doubtnut
India's Number 1 Education App

PHYSICS

BOOKS - IE IRODOV PHYSICS (HINGLISH)

MOLECULAR PHYSICS AND THERMODYNAMICS

Others

1. Two balloons of the same volume are filled wi t.h gases at the same pressure, one with hydrogen and the other with helium. Which of the two has the greater buoyancy (including the weight of the bag) and what is the ratio of buoyancies?

Watch Video Solution

2. Because of the chaotic motion ofmolecules in a gas the free paths of molecules have

different values. If on the vertical axis we layoff the logarithm of the number of molecules whose free paths exceed a certain value x and on the horizontal axis the value of x, the graph representing the dependence of these two quantities is a straight line with a negative slope, $\log N = \log N_o - ax$. How can one find the free path of molecules using such a graph?

Watch Video Solution

3. The temperature of a gas in a vessel changes depending on whether the vessel is open or closed, and so does the diffusion coefficient. The temperature dependence of the diffusion coefficient D for both cases is shown in the figure on the log-log scale. Which line corresponds to the case of an open vessel and which to the case of a closed vessel? The effective cross sections of the molecules are assumed to be constant

Watch Video Solution

4. A vessel is divided by a solid partition into two parts of equal volume. One part is filled with nitrogen and the other with carbon monoxide. It may be assumed that the cross-sect.ional areas of the molecules of the two gases are the same. The relative molecular masses of hoth gases are also the same (equal to 28). Finally, the pressures in both parts are the same. After the partition is lifted, the gases begin to diffuse into each other. flow does the amount of each gas that has transferred to the part occupied by the other

gas depend on the initial pressures of the gases?

Watch Video Solution

5. A heat flux passes through a gas from a heated plate with a temperature T_1 to a cold plate with a temperature T_2 . The linear dimensions of the plates are large compared to the distance between them. Is the temperature gradient the same along the entire heat flux? Why when measuring the

thermal conductivity coefficient must we place the plates horizontally, with the plate with the higher temperature placed above the one with the lower temperature?

Watch Video Solution

6. Liquid nitrogen $(t = -196^{\circ}C)$ is inside a Dewar vessel. The air surrounding the vessel has a temperature $t = 20^{\circ}C$. The pressure of the residual gas between the walls of the vessel is about 10^{-1} Pa (roughly 10^{-6}rnm fig).

The mean free pa th of the "molecules" of air at atmospheric pressure is about $10^{-7}m$. What is the temperature of the air between the walls of the vessel?

Watch Video Solution

7. Steady-state heat transfer through a gas occurs between two parallel wal ls. The ex periment is conduct ed in such conditions that the only process by which the heat is transferred is pure thermal conduction. The

dependence of the thermal conductivity coefficient λ is measured as a function of the gas pressure p, with the experiment conducted twice, for two different distances between the walls. The results are shown in the figure. What curve corresponds to the greater distance between the walls?

Watch Video Solution

8. Figures $(a), (b)$ and (c) depict three cyclic processes in the $pV-$, $VT-$, and $pT-$

cooroinates. The ourvi linear sections in Figure (a) are isotherms. Depict the same processes in the pT- and VT-eoordinates (for process (a)), the $pV-$ and $pT-$ coordinates (for process (b)), and the $pV-$ and $VT-$ coordinates (for process (c)).

Watch Video Solution

9. A gas is inside a cylinder closed by a piston. The piston is held from above by a spring whose elastic properties obey Hooke's law.

Produce a rough sketch, in the $pV-$ coordinates, of the curve that represents the change in state of the gas upon heating and determine the work that is done in the process if the volume of the gas varies from v_1 to v_2 and the pressure varies from p_1 to p_2.

Watch Video Solution

10. The figure demonstrates the adiabatic curves for two gases, helium and carbon

dioxide. Which curve corresponds to which gas?

Watch Video Solution

11. A gas expands from an initial state characterized by a pressure p_1 and a volume v_1 in two ways, isotherrnically and adiabatically, to the same volume v_2 In which of the two processes is the final pressure higher and in which is the work greater?

Watch Video Solution

12. The amount of heat supplied to an ideal gas is laid off on the horizontal axis and the amount of work performed by the g-as is laid off on the vertical axis. One of the straight lines in the ligure is an isotherm and the other two are isobars of two gases. The initial states of hoth gases (pressure, temperature, volume) are the same, and the scales on the two axes coincide. Which straight line corresponds to which process? How many degrees of freedom does each gas have? (Vibrational degrees of

freedom are not to be taken into account.) The graphs of what processes coincide with the coordinate axes?

Watch Video Solution

13. When diatomic gases are heated, their heat capacity exhibits a peak in the high-temperature region. SilTIi lar behavior is observed in multi atornic gases. What. is the explanation for this?

Watch Video Solution

14. Draw the Carnot eyele in the ST-coordinates

Watch Video Solution

15. Suppose that the entropy grows linearly with temperature in a process. How does the heat capacity vary with temperature?

Watch Video Solution

16. A gas is transferred from a state 1 to a state 2 ill two ways: (a) directly hy an isobar, and (2) first by the isochor $1-3$, then by the isobar $3-4$, and, finally, by the isochor $4-2$. Show, by direct calculation, that the entropy increment in both cases is the same.

Watch Video Solution

17. A heat engine operates according to a cycle that consists of two isochors and two isobars. Prove that the entropy of the heater-gas-

cooler system increases as the engine operates. How does the entropy of the gas change in the process? The heat capacities of the heater and cooler are assumed to he i nfinite

Watch Video Solution

18. flow does the temperature of a liquid change under adiabatic evaporation?

Watch Video Solution

19. The bending of the surface of a liquid creates excess pressure (known as the Laplace pressure). Because of this the pressure inside a soap bubble is somewhat higher than the atmospheric pressure. In a drop, too, there is excess pressure. Suppose we have a drop of liquid and a soap bubble of the same liquid and the same diameter. Where is the pressure greater: inside the drop or inside the bubble?

 Watch Video Solution

20. Inside two conical pipes there is a drop of water (Figure (a)) and a drop of mercury (Figure (b)). Where does each drop lend to move? 2.53. Which of the curves shown ill the figure depicts correctly the temperature dependence of surface tension? Curve 1 falls off to zero at the boiling- point of the liquid, curve 2 falls off to zero at the critical temperature, curve 3 tends to zero asymptotically, and curve 4 shows that surface tension is temperature independent.

Watch Video Solution

21. A volume V of a viscous liquid flows per unit time due to a pressure head ΔP along a pipe of diameter d and length l. instead of this pipe a set of four pipes each of diameter $\frac{d}{2}$ and length 2l is connected to the same pressure head ΔP. Now the volume of liquid flowing per unit time is:

Watch Video Solution

22. The wall of a house consists of two layers with different thermal conductivity coefficients. The ternpera ture of the outer wall is T_1 and that of the inuer wall is T_2. Temperature variations inside the wall are shown in the figure. What layer, the inner or the outer, has a higher thermal conductivity coefficient?

Watch Video Solution