepwiser.in/questions/a-luVs62K5](https://www.prepwiser.in/questions/a-luVs62K5)

Q2 JEE Main 2025 · 29 Jan · Shift 1

A container of fixed volume contains a gas at 27°C . To double the pressure of the gas, the temperature of gas should be raised to _____ $^{\circ}\text{C}$.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/iut4Tyh4GL](https://www.prepwiser.in/questions/iut4Tyh4GL)

Q3 JEE Main 2024 · 29 Jan · Shift 1

Two vessels A and B are of the same size and are at same temperature. A contains 1g of hydrogen and B contains 1g of oxygen. P_A and P_B are the pressures of the gases in A and B respectively, then $\frac{P_A}{P_B}$ is:

- (A) 4 (B) 32
(C) 8 (D) 16

[Step-by-step solution ► prepwiser.in/questions/RcnIkQv2Dy](https://www.prepwiser.in/questions/RcnIkQv2Dy)

Q4 JEE Main 2024 · 29 Jan · Shift 2

The temperature of a gas having 2.0×10^{25} molecules per cubic meter at 1.38atm (Given, $k = 1.38 \times 10^{-23} \text{JK}^{-1}$) is :

- (A) 500 K (B) 300 K
(C) 200 K (D) 100 K

[Step-by-step solution ► prepwiser.in/questions/AY4kGTo6uB](https://www.prepwiser.in/questions/AY4kGTo6uB)

Q5 JEE Main 2023 · 30 Jan · Shift 1

The pressure (P) and temperature (T) relationship of an ideal gas obeys the equation $PT^2 = \text{constant}$. The volume expansion coefficient of the gas will be :

- (A) $3T^2$ (B) $\frac{3}{T^2}$
(C) $\frac{3}{T^3}$ (D) $\frac{3}{T}$

[Step-by-step solution ► prepwiser.in/questions/tvIJC_K5K9](https://www.prepwiser.in/questions/tvIJC_K5K9)

Q6 JEE Main 2023 · 29 Jan · Shift 1

A bicycle tyre is filled with air having pressure of 270kPa at 27°C . The approximate pressure of the air in the tyre when the temperature increases to 36°C is

- (A) 262 kPa (B) 360 kPa
(C) 270 kPa (D) 278 kPa

[Step-by-step solution ► prepwiser.in/questions/PAxW2t2Mdl](https://www.prepwiser.in/questions/PAxW2t2Mdl)

Q7 JEE Main 2022 · 27 Jul · Shift 1

Same gas is filled in two vessels of the same volume at the same temperature. If the ratio of the number of molecules is 1 : 4, then

- A. The r.m.s. velocity of gas molecules in two vessels will be the same.
- B. The ratio of pressure in these vessels will be 1 : 4.
- C. The ratio of pressure will be 1 : 1.
- D. The r.m.s. velocity of gas molecules in two vessels will be in the ratio of 1 : 4.

Choose the correct answer from the options given below :

- (A) A and C only
- (B) B and D only
- (C) A and B only
- (D) C and D only

[Step-by-step solution ► prepwisser.in/questions/r6puE5gSHE](https://www.prepwisser.in/questions/r6puE5gSHE)

Q8 JEE Main 2022 · 29 Jun · Shift 2

A vessel contains 16g of hydrogen and 128g of oxygen at standard temperature and pressure. The volume of the vessel in cm^3 is :

- (A) 72×10^5
- (B) 32×10^5
- (C) 27×10^4
- (D) 54×10^4

[Step-by-step solution ► prepwisser.in/questions/4DY4XNI5wN](https://www.prepwisser.in/questions/4DY4XNI5wN)

Q9 JEE Main 2022 · 27 Jun · Shift 1

A mixture of hydrogen and oxygen has volume 2000 cm^3 , temperature 300 K, pressure 100 kPa and mass 0.76 g. The ratio of number of moles of hydrogen to number of moles of oxygen in the mixture will be:

[Take gas constant $R = 8.3 \text{ JK}^{-1}\text{mol}^{-1}$]

- (A) $\frac{1}{3}$
- (B) $\frac{3}{1}$
- (C) $\frac{1}{16}$
- (D) $\frac{16}{1}$

[Step-by-step solution ► prepwisser.in/questions/U6EsEWY44g](https://www.prepwisser.in/questions/U6EsEWY44g)

Q10 JEE Main 2022 · 25 Jun · Shift 2

When a gas filled in a closed vessel is heated by raising the temperature by 1°C , its pressure increases by 0.4%. The initial temperature of the gas is _____ K.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/s-EkGZji7A](https://www.prepwisser.in/questions/s-EkGZji7A)

Q11 JEE Main 2021 · 31 Aug · Shift 2

A mixture of hydrogen and oxygen has volume 500 cm^3 , temperature 300 K, pressure 400 kPa and mass 0.76 g. The ratio of masses of oxygen to hydrogen will be :-

- (A) 3 : 8
- (B) 3 : 16
- (C) 16 : 3
- (D) 8 : 3

[Step-by-step solution ► prepwisser.in/questions/nqXkUFb4bl](https://www.prepwisser.in/questions/nqXkUFb4bl)

Q12 JEE Main 2021 · 26 Aug · Shift 2

A cylindrical container of volume $4.0 \times 10^{-3} \text{ m}^3$ contains one mole of hydrogen and two moles of carbon dioxide. Assume the temperature of the mixture is 400 K. The pressure of the mixture of gases is :

[Take gas constant as $8.3 \text{ J mol}^{-1} \text{ K}^{-1}$]

- (A) $249 \times 10^1 \text{ Pa}$
- (B) $24.9 \times 10^3 \text{ Pa}$
- (C) $24.9 \times 10^5 \text{ Pa}$
- (D) 24.9 Pa

[Step-by-step solution ► prepwiser.in/questions/5mni6wA76C](https://www.prepwiser.in/questions/5mni6wA76C)

Q13 JEE Main 2021 · 27 Jul · Shift 1

The number of molecules in one litre of an ideal gas at 300 K and 2 atmospheric pressure with mean kinetic energy $2 \times 10^{-9} \text{ J}$ per molecules is :

- (A) 0.75×10^{11}
- (B) 3×10^{11}
- (C) 1.5×10^{11}
- (D) 6×10^{11}

[Step-by-step solution ► prepwiser.in/questions/QLP1mWNIga](https://www.prepwiser.in/questions/QLP1mWNIga)

Q14 JEE Main 2021 · 16 Mar · Shift 1

The volume V of an enclosure contains a mixture of three gases, 16 g of oxygen, 28 g of nitrogen and 44 g of carbon dioxide at absolute temperature T. Consider R as universal gas constant. The pressure of the mixture of gases is :

- | | |
|----------------------|--------------------------------|
| (A) $\frac{3RT}{V}$ | (B) $\frac{4RT}{V}$ |
| (C) $\frac{88RT}{V}$ | (D) $\frac{5}{2} \frac{RT}{V}$ |

[Step-by-step solution ► prepwiser.in/questions/_fxjDE3u5y](https://www.prepwiser.in/questions/_fxjDE3u5y)

Q15 JEE Main 2021 · 26 Feb · Shift 1

A container is divided into two chambers by a partition. The volume of first chamber is 4.5 litre and second chamber is 5.5 litre. The first chamber contain 3.0 moles of gas at pressure 2.0 atm and second chamber contain 4.0 moles of gas at pressure 3.0 atm. After the partition is removed and the mixture attains equilibrium, then, the common equilibrium pressure existing in the mixture is $x \times 10^{-1} \text{ atm}$. Value of x is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/ZFvD9cOORM](https://www.prepwiser.in/questions/ZFvD9cOORM)

Q16 JEE Main 2020 · 5 Sep · Shift 1

Number of molecules in a volume of 4 cm^3 of a perfect monoatomic gas at some temperature T and at a pressure of 2 cm of mercury is close to?

