EdLoop JEE

PHYSICS · JEE MAIN

Kinetic Theory of Gases

Previous Year Questions with answers

175 questions · **156** papers · **2002–2026** · newest paper first

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What is in this PDF: every Kinetic Theory of Gases question we hold from past JEE Main and AIEEE papers, with its options and answer. Where an answer comes from a source other than the official final key, it says so next to the answer.

Step-by-step solutions for every question are free in the EdLoop JEE app (Google Play) and on app.edloop.in. More chapters: pyq.edloop.in/free-pdfs/

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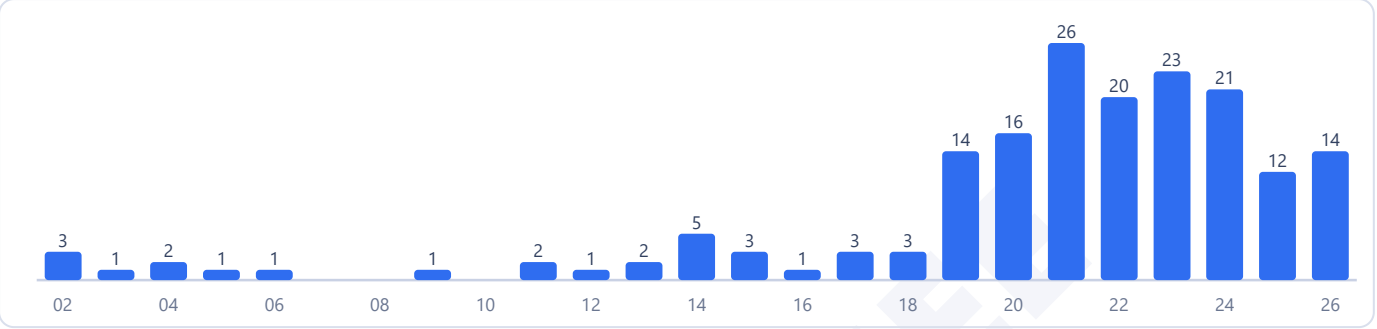
Chapter at a glance

3.2%	175	131 of 162	158 / 17
of Physics questions, 2019–2026	questions, 2002–2026	papers asked it, 2019–2026	MCQ / numerical, 2002–2026

Trend. Steady: 0.8 questions per paper in 2024–2026 against 1 in 2019–2023.

Questions per year



Counts are the questions we hold: 175 in 156 papers. 2 questions in this chapter came back in more than one paper.

Most-asked topics in this chapter (2002–2026)



How often it comes up

Kinetic Theory of Gases provides the statistical microscopic bridge between classical Newtonian mechanics and macroscopic thermal physics. In the papers we hold from 2019 to 2026, the chapter generated **146 questions in 162 papers**, which corresponds to **0.9 questions per paper**, and appeared in 131 of those 162 papers. Over that span, it holds the **16th rank among 29 Physics chapters** by question count, making up 3.2% of the Physics section.

The chapter has grown in weighting compared to the older AIEEE era. From 2002 to 2018, it represented 2.2% of Physics; across the last three exam years (2024 to 2026), its share rose to 3.0%, producing 47 questions in 58 papers. The busiest year in our collection was 2021, when our records show 26 questions across 26 papers, followed by 2024 with 21 questions across 20 papers. Across every year from 2019 to 2026, questions on kinetic theory appeared consistently, featuring in 131 of the 162 papers in our set.

The topics form Unit 9: Kinetic Theory of Gases in NTA's Class 11 curriculum, concluding the mechanics and properties of matter sequence before the study of oscillations and waves.

Most-asked topics

Between 2019 and 2026, the chapter's questions divided into three closely matched topics:

- **Gas Laws & Kinetic Model**: 52 questions. Ideal gas state equation (PV = nRT), Dalton's law of partial pressures, pressure exerted by gas collisions against container walls, and bubbles expanding with depth.
- **Degrees of Freedom & Specific Heats**: 49 questions. Equipartition of energy, vibrational contributions, molar heat capacities (Cv and Cp), and mixtures of non-reacting gases.
- **Molecular Speeds**: 45 questions. Root mean square speed, average speed, most probable speed, Maxwellian distributions, mean free path, and collision frequency.

All three topic areas appeared in 2026 shifts, demonstrating that examiners treat the entire chapter as active testing territory.

What the questions look like

Molecular speed problems frequently test functional dependencies on temperature and molar mass. A standard problem asks for the temperature at which hydrogen molecules possess the same root mean square speed as oxygen molecules at a given temperature like 47 °C. Because root mean square speed is proportional to the square root of absolute temperature divided by molar mass, students set up a simple ratio equating T / M for both gases, taking care to convert temperatures from Celsius to Kelvin.

Degrees of freedom questions evaluate energy equipartition. Each translational and rotational degree of freedom contributes (1/2)kT of thermal energy per molecule, or (1/2)RT per mole. Questions frequently present mixtures of non-reacting gases, such as two moles of helium combined with three moles of oxygen, asking for the equivalent molar specific heat or the adiabatic exponent of the mixture.

Gas law problems test simultaneous shifts in pressure, volume, and temperature. For example, a sample of gas at 2 atm and 27 °C inside 60 cm^3 is compressed to 20 cm^3 while heated to 77 °C, and students calculate the final pressure using combined gas laws. Other problems compute the mean free path of gas molecules from given values of molecular diameter, pressure, and ambient temperature.

Direct calculation without options is required on occasion: 17 of the 146 questions between 2019 and 2026 were numerical answer questions.

How to practise it

Master the three characteristic molecular speeds: root mean square speed, average speed, and most probable speed. Notice that all three scale identically with the square root of temperature over molar mass. Remember that kinetic energy per mole depends strictly on temperature, completely independent of molecular mass or gas density.

For gas mixtures, learn the weighted average rules for molar heat capacity rather than memorizing complicated formulas. The effective Cv of a mixture is the total internal energy derivative, which equals (n1 Cv1 + n2 Cv2) / (n1 + n2). Once you have Cv for the mixture, simply add R to get Cp, and take their ratio to find γ.

For mean free path problems, write the formula $1 / (\sqrt{2}\, n\, \pi\, d^2)$, where n is number density (N/V = P / (kT)) and d is molecular diameter. Keep track of SI prefixes, converting angstroms to meters and pressure from atmospheres or kilopascals into pascals.

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Q1 JEE Main 2026 · 6 Apr · Shift 1 MCQ

Two closed vessels of same volume are joined through a narrow tube and both vessels are filled with air of pressure 90 kPa and temperature 400 K. Keeping the temperature of one vessel constant at 400 K the second vessel temperature is raised to 500 K. The final pressure in the vessels is _____ kPa.

(A) 100
(B) 120
(C) 90
(D) 105

Answer: (A) 100 · Official NTA final key

Q2 JEE Main 2026 · 6 Apr · Shift 2 MCQ

If 2 mole of an ideal monoatomic gas at temperature T, is mixed with 6 mole of another ideal monoatomic gas at temperature $2T$ then the temperature of mixture is :

(A) $\frac{5}{2}T$
(B) $\frac{5}{4}T$
(C) $\frac{7}{2}T$
(D) $\frac{7}{4}T$

Answer: (D) $\frac{7}{4}T$ · Official NTA final key

Q3 JEE Main 2026 · 5 Apr · Shift 1 MCQ

Given below are two statements: one is labelled as **Assertion A** and the other is labelled as **Reason R**

Statement I: Change in internal energy of a system containing n mole of ideal gas can be written as $\Delta U = n\,C_v\,(T_f - T_i) = \frac{nR}{\gamma - 1}\,(T_f - T_i)$, where $\gamma = \frac{C_p}{C_v}$, T_i = initial temperature, T_f = final temperature.

Statement II: Relation between degree of freedom f and $\gamma\,(= C_p/C_v)$ is $\left(\gamma = 1 + \frac{2}{f}\right)$

Choose the *__correct__* answer from the options given below

(A) Both **A** and **R** are true and **R** is the correct explanation of **A**
(B) Both **A** and **R** are true but **R** is **NOT** the correct explanation of **A**
(C) **A** is true but **R** is false
(D) **A** is false but **R** is true

Answer: (B) Both A and R are true but R is NOT the correct explanation of A · Official NTA final key

Q4 JEE Main 2026 · 5 Apr · Shift 2 MCQ

An ideal gas at pressure P and temperature T is expanding such that PT^3 = constant. The coefficient of volume expansion of the gas is _____.

(A) $\frac{2}{T}$
(B) $\frac{1}{T}$
(C) $\frac{4}{T}$
(D) $\frac{3}{T}$

Answer: (C) $\frac{4}{T}$ · Official NTA final key

Q5 JEE Main 2026 · 4 Apr · Shift 1 MCQ

One gas of n_1 mole of molecules at temperature T_1, volume V_1, and pressure P_1, and another gas of n_2 mole of molecules at temperature T_2, volume V_2, and pressure P_2, are mixed resulting in pressure P and volume V of the mixture. The temperature of the mixture is _____.

(A) $(T_1 + T_2)/2$
(B) $\mathrm{T_1\,T_2\,PV/(T_2\,P_1V_1 + T_1\,P_2V_2)}$
(C) $\mathrm{(T_2\,P_1V_1 + T_1\,P_2V_2)/(T_1\,T_2\,PV)}$
(D) $|T_1 - T_2|/2$

Answer: (B) $\mathrm{T_1\,T_2\,PV/(T_2\,P_1V_1 + T_1\,P_2V_2)}$ · Official NTA final key

Q6 JEE Main 2026 · 4 Apr · Shift 1 MCQ

An ideal gas undergoes a process maintaining relation between pressure (P) and volume(V) as $P = P_o\left(1 + \left(\frac{V_o}{V}\right)^2\right)^{-1}$, where P_o and V_o are constants. If two samples A and B (two moles each) with initial volumes V_o and $3V_o$ respectively undergo above mentioned process and attain same pressure, then the difference at the temperatures of these samples, $T_B - T_A$ is _____.
(R = gas constant)

(A) $\frac{9P_oV_o}{8R}$
(B) $\frac{11P_oV_o}{10R}$
(C) $\frac{7P_oV_o}{6R}$
(D) $\frac{13P_oV_o}{11R}$

Dropped by NTA. Full marks to everyone. · Official NTA final key

Q7 JEE Main 2026 · 4 Apr · Shift 2 MCQ

Given below are two statements: one is labelled as **Assertion A** and the other is labelled as **Reason R**

Assertion A: If the average kinetic energy of $\mathrm{H_2}$ and $\mathrm{O_2}$ molecules, kept in two different sized containers are same, then their temperatures will be same.

