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PHYSICS

BOOKS - DISHA PHYSICS (HINGLISH)

KINETIC THEORY OF GASES

Physics

1. The pressure of a gas filled in a closed vessel increase by 0.4% when temperature is

increased by $1^\circ C$. Find the initial temperature of the gas.

A. $250K$

B. $250^\circ C$

C. $2500K$

D. $25^\circ C$

Answer:

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2. To double the volume of a given mass of an ideal gas at $27^{\circ}C$ keeping the pressure constant, one must raise the temperature in degree centigrade to

A. 54

B. 270

C. 327

D. 600

Answer:

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3. Under which of the following conditions is the law PV=RT obeyed most closed by a real gas?

A. High pressure and high temperature

B. Low pressure and low temperature

C. Low pressure and high temperature

D. High pressure and low temperature

Answer:

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4. The pressure P, Volume V and temperature T of a gas in the jar A and the other gas in the jar B at pressure $2P$, volume $V/4$ and temperature $2T$, then the ratio of the number of molecules in the jar A and B will be

A. $1:1$

B. $1:2$

C. $2:1$

D. $4:1$

Answer:

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5. A flask is filled with $13g$ of an ideal gas at $27^\circ C$ and its temperature is raised to $52^\circ C$. The mass of the gas that has to be released to maintain the temperature of the gas in the flask at $52^\circ C$, the pressure remaining the same is

A. $2.5g$

B. $2.0g$

C. $1.5g$

D. $1.0g$

Answer:

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6. Two gases each at temperature T, volume V and pressure P are mixed such that temperature of mixture is T and volume is V. What will be the pressure of the mixture ?

A. $p/2$

B. p

C. $2p$

D. $4p$

Answer:

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7. The root mean square velocity of a gas molecule of mass m at a given temperature is proportional to

A. m°

B. m

C. $\sqrt{m}$

D. $\frac{1}{\sqrt{m}}$

Answer:

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8. Which of the following statements is true?

A. Absolute zero temperature is not zero energy temperature

B. Two different gases at the same temperature and pressure have equal root mean square velocities

C. The root mean square speed of the molecules of different ideal gases, maintained at the same temperature are the same

D. Given sample of 1 cc of hydrogen and 1 cc of oxygen both at NTP, oxygen sample has a large number of molecules

Answer:

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9. At room temperature, the rms speed of the molecules of a certain diatomic gas is found to be $1930 m / s$. The gas is

A. H_2

B. F_2

C. o_2

D. Cl_2

Answer:

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10. Root mean square velocity of a particle is v at pressure P. If pressure is increased two times, then the r.m.s. velocity becomes

A. $2v$

B. $3v$

C. $0.5v$

D. v

Answer:

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11. In the two vessels of same volume, atomic hydrogen and helium at pressure 1 atm and 2 atm are filled. If temperature of both the

sample is same then average speed of hydrogen atoms $< C_H <$ will be related to that of helium $< C_{He} >$ as

A. $< C_H \geq \sqrt{2} < C_{He} >$

B. $< C_H > = < C_{He} >$

C. $itC_H > = 2itC_{He} >$

D. $< C_H > = \frac{< C_{He} >}{2}$

Answer:

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12. For gas at a temperature T the root-mean-square speed v_{rms}, the most probable speed v_{mp}, and the average speed v_{av} obey the relationship

A. $v_{av} > v_{rms} > v_{mp}$

B. $v_{rms} > v_{av} > v_{mp}$

C. $v_{mp} > v_{av} > v_{rms}$

D. $v_{mp} > v_{rms} > v_{av}$

Answer:

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13. One mole of gas having $\gamma = 7/5$ is mixed with 1 mole of a gas having $\gamma = 4/3$. What will be γ for the mixture ?

A. $3/2$

B. $23/15$

C. $35/23$

D. $4/3$

Answer:

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14. The value of the gas constant (R) calculated from the perfect gas equation is 8.32 Joule/gm mol K , whereas its value calculated from the knowledge of C_P and C_V of the gas is 1.98 cal/gm mole K . From this data, the value of J is

A. $4.16 J / cal$

B. $4.18 J / cal$

C. $4.20 J / cal$

D. $4.22 J / cal$

Answer:

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15. Gas at a pressure P_0 in contained as a vessel. If the masses of all the molecules are halved and their speeds are doubles. The resulting pressure P will be equal to

A. $4p_0$

B. $2p_0$

C. p_0

D. $\frac{p_0}{2}$

Answer:

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16. The mean kinetic energy per unit volume of gas (E) is related to average pressure P, exerted by the gas is

A. $P = -\frac{1}{2}E$

B. $P = E$

C. $P = \frac{3}{2}E$

D. $P = \frac{2}{3}E$

Answer:

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17. Mean kinetic energy (or average energy) per gm molecule of a monoatomic gas is given by

A. $\frac{3}{2}RT$

B. $\frac{1}{2}KT$

C. $\frac{1}{2}RT$

D. $\frac{3}{2}KT$

Answer:

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18. At which of the following temperatures would the molecules of a gas have twice the average kinetic energy they have at $20^{\circ}C$?