(Given, mean kinetic energy of a molecule

(at T) is $4 \times 10^{-14} \text{ erg}$, $g = 980 \text{ cm/s}^2$, density of mercury = 13.6 g/cm^3)

(A) 5.8×10^{18}

(B) 4.0×10^{16}

(C) 5.8×10^{16}

(D) 4.0×10^{18}

[Step-by-step solution ► prepwiser.in/questions/Nbfs8QqOgO](https://www.prepwiser.in/questions/Nbfs8QqOgO)

Q17 JEE Main 2020 · 4 Sep · Shift 1

A closed vessel contains 0.1 mole of a monoatomic ideal gas at 200 K. If 0.05 mole of the same gas at 400 K is added to it, the final equilibrium temperature (in K) of the gas in the vessel will be close to _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/BArBqz9KNN](https://www.prepwiser.in/questions/BArBqz9KNN)

Q18 JEE Main 2020 · 4 Sep · Shift 2

The change in the magnitude of the volume of an ideal gas when a small additional pressure ΔP is applied at a constant temperature, is the same as the change when the temperature is reduced by a small quantity ΔT at constant pressure. The initial temperature and pressure of the gas were 300 K and 2 atm. respectively.

If $|\Delta T| = C |\Delta P|$ then value of C in (K/atm.) is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/LSrRijSapX](https://www.prepwiser.in/questions/LSrRijSapX)

Kinetic Theory Assumptions · 1 PYQs

Q19 JEE Main 2021 · 24 Feb · Shift 2

On the basis of kinetic theory of gases, the gas exerts pressure because its molecules :

(A) continuously lose their energy till it reaches wall.

(B) are attracted by the walls of container.

(C) suffer change in momentum when impinge on the walls of container.

(D) continuously stick to the walls of container.

[Step-by-step solution ► prepwiser.in/questions/5fk9ohAC_O](https://www.prepwiser.in/questions/5fk9ohAC_O)

RMS Speed and Distribution · 13 PYQs

Q20 JEE Main 2025 · 28 Jan · Shift 2

The ratio of vapour densities of two gases at the same temperature is $\frac{4}{25}$, then the ratio of r.m.s. velocities will be :

- (A) $\frac{5}{2}$
- (B) $\frac{25}{4}$
- (C) $\frac{4}{25}$
- (D) $\frac{2}{5}$

[Step-by-step solution ► prepwiser.in/questions/p4GnXBtS7c](https://www.prepwiser.in/questions/p4GnXBtS7c)

Q21 JEE Main 2024 · 6 Apr · Shift 1

A sample contains mixture of helium and oxygen gas. The ratio of root mean square speed of helium and oxygen in the sample, is :

- (A) $\frac{1}{2\sqrt{2}}$
- (B) $\frac{1}{4}$
- (C) $\frac{2\sqrt{2}}{1}$
- (D) $\frac{1}{32}$

[Step-by-step solution ► prepwiser.in/questions/9ckTnXyPRI](https://www.prepwiser.in/questions/9ckTnXyPRI)

Q22 JEE Main 2024 · 1 Feb · Shift 2

If the root mean square velocity of hydrogen molecule at a given temperature and pressure is 2 km/s , the root mean square velocity of oxygen at the same condition in km/s is :

- (A) 1.0
- (B) 1.5
- (C) 2.0
- (D) 0.5

[Step-by-step solution ► prepwiser.in/questions/I2rkpPIWtt](https://www.prepwiser.in/questions/I2rkpPIWtt)

Q23 JEE Main 2024 · 30 Jan · Shift 1

At which temperature the r.m.s. velocity of a hydrogen molecule equal to that of an oxygen molecule at 47°C ?

- (A) 20 K
- (B) 80 K
- (C) 4 K
- (D) -73 K

[Step-by-step solution ► prepwiser.in/questions/eFIkKimOJl](https://www.prepwiser.in/questions/eFIkKimOJl)

Q24 JEE Main 2023 · 12 Apr · Shift 1

If the r. m.s speed of chlorine molecule is 490 m/s at 27°C , the r. m. s speed of argon molecules at the same temperature will be (Atomic mass of argon = 39.9u , molecular mass of chlorine = 70.9u)

- (A) 451.7 m/s
- (B) 751.7 m/s
- (C) 551.7 m/s
- (D) 651.7 m/s

[Step-by-step solution ► prepwiser.in/questions/V8v6xMLa_c](https://www.prepwiser.in/questions/V8v6xMLa_c)

Q25 JEE Main 2023 · 11 Apr · Shift 2

The root mean square speed of molecules of nitrogen gas at 27°C is approximately : (Given mass of a nitrogen molecule = $4.6 \times 10^{-26}\text{kg}$ and take Boltzmann constant $k_B = 1.4 \times 10^{-23}\text{JK}^{-1}$)

- (A) 91 m/s (B) 1260 m/s
(C) 27.4 m/s (D) 523 m/s

Step-by-step solution ► [prepwisser.in/questions/txOuRXm2r3](https://www.prepwisser.in/questions/txOuRXm2r3)

Q26 JEE Main 2023 · 6 Apr · Shift 2

The temperature of an ideal gas is increased from 200K to 800K. If r.m.s. speed of gas at 200K is v_0 . Then, r.m.s. speed of the gas at 800K will be:

- (A) v_0 (B) $2v_0$
(C) $4v_0$ (D) $\frac{v_0}{4}$

Step-by-step solution ► [prepwisser.in/questions/Bu_2yZO3P4](https://www.prepwisser.in/questions/Bu_2yZO3P4)

Q27 JEE Main 2023 · 25 Jan · Shift 1

The root mean square velocity of molecules of gas is

- (A) Proportional to temperature (T)
(B) Inversely proportional to square root of temperature ($\sqrt{\frac{1}{T}}$)
(C) Proportional to square of temperature (T^2)
(D) Proportional to square root of temperature ($\sqrt{T}$)

Step-by-step solution ► [prepwisser.in/questions/GYHGdvby4U](https://www.prepwisser.in/questions/GYHGdvby4U)

Q28 JEE Main 2022 · 29 Jul · Shift 2

The root mean square speed of smoke particles of mass $5 \times 10^{-17}\text{kg}$ in their Brownian motion in air at NTP is approximately. [Given $k = 1.38 \times 10^{-23}\text{JK}^{-1}$]

- (A) 60mms^{-1} (B) 12mms^{-1}
(C) 15mms^{-1} (D) 36mms^{-1}

Step-by-step solution ► [prepwisser.in/questions/zIBHxXdl3E](https://www.prepwisser.in/questions/zIBHxXdl3E)

Q29 JEE Main 2022 · 28 Jul · Shift 2

A vessel contains 14g of nitrogen gas at a temperature of 27°C . The amount of heat to be transferred to the gas to double the r.m.s speed of its molecules will be :

Take $R = 8.32\text{Jmol}^{-1}\text{K}^{-1}$.