Reason R: The r.m.s. speed of $\mathrm{H_2}$ and $\mathrm{O_2}$ molecules are same at same temperature.

Choose the ***correct*** answer from the options given below

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

(B) Both **A** and **R** are true but **R** is **NOT** the correct explanation of **A**

(C) **A** is true but **R** is false

(D) **A** is false but **R** is true

Answer: (C) A is true but R is false · Official NTA final key

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Q8 JEE Main 2026 · 2 Apr · Shift 2 MCQ

A mixture of carbon dioxide and oxygen has volume 8310 cm^3, temperature 300 K, pressure 100 kPa and mass 13.2 g. The number of moles of carbon dioxide and oxygen gases in the mixture respectively are _____.
(Assume both carbon dioxide and oxygen gases behave like ideal gases) [R = 8.31 J/mol.K]

(A) 0.15 and 0.18

(B) 0.25 and 0.08

(C) 0.21 and 0.12

(D) 0.13 and 0.20

Answer: (C) 0.21 and 0.12 · Official NTA final key

Q9 JEE Main 2026 · 28 Jan · Shift 2 MCQ

The mean free path of a molecule of diameter 5×10^{-10} m at the temperature 41 °C and pressure 1.38×10^5 Pa, is given as _____ m. (Given $k_B = 1.38 \times 10^{-23}$ J/K).

(A) $2\sqrt{2} \times 10^{-8}$

(B) $10\sqrt{2} \times 10^{-8}$

(C) 2×10^{-8}

(D) $2\sqrt{2} \times 10^{-10}$

Answer: (A) $2\sqrt{2} \times 10^{-8}$ · Official NTA final key

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Q10 JEE Main 2026 · 24 Jan · Shift 1 Numerical

A gas of certain mass filled in a closed cylinder at a pressure of 3.23 kPa has temperature 50 °C. The gas is now heated to double its temperature. The modified pressure is _____ Pa.

Numerical value type: the answer is a number.

Answer: 3730. · Official NTA final key

Q11 JEE Main 2026 · 23 Jan · Shift 2 MCQ

An air bubble of volume 2.9 cm^3 rises from the bottom of a swimming pool of 5 m deep. At the bottom of the pool water temperature is 17 °C. The volume of the bubble when it reaches the surface, where the water temperature is 27 °C, is _____ cm^3.

($g = 10$ m/s^2, density of water $= 10^3$ kg/m^3, and 1 atm pressure is 10^5 Pa)

(A) 2.0
(B) 3.0
(C) 4.5
(D) 4.2

Answer: (C) 4.5 · Official NTA final key

Q12 JEE Main 2026 · 22 Jan · Shift 2 MCQ

Consider two boxes containing ideal gases A and B such that their temperatures, pressures and number densities are same. The molecular size of A is half of that of B and mass of molecule A is four times that of B. If the collision frequency in gas B is 32×10^{18}/s then collision frequency in gas A is _____ /s.

(A) 2×10^8
(B) 32×10^8
(C) 4×10^8
(D) 8×10^8

Dropped by NTA. Full marks to everyone. · Official NTA final key

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Q13 JEE Main 2026 · 22 Jan · Shift 2 Numerical

An insulated cylinder of volume 60 cm^3 is filled with a gas at 27 °C and 2 atmospheric pressure. Then the gas is compressed making the final volume as 20 cm^3 while allowing the temperature to rise to 77 °C. The final pressure is _____ atmospheric pressure.

Numerical value type: the answer is a number.

Answer: 7. · Official NTA final key

Q14 JEE Main 2026 · 21 Jan · Shift 2 MCQ

The r.m.s. speed of oxygen molecules at 47 °C is equal to that of the hydrogen molecules kept at _____ °C. (Mass of oxygen molecule/mass of hydrogen molecule = 32/2)

(A) -20
(B) -253
(C) -235
(D) -100

Answer: (B) -253 · Official NTA final key

Q15 JEE Main 2025 · 7 Apr · Shift 1 MCQ

Match the LIST-I with LIST-I

List-I	List-II

A. Triatomic rigid gas	I. $\frac{C_P}{C_V} = \frac{5}{3}$
B. Diatomic non-rigid gas	II. $\frac{C_P}{C_V} = \frac{7}{5}$
C. Monoatomic gas	III. $\frac{C_P}{C_V} = \frac{4}{3}$
D. Diatomic rigid gas	IV. $\frac{C_P}{C_V} = \frac{9}{7}$

Choose the correct answer from the options given below:

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

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

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

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

Answer: (D) A-III, B-IV, C-I, D-II · Key from source paper

Q16 JEE Main 2025 · 7 Apr · Shift 2 MCQ

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

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

(A) 1: 10

(B) 1: 1

(C) 10: 1

(D) 1: $\sqrt{10}$

Answer: (B) 1: 1 · Key from source paper

Q17 JEE Main 2025 · 4 Apr · Shift 1 MCQ

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

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

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

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

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

Answer: (B) $2 \times 10^{9}/s$ · Key from source paper

Q18 JEE Main 2025 · 4 Apr · Shift 2 MCQ

There are two vessels filled with an ideal gas where volume of one is double the volume of other. The large vessel contains the gas at 8 kPa at 1000 K while the smaller vessel contains the gas at 7 kPa at 500 K. If the vessels are connected to each other by a thin tube allowing the gas to flow and the temperature of both the vessels is maintained at 600 K, at steady state the pressure in the vessels will be (in kPa).

(A) 18
(B) 6
(C) 24
(D) 4.4

Answer: (B) 6 · Key from source paper

Q19 JEE Main 2025 · 3 Apr · Shift 2 MCQ

Pressure of an ideal gas, contained in a closed vessel, is increased by 0.4% when heated by $1^{\circ}C$. Its initial temperature must be:

(A) 2500 K
(B) $25^{\circ}C$
(C) 250 K
(D) $250^{\circ}C$

Answer: (C) 250 K · Key from source paper

Q20 JEE Main 2025 · 2 Apr · Shift 1 Numerical

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 value type: the answer is a number.

Answer: 3. · Key from source paper

Q21 JEE Main 2025 · 2 Apr · Shift 2 Numerical

The internal energy of air in $4m \times 4m \times 3m$ sized room at 1 atmospheric pressure will be _____ $\times 10^6 J$. (Consider air as diatomic molecule)

Numerical value type: the answer is a number.

Answer: 12. · Key from source paper

Q22 JEE Main 2025 · 29 Jan · Shift 1 Numerical

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 _____ $^{\circ}$C.

Numerical value type: the answer is a number.

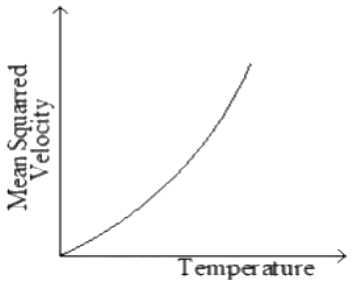
Answer: 327. · Key from source paper

Q23 JEE Main 2025 · 28 Jan · Shift 1 MCQ

For a particular ideal gas which of the following graphs represents the variation of mean squared velocity of the gas molecules with temperature?

Q44. For a particular ideal gas which of the following graphs represents the variation of mean squared velocity of the gas molecules with temperature?

(1)



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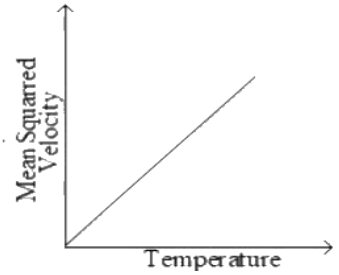

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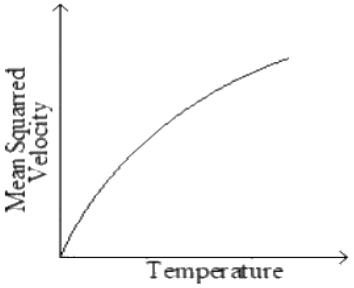
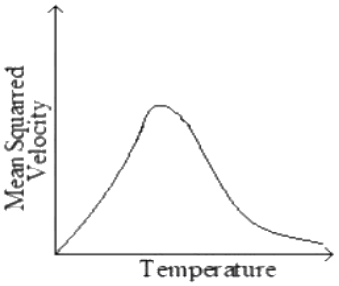


(4)



(A) *see figure*
(B) *see figure*
(C) *see figure*
(D) *see figure*

Answer: (B) · Key from source paper

Q24 JEE Main 2025 · 28 Jan · Shift 2 MCQ

The kinetic energy of translation of the molecules in 50 g of CO_2 gas at $17^\circ C$ is

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

Answer: (B) 4102.8 J · Key from source paper

Q25 JEE Main 2025 · 28 Jan · Shift 2 MCQ

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

Answer: (C) $\frac{5}{2}$ · Key from source paper

Q26 JEE Main 2025 · 22 Jan · Shift 2 MCQ

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 ? (Cp and Cv are specific heats of the gas at constant pressure and volume)

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

Answer: (C) $\gamma_2 < \gamma_1$ · Key from source paper

Q27 JEE Main 2024 · 9 Apr · Shift 2 MCQ

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 2 K is :

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

Answer: (B) 117°C · Key from source paper

Q28 JEE Main 2024 · 8 Apr · Shift 1 MCQ

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

Answer: (B) $\frac{3}{5}$ · Key from source paper

Q29 JEE Main 2024 · 8 Apr · Shift 2 MCQ

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

Answer: (C) Both Statement I and Statement II are true · Key from source paper

Q30 JEE Main 2024 · 6 Apr · Shift 1 MCQ

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

Answer: (B) $\frac{2\sqrt{2}}{1}$ · Key from source paper

Q31 JEE Main 2024 · 6 Apr · Shift 2 MCQ

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

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

Answer: (B) 35 K_BT · Key from source paper

Q32 JEE Main 2024 · 5 Apr · Shift 1 MCQ

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

Answer: (B) $\frac{2}{\sqrt{3}}$Z · Key from source paper

Q33 JEE Main 2024 · 5 Apr · Shift 2 MCQ

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

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

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

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

Answer: (C) $\frac{1}{\sqrt{2}n\pi d^2}$ · Key from source paper

Q34 JEE Main 2024 · 4 Apr · Shift 1 MCQ

P-T diagram of an ideal gas having three different densities ρ_1, ρ_2, ρ_3 (in three different cases) is shown in the figure. Which of the following is correct :

(see the figure above)

Q11. P-T diagram of an ideal gas having three different densities ρ_1, ρ_2, ρ_3 (in three different cases) is shown in the

