PHYSICS

BOOKS - JBD PUBLICATION

Behaviour of Perfect Gases and Kinetic Theory of Gases

Exercise

1. The number of drgrees of freedom of a molecule of a monotomic gas will be:

A. 1

B. 3

C. 3

D. 4

Answer:

2. A gas will approach ideal behaviour at

A. Low pressure and low temperature

B. Low pressure and high temprature

C. high pressure and high temperature

D. High pressure and low temperature

Answer:

Watch Video Solution

3. According to kinetic theory of gases, pressure exerted by ideal gas is equal to:

ρ - density, ν - Root mean square speed)`

A. $\frac{1}{3}\rho v^2$

B. $\frac{1}{2}\rho v^2$

C. ρv^2

D. $\frac{3}{2}\rho v^2$

Answer:

Watch Video Solution

4. The Sl unit of gas constant is:

A. Calorie/ $\hat{}\ \circ C$

B. Joule / mol

C. Joule / k-mol

D. Joule/kg

Answer:

 Watch Video Solution

5. What is meant by degrees of freedom? Find degrees of freedom for mono di and tri-atomic gas molecule.

A. 2

B. 3

C. 5

D. 6

Answer:

Watch Video Solution

6. Absolue temperature can be calculated by:

A. mean square velocity

B. motion of the molecules

C. both a and b

D. None of these

Answer:

Watch Video Solution

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

A. high pressure and high temperature

B. low pressure and low temprature

C. Low pressure and high temprature

D. High pressure and low temperature

Answer:

Watch Video Solution

8. Kinetic theory is primarily the contribution of:

A. Newton and Hydrogen

B. Rutherfood and Bohr

C. Bohr and Einstern

D. Claussis and Maxwell

Answer:

Watch Video Solution

9. If the mass of all molecules of a gas are halved and their speeds doubled then the ratio of initial and final pressure will be

A. $2:1$

B. $1:2$

C. $4:1$

D. $1:4$

Answer:

Watch Video Solution

10. RMS velocity of a particle is $v_{r.m.s.}$ at pressure P. If pressure is increased by two times, the r.m.s. velocity becomes:

A. $2v_{r.m.s}$

B. $3v_{r.m.s}$

C. $0.5v_{r.m.s}$

D. $v_{r.m.s}$

Answer:

Watch Video Solution

11. According to kinetic theory of gases, at absolute zero of temperature:

A. water freezes

B. liquid helium freezes

C. molecular motion stops

D. liquid hydrogen freezes

Answer:

Watch Video Solution

12. In equation PV= RT, V represents the volume of:

A. 1 mole of gas

B. one gram of gas

C. one gram moleule of gas

D. one litre of gas

Answer:

Watch Video Solution

13. The mean translation kinetic energy of a perfect gas molecule at temperature T is (k = Boltzmann constant)

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

B. KT

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

D. 2 KT

Answer:

Watch Video Solution

14. At 0k which of the following property of a gas will be zero?

A. kinetic energy

B. Potential energy

C. Vibrational energy Density

D. Density

Answer:

Watch Video Solution

15. The number of drgrees of freedom of a molecule of a monotomic gas will be:

A. 3

B. 5

C. 6

D. 1

Answer:

Watch Video Solution

16. At what temperature, the molecules of nitrogen will yhave the same rms velocity as the molecules of oxygen at $127^{\circ} C$?

A. $77^{\circ} C$

B. $350^{\circ} C$

C. $273^{\circ} C$

D. $457^{\circ} C$

Answer:

Watch Video Solution

17. If gas molecules undergo inelastic collision with the wall of the container:

A. the temperature of the gas will decrease

B. the pressure of the gas will increase

C. neither the temperature nor the pressure will change

D. the temperature of the gas will increase

Answer:

 Watch Video Solution

18. Two gases A and B having same preesure P, volume V and temperature T are mixed. If mixture has volume and temperature as V and T respectively . Then pressure of the mixture wil be:

A. 4P

B. 3P

C. 2P

D. P

Answer:

Watch Video Solution

19. What is the nature of graph between pressure P and volume V for a gas at constant temperature?

A. straight line

B. ellipse

C. parabola

D. hyperbola

Answer:

Watch Video Solution

20. If a gas contains molecules of two different masses m_1 and m_2 both at the same temperature, then $\left(\frac{v_1}{v_2}\right)_{r.m.s.}$ is:

A. $\frac{m_1}{m_2}$

B. $\frac{m_2}{m_1}$

C. $\sqrt{\frac{m_1}{m_2}}$

D. $\sqrt{\frac{m_2}{m_1}}$

Answer:

Watch Video Solution

21. 10,000 small balls, each weighting 1g, strikle one square cm of area per second with velocity 100m/s in a normal direction and rebound with the same velocity. The value of pressure on the surface will be:

A. $2 \times 10^3 Nm^{-2}$

B. $2 \times 10^5 Nm^{-2}$

C. $10^7 Nm^{-2}$

D. $2 \times 10^7 Nm^{-2}$

Answer:

Watch Video Solution

22. The total kinetic energy of all the molecules of helium having a volume V exerting a pressure P is 1500 J. The total kinetic energy in joules of all the molecules of N_2

having the same volume V and exerting pressue 2P is:

A. 3000

B. 4000

C. 5000

D. 6000

Answer:

Watch Video Solution

23. At a given volume and temperature, the pressure of a gas:

A. varies inversly as its mass

B. varies invesely as the square of its mass

C. varies invesely as its mass

D. is independent of it mass

Answer:

Watch Video Solution

24. The temperature at which real gases obey the ideal gas laws over a wide range of low pressure is called:

A. hight pressure and low temperature

B. Low pressure and high temprature

C. high pressure and high temperature

D. low pressure and low temperature

Answer:

 Watch Video Solution

25. Air in a cylinder is suddenly compressed by a piston, which is then maintained at the same position. With hpassage of time

A. the pressure increases

B. the pressure may incresase or decrease

C. the pressure decreases

D. the pressure remains the same

Answer:

Watch Video Solution

26. To double the translational kinetic energy of the molecules of a gas one has to:

A. double the absoluble temperature

B. reduce the absolute temperature to half

C. increase the absolute temperature fourfold

D. increase the absolute temperature by a factor of $\sqrt{2}$.

Answer:

Watch Video Solution

27. If a van der Waals' gas expands freely, then final temperature is :

A. less than the initial temperature

B. equal to the initial temperature

C. more than the initial temperature

D. less or more than the initial temperature

Answer:

Watch Video Solution

28. What is the velocity of wave in monoatomic gas having pressure 1 kilo-pascal and densitry $2.6k\frac{g}{m^3}$?

A. $3.6ms^{-1}$

B. $8.9 \times 10^3 ms^{-1}$

C. Zero

D. None of these

Answer:

Watch Video Solution

29. On any planet, the presence of atmsophere implies: [$c_{r.m.s}$ = root mean square velocity of molecules and v_e = escape velocity]

A. $c_{r.m.s.} < < v_e$

B. $c_{r.m.s.} > v_e$

C. $c_{r.m.s.} = v_e$

D. `c_(r.m.s.) = 0

Answer:

Watch Video Solution

Watch Video Solution

30. Absolue temperature can be calculated by:

A. mean square velocity

B. motion of the molecules

C. both a and b

D. None of these

Answer:

Watch Video Solution

31. The process by which gas is converted into liquid:

A. sublimation

B. evaporation

C. liquefaction

D. none of these

Answer:

Watch Video Solution

32. At the same temperature and pressure and volume of two gases which of the following quantities is constant?

A. total number of molecules

B. Average kinetic energy

C. root mean square velocity

D. mean free path

Answer:

 Watch Video Solution

33. At room temperature $(27^{\circ}C)$,the rms speed of a diatomic gas molecules is found to be $1930ms^{-1}$.The gas is :

A. H_2

B. O_2

C. I_2

D. CI_2

Answer:

Watch Video Solution

34. The mean translation kinetic energy of a perfect gas molecule at temperature T is (k = Boltzmann constant)

A. $\frac{1}{2}k_BT$

B. k_BT

C. $\frac{3}{2}k_BT$

D. $\frac{5}{2}k_BT$

Answer:

Watch Video Solution

35. At a given volume and temperature, the pressure of a gas:

A. varies inversly as its mass

B. varies invesely as the square of its mass

C. varies invesely as its mass

D. is independent of it mass

Answer:

 Watch Video Solution

36. Pressure of an ideal gas is increased by keeping temperature constant. What is the effect on kinetic energy of molecules?