- (A) 2229 J (B) 5616 J
(C) 9360 J (D) 13,104 J

Step-by-step solution ► [prepwisser.in/questions/2umxYK0RRR](https://www.prepwisser.in/questions/2umxYK0RRR)

Q30 JEE Main 2022 · 28 Jun · Shift 2

What will be the effect on the root mean square velocity of oxygen molecules if the temperature is doubled and oxygen molecule dissociates into atomic oxygen?

- (A) The velocity of atomic oxygen remains same
- (B) The velocity of atomic oxygen doubles
- (C) The velocity of atomic oxygen becomes half
- (D) The velocity of atomic oxygen becomes four times

Step-by-step solution ► [prepwiser.in/questions/0p_OHXbN2](https://www.prepwiser.in/questions/0p_OHXbN2)

Q31 JEE Main 2021 · 20 Jul · Shift 1

Consider a mixture of gas molecule of types A, B and C having masses $m_A < m_B < m_C$. The ratio of their root mean square speeds at normal temperature and pressure is :

- (A) $v_A = v_B \neq v_C$
- (B) $\frac{1}{v_A} > \frac{1}{v_B} > \frac{1}{v_C}$
- (C) $\frac{1}{v_A} < \frac{1}{v_B} < \frac{1}{v_C}$
- (D) $v_A = v_B = v_C = 0$

Step-by-step solution ► [prepwiser.in/questions/7bZvcjZcEM](https://www.prepwiser.in/questions/7bZvcjZcEM)

Q32 JEE Main 2021 · 24 Feb · Shift 2

The root mean square speed of molecules of a given mass of a gas at 27°C and 1 atmosphere pressure is 200 ms^{-1} . The root mean square speed of molecules of the gas at 127°C and 2 atmosphere pressure is $\frac{x}{\sqrt{3}} \text{ ms}^{-1}$. The value of x will be _____.

Numerical answer — enter the value.

Step-by-step solution ► [prepwiser.in/questions/laQkfd9F2Z](https://www.prepwiser.in/questions/laQkfd9F2Z)

Degrees of Freedom · 4 PYQs

Q33 JEE Main 2024 · 4 Apr · Shift 2

The translational degrees of freedom (f_t) and rotational degrees of freedom (f_r) of CH_4 molecule are:

- (A) $f_t = 2$ and $f_r = 2$
- (B) $f_t = 3$ and $f_r = 3$
- (C) $f_t = 3$ and $4f_r = 2$
- (D) $f_t = 2$ and $f_r = 3$

Step-by-step solution ► [prepwiser.in/questions/oKPFd92Cne](https://www.prepwiser.in/questions/oKPFd92Cne)

Q34 JEE Main 2024 · 29 Jan · Shift 2

N moles of a polyatomic gas ($f = 6$) must be mixed with two moles of a monoatomic gas so that the mixture behaves as a diatomic gas. The value of N is :

- (A) 6
- (B) 2
- (C) 4
- (D) 3

Step-by-step solution ► [prepwiser.in/questions/6V9pkj-ZN-](https://www.prepwiser.in/questions/6V9pkj-ZN-)

Q35 JEE Main 2022 · 25 Jun · Shift 2

The ratio of specific heats $\left(\frac{C_P}{C_V}\right)$ in terms of degree of freedom (f) is given by :

(A) $\left(1 + \frac{f}{3}\right)$

(B) $\left(1 + \frac{2}{f}\right)$

(C) $\left(1 + \frac{f}{2}\right)$

(D) $\left(1 + \frac{1}{f}\right)$

[Step-by-step solution ► prepwiser.in/questions/-8N2bCwkg_](https://www.prepwiser.in/questions/-8N2bCwkg_)

Q36 JEE Main 2021 · 17 Mar · Shift 1

A polyatomic ideal gas has 24 vibrational modes. What is the value of γ ?

(A) 1.37

(B) 1.30

(C) 1.03

(D) 10.3

[Step-by-step solution ► prepwiser.in/questions/S-EN4pCYHx](https://www.prepwiser.in/questions/S-EN4pCYHx)

Mean Free Path · 13 PYQs

Q37 JEE Main 2025 · 4 Apr · Shift 1

The mean free path and the average speed of oxygen molecules at 300 K and 1 atm are $3 \times 10^{-7}\text{m}$ and 600m/s , respectively. Find the frequency of its collisions.

(A) $5 \times 10^8/\text{s}$

(B) $9 \times 10^5/\text{s}$

(C) $2 \times 10^{10}/\text{s}$

(D) $2 \times 10^9/\text{s}$

[Step-by-step solution ► prepwiser.in/questions/QLYHeC7bsD](https://www.prepwiser.in/questions/QLYHeC7bsD)

Q38 JEE Main 2024 · 8 Apr · Shift 2

Given below are two statements :

Statement (I) : The mean free path of gas molecules is inversely proportional to square of molecular diameter.

Statement (II) : Average kinetic energy of gas molecules is directly proportional to absolute temperature of gas.

In the light of the above statements, choose the correct answer from the options given below :

(A) Statement I is false but Statement II is true

(B) Both Statement I and Statement II are true

(C) Statement I is true but Statement II is false

(D) Both Statement I and Statement II are false

[Step-by-step solution ► prepwiser.in/questions/UX_hSVRLay](https://www.prepwiser.in/questions/UX_hSVRLay)

Q39 JEE Main 2024 · 5 Apr · Shift 2

If n is the number density and d is the diameter of the molecule, then the average distance covered by a molecule between two successive collisions (i.e. mean free path) is represented by :

(A) $\frac{1}{\sqrt{2}n\pi d^2}$

(B) $\frac{1}{\sqrt{2}n^2\pi^2 d^2}$

(C) $\frac{1}{\sqrt{2}n\pi d^2}$

(D) $\sqrt{2}n\pi d^2$

[Step-by-step solution ► prepwiser.in/questions/JQLz5OX5tY](https://www.prepwiser.in/questions/JQLz5OX5tY)

Q40 JEE Main 2024 · 5 Apr · Shift 1

If the collision frequency of hydrogen molecules in a closed chamber at 27°C is Z , then the collision frequency of the same system at 127°C is :

- (A) $\frac{\sqrt{3}}{2}Z$ (B) $\frac{2}{\sqrt{3}}Z$
(C) $\frac{3}{4}Z$ (D) $\frac{4}{3}Z$

[Step-by-step solution ► prepwiser.in/questions/Z59O3KeoEX](https://www.prepwiser.in/questions/Z59O3KeoEX)

Q41 JEE Main 2023 · 13 Apr · Shift 2

The mean free path of molecules of a certain gas at STP is $1500d$, where d is the diameter of the gas molecules. While maintaining the standard pressure, the mean free path of the molecules at 373K is approximately:

- (A) $750d$ (B) $1500d$
(C) $2049d$ (D) $1098d$

[Step-by-step solution ► prepwiser.in/questions/KRI4039Hhg](https://www.prepwiser.in/questions/KRI4039Hhg)

Q42 JEE Main 2023 · 6 Apr · Shift 1

The number of air molecules per cm^3 increased from 3×10^{19} to 12×10^{19} . The ratio of collision frequency of air molecules before and after the increase in number respectively is:

- (A) 1.25 (B) 0.25
(C) 0.50 (D) 0.75

[Step-by-step solution ► prepwiser.in/questions/zmyIvTyKji](https://www.prepwiser.in/questions/zmyIvTyKji)

Q43 JEE Main 2022 · 27 Jun · Shift 2

According to kinetic theory of gases,

- A. The motion of the gas molecules freezes at 0°C .
B. The mean free path of gas molecules decreases if the density of molecules is increased.
C. The mean free path of gas molecules increases if temperature is increased keeping pressure constant.
D. Average kinetic energy per molecule per degree of freedom is $\frac{3}{2}k_B T$ (for monoatomic gases).

