PHYSICS

BOOKS - JEEVITH PUBLICATIONS PHYSICS (KANNADA ENGLISH)

KINETIC THEORY

One Mark Question And Answers

1. What does 'atom' in Greek mean?

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2. Name the ancient Indian scholar who introduced the concept of atom.

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3. Name the ancient Greek scholar who prppounded the atomic hypothesis.

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4. Who propounded the scientific 'atomic theory' (also called molecular theory)?

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5. Name the smallest chemical constituent of an element.

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6. State Avogadro's hypothesis.

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7. State Gay Lussac's law with relevance to the chemical reaction.

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8. Write the postulates of Daltons Atomic theory.

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9. Atoms of one element diifer form those of other elements. Say whether this statement is true of false.

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10. What is meant by a free path ?

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11. Give any one property of molecular force.

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12. Give any one condition at which a real gas behaves as an ideal gas.

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13. Relate Boltzmann costant and Universal gas constant.

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14. Write the SI unit fo Boltzmann's constant.

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15. Say whether two different gases have the same value of Boltzmann's constant or not.

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16. Represent graphically that real gases approach ideal gas behaviour at low pressures and high temperatures.

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17. Give any one condition at which a real gas behaves as an ideal gas.

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18. State Boyle's law.

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19. State Charles' law.

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20. Write ideal gas equation for one mole of gas.

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21. State Dalton's law of partial presuures.

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22. What is meant by a partial presuure?

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23. Write the formula to calculate the size of the molecule of gas.

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24. Give the expression for the radius of a molecule.

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25. Write the expression for the pressure exerted by a gas in terms of rms velocity.

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26. Give the expression for the average distance (interatomic) between atoms.

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27. State law of equipartition of energy.

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28. Give the expression for internal energy of a monotamic gas.

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29. How many degrees of freedom are there in there in the translatory motion of atoms?

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30. Why is the number of degrees of freedom for rotatory motion taken as two diatomic gases?

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31. The experimental values for specific heats of polyatomic gases are greater than the predicted values. Suggest one probable method to improve the results.

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32. Give the expression for the average difference between the successive collisions (also called mean free path).

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33. How does the mean free path depend on the number density of molecules?

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34. How does the mean free path depent on the diameter (size) of the molecules?

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35. Give the expression for root mean square velocity of the molecules.

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36. How does the internal energy of a system depent on pressure and volume?

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37. How does root means square velocity depend on the mass of the molecule?

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38. What is meant by translatory motion ?

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39. What is meant by rotatory motion ?

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40. What is meant by vibratory motion of a molecule?

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41. Express ratio of specific heats of a gas in terms of degrees of frredom?

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42. Define degrees of freedom of a molecule.

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Two Mark Question And Answers

1. Give the expression for the average kinetic energy of a molecule.

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2. Show that the specific heat capacity of water in terms of universal gas constant.

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3. Obtain the value of specific heat of water in terms of $Jkg^{-1}K^{-1}$.

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4. Give the expression for the vibrational energy of molecules?

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5. Show that specific heat capacity of a solid is equal to three times that of Gas constant (C = 3R)

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6. Draw PV indicator diagram for the ideal and real behaviours of a gas.

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7. Draw T-V curves for ideal and real gas behaviours.

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8. Write the expression for pressure exerted by an ideal gas on the walls of a container and explain the symbols

used.

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9. Express average K.E. per molecule of two gaseous mixtures?

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Three Mark Question And Answers

1. State the postulates of Kinetic theory of ideal gases.

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2. Distinguish between gas constant and universal gas constant.

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3. State and explain Dalton's low of partial pressures.

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Fivemark Question And Answers

1. Obtain an expression for the pressure of an ideal gas from the kinetic theory of an ideal gas.

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2. Show that the average K.E. per molecule does not depends on pressure, volume or nature of gas staring from the expression of pressure of an ideal gas.

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3. Briefly discuss the law of equipartition of energy.

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4. Write a note on mean free path.

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Numericals With Solutions

1. If atomic mass of Argon = 39.9 μ, molecular mass of chlorine = 70.9μ then find the ratio of r.m.s speed of argon atom and chlorine gas molecule.

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2. Give the expression for the radius of a molecule.

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3. If for a given volume and temperature, partial pressure of monatomic and diatomic gases maintain the ratio 3 : 2 then compare the number of moles of gases.

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4. If the ratio of partial pressures of two gases is 3 : 2 and atomic mass of monoatiomic gaw is 20.2 unit and molecular mass of diatomic gas is 32.0 unit, then compare their mass densities.

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5. Estimate the size of fluorine (liquid) molecule, given its atomic mass $19.01u$ and density $1.14 \times 10^3 kgm^{-3}$.

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6. Estimate the size of fluorine (liquid) molecule, given its atomic mass 19.01u and density $1.14 kgm^{-3}$.

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7. For a molecule of diameter 2.5 Å and number density of molecule 2.1×10^{25} molecule $/m^3$, calculate average distance (mean free path) covered by a molecule between two successive collisions.

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8. Calculate the rms speed of an ideal gas molecule of mass 2.99×10^{-25} kg at 300k.

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9. An oxygen cylinder of volume 30 litres has an intial gauge pressure of 15 atm and a temperature of $27^{\circ}C$. After some oxygen is withdraw 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 $\left(R = 8.31 \text{Jmole}^{-1}K^{-1}, \text{molecular mass of} O_2 = 32 \text{unit}\right)$.

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10. An air bubble of volume $1.0 \times 10^{-6} m^3$ rises from the bottom of a lake 40 m deep at a temperature $12^\circ C$. To what volume does it grow when it reaches the surface, which is at a temperature of $35^\circ C$?

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11. Estimate the total number of air molecules in a room capacity $25 m^3$ at a temperature of $27^\circ C$ and 1 atm pressure.

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12. Estimate the average thernal energy of a helium atom at (i) room temperature $27^{\circ}C$ (ii) the temperature on the surface of the sun (6000k) and (iii) the typical core temperature of the star (10 million kelvin).

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13. At what temperature is the root mean square speed of a an atom is an argon gas cylinder equal to the rms speed of helium gas at $-20^{\circ}C$? (atomic mass of Ar = 39.9 u and of He = 4.0u)

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14. Estimate the mean free path and collision frequency of a nitrogen molecule in a cylinder containing nitrogen at 2.0 atm and temperature $17^{\circ}C$. Take the radius of a nitrogen molecule to be roughly 1.0Å. Compare the collision time with the time molecule moves freely between two successive collision $(MofN_2 = 28)$

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

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16. The specific heat at constant volume of a certain metal is $420 Jkg^{-1}$. Write the chemical formula of its chloride, if contains 0.345 fraction of the metal (NCERT).

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17. A vessel contains two non - reactive gases : neon (atomic mass = 20.2u) and oxygen (atomic mass = 32,0u). The ratio of their partial pressures is 3 : 2 Estimate the ratio of (a) number of molecule and (b) mass density of neon and oxygen in the vessel.

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18. The ratio of specific heats of a gas is 1.41. If at NTP_1 the volume occupied by the gas is $0.0224m^3$, then calculate the molar specific heats at constant volume and pressure.

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19. Calculate the internal energy of a diatomic (rigid) gas molecule at $27^\circ C$. Estimate C_p and C_v.

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