A. Increase

B. Decrease

C. No change

D. Can't be determined

Answer:

 Watch Video Solution

37. The root mean square and most probable speed of the molecules in a gas are:

A. same

B. different

C. cannot say

D. depend upon nature of the gas

Answer:

 Watch Video Solution

38. The mean free path of a molecule of a gas (radius r)is inversely proportional to:

A. r^3

B. r^2

C. r

D. $\sqrt{r}$

Answer:

Watch Video Solution

39. In kinetic theory of gases, a molecule of mass m of an ideal gas collides with a wall of vessel with velocity 'v'. The change in the linear momentum of the molecule is:

A. 2mv

B. mv

C. $-mv$

D. zero

Answer:

Watch Video Solution

40. At constant volume, temperature is increased. Then :

A. collision on walls will be less:

B. number of collisions per unit time will increase

C. collisions will be in straight lines

D. collisions will not change .

Answer:

 Watch Video Solution

41. Two ballons are filled, one with pure He gas and the other by air respectively. If the pressure and temperature of these ballon are same, then the number of molecule sper unit volume is:

A. more in the filled ballon

B. same in both the ballons

C. more in air filled ballon

D. in the ratio 1:4

Answer:

Watch Video Solution

42. Fill in the blanks:

C_p of a gas is .....than its C_v.

Watch Video Solution

43. Fill in the blanks:

Collisions among the molecules of a gas are perfectly .....in nature.

Watch Video Solution

44. Fill in the blanks:

The size of a molecule is very.....as compared to the distance between them.

Watch Video Solution

45. Fill in the blanks:

All the molecules a gas are .....in energy respect.

Watch Video Solution

46. Fill in the blanks:

During adiabatic process, heat.....escape to the surroundings.

Watch Video Solution

47. Fill in the blanks:

During an isothermal process .....of the system remains constant.

Watch Video Solution

48. Fill in the blanks:

The r.m.s. speed of a molecule of a gas is .....its average speed.

Watch Video Solution

49. Fill in the blanks:

The pressure exerted by a perfect gas on the walls of its container.....mass of the gas inside.

Watch Video Solution

50. Fill in the blanks:

The average kinetic energy of a molecule of a gas is equal to .....

Watch Video Solution

51. Fill in the blanks:

The r.m.s. sped of a molecules of a gas is.....

Watch Video Solution

52. Fill in the blanks:

The ratio of r.m.s. speed of an hydrogen and an oxygen molecule at the same temperature is .....

Watch Video Solution

53. Fill in the blanks:

The value of gas constant is .....J/mol/K

Watch Video Solution

54. Fill in the blanks:

The value of Boltzmann's constant is 1.38×10^{-23}.....

Watch Video Solution

55. Fill in the blanks:

The r.m.s. speed of air molecules at STP is ablout .....ms^{-1}

Watch Video Solution

56. Fill in the blanks:

If we include the effect of gravity on the molecule of a perfect gas, the equation of the state will .....(remain same/ become different)

Watch Video Solution

57. Fill in the blanks:

Mean free path of molecules of a gas .....upon its density.

Watch Video Solution

58. Fill in the blanks:

Air molecules suffer about .....collisions in one second.

Watch Video Solution

59. Fill in the blanks:

The man free path of a molecule of a gas at S.T.P is .....its diameter.(much greater than/ much smaller than comparable to)

Watch Video Solution

60. What is the temperature, at which molecular motion ceases?

Watch Video Solution

61. Does the experimental voume versus temperature relation at constant pressure deviates from which is given by Charles, law, if so, under what condition?

Watch Video Solution

62. On what factors does the average kinetic energy of gas molecules depend : Nature of the gas, temperature, volume?

Watch Video Solution

63. What is the importance of a absolute scale of temperature?

Watch Video Solution

64. At 273 K, watr solidifies into ice. What happens to the kinetic energy of water molecules?

Watch Video Solution

65. A box contains equal number of molecules of hydrogen and oxygen. If there is a fine hole in the box then which gas will leak rapidly and why?

Watch Video Solution

66. Prove that kinetic energy of gas is proportional to absolute temperature.

Watch Video Solution

67. Name the various speeds which are used to characterise the motion of a molecule in a gas and write them in increasing order.

Watch Video Solution

68. A gas behaves like an ideal gas at :

Watch Video Solution

69. Given sample of 1 c.c. of hydrogen and $1cm^3$ of oxygen both at NTP. Which sample has larger number of molecules.

Watch Video Solution

70. Does Boye's law hold true for real gases even for high pressure and low temerature?

Watch Video Solution

71. Define critical temperature.

Watch Video Solution

72. Why don't we consider the changes in gravitational potential energy of molecues in the kinetic theory of gas?

Watch Video Solution

73. What is the difference between vapour and gas?

Watch Video Solution

74. A box contains equal number of molecules of hydrogen and oxygen. If there is a fine hole in the box then which gas will leak rapidly and why?