Choose the most appropriate answer from the options given below :

- (A) A and C only (B) B and C only
(C) A and B only (D) C and D only

[Step-by-step solution ► prepwiser.in/questions/FmfCLjkhIQ](https://www.prepwiser.in/questions/FmfCLjkhIQ)

Q44 JEE Main 2021 · 25 Jul · Shift 2

A system consists of two types of gas molecules A and B having same number density $2 \times 10^{25}/\text{m}^3$. The diameter of A and B are $10 \text{ \AA}$ and $5 \text{ \AA}$ respectively. They suffer collision at room temperature. The ratio of average distance covered by the molecule A to that of B between two successive collision is _____ $\times 10^{-2}$

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/Cn0bgXngjT](https://www.prepwiser.in/questions/Cn0bgXngjT)

Q45 JEE Main 2021 · 16 Mar · Shift 2

Calculate the value of mean free path (λ) for oxygen molecules at temperature 27°C and pressure 1.01×10^5 Pa. Assume the molecular diameter 0.3 nm and the gas is ideal. ($k = 1.38 \times 10^{-23} \text{ J K}^{-1}$)

- (A) 32 nm (B) 58 nm
(C) 86 nm (D) 102 nm

Step-by-step solution ► [prepwisar.in/questions/uHnWlrIOet](https://www.prepwisar.in/questions/uHnWlrIOet)

Q46 JEE Main 2020 · 6 Sep · Shift 2

In a dilute gas at pressure P and temperature T, the mean time between successive collisions of a molecule varies with T as :

- (A) $\sqrt{T}$ (B) T
(C) $\frac{1}{T}$ (D) $\frac{1}{\sqrt{T}}$

Step-by-step solution ► [prepwisar.in/questions/3Azhm0zUGP](https://www.prepwisar.in/questions/3Azhm0zUGP)

Q47 JEE Main 2020 · 2 Sep · Shift 2

An ideal gas in a closed container is slowly heated. As its temperature increases, which of the following statements are true?

- (A) the mean free path of the molecules decreases.
(B) the mean collision time between the molecules decreases.
(C) the mean free path remains unchanged.
(D) the mean collision time remains unchanged.
- (A) (C) and (D) (B) (A) and (D)
(C) (B) and (C) (D) (A) and (B)

Step-by-step solution ► [prepwisar.in/questions/9oBsTZpwWn](https://www.prepwisar.in/questions/9oBsTZpwWn)

Q48 JEE Main 2020 · 9 Jan · Shift 2

Two gases-argon (atomic radius 0.07 nm, atomic weight 40) and xenon (atomic radius 0.1 nm, atomic weight 140) have the same number density and are at the same temperature. The ratio of their respective mean free times is closest to :

- (A) 2.3 (B) 1.83
(C) 4.67 (D) 3.67

Step-by-step solution ► [prepwisar.in/questions/SGGOZNhX7m](https://www.prepwisar.in/questions/SGGOZNhX7m)

Q49 JEE Main 2020 · 7 Jan · Shift 2

Under an adiabatic process, the volume of an ideal gas gets doubled. Consequently the mean collision time between the gas molecule changes from τ_1 to τ_2 . If $\frac{C_p}{C_v} = \gamma$ for this gas then a good estimate for $\frac{\tau_2}{\tau_1}$ is given by :

- (A) $(2)^{\frac{1+\gamma}{2}}$
(B) 2
(C) $(\frac{1}{2})^{\frac{1+\gamma}{2}}$
(D) $(\frac{1}{2})^\gamma$

Step-by-step solution ► [prepwisar.in/questions/aG_dDLtT8z](https://www.prepwisar.in/questions/aG_dDLtT8z)

Degrees of Freedom and Equipartition · 47 PYQs

Q50 JEE Main 2025 · 7 Apr · Shift 2

The helium and argon are put in the flask at the same room temperature (300 K). The ratio of average kinetic energies (per molecule) of helium and argon is:

(Give: Molar mass of helium = 4 g/mol, Molar mass of argon = 40 g/mol)

- (A) $1 : \sqrt{10}$
- (B) 10 : 1
- (C) 1 : 10
- (D) 1 : 1

[Step-by-step solution ► prepwiser.in/questions/8r35RxPS1j](https://www.prepwiser.in/questions/8r35RxPS1j)

Q51 JEE Main 2025 · 2 Apr · Shift 1

γ_A is the specific heat ratio of monoatomic gas A having 3 translational degrees of freedom. γ_B is the specific heat ratio of polyatomic gas B having 3 translational, 3 rotational degrees of freedom and 1 vibrational mode. If $\frac{\gamma_A}{\gamma_B} = \left(1 + \frac{1}{n}\right)$, then the value of n is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/SBGdmz8r_p](https://www.prepwiser.in/questions/SBGdmz8r_p)

Q52 JEE Main 2025 · 2 Apr · Shift 2

The internal energy of air in $4\text{m} \times 4\text{m} \times 3\text{m}$ sized room at 1 atmospheric pressure will be _____ $\times 10^6 \text{J}$

(Consider air as diatomic molecule)

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/efO96uzH6j](https://www.prepwiser.in/questions/efO96uzH6j)

Q53 JEE Main 2025 · 28 Jan · Shift 2

The kinetic energy of translation of the molecules in 50 g of CO_2 gas at 17°C is :

- (A) 4205.5 J
- (B) 3582.7 J
- (C) 3986.3 J
- (D) 4102.8 J

[Step-by-step solution ► prepwiser.in/questions/WGohuh83sg](https://www.prepwiser.in/questions/WGohuh83sg)

Q54 JEE Main 2025 · 22 Jan · Shift 2

For a diatomic gas, if $\gamma_1 = \left(\frac{C_p}{C_v}\right)$ for rigid molecules and $\gamma_2 = \left(\frac{C_p}{C_v}\right)$ for another diatomic molecules, but also having vibrational modes. Then, which one of the following options is correct? (C_p and C_v are specific heats of the gas at constant pressure and volume)

- (A) $\gamma_2 < \gamma_1$
- (B) $\gamma_2 > \gamma_1$
- (C) $\gamma_2 = \gamma_1$
- (D) $2\gamma_2 = \gamma_1$

[Step-by-step solution ► prepwiser.in/questions/KuMKRABKId](https://www.prepwiser.in/questions/KuMKRABKId)

Q55 JEE Main 2024 · 9 Apr · Shift 2

The temperature of a gas is -78°C and the average translational kinetic energy of its molecules is K . The temperature at which the average translational kinetic energy of the molecules of the same gas becomes $2K$ is :

- (A) -78°C (B) 127°C
(C) -39°C (D) 117°C

[Step-by-step solution ► prepwiser.in/questions/c4mrtitNyY](https://www.prepwiser.in/questions/c4mrtitNyY)