A. $40^\circ C$

B. 80°

C. 313°

D. 586°

Answer:

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19. The kinetic energy of one gram molecule of a gas at normal temperature and pressure is $(R = 8.31 J/mol - K)$

A. $0.56 \times 10^4 J$

B. $1.3 \times 10^2 J$

C. $2.7 \times 10^2 J$

D. $3.4 \times 10^3 J$

Answer:

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20. 70 calories of heat required to raise the temperature of 2 moles of an ideal gas at constant pressure from $30^\circ C \rightarrow 35^\circ C$. The

amount of heat required (in calories) to raise the temperature of the same gas through the same range $(30^{\circ}C \rightarrow 35^{\circ}C)$ at constant volume is:

A. $30cal$

B. $50cal$

C. $70cal$

D. $90cal$

Answer:

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21. A vessel contains a mixture of one mole of oxygen and two moles of nitrogen at 300K. The ratio of the average rorational kinetic energy per O_2 molecules to that per N_2 molecules is

A. 1 : 1

B. 1 : 2

C. 2 : 1

D. Depends on the moments of inertia of the two molecules

Answer:

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22. From the following statements, concerning ideal gas at any given temperature T, select the correct one(s)

(1) The coefficient of volume expansion at constant

pressure is same for all ideal gases

(2) In a gaseous mixture, the average translational kinetic

energy of the molecules of each component is same

(3) The mean free path of molecules increases with the

decrease in pressure

(4) The average translational kinetic energy per molecule

of oxygen gas is 3KT (K being Boltzmann constant)

A. 1,2and 3 are correct

B. 1 and 2 are correct

C. 2 and 4 are correct

D. 1 and 3 are correct

Answer:

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23. Let $\bar{v}$, v_{rms} and v_p respectively denote the mean speed. Root mean square speed, and most probable speed of the molecules in an ideal monoatomic gas at absolute temperature T. The mass of a molecule is m. Then

A. 1,2and 3 are correct

B. 1 and 2 are correct

C. 2 and 4 are correct

D. 1 and 3 are correct

Answer:

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24. A gas in container A is in thermal equilibrium with another gas in container B, both contain equal masses of the two gases in

the respective containers. Which of the following can be true

(1) $P_A = P_B, V_A \neq P_B V_B$

(2) $P_A V_B = P_B V_B$

(3) $P_A \neq P_B, V_A = V_B$

(4) $\frac{P_A}{V_A} = \frac{P_B}{V_B}$

A. 1,2and 3 are correct

B. 1 and 2 are correct

C. 2 and 4 are correct

D. 1 and 3 are correct

Answer:

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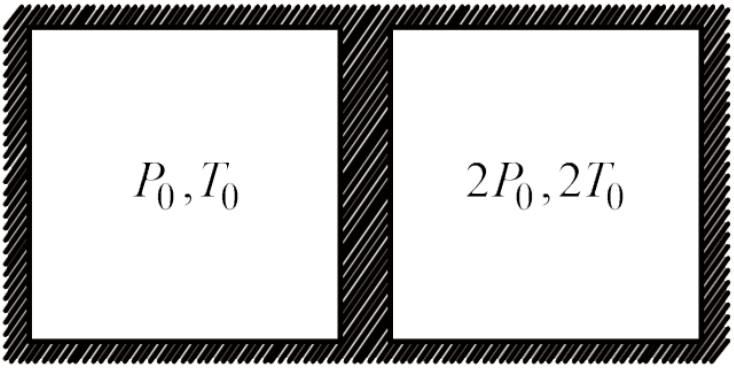
25. A diathermic piston divides adiabatic cylinder of volume V0 into two equal parts as shown in the figure. Both parts contain ideal monoatomic gases. The initial pressure and temperature of gas in left compartment are P0 and T0 while that in right compartment are 2P0 and 2T0. Initially the piston is kept fixed and the system is allowed to acquire a state of thermal equilibrium.