Watch Video Solution

75. What is an ideal gas ?

Watch Video Solution

76. Give the kinetic Interpretatin of Temperature.

Watch Video Solution

77. What is meant by degrees of freedom? Find degrees of freedom for mono di and tri-atomic gas molecule.

Watch Video Solution

78. A gas behaves like an ideal gas at :

Watch Video Solution

79. Define thermodynamical variables, equation of state

Watch Video Solution

80. At what temperature, the gas loses all its energy (i.e. molecular motion ceases).

 Watch Video Solution

81. Why a gas has two principal specific heat capacities?

 Watch Video Solution

82. Two different gases have exactly the same temperature. Does this mean that their molecules have the same r.m.s. speed?

Watch Video Solution

83. Why a gas has two principal specific heat capacities?

Watch Video Solution

84. How does the perfume of an agarbatti spread throughout the room even in still air?

Watch Video Solution

85. Given sample of 1 c.c. of hydrogen and $1cm^3$ of oxygen both at NTP. Which sample has larger number of molecules.

Watch Video Solution

86. Write short note on mean free path.

Watch Video Solution

87. According to the law of equipartition of energy, the energy associated with each degree of freedom is :

Watch Video Solution

88. State Avogadro's law

Watch Video Solution

89. What do you understand by Graham's law of diffusion?

Watch Video Solution

90. Write sshort note on root mean square velocity of gas molecules.

Watch Video Solution

91. Two perfect gases at absolute temperatures T_1 and T_2 are mixed. There is no loss of energy. Find the temperature of the mixture if the masses of the molecules are m_1 and m_2 and the number of the molecules in the gases are n_1 and n_2 respectively.

Watch Video Solution

92. A jar contains mixture of hydrogen and oxygen gases in the ratio 1: 5 . What is the

ratio of mean translational kinetic energy of hydrogen and oxygen molceule?

Watch Video Solution

93. Sugar cube added to a cup of tea dissolves quickly when stirred . Why?

Watch Video Solution

94. Give an example of seeing is believing in daily life.

Watch Video Solution

95. On driving the sccoter for a long time, the air pressure in the tyres slightly increases . Why?

Watch Video Solution

96. The volume of vessel A is thrice the volume of another vessel of another vessel B and both of them are filled with the same gas. If the gas

in vessel A is at thrice the temperature and thrice the pressure as compared to that of gas in vessel B. what is ratio of gas molecules in the two vessels?

Watch Video Solution

97. State whether the following statements are true or false gving reason in brief:

The r.m.s. speed of molecules of different ideal gases maintained at same temperature are same.

Watch Video Solution

98. State whether the following statements are true or false gving reason in brief:

The r.m.s. speed of oygen molecules (O_2) at a certain temperature TK is v. If the temperature is double and oxygen gas dissociates into atomic oxygen, the r.m.s. speed remains unchanged.

Watch Video Solution

99. A vessel is filled with an ideal gas at a pressure of 20 atm is at a temperature of $27^{\circ} C$. One half of the mass is removed from the vessel and the temperature of the remianing gas is increated to $87^{\circ} C$. What will be the pressure at this temperature?

Watch Video Solution

100. State Boyle's law.

Watch Video Solution

101. Estimate the fraction of molecular volume to the actual volume occupied by oxygen gas at STP. Take the diameter of an oxygen molecule to be $3\overset{\circ}{A}$.

Watch Video Solution

102. Molar volume is the volume occupied by 1 mol of any (ideal) gas at standard temperature and pressure (STP : 1 atmospheric pressure, $0^{\circ}C$). Show that it is 22.4 litres.

Watch Video Solution

103. An oxygen cylinder of volume 30 litres has an initial gauge pressure of 15 atm and a temperature of $27^{\circ}C$. After some oxygen is withdrawn from the cylinder, the gauge pressure drops to 11 atm and its temperature drops to $17^{\circ}C$. Estimate the mass of oxygen taken out of the cylinder ($R = 8.31 Jmol^{-1}K^{-1}$', $mo \leq \underline{ca}rmassof$ O_2` = 32 u)

Watch Video Solution

104. An air bubble of volume $1.0 cm^3$ rises from the bottom of a lake 40 m deep at a temperature of $12^\circ C$. To what volume does it grow when it reaches the surface, which is at a temperature of $35^\circ C$?

Watch Video Solution

105. Estimate the total number of air molecules (inclusive of oxygen, nitrogen, water

vapour and other constituents) in a room of capacity $25.0m^3$ at a temperature of $27^\circ C$ and 1 atm pressure.

Watch Video Solution

106. Estimate the average thermal energy of a helium atom at room temperature $(27^\circ C)$

Watch Video Solution

107. Estimate the average thermal energy of a helium atom at the temperature on the surface of the Sun (6000 K)

Watch Video Solution

108. Estimate the average thermal energy of a helium atom the temperature of 10 million kelvin (the typical core temperature in the case of a star)

Watch Video Solution

109. Three vessels of equal capacity have gases at the same temperature and pressure. The first vessel contains neon (monatomic), the second contains chlorine (diatomic), and the third contains uranium hexafluoride (polyatomic). Do the vessels contain equal number of respective molecules ? Is the root mean square speed of molecules the same in the three cases? If not, in which case is u_rms the largest ?