Q56 JEE Main 2024 · 8 Apr · Shift 1

A mixture of one mole of monoatomic gas and one mole of a diatomic gas (rigid) are kept at room temperature (27°C). The ratio of specific heat of gases at constant volume respectively is:

- (A) $\frac{3}{2}$ (B) $\frac{3}{5}$
(C) $\frac{7}{5}$ (D) $\frac{5}{3}$

[Step-by-step solution ► prepwiser.in/questions/8V-ed3BvCq](https://www.prepwiser.in/questions/8V-ed3BvCq)

Q57 JEE Main 2024 · 6 Apr · Shift 2

Energy of 10 non rigid diatomic molecules at temperature T is :

- (A) $35 RT$
(B) $\frac{7}{2} RT$
(C) $70 K_B T$
(D) $35 K_B T$

[Step-by-step solution ► prepwiser.in/questions/20H2QmujPH](https://www.prepwiser.in/questions/20H2QmujPH)

Q58 JEE Main 2024 · 1 Feb · Shift 1

Two moles a monoatomic gas is mixed with six moles of a diatomic gas. The molar specific heat of the mixture at constant volume is :

- (A) $\frac{3}{2} R$ (B) $\frac{7}{4} R$
(C) $\frac{5}{2} R$ (D) $\frac{9}{4} R$

[Step-by-step solution ► prepwiser.in/questions/28hqaS2whC](https://www.prepwiser.in/questions/28hqaS2whC)

Q59 JEE Main 2024 · 31 Jan · Shift 1

The parameter that remains the same for molecules of all gases at a given temperature is :

- (A) kinetic energy (B) mass
(C) momentum (D) speed

[Step-by-step solution ► prepwiser.in/questions/9WA-Yeo6ch](https://www.prepwiser.in/questions/9WA-Yeo6ch)

Q60 JEE Main 2024 · 31 Jan · Shift 2

A gas mixture consists of 8 moles of argon and 6 moles of oxygen at temperature T . Neglecting all vibrational modes, the total internal energy of the system is:

- (A) $29 RT$ (B) $27 RT$
(C) $20 RT$ (D) $21 RT$

[Step-by-step solution ► prepwiser.in/questions/F2VqPvSwm0](https://www.prepwiser.in/questions/F2VqPvSwm0)

Q61 JEE Main 2024 · 30 Jan · Shift 2

If three moles of monoatomic gas ($\gamma = \frac{5}{3}$) is mixed with two moles of a diatomic gas ($\gamma = \frac{7}{5}$), the value of adiabatic exponent γ for the mixture is

- (A) 1.35 (B) 1.52
(C) 1.40 (D) 1.75

Step-by-step solution ► [prepwisar.in/questions/W5yzTbETn1](https://www.prepwisar.in/questions/W5yzTbETn1)

Q62 JEE Main 2024 · 27 Jan · Shift 2

The total kinetic energy of 1 mole of oxygen at 27°C is : [Use universal gas constant (R) = 8.31J/ mole K]

- (A) 6232.5 J (B) 5670.5 J
(C) 6845.5 J (D) 5942.0 J

Step-by-step solution ► [prepwisar.in/questions/hjXfTuPvuq](https://www.prepwisar.in/questions/hjXfTuPvuq)

Q63 JEE Main 2024 · 27 Jan · Shift 1

The average kinetic energy of a monatomic molecule is 0.414eV at temperature :

(Use $K_B = 1.38 \times 10^{-23}\text{J/mol} - \text{K}$)

- (A) 3000 K (B) 3200 K
(C) 1600 K (D) 1500 K

Step-by-step solution ► [prepwisar.in/questions/cjwkKA5wZ4](https://www.prepwisar.in/questions/cjwkKA5wZ4)

Q64 JEE Main 2023 · 15 Apr · Shift 1

A flask contains Hydrogen and Argon in the ratio 2 : 1 by mass. The temperature of the mixture is 30°C . The ratio of average kinetic energy per molecule of the two gases (K argon/K hydrogen) is :

(Given: Atomic Weight of Ar = 39.9)

- (A) $\frac{39.9}{2}$ (B) 2
(C) 39.9 (D) 1

Step-by-step solution ► [prepwisar.in/questions/J-dZbI3ll-](https://www.prepwisar.in/questions/J-dZbI3ll-)

Q65 JEE Main 2023 · 10 Apr · Shift 2

A gas mixture consists of 2 moles of oxygen and 4 moles of neon at temperature T. Neglecting all vibrational modes, the total internal energy of the system will be,

- (A) 4RT (B) 16RT
(C) 8RT (D) 11RT

Step-by-step solution ► [prepwisar.in/questions/rZMftxkqov](https://www.prepwisar.in/questions/rZMftxkqov)

Q66 JEE Main 2023 · 8 Apr · Shift 2

The temperature at which the kinetic energy of oxygen molecules becomes double than its value at 27°C is

- (A) 627°C (B) 927°C
(C) 327°C (D) 1227°C

Step-by-step solution ► [prepwisar.in/questions/k1Hy27FIir](https://www.prepwisar.in/questions/k1Hy27FIir)

Q67 JEE Main 2023 · 1 Feb · Shift 1

The average kinetic energy of a molecule of the gas is

- (A) proportional to volume (B) dependent on the nature of the gas
(C) proportional to absolute temperature (D) proportional to pressure

[Step-by-step solution ► prepwiser.in/questions/QDQgZLLViQ](https://www.prepwiser.in/questions/QDQgZLLViQ)

Q68 JEE Main 2023 · 31 Jan · Shift 1

The correct relation between $\gamma = \frac{c_p}{c_v}$ and temperature T is :

- (A) $\gamma \propto T$ (B) $\gamma \propto \frac{1}{\sqrt{T}}$
(C) $\gamma \propto \frac{1}{T}$ (D) $\gamma \propto T^\circ$

[Step-by-step solution ► prepwiser.in/questions/sOjkhKTikZ](https://www.prepwiser.in/questions/sOjkhKTikZ)

Q69 JEE Main 2023 · 30 Jan · Shift 2

A flask contains hydrogen and oxygen in the ratio of 2 : 1 by mass at temperature 27°C. The ratio of average kinetic energy per molecule of hydrogen and oxygen respectively is:

- (A) 1 : 1 (B) 4 : 1
(C) 1 : 4 (D) 2 : 1

[Step-by-step solution ► prepwiser.in/questions/s7F1IzJFBk](https://www.prepwiser.in/questions/s7F1IzJFBk)

Q70 JEE Main 2023 · 25 Jan · Shift 2

According to law of equipartition of energy the molar specific heat of a diatomic gas at constant volume where the molecule has one additional vibrational mode is :-

- (A) $\frac{9}{2}R$ (B) $\frac{5}{2}R$
(C) $\frac{3}{2}R$ (D) $\frac{7}{2}R$

[Step-by-step solution ► prepwiser.in/questions/jyCbRAXwXy](https://www.prepwiser.in/questions/jyCbRAXwXy)

Q71 JEE Main 2023 · 24 Jan · Shift 2

Let γ_1 be the ratio of molar specific heat at constant pressure and molar specific heat at constant volume of a monoatomic gas and γ_2 be the similar ratio of diatomic gas. Considering the diatomic gas molecule as a rigid rotator, the ratio, $\frac{\gamma_1}{\gamma_2}$ is :

- (A) $\frac{35}{27}$ (B) $\frac{25}{21}$
(C) $\frac{21}{25}$ (D) $\frac{27}{35}$

[Step-by-step solution ► prepwiser.in/questions/SVhdVGVVMN](https://www.prepwiser.in/questions/SVhdVGVVMN)

Q72 JEE Main 2022 · 29 Jul · Shift 1

One mole of a monoatomic gas is mixed with three moles of a diatomic gas. The molecular specific heat of mixture at constant volume is $\frac{\alpha^2}{4}R \text{ J/mol K}$; then the value of α will be _____. (Assume that the given diatomic gas has no vibrational mode).

