PHYSICS

BOOKS - NCERT PHYSICS (HINGLISH)

KINETIC THEORY

Multiple Choice Questions Mcqs

1. A cubic vessel (with face horizontal + vetical) contains an ideal gas at NTP. The vessel is being carried by a rocket which is moving at a

speed of $500ms^{-1}$ in vertical direction. The pressure of the gas inside the vessel as observed by us on the ground.

A. remains the same because $500ms^{-1}$ is very much smaller than v_{rms} of the gas

B. remains the same because motion of the vessel as a whole does not not affect the relative motion of the gas molecules and the walls

C. will increase by a factor equal to $\left(V_{\mathrm{rms}}^2 + (500)^2\right)/V_{\mathrm{rms}}^2$ where V_{rms} was the original mean square velocity of the gas

D. will be different on the top wall and bottom wall of the vessel

Answer:

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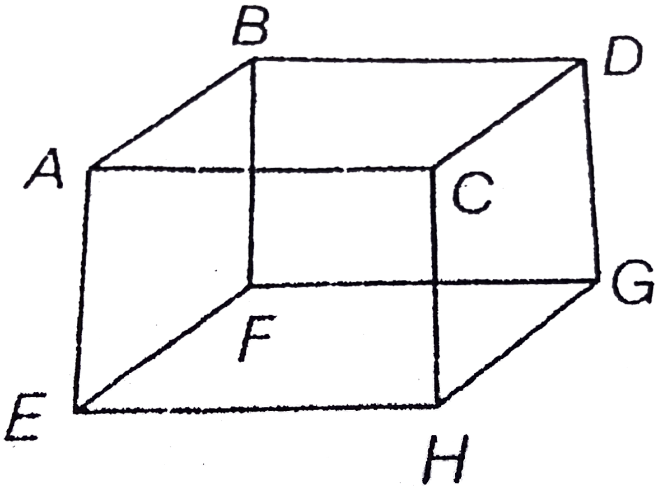
2. Mole of an ideal gas is contained in a cubical volume V, ABCDEFGH at 300 K (figure). One face of the cube (EFGH) is made up of a material which totally absorbs any gas molecule incident on it .At any given time.



A. the pressure on EFGH would be zero

B. the pressure on all the faces will the equal

C. the pressure of EFGH would be double the pressrue on ABCD

D. the pressure on EFGH would be halt that on ABCD

Answer:

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3. Boyles's Law is applicable for an

A. adiabatic process

B. isothermal process

C. isobaric process

D. isochoric process

Answer:

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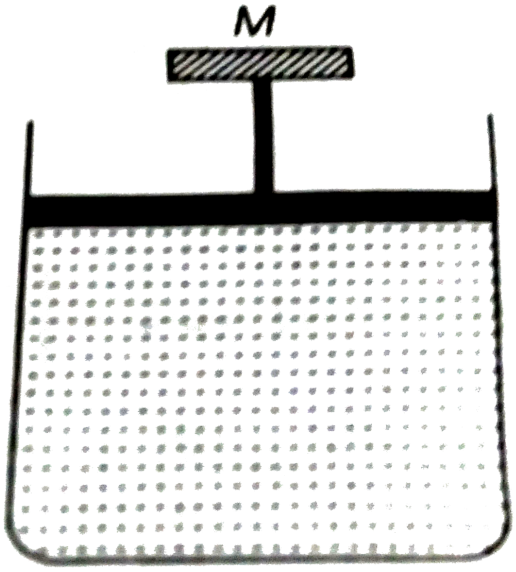
4. A cylinder containing an ideal gas is in vertical position and has a piston of mass M that is able to move up or down without friction (figure). If the temperature is increased



A. both p and v of the gas will change

B. only p will increase according to Charles' law

C. V will change but not p

D. p will change but not V

Answer:

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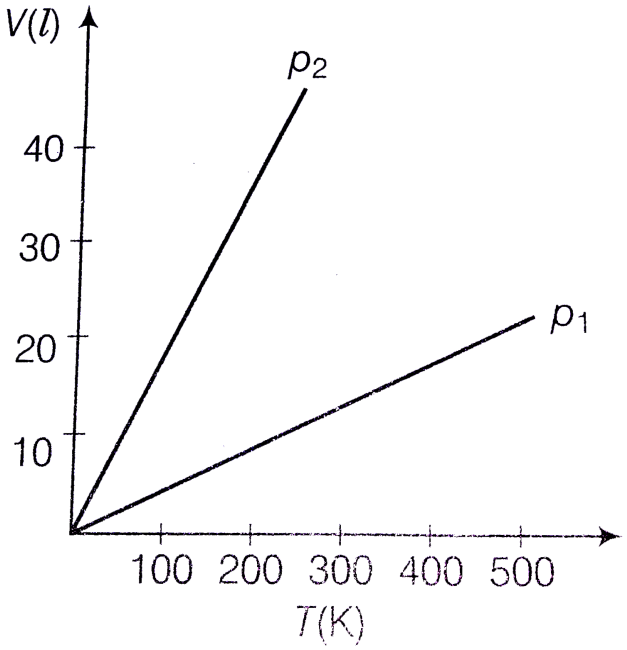
5. Volume versus temperature graphs for a given mass of an ideal gas are shown in figure. At two different values of constant pressure.