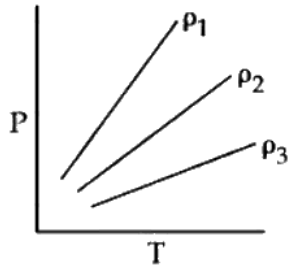


figure. Which of the following is correct :

(1) $\rho_1 > \rho_2$

(2) $\rho_2 < \rho_3$

(3) $\rho_1 = \rho_2 = \rho_3$

(4) $\rho_1 < \rho_2$

(A) $\rho_1 > \rho_2$

(B) $\rho_2 < \rho_3$

(C) $\rho_1 = \rho_2 = \rho_3$

(D) $\rho_1 < \rho_2$

Answer: (A) $\rho_1 > \rho_2$ · Key from source paper

Q35 JEE Main 2024 · 4 Apr · Shift 2 MCQ

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 $f_r = 2$

(D) $f_t = 2$ and $f_r = 3$

Answer: (B) $f_t = 3$ and $f_r = 3$ · Key from source paper

Q36 JEE Main 2024 · 1 Feb · Shift 1 MCQ

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

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

Answer: (A) $\frac{9}{4}R$ · Key from source paper

Q37 JEE Main 2024 · 1 Feb · Shift 2 MCQ

If the root mean square velocity of hydrogen molecule at a given temperature and pressure is 2 $\mathrm{km\ s^{-1}}$, the root mean square velocity of oxygen at the same condition in $\mathrm{km\ s^{-1}}$ is:

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

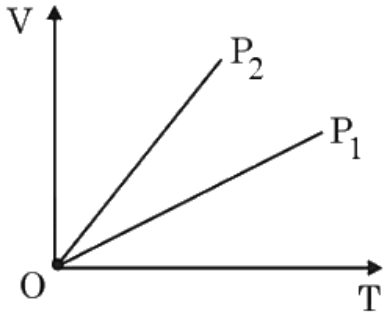
Answer: (B) 0.5 · Key from source paper

Q38 JEE Main 2024 · 31 Jan · Shift 1 MCQ

The given figure represents two isobaric processes for the same mass of an ideal gas, then

(see the figure above)

Q10. The given figure represents two isobaric processes for the same mass of an ideal gas, then



(1) $P_2 \geq P_1$
(2) $P_2 > P_1$
(3) $P_1 = P_2$
(4) $P_1 > P_2$

(A) $P_2 \geq P_1$
(B) $P_2 > P_1$
(C) $P_1 = P_2$
(D) $P_1 > P_2$

Answer: (D) $P_1 > P_2$ · Key from source paper

Q39 JEE Main 2024 · 31 Jan · Shift 1 MCQ

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

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

Answer: (A) kinetic energy · Key from source paper

Q40 JEE Main 2024 · 31 Jan · Shift 2 MCQ

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) $20\ RT$
(C) $27\ RT$
(D) $21\ RT$

Answer: (C) $27\ RT$ · Key from source paper

Q41 JEE Main 2024 · 30 Jan · Shift 1 MCQ

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

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

Answer: (D) 20 K · Key from source paper

Q42 JEE Main 2024 · 30 Jan · Shift 2 MCQ

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

Answer: (C) 1.52 · Key from source paper

Q43 JEE Main 2024 · 29 Jan · Shift 1 MCQ

Two vessels A and B are of the same size and are at same temperature. A contains 1 g of hydrogen and B contains 1 g 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) 16
(B) 8
(C) 4
(D) 32

Answer: (A) 16 · Key from source paper

Q44 JEE Main 2024 · 29 Jan · Shift 2 MCQ

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

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

Answer: (A) 500 K · Key from source paper

Q45 JEE Main 2024 · 29 Jan · Shift 2 MCQ

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) 3
(C) 4
(D) 2

Answer: (C) 4 · Key from source paper

Q46 JEE Main 2024 · 27 Jan · Shift 1 MCQ

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

(Use $K_B = 1.38 \times 10^{-23}$ J mol^{-1} K^{-1})

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

Answer: (B) 3200 K · Key from source paper

Q47 JEE Main 2024 · 27 Jan · Shift 2 MCQ

The total kinetic energy of 1 mole of oxygen at $27^{\circ}C$ is :

[Use universal gas constant $(R) = 8.31$ J mol^{-1} K^{-1}]

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

Answer: (C) 6232.5 J · Key from source paper

Q48 JEE Main 2023 · 15 Apr · Shift 1 MCQ

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 $\left(\frac{K_{argon}}{K_{hydrogen}}\right)$ is: (Given : Atomic Weight of Ar = 39.9)

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

Answer: (B) 1 · Key from source paper

Q49 JEE Main 2023 · 13 Apr · Shift 1 MCQ

The rms speed of oxygen molecule in a vessel at particular temperature is $\left(1+\frac{5}{x}\right)^{\frac{1}{2}} v$, when v is the average speed of the molecule. The value of x will be:
(take $\pi = \frac{22}{7}$)

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

Answer: (C) 28 · Key from source paper

Q50 JEE Main 2023 · 13 Apr · Shift 2 MCQ

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 373 K is approximately:

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

Answer: (C) $2049d$ · Key from source paper

Q51 JEE Main 2023 · 12 Apr · Shift 1 MCQ

If the r.m.s speed of chlorine molecule is $490\ \text{m s}^{-1}$ at 27°C, the r.m.s speed of argon molecules at the same temperature will be (Atomic mass of argon $= 39.9$ u, molecular mass of chlorine $= 70.9$ u)

(A) $551.7\ \text{m s}^{-1}$
(B) $651.7\ \text{m s}^{-1}$
(C) $451.7\ \text{m s}^{-1}$
(D) $751.7\ \text{m s}^{-1}$

Answer: (B) $651.7\ \text{m s}^{-1}$ · Key from source paper

Q52 JEE Main 2023 · 11 Apr · Shift 1 MCQ

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) $v_{rms}\,(\text{mono}) < v_{rms}\,(\text{dia}) < v_{rms}\,(\text{poly})$
(D) $v_{rms}\,(\text{dia}) < v_{rms}\,(\text{poly}) < v_{rms}\,(\text{mono})$

Answer: (A) $v_{rms}\,(\text{mono}) > v_{rms}\,(\text{dia}) > v_{rms}\,(\text{poly})$ · Key from source paper

Q53 JEE Main 2023 · 11 Apr · Shift 2 MCQ

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

(A) $27.4\ \text{m s}^{-1}$
(B) $91\ \text{m s}^{-1}$
(C) $1260\ \text{m s}^{-1}$
(D) $523\ \text{m s}^{-1}$

Answer: (D) $523\ \text{m s}^{-1}$ · Key from source paper

Q54 JEE Main 2023 · 10 Apr · Shift 1 MCQ

Match List I with List II:
List I List II
(A) 3 Translational degrees of freedom (I) Monoatomic gases
(B) 3 Translational, 2 rotational degrees of freedoms (II) Polyatomic gases
(C) 3 Translational, 2 rotational and 1 vibrational degrees of freedom (III) Rigid diatomic gases
(D) 3 Translational, 3 rotational and more than one vibrational degrees of freedom (IV) Nonrigid

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diatomic gases

Choose the correct answer from the options given below:

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

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

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

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

Answer: (A) A - I, B - III, C - IV, D - II · Key from source paper

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Q55 JEE Main 2023 · 10 Apr · Shift 2 MCQ

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) $11RT$

(B) $8RT$

(C) $4RT$

(D) $16RT$

Answer: (A) $11RT$ · Key from source paper

Q56 JEE Main 2023 · 8 Apr · Shift 1 MCQ

An air bubble of volume $1\ \text{cm}^3$ rises from the bottom of a lake 40 m deep to the surface at a temperature of 12°C. The atmospheric pressure is 1×10^5 Pa, the density of water is $1000\ \text{kg m}^{-3}$ and $\text{g} = 10\ \text{m s}^{-2}$. There is no difference of the temperature of water at the depth of 40 m and on the surface. The volume of air bubble when it reaches the surface will be

(A) $2\ \text{cm}^3$

(B) $3\ \text{cm}^3$

(C) $4\ \text{cm}^3$

(D) $5\ \text{cm}^3$

Answer: (D) $5\ \text{cm}^3$ · Key from source paper

Q57 JEE Main 2023 · 8 Apr · Shift 2 MCQ

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

(A) 927°C

(B) 327°C

(C) 1227°C

(D) 627°C

Answer: (B) 327°C · Key from source paper

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Q58 JEE Main 2023 · 6 Apr · Shift 1 MCQ

The number of air molecules per cm^3 is 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) 0.75
(B) 1.25
(C) 0.50
(D) 0.25

Answer: (D) 0.25 · Key from source paper

Q59 JEE Main 2023 · 6 Apr · Shift 2 MCQ

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

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

Answer: (D) $2v_0$ · Key from source paper

Q60 JEE Main 2023 · 1 Feb · Shift 1 MCQ

The average kinetic energy of a molecule of the gas is

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

Answer: (A) proportional to absolute temperature · Key from source paper

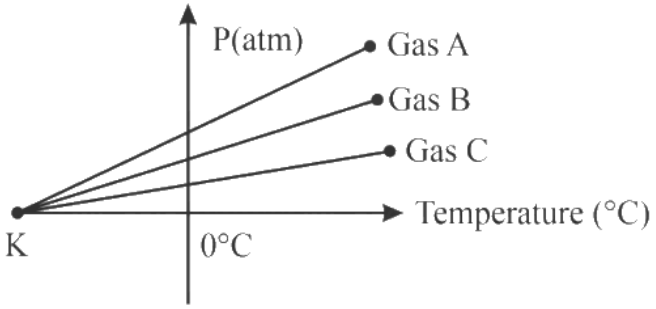
Q61 JEE Main 2023 · 1 Feb · Shift 2 MCQ

For three low density gases A, B, C pressure versus temperature graphs are plotted while keeping them at constant volume, as shown in the figure

(see the figure above)

The temperature corresponding to the point 'K' is:

Q12. For three low density gases A, B, C pressure versus temperature graphs are plotted while keeping them at constant volume, as shown in the figure



The temperature corresponding to the point 'K' is:

(1) $-273^{\circ}\mathrm{C}$ (2) $-100^{\circ}\mathrm{C}$

(3) $-373^{\circ}\mathrm{C}$ (4) $-40^{\circ}\mathrm{C}$

(A) $-273°\mathrm{C}$

(B) $-100°\mathrm{C}$

(C) $-373°\mathrm{C}$

(D) $-40°\mathrm{C}$

Answer: (A) $-273°\mathrm{C}$ · Key from source paper

Q62 JEE Main 2023 · 31 Jan · Shift 1 MCQ

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

(A) $\gamma \propto \frac{1}{\sqrt{T}}$

(B) $\gamma \propto T^0$

(C) $\gamma \propto \frac{1}{T}$

(D) $\gamma \propto T$

Answer: (B) $\gamma \propto T^0$ · Key from source paper

Q63 JEE Main 2023 · 30 Jan · Shift 1 MCQ

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

(A) $3T^2$

(B) $\frac{3}{T^2}$

(C) $\frac{3}{T^3}$

(D) $\frac{3}{T}$

Answer: (D) $\frac{3}{T}$ · Key from source paper

Q64 JEE Main 2023 · 30 Jan · Shift 2 MCQ

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

Answer: (B) 1 : 1 · Key from source paper

Q65 JEE Main 2023 · 29 Jan · Shift 1 MCQ

A bicycle tyre is filled with air having pressure of $270\ \mathrm{kPa}$ at $27^{\circ}\mathrm{C}$. The approximate pressure of the air in the tyre when the temperature increases to $36^{\circ}\mathrm{C}$ is

(A) $270\ \mathrm{kPa}$
(B) $262\ \mathrm{kPa}$
(C) $278\ \mathrm{kPa}$
(D) $360\ \mathrm{kPa}$

Answer: (C) $278\ \mathrm{kPa}$ · Key from source paper

Q66 JEE Main 2023 · 29 Jan · Shift 2 MCQ

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

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

Answer: (B) 28 · Key from source paper

Q67 JEE Main 2023 · 25 Jan · Shift 1 MCQ

The root mean square velocity of molecules of gas is

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

Answer: (C) Proportional to square root of temperature $\sqrt{T}$. · Key from source paper

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Q68 JEE Main 2023 · 25 Jan · Shift 2 MCQ

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) $\frac{7}{2}R$

Answer: (D) $\frac{7}{2}R$ · Key from source paper

Q69 JEE Main 2023 · 24 Jan · Shift 1 MCQ

Given below are two statements:

Statement I: The temperature of a gas is $-73\ ^\circ$C. When the gas is heated to $527\ ^\circ$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 options given below:

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

Answer: (B) Statement I is true but Statement II is false · Key from source paper

Q70 JEE Main 2023 · 24 Jan · Shift 2 MCQ

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

Answer: (C) $\frac{25}{21}$ · Key from source paper

Q71 JEE Main 2022 · 29 Jul · Shift 1 Numerical

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 $\frac{\alpha^2}{4}R\ \mathrm{J\ mol\ K^{-1}}$; then the value of α will be _____. (Assume that the given diatomic gas has no vibrational mode.)

Numerical value type: the answer is a number.

Answer: 3. · Key from source paper

Q72 JEE Main 2022 · 29 Jul · Shift 2 MCQ

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

(A) $60\ \mathrm{mm\ s^{-1}}$
(B) $12\ \mathrm{mm\ s^{-1}}$
(C) $15\ \mathrm{mm\ s^{-1}}$
(D) $36\ \mathrm{mm\ s^{-1}}$

Answer: (C) $15\ \mathrm{mm\ s^{-1}}$ · Key from source paper

Q73 JEE Main 2022 · 28 Jul · Shift 1 MCQ

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

Answer: (D) Statement I is false but Statement II is true · Key from source paper

Q74 JEE Main 2022 · 27 Jul · Shift 1 MCQ

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.

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

Answer: (C) A and B only · Key from source paper

Q75 JEE Main 2022 · 27 Jul · Shift 2 MCQ

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 monoatomic gas molecule has 1 rotational degree of freedom where as diatomic molecule has 2 rotational degrees of freedom
D. CH_4 has a total to 6 degrees of freedom.
Choose the correct answer from the option given below:

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

Answer: (B) B and D only · Key from source paper

Q76 JEE Main 2022 · 26 Jul · Shift 2 MCQ

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

Answer: (A) $\frac{n}{n+2}$ · Key from source paper

Q77 JEE Main 2022 · 25 Jul · Shift 1 MCQ

Following statements are given
(1) The average kinetic energy of a gas molecule decreases when the temperature is reduced.
(2) The average kinetic energy of a gas molecule increases with increase in pressure at constant temperature.
(3) The average kinetic energy of a gas molecule decreases with increases in volume.
(4) Pressure of a gas increases with increase in temperature at constant volume.
(5) The volume of gas decreases with increase in temperature.
Choose the correct answer from the options given below :

(A) (1) and (4) only
(B) (1), (2) and (4) only
(C) (2) and (4) only
(D) (1), (2) and (5) only

Answer: (A) (1) and (4) only · Key from source paper

Q78 JEE Main 2022 · 25 Jul · Shift 2 MCQ

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

Answer: (B) 2 · Key from source paper

Q79 JEE Main 2022 · 29 Jun · Shift 2 MCQ

A vessel contains $16\ \mathrm{g}$ of hydrogen and $128\ \mathrm{g}$ 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

Answer: (C) 27×10^4 · Key from source paper

Q80 JEE Main 2022 · 28 Jun · Shift 1 Numerical

The total internal energy of two mole monoatomic ideal gas at temperature $T = 300\ \mathrm{K}$ will be _____ J. (Given $R = 8.31\ \mathrm{J\,mol^{-1}\,K^{-1}}$)

Numerical value type: the answer is a number.

Answer: 7479. · Key from source paper

Q81 JEE Main 2022 · 28 Jun · Shift 2 MCQ

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

Answer: (B) The velocity of atomic oxygen doubles · Key from source paper

Q82 JEE Main 2022 · 27 Jun · Shift 1 MCQ

A mixture of hydrogen and oxygen has volume $2000\ \mathrm{cm}^3$, temperature $300\ \mathrm{K}$, pressure $100\ \mathrm{kPa}$ and mass $0.76\ \mathrm{g}$. The ratio of number of moles of hydrogen to number of moles of oxygen in the mixture

will be

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

(A) $\frac{1}{3}$

(B) $\frac{3}{1}$

(C) $\frac{1}{16}$

(D) $\frac{16}{1}$

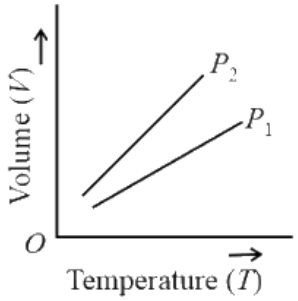
Answer: (B) $\frac{3}{1}$ · Key from source paper

Q83 JEE Main 2022 · 27 Jun · Shift 2 MCQ

For a perfect gas, two pressures P_1 and P_2 are shown in figure. The graph shows

(see the figure above)

Q9. For a perfect gas, two pressures P_1 and P_2 are shown in figure. The graph shows



(1) $P_1 > P_2$

(2) $P_1 < P_2$

(3) $P_1 = P_2$

(4) Insufficient data to draw any conclusion

(A) $P_1 > P_2$

(B) $P_1 < P_2$

(C) $P_1 = P_2$

(D) Insufficient data to draw any conclusion

Answer: (A) $P_1 > P_2$ · Key from source paper

Q84 JEE Main 2022 · 27 Jun · Shift 2 MCQ

According to kinetic theory of gases,

A. The motion of 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 $\frac{3}{2}k_BT$ (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

Answer: (B) B and C only · Key from source paper

Q85 JEE Main 2022 · 26 Jun · Shift 1 MCQ

A thermally insulated vessel contains an ideal gas of molecular mass M and ratio of specific heats 1.4. Vessel is moving with speed v and is suddenly brought to rest. Assuming no heat is lost to the surrounding and vessel temperature of the gas increases by :
(R = universal gas constant)

(A) $\frac{Mv^2}{7R}$
(B) $\frac{Mv^2}{5R}$
(C) $2\frac{Mv^2}{7R}$
(D) $7\frac{Mv^2}{5R}$

Answer: (B) $\frac{Mv^2}{5R}$ · Key from source paper

Q86 JEE Main 2022 · 26 Jun · Shift 2 MCQ

A flask contains argon and oxygen in the ratio of $3:2$ in mass and the mixture is kept at $27^{\circ}\mathrm{C}$. The ratio of their average kinetic energy per molecule respectively

(A) $3:5$
(B) $9:4$
(C) $2:3$
(D) $1:1$

Options (1) or (4) were accepted. More than one answer was accepted. · Key from source paper

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Q87 JEE Main 2022 · 25 Jun · Shift 1 MCQ

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 $300\ \mathrm{K}$ will be

(A) $v_{\mathrm{rms}} = \sqrt{\frac{2}{3}}v_{\mathrm{p}}$
(B) $v_{\mathrm{rms}} = \sqrt{\frac{1}{3}}v_{\mathrm{p}}$
(C) $v_{\mathrm{rms}} = \sqrt{\frac{3}{2}}v_{\mathrm{p}}$
(D) $v_{\mathrm{rms}} = v_{\mathrm{p}}$

Answer: (C) $v_{\mathrm{rms}} = \sqrt{\frac{3}{2}}v_{\mathrm{p}}$ · Key from source paper

Q88 JEE Main 2022 · 25 Jun · Shift 2 MCQ

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

(A) $1+\frac{f}{3}$
(B) $1+\frac{2}{f}$
(C) $1+\frac{f}{2}$
(D) $1+\frac{1}{f}$

Answer: (B) $1+\frac{2}{f}$ · Key from source paper

Q89 JEE Main 2022 · 25 Jun · Shift 2 Numerical

When a gas filled in a closed vessel is heated by raising the temperature by $1^{\circ}\mathrm{C}$, its pressure increases by 0.4% The initial temperature of the gas is _____ K.

Numerical value type: the answer is a number.

Answer: 250. · Key from source paper

Q90 JEE Main 2022 · 24 Jun · Shift 1 Numerical

$0.056\ \mathrm{kg}$ of Nitrogen is enclosed in a vessel at a temperature of $127^{\circ}\mathrm{C}$. The amount of heat required to double the speed of its molecules is _____ kcal.
(Take $R=2\ \mathrm{cal\ mole^{-1}\ K^{-1}}$)

Numerical value type: the answer is a number.

Answer: 12. · Key from source paper

Q91 JEE Main 2021 · 1 Sep · Shift 2 Numerical

The average translational kinetic energy of $\mathrm{N_2}$ gas molecules at _____ $^{\circ}\mathrm{C}$ becomes equal to the $K.E.$ of an electron accelerated from rest through a potential difference of 0.1 volt.
(Given $k_B=1.38\times10^{-23}$ J $\mathrm{K^{-1}}$ (Fill the nearest integer).

Numerical value type: the answer is a number.