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/pEQIk4TYtb](https://www.prepwiser.in/questions/pEQIk4TYtb)

Q73 JEE Main 2022 · 27 Jul · Shift 2

Which statements are correct about degrees of freedom ?

(A) A molecule with n degrees of freedom has n^2 different ways of storing energy.

(B) Each degree of freedom is associated with $\frac{1}{2} RT$ average energy per mole.

(C) A monatomic gas molecule has 1 rotational degree of freedom where as diatomic molecule has 2 rotational degrees of freedom.

(D) CH_4 has a total of 6 degrees of freedom.

Choose the correct answer from the options given below :

(A) (B) and (C) only

(B) (B) and (D) only

(C) (A) and (B) only

(D) (C) and (D) only

[Step-by-step solution ► prepwisser.in/questions/eA0Sx1CGn](https://www.prepwisser.in/questions/eA0Sx1CGn)

Q74 JEE Main 2022 · 26 Jul · Shift 2

A gas has n degrees of freedom. The ratio of specific heat of gas at constant volume to the specific heat of gas at constant pressure will be :

(A) $\frac{n}{n+2}$

(B) $\frac{n+2}{n}$

(C) $\frac{n}{2n+2}$

(D) $\frac{n}{n-2}$

[Step-by-step solution ► prepwisser.in/questions/4XFBhtBR63](https://www.prepwisser.in/questions/4XFBhtBR63)

Q75 JEE Main 2022 · 28 Jun · Shift 1

The total internal energy of two mole monoatomic ideal gas at temperature $T = 300 \text{ K}$ will be _____ J. (Given $R = 8.31 \text{ J/mol.K}$)

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/jHjX_N89nK](https://www.prepwisser.in/questions/jHjX_N89nK)

Q76 JEE Main 2022 · 26 Jun · Shift 2

A flask contains argon and oxygen in the ratio of 3 : 2 in mass and the mixture is kept at 27°C . The ratio of their average kinetic energy per molecule respectively will be :

(A) 3 : 2

(B) 9 : 4

(C) 2 : 3

(D) 1 : 1

[Step-by-step solution ► prepwisser.in/questions/AVmG7pAzOT](https://www.prepwisser.in/questions/AVmG7pAzOT)

Q77 JEE Main 2022 · 24 Jun · Shift 1

0.056 kg of Nitrogen is enclosed in a vessel at a temperature of 127°C . The amount of heat required to double the speed of its molecules is _____ k cal.

Take $R = 2 \text{ cal mole}^{-1} \text{ K}^{-1}$

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/Xbyrkdook8](https://www.prepwisser.in/questions/Xbyrkdook8)

Q78 JEE Main 2021 · 1 Sep · Shift 2

The average translational kinetic energy of N_2 gas molecules at°C becomes equal to the K.E. of an electron accelerated from rest through a potential difference of 0.1 volt. (Given $k_B = 1.38 \times 10^{-23}$ J/K) (Fill the nearest integer).

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/fwa2FXomU8](https://www.prepwiser.in/questions/fwa2FXomU8)

Q79 JEE Main 2021 · 27 Jul · Shift 2

One mole of an ideal gas is taken through an adiabatic process where the temperature rises from 27° C to 37° C. If the ideal gas is composed of polyatomic molecule that has 4 vibrational modes, which of the following is true? [$R = 8.314 \text{ J mol}^{-1} \text{ K}^{-1}$]

- (A) work done by the gas is close to 332 J (B) work done on the gas is close to 582 J
(C) work done by the gas is close to 582 J (D) work done on the gas is close to 332 J

[Step-by-step solution ► prepwiser.in/questions/Nryk9RcvHj](https://www.prepwiser.in/questions/Nryk9RcvHj)

Q80 JEE Main 2021 · 25 Jul · Shift 1

For a gas $C_p - C_v = R$ in a state P and $C_p - C_v = 1.10 R$ in a state Q, T_P and T_Q are the temperatures in two different states P and Q respectively. Then

- (A) $T_P = T_Q$
(B) $T_P < T_Q$
(C) $T_P = 0.9 T_Q$
(D) $T_P > T_Q$

[Step-by-step solution ► prepwiser.in/questions/62BloKncfb](https://www.prepwiser.in/questions/62BloKncfb)

Q81 JEE Main 2021 · 22 Jul · Shift 2

What will be the average value of energy for a monoatomic gas in thermal equilibrium at temperature T?

- (A) $\frac{3}{2} k_B T$ (B) $k_B T$
(C) $\frac{2}{3} k_B T$ (D) $\frac{1}{2} k_B T$

[Step-by-step solution ► prepwiser.in/questions/HRX4-6OhnI](https://www.prepwiser.in/questions/HRX4-6OhnI)

Q82 JEE Main 2021 · 20 Jul · Shift 2

The correct relation between the degrees of freedom f and the ratio of specific heat γ is :

- (A) $f = \frac{2}{\gamma-1}$ (B) $f = \frac{2}{\gamma+1}$
(C) $f = \frac{\gamma+1}{2}$ (D) $f = \frac{1}{\gamma+1}$

[Step-by-step solution ► prepwiser.in/questions/SfirLZwuGj](https://www.prepwiser.in/questions/SfirLZwuGj)

Q83 JEE Main 2021 · 18 Mar · Shift 1

What will be the average value of energy along one degree of freedom for an ideal gas in thermal equilibrium at a temperature T? (k_B is Boltzmann constant)

- (A) $\frac{1}{2} k_B T$ (B) $\frac{2}{3} k_B T$
(C) $\frac{3}{2} k_B T$ (D) $k_B T$

[Step-by-step solution ► prepwiser.in/questions/iROUXEi6Fg](https://www.prepwiser.in/questions/iROUXEi6Fg)

Q84 JEE Main 2021 · 17 Mar · Shift 1

Two ideal polyatomic gases at temperatures T_1 and T_2 are mixed so that there is no loss of energy. If F_1 and F_2 , m_1 and m_2 , n_1 and n_2 be the degrees of freedom, masses, number of molecules of the first and second gas respectively, the temperature of mixture of these two gases is :

- (A) $\frac{n_1 F_1 T_1 + n_2 F_2 T_2}{F_1 + F_2}$
(B) $\frac{n_1 F_1 T_1 + n_2 F_2 T_2}{n_1 F_1 + n_2 F_2}$
(C) $\frac{n_1 T_1 + n_2 T_2}{n_1 + n_2}$
(D) $\frac{n_1 F_1 T_1 + n_2 F_2 T_2}{n_1 + n_2}$

[Step-by-step solution ► prepwisser.in/questions/0VQCCz4Ndr](https://www.prepwisser.in/questions/0VQCCz4Ndr)

Q85 JEE Main 2021 · 17 Mar · Shift 2

If one mole of the polyatomic gas is having two vibrational modes and β is the ratio of molar specific heats for polyatomic gas ($\beta = \frac{C_p}{C_v}$) then the value of β is :

- (A) 1.02 (B) 1.35
(C) 1.2 (D) 1.25

[Step-by-step solution ► prepwisser.in/questions/1xg5-egAZK](https://www.prepwisser.in/questions/1xg5-egAZK)

Q86 JEE Main 2021 · 26 Feb · Shift 2

The internal energy (U), pressure (P) and volume (V) of an ideal gas are related as $U = 3PV + 4$. The gas is :

- (A) either monoatomic or diatomic. (B) monoatomic only.
(C) polyatomic only. (D) diatomic only.