Watch Video Solution

110. Three vessels of equal capacity have gases at the same temperature and pressure. The first vessel contains neon (monatomic), the second contains chlorine (diatomic), and the third contains uranium hexafluoride (polyatomic). Do the vessels contain equal number of respective molecules ? Is the root mean square speed of molecules the same in the three cases? If not, in which case is u_rms the largest ?

Watch Video Solution

111. Two vessels of the same size are at the same temperature. One of them holds on kg of H_2 gas and another 1 kg of N_2 gas.

Which of the vessels contains more molecules?

Watch Video Solution

112. Two vessels of the same size are at the same temperature. One of them holds on kg of

H_2 gas and another 1 kg of N_2 gas.

Which of the vessels is under greater pressure and why?

Watch Video Solution

113. Two vessels of the same size are at the same temperature. One of them holds on kg of H_2 gas and another 1 kg of N_2 gas.

In which vessel is the average molecular speed greater? How many times greater?

Watch Video Solution

114. Two different gases have exactly the same temperature. Does this mean that their molecules have the same r.m.s. speed?

Watch Video Solution

115. What is an ideal gas ?

Watch Video Solution

116. The Sl unit of gas constant is:

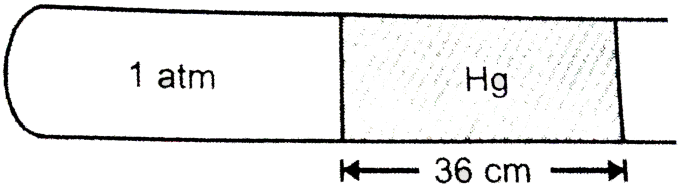
Watch Video Solution

117. STATEMENT-1 : The average translational kinetic energy per molecule of the gas per degree of freedom is 1/2 KT.

STATEMENT-2 : For every molecule there are three rotational degree of freedom.

Watch Video Solution

118. Air is trapped in a horizontal glass tube by 36 cm mercury column as shown below :



If the tube is held vertical keeping the open end up, lengh of air column shrink to 19 cm. What is the lengh (in cm) by which the mercury column shifts down?

Watch Video Solution

119. What is the average kinetic energy. Of the molecule of any gas at $100^{\circ} C$?

Watch Video Solution

120. Calculate the most probable speed of a molecule of hydrogen at N.T.P. The Boltzmann constant is 1.38×10^{-23} J per degree and Avogadro's number is 6×10^{26} per kg mole.

Watch Video Solution

121. The speed of 8 particles are 1, 1, 1.5, 1, 2, 2, 1, 3 cm s^{-1}. Calculate

average speed

Watch Video Solution

122. The speed of 8 particles are 1, 1, 1.5, 1, 2, 2, 1, 3 cm s^{-1}. Calculate

root mean square speed

Watch Video Solution

123. The speed of 8 particles are 1, 1, 1.5, 1, 2, 2, 1, 3 cm s^{-1}. Calculate

the most probable speed of these particles.

Watch Video Solution

124. Derive ideal gas equation.

Watch Video Solution

125. The volume of a gas sample is increased. Why does the pressure which is exerted by the

gas decreases?

Watch Video Solution

126. In the light of kinetic theory of gases, why pressure of container increases when the gas is heated?

Watch Video Solution

127. Explain the phenomenon of evaporation on the basis of kinetic theory of gases.

Watch Video Solution

128. Why there is practically no atmosphere near the surface of the moon?

Watch Video Solution

129. In the light of kinetic theory of gases, why pressure of container increases when the gas is heated?

Watch Video Solution

130. Explain with the help of kinetic theory, why pressure of a gas in its container walls rise when volume is reduced?

Watch Video Solution

131. In the derivation of perfect gas equation, the effect of gravity has not been taken into account. Justify it by giving an example.

Watch Video Solution

132. Do diatomic gases have same specific heat at constant volume as monoatomic gases? Explain.

Watch Video Solution

133. A vessel contains two non-reactive gases, neon (monatomic) and oxygen (diatomic). The ratio of their partial pressures is 3.2. Estimate the ration of (i) number of molecules and (ii) mass density of neon and oxyge in the vessel.

Atomic mass of Ne- 20.2 u, molecular mass of O_2 = 32.0 u.

Watch Video Solution