Answer: 500. · Key from source paper

Q92 JEE Main 2021 · 31 Aug · Shift 1 MCQ

For an ideal gas the instantaneous change in pressure P with volume V is given by the equation $\frac{dP}{dV}=-aP$. If $P=P_0$ at $V=0$ is the given boundary condition, then the maximum temperature one mole of gas can attain is: (Here R is the gas constant)

(A) $\frac{aP_0}{eR}$
(B) infinity
(C) 0°C
(D) $\frac{P_0}{aeR}$

Answer: (D) $\frac{P_0}{aeR}$ · Key from source paper

Q93 JEE Main 2021 · 31 Aug · Shift 2 MCQ

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) $16 : 3$
(B) $3 : 8$
(C) $8 : 3$
(D) $3 : 16$

Answer: (A) $16 : 3$ · Key from source paper

Q94 JEE Main 2021 · 27 Aug · Shift 1 MCQ

An ideal gas is expanding such that PT^3 = constant. The coefficient of volume expansion of the gas is:

(A) $\frac{2}{T}$
(B) $\frac{3}{T}$
(C) $\frac{1}{T}$
(D) $\frac{4}{T}$

Answer: (D) $\frac{4}{T}$ · Key from source paper

Q95 JEE Main 2021 · 27 Aug · Shift 1 MCQ

A balloon carries a total load of 185 kg at normal pressure and temperature of 27°C. What load will the balloon carry on rising to a height at which the barometric pressure is 45 cm of Hg and the temperature is -7°C. Assuming the volume constant?

(A) 214.15 kg
(B) 123.54 kg
(C) 219.07 kg
(D) 181.46 kg

Answer: (B) 123.54 kg · Key from source paper

Q96 JEE Main 2021 · 27 Aug · Shift 2 MCQ

If the R.M.S. speed of oxygen molecules at 0°C is $160\ \mathrm{m\ s^{-1}}$. Find the R.M.S. speed of hydrogen molecules at 0°C.

(A) $40\ \mathrm{m\ s^{-1}}$
(B) $80\ \mathrm{m\ s^{-1}}$
(C) $640\ \mathrm{m\ s^{-1}}$
(D) $332\ \mathrm{m\ s^{-1}}$

Answer: (C) $640\ \mathrm{m\ s^{-1}}$ · Key from source paper

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Q97 JEE Main 2021 · 26 Aug · Shift 1 MCQ

The R.M.S. 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) $v_{\mathrm{C}} > v_{\mathrm{O}} > v_{\mathrm{H}}$
(B) $v_{\mathrm{H}} = v_{\mathrm{O}} > v_{\mathrm{C}}$
(C) $v_{\mathrm{H}} > v_{\mathrm{O}} > v_{\mathrm{C}}$
(D) $v_{\mathrm{H}} = v_{\mathrm{O}} = v_{\mathrm{C}}$

Answer: (C) $v_{\mathrm{H}} > v_{\mathrm{O}} > v_{\mathrm{C}}$ · Key from source paper

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Q98 JEE Main 2021 · 26 Aug · Shift 2 MCQ

A cylindrical container of volume $4.0 \times 10^{-3}\ \mathrm{m^3}$ contains one mole of hydrogen and two moles of carbon dioxide. Assume the temperature of the mixture is $400\ \mathrm{K}$. The pressure of the mixture of gases is :
[Take gas constant as $8.3\ \mathrm{J\ mol^{-1}\ K^{-1}}$]

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

Answer: (C) $24.9 \times 10^{5}\ \mathrm{Pa}$ · Key from source paper

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Q99 JEE Main 2021 · 27 Jul · Shift 1 MCQ

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

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

Answer: (C) 1.5×10^{11} · Key from source paper

Q100 JEE Main 2021 · 25 Jul · Shift 2 Numerical

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

Numerical value type: the answer is a number.

Answer: 25. · Key from source paper

Q101 JEE Main 2021 · 22 Jul · Shift 1 MCQ

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

(A) $\frac{2}{3}k_BT$
(B) k_BT
(C) $\frac{3}{2}k_BT$
(D) $\frac{1}{2}k_BT$

Answer: (C) $\frac{3}{2}k_BT$ · Key from source paper

Q102 JEE Main 2021 · 20 Jul · Shift 1 MCQ

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:

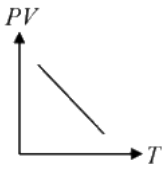
(A) $v_A = v_B = v_C = 0$
(B) $\frac{1}{v_A} > \frac{1}{v_B} > \frac{1}{v_C}$
(C) $v_A = v_B \neq v_C$
(D) $\frac{1}{v_A} < \frac{1}{v_B} < \frac{1}{v_C}$

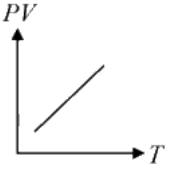
Answer: (D) $\frac{1}{v_A} < \frac{1}{v_B} < \frac{1}{v_C}$ · Key from source paper

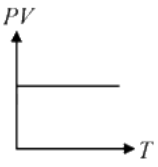
Q103 JEE Main 2021 · 20 Jul · Shift 2 MCQ

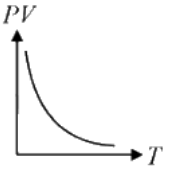
Which of the following graphs represent the behaviour of an ideal gas? Symbols have their usual meaning.

Q11. Which of the following graphs represent the behaviour of an ideal gas? Symbols have their usual meaning.

(1) 

(2) 

(3) 

(4) 

(A) *see figure*
(B) *see figure*
(C) *see figure*
(D) *see figure*

Answer: (B) · Key from source paper

Q104 JEE Main 2021 · 20 Jul · Shift 2 MCQ

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) $f = \frac{1}{\gamma+1}$

Answer: (A) $f = \frac{2}{\gamma-1}$ · Key from source paper

Q105 JEE Main 2021 · 18 Mar · Shift 1 MCQ

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) $\frac{1}{2}k_BT$
(B) $\frac{2}{3}k_BT$
(C) $\frac{3}{2}k_BT$
(D) k_BT

Answer: (A) $\frac{1}{2}k_BT$ · Key from source paper

Q106 JEE Main 2021 · 18 Mar · Shift 2 MCQ

Consider a sample of oxygen behaving like an ideal gas. At $300\ \text{K}$, the ratio of root-mean-square (RMS) velocity to the average velocity of the gas molecule would be :
(Molecular weight of oxygen is $32\ \text{g mol}^{-1}$; $R = 8.3\ \text{J K}^{-1}\ \text{mol}^{-1}$)

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

Answer: (C) $\sqrt{\frac{3\pi}{8}}$ · Key from source paper

Q107 JEE Main 2021 · 17 Mar · Shift 1 MCQ

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

(A) 1.03
(B) 1.30
(C) 1.37
(D) 10.3

Answer: (A) 1.03 · Key from source paper

Q108 JEE Main 2021 · 17 Mar · Shift 1 MCQ

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) $\frac{n_1T_1+n_2T_2}{n_1+n_2}$
(B) $\frac{n_1F_1T_1+n_2F_2T_2}{n_1F_1+n_2F_2}$
(C) $\frac{n_1F_1T_1+n_2F_2T_2}{F_1+F_2}$
(D) $\frac{n_1F_1T_1+n_2F_2T_2}{n_1+n_2}$

Answer: (B) $\frac{n_1F_1T_1+n_2F_2T_2}{n_1F_1+n_2F_2}$ · Key from source paper

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Q109 JEE Main 2021 · 17 Mar · Shift 2 MCQ

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

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

Answer: (B) 1.2 · Key from source paper

Q110 JEE Main 2021 · 16 Mar · Shift 1 MCQ

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

Answer: (C) $\frac{5}{2}\frac{RT}{V}$ · Key from source paper

Q111 JEE Main 2021 · 16 Mar · Shift 2 MCQ

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

(A) $58\ \mathrm{nm}$
(B) $32\ \mathrm{nm}$
(C) $86\ \mathrm{nm}$
(D) $102\ \mathrm{nm}$

Answer: (D) $102\ \mathrm{nm}$ · Key from source paper

Q112 JEE Main 2021 · 26 Feb · Shift 1 Numerical

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 $x \times 10^{-1}$ atm. Value of x (nearest integer) is _____

Numerical value type: the answer is a number.

Answer: 26. · Key from source paper

Q113 JEE Main 2021 · 26 Feb · Shift 2 MCQ

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) polyatomic only
(C) monoatomic only
(D) diatomic only

Answer: (B) polyatomic only · Key from source paper

EdLoop JEE

Q114 JEE Main 2021 · 25 Feb · Shift 2 MCQ

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

Answer: (B) Statement I is true but Statement II is false. · Key from source paper

Q115 JEE Main 2021 · 24 Feb · Shift 2 MCQ

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

(A) continuously stick to the walls of container.
(B) suffer change in momentum when impinge on the walls of container.
(C) continuously lose their energy till it reaches wall.
(D) are attracted by the walls of container.

Answer: (B) suffer change in momentum when impinge on the walls of container. · Key from source paper

Q116 JEE Main 2021 · 24 Feb · Shift 2 Numerical

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

Numerical value type: the answer is a number.

Answer: 400. · Key from source paper

Q117 JEE Main 2020 · 6 Sep · Shift 1 MCQ

Molecules of an ideal gas are known to have three translational 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) $\mathrm{U}=\frac{5}{2}\mathrm{RT}$ and $\gamma=\frac{6}{5}$
(B) $U=5\,RT$ and $\gamma=\frac{7}{5}$
(C) $\mathrm{U}=\frac{5}{2}\mathrm{RT}$ and $\gamma=\frac{7}{5}$
(D) $\mathrm{U}=5RT$ and $\gamma=\frac{6}{5}$

Answer: (C) $\mathrm{U}=\frac{5}{2}\mathrm{RT}$ **and** $\gamma=\frac{7}{5}$ · Key from source paper

Q118 JEE Main 2020 · 6 Sep · Shift 1 Numerical

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 $\mathrm{P}_2/\mathrm{P}_1$ is -

Numerical value type: the answer is a number.

Answer: 5. · Key from source paper

Q119 JEE Main 2020 · 6 Sep · Shift 2 MCQ

In a dilute gas at pressure P and temperature 't', the time between successive collision of a molecule varies with T as :

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

Options (2) or (4) were accepted. More than one answer was accepted. · Key from source paper

Q120 JEE Main 2020 · 5 Sep · Shift 1 MCQ

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 4×10^{-14} erg, g = 980 cm s^{-2} density of mercury = 13. 6 g cm^{-3})

(A) 4.8×10^{18}
(B) 0×10^{16}
(C) 8×10^{16}
(D) 8×10^{18}

Answer: (A) 4.8×10^{18} · Key from source paper

Q121 JEE Main 2020 · 5 Sep · Shift 2 Numerical

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 value type: the answer is a number.