What can be inferred about relation between P_1 and P_2 ?



A. $P_1 > P_2$

B. $P_1 = P_2$

C. $P_1 < P_2$

D. Data is insufficient

Answer:

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6. 1 mole of H_2 gas in contained in a box of volume V 1.00 m^3 at T =300 K. The gas is heated to a temperature of T= 3000K and the gas gets converted to a gas of hydrogen atoms. The final pressure would be (considering all gases to be ideal)

A. same as the pressure initially

B. 2 times the pressure initially

C. 10 times the pressure initially

D. 20 times the pressure initially

Answer:

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7. A vessel of volume V contains a mixture of 1 mole of hydrogen and 1 mole oxygen (both considered as ideal). Let $f_1(v)dv,$ denote the

fraction of molecules with speed between v and (v+ dv) with $f_2(v)dv$, similarly for oxygen . Then ,

A. $f_1(v) + f_2(v) = f(v)$obeys the Maxwell's distribution law

B. $f_1(v)$, $f_2(v)$ will obey the Maxwell's distribution law separately

C. neither $f_1(v)$, nor $f_2(v)$ will obey the Maxwell's distribution law

D. $f_2(v)$ and $f_1(v)$ will be the same

Answer:

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8. An inflated rubber ballon contains one mole of an ideal gas , has a pressure P, volume V and temperature T. If the temperature rises to 1.1 T, and the volume isincreased to 1.05 V, the final pressure will be

A. 1.1 p

B. p

C. Less than p

D. between p and 1.1

Answer:

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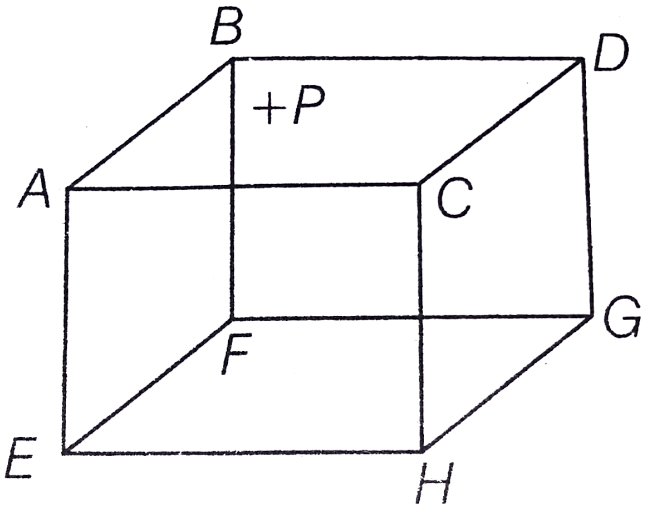
9. ABCDEFGH is a hollow cube made of an insulator (figure) face ABCD has positive charge on it. Inside the cube, we have ionised

hydrogen.



A. will be valid

B. will not be valid, since the ions would experience forece other than due to collisions with the walls.

C. will not be valid since collisions with would not be elastic

D. will not be valid because isotropy is lost

Answer:

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10. Diatomic molecules like hydrogen have energies due to both translations as well as rotational motion. From the equation in kinetic theory $pV = \frac{2}{3}E$, E is

A. The total energy per unit volume

B. only the translational part of energy because rotational energy is very small compared to the translational energy.

C. only the translational part of the energy because during collisions with the wall pressure relates to change in linear momentum

D. the translational part of the energy because rotational energies of

molecules can be of either sign and its average over all the molecules is zero

Answer:

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11. In a diatiomic molecule, the rotational energy at a given temperature

A. obeys Maxwell's distribution

B. have the same value for all molecules

C. equals the translational kinetic energy for each molecule

D. is $(2/3)$ rd the translational kinetic energy for each molecule

Answer:

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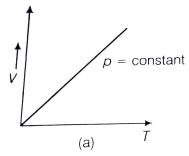
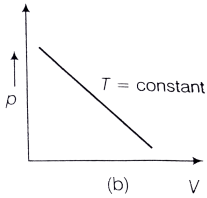
12. Which of the following diagrams (figure) depicts ideal gas behaviour?

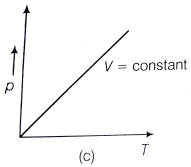
A.



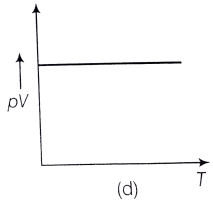
B.



C.



D.



Answer:

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13. When an ideal gas is compressed adiabatically , its temperature rises the molecules on the average have more energy than before. The kinetic energy increases,

A. because of collisions with moving parts of the wall only

B. because of collisions with the entire wall

C. because the molecules gets accelerated in their motion inside the volume

D. because the redistribution of energy amongest the molecules

Answer:

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14. Caculate the number of atoms in 39.4 g gold. Molar mass of gold is 197g$mo \leq^{-1}$.

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15. The volume of a given mass of a gas at $27^{\circ} C$, 1 atm is 100cc. What will be its volume at $327^{\circ} C$?