[Step-by-step solution ► prepwisser.in/questions/8rvFjs8dXL](https://www.prepwisser.in/questions/8rvFjs8dXL)

Q87 JEE Main 2021 · 25 Feb · Shift 1

A monoatomic gas of mass 4.0 u is kept in an insulated container. Container is moving with velocity 30 m/s. If container is suddenly stopped then change in temperature of the gas (R = gas constant) is $\frac{x}{3R}$. Value of x is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/UPTTOlcIXA](https://www.prepwisser.in/questions/UPTTOlcIXA)

Given below are two statements :

Statement I : In a diatomic molecule, the rotational energy at a given temperature obeys Maxwell's distribution.

Statement II : In a diatomic molecule, the rotational energy at a given temperature equals the translational kinetic energy for each molecule.

In the light of the above statements, choose the correct answer from the options given below :

- (A) Both Statement I and Statement II are true
- (B) Both Statement I and Statement II are false
- (C) Statement I is true but Statement II is false.
- (D) Statement I is false but Statement II is true.

[Step-by-step solution ► prepwiser.in/questions/VqLE7Svo7o](https://www.prepwiser.in/questions/VqLE7Svo7o)

Molecules of an ideal gas are known to have three translational degrees of freedom and two rotational degrees of freedom. The gas is maintained at a temperature of T . The total internal energy, U of a mole of this gas, and the value of

$\gamma \left(= \frac{C_p}{C_v} \right)$ are given, respectively by:

- (A) $U = \frac{5}{2}RT$ and $\gamma = \frac{7}{5}$
- (B) $U = 5RT$ and $\gamma = \frac{6}{5}$
- (C) $U = 5RT$ and $\gamma = \frac{7}{5}$
- (D) $U = \frac{5}{2}RT$ and $\gamma = \frac{6}{5}$

[Step-by-step solution ► prepwiser.in/questions/JSfYDPiE5Y](https://www.prepwiser.in/questions/JSfYDPiE5Y)

Initially a gas of diatomic molecules is contained in a cylinder of volume V_1 at a pressure P_1 and temperature 250 K. Assuming that 25% of the molecules get dissociated causing a change in number of moles. The pressure of the resulting gas at temperature 2000 K, when contained in a volume $2V_1$ is given by P_2 . The ratio $\frac{P_2}{P_1}$ is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/9jLzNfGqN8](https://www.prepwiser.in/questions/9jLzNfGqN8)

Q91 JEE Main 2020 · 4 Sep · Shift 1

Match the $\frac{C_P}{C_V}$ ratio for ideal gases with different type of molecules :

Molecule Type	C_P/C_V
(A) Monatomic	(I) 7/5
(B) Diatomic rigid molecules	(II) 9/7
(C) Diatomic non-rigid molecules	(III) 4/3
(D) Triatomic rigid molecules	(IV) 5/3

(A) (A)-(III), (B)-(IV), (C)-(II), (D)-(I)

(B) (A)-(IV), (B)-(II), (C)-(I), (D)-(III)

(C) (A)-(IV), (B)-(I), (C)-(II), (D)-(III)

(D) (A)-(II), (B)-(III), (C)-(I), (D)-(IV)

[Step-by-step solution ► prepwiser.in/questions/XLkuGSub2P](https://www.prepwiser.in/questions/XLkuGSub2P)

Q92 JEE Main 2020 · 3 Sep · Shift 2

To raise the temperature of a certain mass of gas by 50°C at a constant pressure, 160 calories of heat is required. When the same mass of gas is cooled by 100°C at constant volume, 240 calories of heat is released. How many degrees of freedom does each molecule of this gas have (assume gas to be ideal)?

(A) 6

(B) 7

(C) 5

(D) 3

[Step-by-step solution ► prepwiser.in/questions/D3Xf_N84in](https://www.prepwiser.in/questions/D3Xf_N84in)

Q93 JEE Main 2020 · 2 Sep · Shift 1

A gas mixture consists of 3 moles of oxygen and 5 moles of argon at temperature T . Assuming the gases to be ideal and the oxygen bond to be rigid, the total internal energy (in units of RT) of the mixture is :

(A) 11

(B) 20

(C) 15

(D) 13

[Step-by-step solution ► prepwiser.in/questions/W2xCX9I9P-](https://www.prepwiser.in/questions/W2xCX9I9P-)

Q94 JEE Main 2020 · 9 Jan · Shift 1

Consider two ideal diatomic gases A and B at some temperature T . Molecules of the gas A are rigid, and have a mass m . Molecules of the gas B have an additional vibrational mode, and have a mass $\frac{m}{4}$. The ratio of the specific heats (C_V^A and C_V^B) of gas A and B, respectively is :

(A) 7 : 9

(B) 5 : 7

(C) 3 : 5

(D) 5 : 9

[Step-by-step solution ► prepwiser.in/questions/6VO_337CjE](https://www.prepwiser.in/questions/6VO_337CjE)

Q95 JEE Main 2020 · 8 Jan · Shift 2

Consider a mixture of n moles of helium gas and $2n$ moles of oxygen gas (molecules taken to be rigid) as an ideal gas. Its C_p/C_v value will be :

- (A) 23/15 (B) 67/45
(C) 40/27 (D) 19/13

[Step-by-step solution ► prepwisser.in/questions/QW283MBwYA](https://www.prepwisser.in/questions/QW283MBwYA)

Q96 JEE Main 2020 · 7 Jan · Shift 1

Two moles of an ideal gas with $\frac{C_p}{C_v} = \frac{5}{3}$ are mixed with 3 moles of another ideal gas with $\frac{C_p}{C_v} = \frac{4}{3}$. The value of $\frac{C_p}{C_v}$ for the mixture is :

- (A) 1.50 (B) 1.45
(C) 1.47 (D) 1.42

[Step-by-step solution ► prepwisser.in/questions/3i7g9zKhSM](https://www.prepwisser.in/questions/3i7g9zKhSM)

RMS, Average and Most Probable Speed · 11 PYQs

Q97 JEE Main 2023 · 13 Apr · Shift 1

The rms speed of oxygen molecule in a vessel at particular temperature is $(1 + \frac{5}{x})^{\frac{1}{2}} v$, where v is the average speed of the molecule. The value of x will be:

(Take $\pi = \frac{22}{7}$)

- (A) 4 (B) 8
(C) 28 (D) 27

[Step-by-step solution ► prepwisser.in/questions/4JRWYCTOwt](https://www.prepwisser.in/questions/4JRWYCTOwt)

