



PHYSICS

BOOKS - MAXIMUM PUBLICATION

KINETIC THEORY

Exercise

1. Why theoretical value does not agree with experimental value?



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2. Derive the ideal gas equation.



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3. The value of γ for one mole of an ideal gas is nearly equal : (a) 2 J / mol K (b) 8.3 J / mol K (c) 4.2 J / mol K (d) 2 cal / mol K

A. $2 \text{ J mol}^{-1} \text{ K}^{-1}$

B. $8.3 \text{ J mol}^{-1} \text{ K}^{-1}$

C. $4.2 J mol^{-1} K^{-1}$

D. $2 cal mol^{-1} K^{-1}$

Answer: D



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4. Mean free path of a gas molecule is :

(a) Inversely proportional to number of molecules per unit volume (b) Inversely

proportional to diameter of the molecule

(c) Directly proportional to the square root of

the absolute temperature (d) Directly proportional to the molecular mass

A. Inversely proportional to number of molecules per unit volume

B. inversely proportional to diameter of the molecule

C. directly proportional to the square root of the absolute temperature

D. directly proportional to the molecular mass

Answer: A



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5. If for a gas $\frac{R}{C_v} = 0.67$, this gas is made up of molecules which are

A. monoatomic

B. diatomic

C. Polyatomic

D. mixture of diatomic and polyatomic molecules

Answer: A



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6. According to kinetic theory of gases, molecules of a gas behave like

A. Inelastic spheres

B. perfectly elastic rigid spheres

C. perfectly elastic non-rigid spheres

D. inelastic non-rigid spheres

Answer: B



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7. Which one of the following is not an assumption of kinetic theory of gases?

A. The volume occupied by the molecules of the gas is negligible

B. The force of attraction between the molecules is negligible

C. the collision between the molecules are elastic

D. All molecules have same speed..

Answer: D



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8. What is the shape of graph between volume and temperature, if pressure is kept constant?



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9. What is the shape of graph between pressure and $\frac{1}{V}$ for a perfect gas at constant temperature?



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10. Identify the minimum possible temperature at which all molecular motion ceases



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11. What is the formula for average translational kinetic energy of a gas molecule?



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12. It is found that real gases do not obey ideal gas equation perfectly under all conditions.

c) What are the conditions under which real gases approach ideal behaviour?



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13. Why the temperature rises when gas is suddenly compressed?



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14. Why evaporation causes cooling?



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15. When an automobile travels long distance air pressure in tyres increases slightly. Why?



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16. 1 mole of ideal gas is taken in vessel. State the following statements as true or false.

I) In gas equation R is constant.

II) All real gases obey gas equation at all temperature and pressures



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17. Air is filled in a vessel at $60^{\circ}C$. To what temperature should it be heated in order that $\frac{1}{3}$ rd of air may escape out of the vessel?



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18. Find the degrees of freedom of the following.
i) A body is confined to move in a straight line.
ii) A body moves in a plane.
iii) A body moves in a space.



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19. What happens to the value of ratio of specific heat capacity if we consider all rotational degrees of freedom of a 1 mole diatomic molecule?





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20. Molar volume is the volume occupied by 1 mol of any (ideal) gas at standard temperature and pressure. (STP : 1 atmospheric pressure, 0°C), Show that it is 22.4 litres



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21. 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°C and 1 atmospheric pressure.



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22. From a certain apparatus, the diffusion rate of hydrogen has an average value of $28.7\text{cm}^3\text{s}^{-1}$. The diffusion of another gas under the same conditions is measured to have an average rate of $7.2\text{cm}^3\text{s}^{-1}$. Identify the gas.



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23. Estimate the fraction of molecular volume to the actual volume occupied by oxygen gas at STP. Take the radius of an oxygen molecule to be 3\AA .



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24. Molar volume is the volume occupied by 1mol of any (ideal) gas at standard temperature and pressure.(STP : 1

atmospheric pressure, $0^{\circ}C$), Show that it is

22.4 litres



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25. 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 atmospheric pressure.



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26. From a certain apparatus, the diffusion rate of hydrogen has an average value of $28.7\text{cm}^3\text{s}^{-1}$. The diffusion of another gas under the same conditions is measured to have an average rate of $7.2\text{cm}^3\text{s}^{-1}$. Identify the gas.



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27. Two vessels of the same size are at the same temperature. One of them contains 1kg of hydrogen (molecular weight 2) and the

other contains 1kg of nitrogen (molecular weight 28).

Which of the vessels contains more molecules?



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28. Two vessels of the same size are at the same temperature. One of them contains 1kg of hydrogen (molecular weight 2) and the other contains 1kg of nitrogen (molecular weight 28).

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



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29. Two vessels of the same size are at the same temperature. One of them contains 1kg of hydrogen (molecular weight 2) and the other contains 1kg of nitrogen (molecular weight 28).

Which of the vessel is at higher pressure?

Why?



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30. At what temperature the r.m.s speed of hydrogen is double its value at STP.



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31. According to the kinetic theory of gases, the molecules of a gas are identical and in random motion. The collisions made by these molecules on the walls of container exert pressure on the walls.

For a gas $\gamma = \frac{3}{2}$ and R is the universal gas constant, find the value of C_p and C_v .



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32. At constant temperature, $P \propto \frac{1}{V}$. Explain it briefly on the basis of Kinetic theory of gases.



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33. Write any four postulates of the kinetic theory of gases.



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34. According to the kinetic theory of gases gas molecules are always in random motion. State the law of equipartition of energy.



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35. What do you mean by Mean free path? Give an equation for Mean free path.



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36. A gas is made up of hydrogen and oxygen molecules.

Which molecule moves faster?



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37. A gas is made up of hydrogen and oxygen molecules.

Find the ratio of the velocities of hydrogen and oxygen molecules.



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38. According to the kinetic theory of gases gas molecules are always in random motion. State the law of equipartition of energy.



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39. What do you mean by Mean free path? Give an equation for Mean free path.



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40. Write the ideal gas equation and mention the terms.



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41. Write any four postulates of the kinetic theory of gases.



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42. What are the conditions under which real gases approach ideal behaviour?



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43. According to the kinetic theory of gases gas molecules are always in random motion. State the law of equipartition of energy.



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44. What are the conditions under which real gases approach ideal behaviour?



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45. Write any four postulates of the kinetic theory of gases.



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46. What do you mean by Mean free path? Give an equation for Mean free path.



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47. Estimate the average thermal energy of helium atom at a temperature of $27^\circ C$.

[Boltzmann constant is $1.38 \times 10^{-23} \frac{J}{K}$].



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