Answer: 41. · Key from source paper

Q122 JEE Main 2020 · 4 Sep · Shift 1 MCQ

Match the $\frac{C_p}{C_v}$ ratio for ideal gases with different type of molecules:
Molecule Type C_p/C_v
(A) Monoatomic (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) – (IV), (B) – (II), (C) – (I), (D) – (III)
(B) (A) – (III), (B) – (IV), (C) – (II), (D) – (I)
(C) (A) – (IV), (B) – (I), (C) – (II), (D) – (III)
(D) (A) – (II), (B) – (III), (C) – (I), (D) – (IV)

Answer: (C) (A) – (IV), (B) – (I), (C) – (II), (D) – (III) · Key from source paper

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Q123 JEE Main 2020 · 4 Sep · Shift 1 Numerical

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 value type: the answer is a number.

Answer: 267. · Key from source paper

Q124 JEE Main 2020 · 4 Sep · Shift 2 Numerical

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 _____

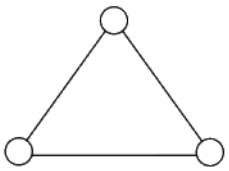
Numerical value type: the answer is a number.

Answer: 150. · Key from source paper

Q125 JEE Main 2020 · 3 Sep · Shift 1 MCQ

see figure

Q6.



Consider a gas of triatomic molecules. The molecules are assumed to be triangular and made of massless rigid rods whose vertices are occupied by atoms. The internal energy of a mole of the gas at temperature T is:

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

(3) $\frac{9}{2}RT$ (4) $3RT$

(A) $\frac{5}{2}RT$

(B) $\frac{3}{2}RT$

(C) $\frac{9}{2}RT$

(D) $3RT$

Answer: (D) $3RT$ · Key from source paper

Q126 JEE Main 2020 · 3 Sep · Shift 2 MCQ

To raise the temperature of a certain mass of gas by $50\ ^{\circ}\mathrm{C}$ at a constant pressure,160 calories of heat is required. When the same mass of gas is cooled by $100\ ^{\circ}\mathrm{C}$ 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) 5

(B) 6

(C) 3

(D) 7

Answer: (B) 6 · Key from source paper

Q127 JEE Main 2020 · 2 Sep · Shift 1 MCQ

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 mixutre is :

(A) 15

(B) 13

(C) 20

(D) 11

Answer: (A) 15 · Key from source paper

Q128 JEE Main 2020 · 2 Sep · Shift 2 MCQ

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 relations unchanged.

(A) (B) and (C)
(B) (A)and (B)
(C) (C) and (D)
(D) (A) and (D)

Answer: (A) (B) and (C) · Key from source paper

Q129 JEE Main 2020 · 9 Jan · Shift 1 MCQ

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) $5:9$
(C) $3:5$
(D) $5:7$

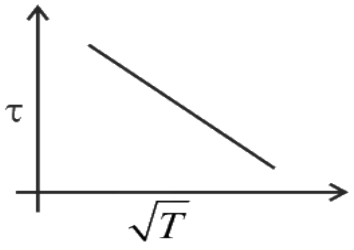
Answer: (D) $5:7$ · Key from source paper

Q130 JEE Main 2020 · 8 Jan · Shift 1 MCQ

The plot that depicts the behavior of the mean free time τ (time between two successive collisions) for the molecules of an ideal gas, as a function of temperature (T), qualitatively, is: (Graphs are schematic and not drawn to scale)

Q9. The plot that depicts the behavior of the mean free time τ (time between two successive collisions) for the molecules of an ideal gas, as a function of temperature (T), qualitatively, is: (Graphs are schematic and not drawn to scale)

(1)



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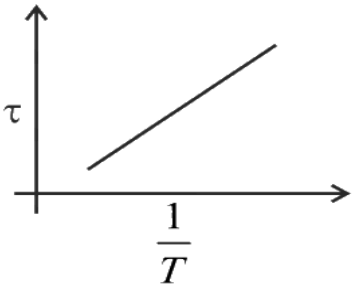

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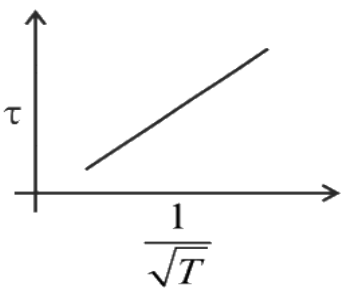

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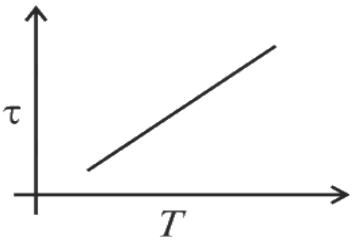

(A) *see figure*
(B) *see figure*
(C) *see figure*
(D) *see figure*

Answer: (C) · Key from source paper

Q131 JEE Main 2020 · 8 Jan · Shift 2 MCQ

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 $\frac{C_P}{C_V}$ value will be:

(A) $\frac{19}{13}$
(B) $\frac{67}{45}$
(C) $\frac{40}{27}$
(D) $\frac{23}{15}$

Answer: (A) $\frac{19}{13}$ · Key from source paper

Q132 JEE Main 2020 · 7 Jan · Shift 1 MCQ

Two moles of an ideal gas, with $\frac{C_P}{C_V} = \frac{5}{3}$, are mixed with three moles of another ideal gas $\frac{C_P}{C_V} = \frac{4}{3}$. The value of $\frac{C_P}{C_V}$ for the mixture is

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

Answer: (D) 1.42 · Key from source paper

Q133 JEE Main 2019 · 12 Apr · Shift 1 MCQ

Two moles of helium gas is mixed with three moles of hydrogen molecules (taken to be rigid). What is the molar specific heat of mixture at constant volume? $\mathrm{R} = 8.3\ \mathrm{J}\ /\ \mathrm{mol\ K}$

(A) 17.4 J / mol K
(B) 19.7 J / mol K
(C) 15.7 J / mol K
(D) 21.6 J / mol K

Answer: (A) 17.4 J / mol K · Key from source paper

Q134 JEE Main 2019 · 10 Apr · Shift 1 MCQ

A $25 \times 10^{-3}\ \mathrm{m}^3$ volume cylinder is filled with 1 mol of O_2 gas at room temperature (300 K) . The molecular diameter of O_2 , and its root mean square speed, are found to be 0.3 nm and 200 m/s , respectively. What is the average collision rate (per second) for an O_2 molecule?

(A) $\sim 10^{11}$
(B) $\sim 10^{12}$
(C) $\sim 10^{10}$
(D) $\sim 10^{13}$

Answer: (C) $\sim 10^{10}$ · Checked by our team

Q135 JEE Main 2019 · 10 Apr · Shift 2 MCQ

One mole of an ideal gas passes through a process where pressure and volume obey the relation $P = P_o\,1 - \frac{1}{2}\left(\frac{V_o}{V}\right)^2$. Here P_o and V_o are constants. Calculate the change in the temperature of the gas if its volume changes from V_o to $2V_o$.

(A) $\frac{1}{4}\frac{P_0V_0}{R}$
(B) $\frac{5}{4}\frac{P_0V_0}{R}$
(C) $\frac{1}{2}\frac{P_0V_0}{R}$
(D) $\frac{3}{4}\frac{P_0V_0}{R}$

Answer: (B) $\frac{5}{4}\frac{P_0V_0}{R}$ · Key from source paper

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Q136 JEE Main 2019 · 9 Apr · Shift 1 MCQ

For given gas at 1 atm pressure, rms speed of the molecules is 200 m/s at 127° C. At 2 atm pressure and at 227° C, the rms speed of the molecules will be:

(A) 100 m/s
(B) 80 m/s
(C) $80\sqrt{5}$ m/s
(D) $100\sqrt{5}$ m/s

Answer: (D) $100\sqrt{5}$ m/s · Key from source paper

Q137 JEE Main 2019 · 9 Apr · Shift 1 MCQ

An HCl molecule has rotational, translational and vibrational motions. If the rms velocity of HCl molecules in its gaseous phase is $\bar{v}$, m is its mass and k_B is Boltzmann's constant, then its temperature will be:

(A) $\frac{m\bar{v}^2}{5k_B}$
(B) $\frac{m\bar{v}^2}{6k_B}$
(C) $\frac{m\bar{v}^2}{3k_B}$
(D) $\frac{m\bar{v}^2}{7k_B}$

Answer: (C) $\frac{m\bar{v}^2}{3k_B}$ · Key from source paper

Q138 JEE Main 2019 · 9 Apr · Shift 2 MCQ

The specific heats, C_p and C_v of a gas of diatomic molecules, A, are given (in units of $\mathrm{J\ mol^{-1}\ K^{-1}}$) by 29 and 22, respectively. Another gas of diatomic molecules, B, has the corresponding values 30 and 21. If they are treated as ideal gases, then:

(A) A has one vibrational mode and B has two
(B) A has a vibrational mode but B has none.
(C) Both A and B have a vibrational mode each.
(D) A is rigid but B has a vibrational mode.