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16. The molecules of a given mass of a gas have root mean square speeds of $100 ms^{-1}$ at $27^{\circ} C$ and 1.00 atmospheric pressure. What will be the root mean square

speeds of the molecules of the gas at $127^{\circ}C$ and 2.0 atmospheric pressure?

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17. Two molecules of a gas have speeds of $9 \times 10^{6} ms^{-1}$ and $1 \times 10^{6} ms^{-1}$, respectively. What is the root mean square speed of these molecules.

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18. A gas mixture consists of 2.0 moles of oxygen and 4.0 moles of neon at temperature T. Neglecting all vibrational modes, calculate the total internal energy of the system . (0xygen has two rotational modes).

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19. Calculate the ratio of the mean free paths of the molecules of two gases having molecular diameters 1Å and 2Å. The gases

may be considered under indentical conditions of temperature pressure and volume.

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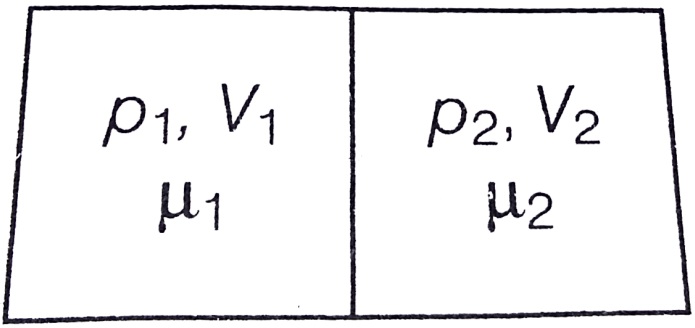
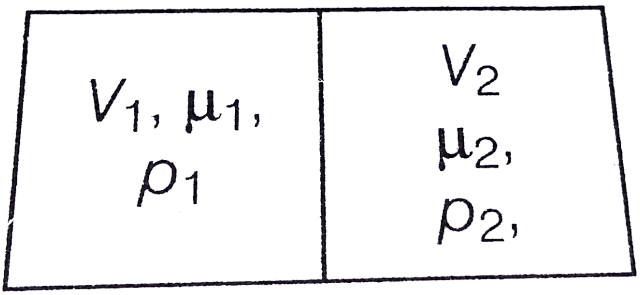
20. The container shown in figure has two chambers separated by a partition of volumes $V_1 = 2.0L$ and $V_2 = 3.0L$. The chambers contain $\mu_1 4.0$ and $\mu_2 = 5.0$ mole of a gas at pressure $p_1 = 1.00$ atm and $P_2 = 2.00$ atm. Calculate the pressure after the partition is

removed and the mixture attains equilibrium.





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21. A gas mixture consists of molecules of A,B and C with masses $m_A > m_B > m_C$. Rank the three types of molecules in decreasing order of (a) average KE (b) rms speeds.

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22. We have 0.5 g of hydrogen gas in a cubic chamber of size 3 cm kept at NTP. The gas in the chamber is compressed keeping the temperature constant till a final pressure of

100 atm. Is one justified in assuming the ideal gas law in the final state ? (Hydrogen molecules can be consider as spheres of radius 1Å).

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23. When air is pumped into a cycle tyre the volume and pressure of the air in the tyre both are increased. What about Bouyle's law in this case?

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24. A balloon has 5.0 mole of helium at $7^{\circ}C$. Calculate

(a) the number of atoms of helium in the balloon.

(b) the total internal energy of the system.

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25. Calculate the number of degrees of freedom of molecules of hydrogen in 1cc of hydrogen gas at NTP.

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26. An insulated container containing monoatomic gas of molar mass m is moving with a velocity V_0. If the container is suddenly stopped , find the change in temperature .

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27. Explain why

(a) there is no atmosphere on moon

(b) there is fall in temperature with altitude

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28. Consider an ideal gas with following distribution of spedds.

Speed (m/s)	**% of molecules**
200	10
400	20
600	40
800	20
1000	10

(a) Calculate V_{rms} and henceT. $\left(m = 3.0 \times 10^{-26} kg\right)$

(b) If all the molecules with speed $1000 m/s$

escape from the system, calculate new V_{rms} and hence T.

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29. Ten small planes are flying at a speed of $150 km/h$ in total darkness in an air space that is $20 \times 20 \times 1.5 km^3$ in volume. You are in one of the planes, flying at random within this space with no way of knowing where the other planes are, On the average about how long a time will elapse between near collision with

your plane. Assume for this rough computation that a safety region around the plane can be approximately by a sphere of radius 10 m.

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30. A box of $1.00m^3$ is filled with nitrogen at 1.50 atm at 300 k. The box has a hole of an area 0.010 mm^2. How much time is required for the pressure to reduce by 0.10 atm, if the pressure outside is 1 atm.

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31. Consider a rectangular block of wood moving with a velocity v_0 in a gas at temperature T and mass density p. Assume the velocity is along x-axis and the are of cross-section of the block perpendicular to v_0 is A. show that the drag force on the block is $4rAv_0\sqrt{\frac{kT}{m}}$ where,m is the mass of the gas molecule.

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