CHEMISTRY

BOOKS - CENGAGE CHEMISTRY (ENGLISH)

STATES OF MATTER

Solved Example

1. What will be the volume occupied by 2 gm of hydrogen at 300 K and 4 atmospheric pressure if at 273 k and 1 atmospheric pressure the gas occupies 22.4 L.

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2. A manometer is connected to a gas containing bulb. The open arm reads $40.0 cm$ where as the arm connected to the bulb reads $15.0 cm$. If barometric pressure is $74.0 cmHg$, then what is the pressure of gas in bar?

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3. A balloon of 21 cm diameter is to be filled with hydrogen gas at S.T.P. from a cylinder containing hydrogen gas at 20 atm and 300 K. The capacity of the cylinder is 2.82 litres at S.T.P. How many balloons can be filled in ?

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4. At fixed temperature and $600 mm$ pressure, the density of a gas is $42.$ At the same temperature and $700 mm$ pressure, what is the density of the gas?

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5. $5g$ of He at $27^{\circ}C$ is subjected to a pressure change from $0.5atm$ to $2atm$. The initial volume of the gas is $10dm^{3}$. Calculate the change in volume of the gas.

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6. Among the plots of $PvsV$ given below, which one corresponds to Boyle's law?

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7. Draw a graph of $\log P$ and $\log(1/V)$ for a fixed amount of gas at constant temperature.

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8. What is the volume of a sample of oxygen at a pressure of 3.5bar if its volume at 1bar is $3.15L$ at the same temperature?

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9. A gas occupies a volume of $2.5L$ at $9 \times 10^5 Nm^{-2}$. Calculate the additional pressure required to decrease the volume of the gas to $1.5L$, Keeping temperature constant.

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10. A vessel of 120 mL capacity contains a certain amount of gas at $35^\circ C$ and 1.2 bar pressure. The gas is transferred to another vessel of volume 180 mL at $35^\circ C$. What would be its pressure?

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11. $103mL$ of carbon dioxide was collected at $27^{\circ}C$ and $763mm$ pressure. What will be its volume if the pressure is changed to $721mm$ at the same temperature?

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12. Pressure remaining constant, at what temperature the volume of a gas will be double of its volume at $0^{\circ}C$?

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13. A sample of gas has a volume of V_1 litre at temperature $t_1.^{\circ}C$. When the temperature of the gas is changed to $t_2.^{\circ}C$ at constant pressure, then the volume of the gas was found to increase by 10%. The percentage increase in temperature is

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14. What is the temperature at which rms velocity of a gas is half its value at $0^{\circ} c$, if the pressure is kept constant ?

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15. An open vessel at $27^{\circ} C$ is heated until three fifth of the air in it has been expelledI Assuming volume of vessel constant find the temperature to which the vessel has been heated

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16. A flask having a volume of $250.0 mL$ and containing air is heated to $100^{\circ} C$, immered in water, and opened. What volume of water will be drawn back into the flask, assuming the pressure remaining constant?

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17. 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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18. In terms of Charles' law explain why $-273^\circ C$ is the lowest possible temperature?

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19. A sample of helium has a volume of $500cm^3$ at 373 K. Calculate the temperature at which the volume will become $260cm^3$. Assume that the pressure is constant.

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20. It is desired to reduce the volume of 1000 cm of a gas by 25%. To what temperature the gas be cooled if the initial temperature is $125^{\circ}C$ and the pressure remains constant ?

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21. An LPG cylinder can withstand a pressure of 14.9 atmosphere. The pressure gauge of the cylinder indicates 12 atmosphere at $27^{\circ}C$. Because of a sudden fire in the building , the temperature rises. At what temperature will the cylinder explode ?

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22. Two glass bulbs of equal volume are connected by a narrow tube and are filled with a gas at $0^{\circ}C$ at a pressure of $76cm$ of mercury. One of the bulbs is then placed in melting ice and the other is placed in a water bath maintained at $62^{\circ}C$.What is the new value of the pressure inside the bulbs? The volume of the connecting tube is negligible.

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23. An iron cylinder contains helium at a pressure of 250 k Pa at 300 K. The cylinder can withstand a pressure of 1×10^6 Pa. The room in which cylinder is placed catches fire. Predict the temperature (in K) at which the cylinder will blow up before it melts or not (m.p.t. of the cylinder =1800K)..

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24. A 0.50 L container is ocupied by nitrogen at a pressure of 800 torr and a temperature of $0^\circ C$. The container can only withstand a pressure of 3.0 atm. What is the highest temperature $(^\circ C)$ to which the container may be heated?

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25. A balloon blown up has a volume of 500 mL at $5^\circ C$. The balloon is distended to 7/8th of its maximum capacity.

Will it burst at $30^\circ C$?