Answer: (B) A has a vibrational mode but B has none. · Key from source paper

Q139 JEE Main 2019 · 8 Apr · Shift 1 MCQ

If 10^{22} gas molecules each of mass 10^{-26} kg collides with a surface (perpendicular to it) elastically per second over an area 1 $\mathrm{m^2}$ with a speed $10^4\ \mathrm{m/s}$, the pressure exerted by the gas molecules will be of the order of:

(A) 2 Pa
(B) 4 Pa
(C) 6 Pa
(D) 8 Pa

Answer: (A) 2 Pa · Key from source paper

Q140 JEE Main 2019 · 8 Apr · Shift 2 MCQ

The temperature, at which the root mean square velocity of hydrogen molecules equals their escape velocity from the earth, is closest to:
[Boltzmann Constant $\mathrm{k_B}$ = 1.38×10^{-23} J / K
Avogadro number $\mathrm{N_A}$ = 6.02×10^{26} / kg
Radius of Earth: 6.4×10^6 m
Gravitational acceleration on Earth = 10 $\mathrm{ms^{-2}}$]

(A) 3×10^5K
(B) 650 K
(C) 800 K
(D) 10^4 K

Answer: (D) 10^4 K · Key from source paper

Q141 JEE Main 2019 · 12 Jan · Shift 1 MCQ

An ideal gas occupies a volume of 2 m^3 at a pressure of $3 \times 10^6\ Pa$. The energy of the gas is:

(A) $10^8 J$
(B) $9 \times 10^6 J$
(C) $3 \times 10^2 J$
(D) $6 \times 10^4 J$

Answer: (B) $9 \times 10^6 J$ · Key from source paper

Q142 JEE Main 2019 · 12 Jan · Shift 2 MCQ

A vertical closed cylinder is separated into two parts by a frictionless piston of mass m and of negligible thickness. The piston is free to move along the length of the cylinder. The length of the cylinder above piston is l_1, and that below the piston is l_2, such that $l_1 > l_2$. Each part of the cylinder contains n moles of an ideal gas at equal temperature T. If the piston is stationary, its mass m will be given by:
(R is universal gas constant and g is the acceleration due to gravity)

(A) $\frac{RT}{ng}\left[\frac{l_1-3l_2}{l_1 l_2}\right]$
(B) $\frac{nRT}{g}\left[\frac{l_1-l_2}{l_1 l_2}\right]$
(C) $\frac{RT}{g}\left[\frac{2l_1+l_2}{l_1 l_2}\right]$
(D) $\frac{RT}{gl}\left[\frac{2l_1+l_2}{l_1 l_2}\right]$

Answer: (B) $\frac{nRT}{g}\left[\frac{l_1-l_2}{l_1 l_2}\right]$ · Key from source paper

Q143 JEE Main 2019 · 12 Jan · Shift 2 MCQ

An ideal gas is enclosed in a cylinder at pressure of 2 atm and temperature, 300 K. The mean time between two successive collisions is $6 \times 10^{-8} s$. If the pressure is doubled and temperature is increased to 500 K, the mean time between two successive collisions will be close to:

(A) $2 \text{ x } 10^{-7} s$
(B) $3 \text{ x } 10^{-6} s$
(C) $0.5 \text{ x } 10^{-8} s$
(D) $4 \text{ x } 10^{-8} s$

Answer: (D) $4 \text{ x } 10^{-8} s$ · Key from source paper

Q144 JEE Main 2019 · 11 Jan · Shift 1 MCQ

A gas mixture consists of 3 moles of oxygen and 5 moles of argon at temperature T. Considering only translational and rotational modes, the total internal energy of the system is

(A) 15RT
(B) 12RT
(C) 4RT
(D) 20RT

Answer: (A) 15RT · Key from source paper

Q145 JEE Main 2019 · 10 Jan · Shift 2 MCQ

$2\ \mathrm{kg}$ of a monoatomic gas is at a pressure of $4 \times 10^4\ \mathrm{N\,m^{-2}}$. The density of the gas is $8\ \mathrm{kg\ m^{-3}}$. What is the order of energy of the gas due to its thermal motion?

(A) $10^5\ \mathrm{J}$
(B) $10^6\ \mathrm{J}$
(C) $10^4\ \mathrm{J}$
(D) $10^3\ \mathrm{J}$

Answer: (C) $10^4\ \mathrm{J}$ · Key from source paper

Q146 JEE Main 2019 · 9 Jan · Shift 1 MCQ

A mixture of 2 moles of helium gas (atomic mass $= 4u$) , and 1 mole of argon gas (atomic mass $= 40\ u$) is kept at $300\ K$ in a container. The ratio of their rms speeds $\frac{V_{rms}\ helium}{V_{rms}\ (argon)}$, is close to:

(A) 0.45
(B) 2.24
(C) 0.32
(D) 3.16

Answer: (D) 3.16 · Key from source paper

Q147 JEE Main 2018 · 16 Apr · Online MCQ

Two moles of helium are mixed with n moles of hydrogen. If $\frac{C_p}{C_v} = \frac{3}{2}$ for the mixture then the value of n is,

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

Answer: (C) 2 · Key from source paper

Q148 JEE Main 2018 · 15 Apr · Shift 2 MCQ

The value closest to the thermal velocity of a Helium atom at room temperature (300 K) in $\mathrm{ms^{-1}}$ is: $\left[\mathrm{k_B} = 1.4 \times 10^{-23}\ \mathrm{J/K};\ \mathrm{m_{He}} = 7 \times 10^{-27}\ \mathrm{kg}\right]$

(A) 1.3×10^4
(B) 1.3×10^5
(C) 1.3×10^2
(D) 1.3×10^3

Answer: (D) 1.3×10^3 · Key from source paper

Q149 JEE Main 2018 · 8 Apr · Offline MCQ

The mass of a hydrogen molecule is 3.32×10^{-27} kg. If 10^{23} hydrogen molecules strike, per second, a fixed wall of the area $2\ \mathrm{cm}^2$ at an angle of 45° to the normal, and rebound elastically with a speed of $10^3\ \mathrm{m\,s^{-1}}$, then the pressure on the wall is nearly:

(A) $4.70 \times 10^2\ \mathrm{N\,m^{-2}}$
(B) $2.35 \times 10^3\ \mathrm{N\,m^{-2}}$
(C) $4.70 \times 10^3\ \mathrm{N\,m^{-2}}$
(D) $2.35 \times 10^2\ \mathrm{N\,m^{-2}}$

Answer: (B) $2.35 \times 10^3\ \mathrm{N\,m^{-2}}$ · Key from source paper

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Q150 JEE Main 2017 · 9 Apr · Online MCQ

N moles of diatomic gas in a cylinder is at a temperature T. Heat is supplied to the cylinder such that the temperature remains constant but n moles of the diatomic gas get converted into monoatomic gas. The change in the total kinetic energy of the gas is

(A) 0
(B) $\frac{5}{2}nRT$
(C) $\frac{3}{2}nRT$
(D) $\frac{1}{2}nRT$

Answer: (D) $\frac{1}{2}nRT$ · Key from source paper

Q151 JEE Main 2017 · 8 Apr · Online MCQ

An ideal gas has molecules with 5 degrees of freedom. The ratio of specific heats at constant pressure (C_p) and at constant volume (C_V) is:

(A) $\frac{7}{5}$
(B) 6
(C) $\frac{7}{2}$
(D) $\frac{5}{2}$

Answer: (A) $\frac{7}{5}$ · Key from source paper

Q152 JEE Main 2017 · 2 Apr · Offline MCQ

The temperature of an open room of volume $30\ \mathrm{m}^3$ increases from $17^\circ\mathrm{C}$ to $27^\circ\mathrm{C}$ due to the sunshine. The atmospheric pressure in the room remains $1 \times 10^5\ \mathrm{Pa}$. If n_i and n_f are the number of molecules in the room before and after heating, then $n_f - n_i$ will be:

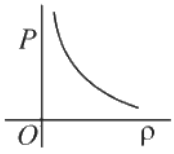
(A) -2.5×10^{25}
(B) -1.61×10^{23}
(C) 1.38×10^{23}
(D) 2.5×10^{25}

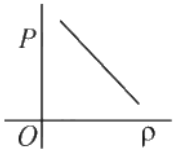
Answer: (A) -2.5×10^{25} · Key from source paper

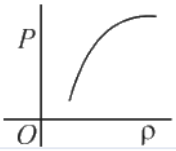
Q153 JEE Main 2016 · 10 Apr · Online MCQ

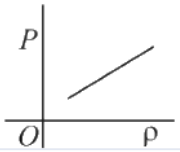
Which of the following shows the correct relationship between the pressure P and density ρ of an ideal gas at constant temperature ?

Q11. Which of the following shows the correct relationship between the pressure 'P' and density ρ of an ideal gas at constant temperature ?

(1) 

(2) 

(3) 

(4) 

(A) *see figure*
(B) *see figure*
(C) *see figure*
(D) *see figure*

Answer: (D) · Key from source paper

Q154 JEE Main 2015 · 11 Apr · Online MCQ

Using equipartition of energy, the specific heat (in J kg^{-1} K^{-1}) of Aluminium at high temperature can be estimated to be (atomic weight of Aluminium $= 27$)

(A) 25
(B) 1850
(C) 410
(D) 925

Answer: (D) 925 · Key from source paper

Q155 JEE Main 2015 · 10 Apr · Online MCQ

In an ideal gas at temperature T, the average force that a molecule applies on the walls of a closed container depends on T as T^q . A good estimate for q is:

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

Answer: (C) 1 · Key from source paper

Q156 JEE Main 2015 · 4 Apr · Offline MCQ

Consider an ideal gas confined in an isolated closed chamber. As the gas undergoes an adiabatic expansion, the average time of collision between molecules increases as V^q, where V is the volume of the gas. The value of q is:
$\left(\gamma = \frac{C_P}{C_v}\right)$

(A) $\frac{\gamma - 1}{2}$
(B) $\frac{3\gamma + 5}{6}$
(C) $\frac{3\gamma - 5}{6}$
(D) $\frac{\gamma + 1}{2}$

Answer: (D) $\frac{\gamma + 1}{2}$ · Key from source paper

Q157 JEE Main 2014 · 19 Apr · Online MCQ

A gas molecule of mass M at the surface of the earth has kinetic energy equivalent to $0\ ^\circ\mathrm{C}$. If it were to go up straight without colliding with any other molecules, how high it would rise? Assume that the height attained is much less than the radius of the earth. (k_B is Boltzmann constant)

(A) $\frac{273k_\mathrm{B}}{2Mg}$
(B) $\frac{819k_\mathrm{B}}{2Mg}$
(C) 0
(D) $\frac{546k_\mathrm{B}}{3Mg}$

Answer: (B) $\frac{819k_\mathrm{B}}{2Mg}$ · Key from source paper

Q158 JEE Main 2014 · 12 Apr · Online MCQ

At room temperature a diatomic gas is found to have an r.m.s. speed of $1930\ \mathrm{ms}^{-1}$. The gas is:

(A) H_2
(B) Cl_2
(C) O_2
(D) F_2

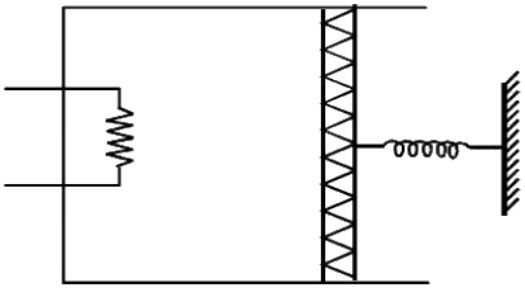
Answer: (A) H_2 · Key from source paper

Q159 JEE Main 2014 · 11 Apr · Online MCQ

An ideal monoatomic gas is confined in a cylinder by a spring loaded piston of cross section $8.0 \times 10^{-3}\ \mathrm{m}^2$. Initially the gas is at $300\ \mathrm{K}$ and occupies a volume of $2.4 \times 10^{-3}\ \mathrm{m}^3$ and the spring is in its relaxed state as shown in figure. The gas is heated by a small heater until the piston moves out slowly by $0.1\ \mathrm{m}$. The force constant of the spring is $8000\ \mathrm{N/m}$ and the atmospheric pressure is $1.0 \times 10^5\ \mathrm{N/m}^2$. The cylinder and the piston are thermally insulated. The piston and the spring are massless and there is no friction between the piston and the cylinder. The final temperature of the gas will be: (Neglect the heat loss through the lead wires of the heater. The heat capacity of the heater coil is also negligible).