Q98 JEE Main 2023 · 11 Apr · Shift 1

Three vessels of equal volume contain gases at the same temperature and pressure. The first vessel contains neon (monoatomic), the second contains chlorine (diatomic) and third contains uranium hexafluoride (polyatomic). Arrange these on the basis of their root mean square speed (v_{rms}) and choose the correct answer from the options given below:

- (A) $v_{rms}(\text{mono}) = v_{rms}(\text{dia}) = v_{rms}(\text{poly})$
(B) $v_{rms}(\text{mono}) > v_{rms}(\text{dia}) > v_{rms}(\text{poly})$
(C) $v_{rms}(\text{dia}) < v_{rms}(\text{poly}) < v_{rms}(\text{mono})$
(D) $v_{rms}(\text{mono}) < v_{rms}(\text{dia}) < v_{rms}(\text{poly})$

[Step-by-step solution ► prepwisser.in/questions/pSIWjTKhAe](https://www.prepwisser.in/questions/pSIWjTKhAe)

Q99 JEE Main 2023 · 29 Jan · Shift 2

At 300 K, the rms speed of oxygen molecules is $\sqrt{\frac{\alpha+5}{\alpha}}$ times to that of its average speed in the gas. Then, the value of α will be

(used $\pi = \frac{22}{7}$)

- (A) 27 (B) 28
(C) 24 (D) 32

[Step-by-step solution ► prepwisser.in/questions/HZLt8Mo2a4](https://www.prepwisser.in/questions/HZLt8Mo2a4)

Q100 JEE Main 2023 · 24 Jan · Shift 1

Given below are two statements :

Statement I : The temperature of a gas is -73°C . When the gas is heated to 527°C , the root mean square speed of the molecules is doubled.

Statement II : The product of pressure and volume of an ideal gas will be equal to translational kinetic energy of the molecules.

In the light of the above statements, choose the correct answer from the option given below :

- (A) Statement I is true but Statement II is false
- (B) Both Statement I and Statement II are true
- (C) Statement I is false but Statement II is true
- (D) Both Statement I and Statement II are false

[Step-by-step solution ► prepwiser.in/questions/pSGqFUGCey](https://www.prepwiser.in/questions/pSGqFUGCey)

Q101 JEE Main 2022 · 28 Jul · Shift 1

Given below are two statements :

Statement I : The average momentum of a molecule in a sample of an ideal gas depends on temperature.

Statement II : The rms speed of oxygen molecules in a gas is v . If the temperature is doubled and the oxygen molecules dissociate into oxygen atoms, the rms speed will become $2v$.

In the light of the above statements, choose the correct answer from the options given below :

- (A) Both Statement I and Statement II are true
- (B) Both Statement I and Statement II are false
- (C) Statement I is true but Statement II is false
- (D) Statement I is false but Statement II is true

[Step-by-step solution ► prepwiser.in/questions/1fl7xyTq2_](https://www.prepwiser.in/questions/1fl7xyTq2_)

Q102 JEE Main 2022 · 25 Jul · Shift 2

Sound travels in a mixture of two moles of helium and n moles of hydrogen. If rms speed of gas molecules in the mixture is $\sqrt{2}$ times the speed of sound, then the value of n will be :

- (A) 1
- (B) 2
- (C) 3
- (D) 4

[Step-by-step solution ► prepwiser.in/questions/R_x0nhYAnj](https://www.prepwiser.in/questions/R_x0nhYAnj)

Q103 JEE Main 2022 · 25 Jun · Shift 1

The relation between root mean square speed (v_{rms}) and most probable speed (v_p) for the molar mass M of oxygen gas molecule at the temperature of 300 K will be :

- (A) $v_{\text{rms}} = \sqrt{\frac{2}{3}}v_p$
- (B) $v_{\text{rms}} = \sqrt{\frac{3}{2}}v_p$
- (C) $v_{\text{rms}} = v_p$
- (D) $v_{\text{rms}} = \sqrt{\frac{1}{3}}v_p$

[Step-by-step solution ► prepwiser.in/questions/wSpmlZ2b6A](https://www.prepwiser.in/questions/wSpmlZ2b6A)

Q104 JEE Main 2021 · 27 Aug · Shift 2

if the rms speed of oxygen molecules at 0°C is 160 m/s , find the rms speed of hydrogen molecules at 0°C .

- (A) 640 m/s (B) 40 m/s
(C) 80 m/s (D) 332 m/s

[Step-by-step solution ► prepwiser.in/questions/gMATtADxXY](https://www.prepwiser.in/questions/gMATtADxXY)

Q105 JEE Main 2021 · 26 Aug · Shift 1

The rms speeds of the molecules of Hydrogen, Oxygen and Carbon dioxide at the same temperature are V_H , V_O and V_C respectively then :

- (A) $V_H > V_O > V_C$
(B) $V_C > V_O > V_H$
(C) $V_H = V_O > V_C$
(D) $V_H = V_O = V_C$

[Step-by-step solution ► prepwiser.in/questions/ZmB5c0f1NC](https://www.prepwiser.in/questions/ZmB5c0f1NC)

Q106 JEE Main 2021 · 18 Mar · Shift 2

Consider a sample of oxygen behaving like an ideal gas. At 300 K , the ratio of root mean square (rms) velocity to the average velocity of gas molecule would be :

(Molecular weight of oxygen is 32g/mol ; $R = 8.3\text{ J K}^{-1}\text{ mol}^{-1}$)

- (A) $\sqrt{\frac{3\pi}{8}}$ (B) $\sqrt{\frac{3}{3}}$
(C) $\sqrt{\frac{8}{3}}$ (D) $\sqrt{\frac{8\pi}{3}}$

[Step-by-step solution ► prepwiser.in/questions/rzx5BytW7C](https://www.prepwiser.in/questions/rzx5BytW7C)

Q107 JEE Main 2020 · 5 Sep · Shift 2

Nitrogen gas is at 300°C temperature. The temperature (in K) at which the rms speed of a H_2 molecule would be equal to the rms speed of a nitrogen molecule, is _____.

(Molar mass of N_2 gas 28 g).

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/rdmDP4IOFY](https://www.prepwiser.in/questions/rdmDP4IOFY)

Answer key — Kinetic Theory of Gases

Numbers match the question numbers above. For full working, open the solution link under each question.

1	D	2	327	3	D	4	A	5	D	6	D	7	C	8	C
9	B	10	250	11	C	12	C	13	C	14	D	15	25	16	D
17	266	18	150	19	C	20	A	21	C	22	D	23	A	24	D
25	D	26	B	27	D	28	C	29	C	30	B	31	C	32	400
33	B	34	C	35	B	36	C	37	D	38	B	39	A	40	B
41	C	42	B	43	B	44	25	45	D	46	D	47	C	48	B
49	A	50	D	51	3	52	12	53	D	54	A	55	D	56	B
57	D	58	D	59	A	60	B	61	B	62	A	63	B	64	D
65	D	66	C	67	C	68	D	69	A	70	D	71	B	72	3
73	B	74	A	75	7479	76	D	77	12	78	500	79	B	80	D
81	A	82	A	83	A	84	B	85	C	86	C	87	3600	88	C
89	A	90	5	91	C	92	A	93	C	94	B	95	D	96	D
97	C	98	B	99	B	100	A	101	D	102	B	103	B	104	A
105	A	106	A	107	40										

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