The pressure in left compartment after thermal equilibrium is achieved is

A. p_o

B. $\frac{3}{2}p_0$

C. $\frac{4}{3}p_0$

D. None of these

Answer:

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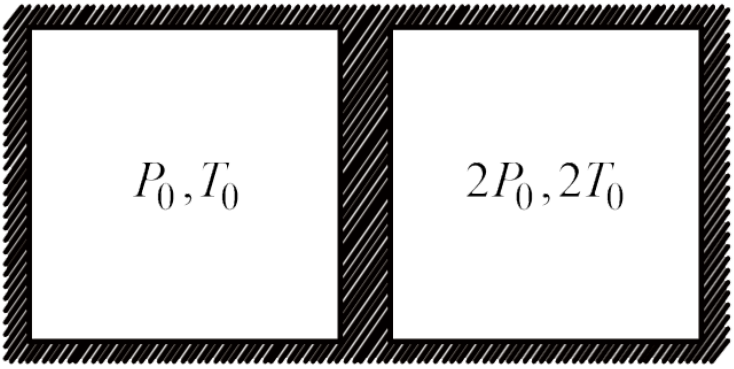
26. A diathermic piston divides adiabatic cylinder of volume V0 into two equal parts as shown in the figure. Both parts contain ideal monoatomic gases. The initial pressure and temperature of gas in left compartment are P0 and T0 while that in right compartment are 2P0 and 2T0. Initially the piston is kept fixed and the system is allowed to acquire a state of thermal equilibrium.



The heat that flown from right compartment to left compartment before thermal equilibrium is achieved is

A. P_0V_0

B. $\frac{3}{4}P_0V_0$

C. $\frac{3}{8}P_0V_0$

D. $\frac{2}{3}P_0V_0$

Answer:

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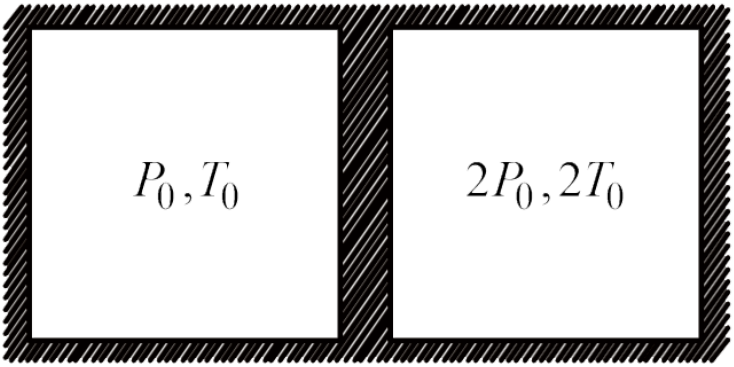
27. A diathermic piston divides adiabatic cylinder of volume V0 into two equal parts as shown in the figure. Both parts contain ideal monoatomic gases. The initial pressure and temperature of gas in left compartment are P0 and T0 while that in right compartment are 2P0 and 2T0. Initially the piston is kept fixed and the system is allowed to acquire a state of

thermal equilibrium.



If the pin which was keeping the piston fixed is removed and the piston is allowed to slide slowly such that a state of mechanical equilibrium is achieved. The volume of left compartment when piston is in equilibrium is

A. $\frac{3}{4}V_0$

B. $\frac{V_0}{4}$

C. $\frac{V_0}{2}$

D. $\frac{2}{3}V_0$

Answer:

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28. Assertion : Internal energy of an ideal gas does not depend upon volume of the gas.

Reason : This is because internal energy of ideal gas depends only on temperature of gas.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1.

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-1.

C. Statement -1 is False, Statement-2 is True.

D. Statement -1 is True, Statement-2 is False.

Answer:

29. Assetion : Equal masses of helium and oxygen gases are given equal quantities of heat. The rise in temperature of helium is greater thant that in case of oxygen.

Reason : The molecular mass of oxygen is more than molecular mass of helium.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1.

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-1.

C. Statement -1 is False, Statement-2 is True.

D. Statement -1 is True, Statement-2 is False.

Answer:

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30. Statement-1 : Maxwell speed distribution graph is

asymmetric about most probable speed.

Statement-2 : rms speed of ideal gas, depends upon it's type (monoatomic, diatomic and polyatomic).

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1.

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-1.

C. Statement -1 is False, Statement-2 is True.

D. Statement -1 is True, Statement-2 is False.

Answer:

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