(see the figure above)

Q13. An ideal monoatomic gas is confined in a cylinder by a spring loaded piston of cross section $8.0 \times 10^{-3}\ \mathrm{m}^2$. Initially the gas is at $300\ \mathrm{K}$ and occupies a volume of $2.4 \times 10^{-3}\ \mathrm{m}^3$ and the spring is in its relaxed state as shown in figure. The gas is heated by a small heater until the piston moves out slowly by $0.1\ \mathrm{m}$. The force constant of the spring is $8000\ \mathrm{N/m}$ and the atmospheric pressure is $1.0 \times 10^5\ \mathrm{N/m}^2$. The cylinder and the piston are thermally insulated. The piston and the spring are massless and there is no friction between the piston and the cylinder. The final temperature of the gas will be: (Neglect the heat loss through the lead wires of the heater. The heat capacity of the heater coil is also negligible).



(1) 300 K
(2) 800 K
(3) 500 K
(4) 1000 K

(A) 300 K
(B) 800 K
(C) 500 K
(D) 1000 K

Answer: (B) 800 K · Checked by our team

Q160 JEE Main 2014 · 9 Apr · Online MCQ

Modern vacuum pumps can evacuate a vessel down to a pressure of 4.0×10^{-15} atm. at room temperature (300 K). Taking R = 8.3 $\mathrm{JK^{-1}\ mole^{-1}}$, 1 atm = 10^5 Pa and $\mathrm{N_{Avogadro}} = 6 \times 10^{23}\ \mathrm{mole^{-1}}$, the mean distance between molecules of gas in an evacuated vessel will be of the order of :

(A) $0.2\ \mu\mathrm{m}$
(B) $0.2\ \mathrm{mm}$
(C) $0.2\ \mathrm{cm}$
(D) $0.2\ \mathrm{nm}$

Answer: (B) $0.2\ \mathrm{mm}$ · Key from source paper

Q161 JEE Main 2014 · 6 Apr · Offline MCQ

An open glass tube is immersed in mercury in such a way that a length of 8 cm extends above the mercury level. The open end of the tube is then closed and sealed and the tube is raised vertically up by additional 46 cm. What will be length of the air column above mercury in the tube now ? (Atmospheric pressure = 76 cm of Hg)

(A) 16 cm
(B) 22 cm
(C) 38 cm
(D) 6 cm

Answer: (A) 16 cm · Key from source paper

Q162 JEE Main 2013 · 25 Apr · Online MCQ

In the isothermal expansion of 10 g of gas from volume V to 2 V the work done by the gas is 575 J. What is the root mean square speed of the molecules of the gas at that temperature?

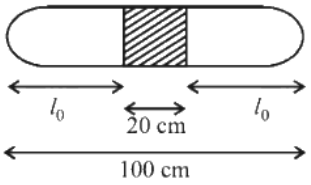
(A) 398 m/s
(B) 520 m/s
(C) 499 m/s
(D) 532 m/s

Answer: (C) 499 m/s · Key from source paper

Q163 JEE Main 2013 · 23 Apr · Online MCQ

A thin tube sealed at both ends is 100 cm long. It lies horizontally, the middle 20 cm containing mercury and two equal ends containing air at standard atmospheric pressure. If the tube is now turned to a vertical position, by what amount will the mercury be displaced ?
(see the figure above)
(Given : cross-section of the tube can be assumed to be uniform)

Q9. A thin tube sealed at both ends is 100 cm long. It lies horizontally, the middle 20 cm containing mercury and two equal ends containing air at standard atmospheric pressure. If the tube is now turned to a vertical position,



by what amount will the mercury be displaced ?

(Given : cross-section of the tube can be assumed to be uniform)

(1) 2.95 cm
(2) 5.18 cm
(3) 8.65 cm
(4) 0.0 cm

(A) 2.95 cm
(B) 5.18 cm
(C) 8.65 cm
(D) 0.0 cm

Answer: (B) 5.18 cm · Key from source paper

Q164 AIEEE 2012 · 7 May · Online MCQ

A perfect gas at 27°C is heated at constant pressure so as to double its volume. The final temperature of the gas will be, close to

(A) 327°C
(B) 200°C
(C) 54°C
(D) 300°C

Answer: (A) 327°C · Key from source paper

Q165 AIEEE 2011 MCQ

A thermally insulated vessel contains an ideal gas of molecular mass M and ratio of specific heats γ. It is moving with speed v and is suddenly brought to rest. Assuming no heat is lost to the surroundings, its temperature increases by :

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

Answer: (C) $\frac{(\gamma-1)}{2R}Mv^2$ K · Key from source paper

Q166 AIEEE 2011 MCQ

Three perfect gases at absolute temperatures T_1, T_2 and T_3 are mixed. The masses of molecules are m_1, m_2 and m_3 and the number of molecules are n_1, n_2 and n_3 respectively. Assuming no loss of

energy, the final temperature of the mixture is :

(A) $\frac{n_1T_1+n_2T_2+n_3T_3}{n_1+n_2+n_3}$
(B) $\frac{n_1T_1+n_2T_2^2+n_3T_3^2}{n_1T_1+n_2T_2+n_3T_3}$
(C) $\frac{n_1^2T_1^2+n_2^2T_2^2+n_3^2T_3^2}{n_1T_1+n_2T_2+n_3T_3}$
(D) $\frac{(T_1+T_2+T_3)}{3}$

Answer: (A) $\frac{n_1T_1+n_2T_2+n_3T_3}{n_1+n_2+n_3}$ · Key from source paper

Q167 AIEEE 2009 MCQ

One kg of a diatomic gas is at a pressure of $8 \times 10^4\ \mathrm{N/m^2}$. The density of the gas is $4\ \mathrm{kg/m^{-3}}$. What is the energy of the gas due to its thermal motion?

(A) 3×10^4 J
(B) 5×10^4 J
(C) 6×10^4 J
(D) 7×10^4 J

Answer: (B) 5×10^4 J · Key from source paper

Q168 AIEEE 2006 MCQ

Two rigid boxes containing different ideal gases are placed on a table. Box A contains one mole of nitrogen at temperature T_0, while Box B contains one mole of helium at temperature $(7/3)T_0$. The boxes are then put into thermal contact with each other and heat flows between them until the gases reach a common final temperature. (Ignore the heat capacity of boxes). Then, the final temperature of the gases, T_f, in terms of T_0 is

(A) $\mathrm{T_f} = \frac{5}{2}\,\mathrm{T_0}$
(B) $\mathrm{T_f} = \frac{3}{7}\,\mathrm{T_0}$
(C) $\mathrm{T_f} = \frac{7}{3}\,\mathrm{T_0}$
(D) $T_f = \frac{3}{2}T_0$

Answer: (D) $T_f = \frac{3}{2}T_0$ · Key from source paper

Q169 AIEEE 2005 MCQ

A gaseous mixture consists of 16 g of helium and 16 g of oxygen. The ratio $\frac{C_p}{C_v}$ of the mixture is

(A) 1.59
(B) 1.62
(C) 1.4
(D) 1.54

Answer: (B) 1.62 · Key from source paper

Q170 AIEEE 2004 MCQ

One mole of ideal monoatomic gas (γ = 5/3) is mixed with one mole of diatomic gas (γ = 7/5). What is γ for the mixture? γ denotes the ratio of specific heat at constant pressure, to that at constant volume.

(A) 3/2
(B) 23/15
(C) 35/23
(D) 4/3

Answer: (A) 3/2 · Key from source paper

Q171 AIEEE 2004 MCQ

Two thermally insulated vessels 1 and 2 are filled with air at temperatures (T_1, T_2), volume (V_1, V_2) and pressure (P_1, P_2) respectively. If the valve joining two vessels is opened, the temperature inside the vessel at equilibrium will be

(A) $\mathrm{T_1 + T_2}$
(B) $(\mathrm{T_1 + T_2})/2$
(C) $\frac{\mathrm{T_1\,T_2(P_1\,V_1+P_2\,V_2)}}{\mathrm{P_1\,V_1\,T_2+P_2\,V_2\,T_1}}$
(D) $\frac{\mathrm{T_1\,T_2(P_1\,V_1+P_2\,V_2)}}{\mathrm{P_1\,V_1\,T_1+P_2\,T_2\,T_2}}$

Answer: (C) $\frac{\mathrm{T_1\,T_2(P_1\,V_1+P_2\,V_2)}}{\mathrm{P_1\,V_1\,T_2+P_2\,V_2\,T_1}}$ · Key from source paper

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Q172 AIEEE 2003 MCQ

In the nuclear fusion reaction $\mathrm{{}_1^2H + {}_1^3H \rightarrow {}_2^4He + n}$ given that the repulsive potential energy between the two nuclei is $\sim 7.7 \times 10^{-14}$ J, the temperature at which the gases must be heated to initiate the reaction is nearly

[Boltzmann's Constant $\mathrm{k} = 1.38 \times 10^{-23}$ J/K]

(A) 10^7 K
(B) 10^5 K
(C) 10^3 K
(D) 10^9 K

Answer: (D) 10^9 K · Key from source paper

Q173 AIEEE 2002 MCQ

Cooking gas containers are kept in a lorry moving with uniform speed. The temperature of the gas molecules inside will

(A) increase
(B) decrease
(C) remain same
(D) decrease for some, while increase for others

Answer: (C) remain same · Checked by our team

Q174 AIEEE 2002 MCQ

At what temperature is the r.m.s. velocity of a hydrogen molecule equal to that of an oxygen molecule at $47^{\circ}\mathrm{C}$?

(A) 80 K
(B) 73 K
(C) 3 K
(D) 20 K

Answer: (D) 20 K · Key from source paper

Q175 AIEEE 2002 MCQ

1 mole of a gas with $\gamma = 7/5$ is mixed with 1 mole of a gas with $\gamma = 5/3$, then the value of γ for the resulting mixture is

(A) 7/5
(B) 2/5
(C) 24/16
(D) 12/7

Answer: (C) 24/16 · Key from source paper

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