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26. 20 mL of hydrogen gas at $15^\circ C$ is heated to $35^\circ C$ at constant pressure . Find the new volume of hydrogen.

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27. At what centigrade temperature will the volume of a gas at $0^\circ C$ triple itself if the pressure remains constant.

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28. A $10.0L$ container is filled with a gas to a pressure of $2.00atm$ at $0^\circ C$. At what temperature will the pressure inside the container be $2.50atm$?

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29. Which of the following is true about the same number of molecules in A and B?

A. Flask A contains eight times more molecules than flasks B.

B. Flask B contains eight times more molecules than flask A.

C. Both flasks contain an equal number if molecules.

D. Flasks A contains four times more molecules than flasks B.

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30. Which of the following is true about pressures in flasks A and B?

A. The pressure in flask A is four times that in flask B.

B. The pressure in flask B is four times that in flask A.

C. Both flasks have some pressure.

D. The pressure in flask A is eight times that in flask B.

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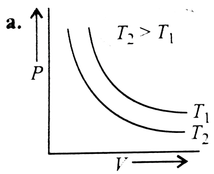
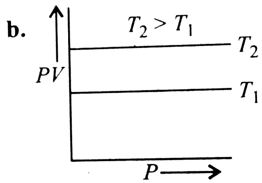
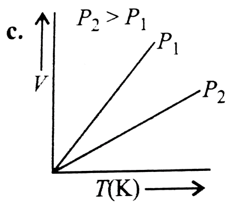
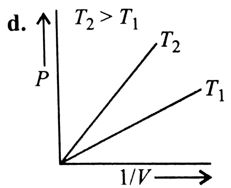
31. Which of the following graphs is consistent with ideal gas behaviour?

A. 

B. 

C. 

D. 

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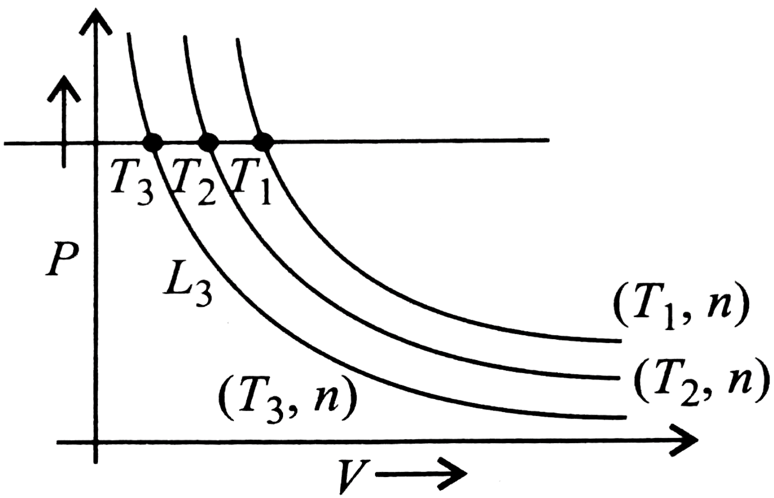
32. Boyle's Law for an ideal gas can be plotted as shown ($\rightarrow$) (n: moles, T: temperature)

Note: T and n are kept constant along line L_1, L_2, and L_3,

It follows from the above graph:



A. $T_1 > T_2 > T_3$

B. $T_1 < T_2 < T_3$

C. $T_1 = T_2 = T_3$

D. None of these

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33. A gas occupies a volume of 300 cm^3 at $27.^\circ C$ and 620 mm pressure . The volume of gas at $47.^\circ C$ and 640 mm pressure is

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34. 2g of hydrogen is sealed in a vessel of volume $0.02m^3$and is maintained at 300K. Calculate the pressure in the vessel.

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35. A sample of gas occupies a volume of $320cm^3$ at STP. Calculate its volume at $66^\circ C$ and $0.825atm$ pressure.

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36. Determine the value of gas constant R when pressure is expressed in Torr and volume in dm^3

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37. How many moles of oxygen are present in $400cm^3$ sample of the gas at a pressure of $760mmHg$ and a temperature of $27^\circ C$. (The value of R is given to be $8.31kPadm^3K^{-1}mol^{-1}$.

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38. A gas of molecular mass 71 g mol^{-1} is enclosed in a vessel at a temperature of $30^\circ C$. If the pressure exerted by the gas is 1065 mm of Hg, calculate the density of the gas.

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39. The drain cleaner Drainex contains small bits of aluminium which react with caustic soda to produce hydrogen What volume of hydrogen at $20^{\circ}C$ aand one bar will be released when $0.15g$ of aluminium reacts ? .

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40. The temperature at the foot of a mountain is $30^{\circ}C$ and pressure is $760mmHg$, whereas at the top of the mountain these are $0^{\circ}C$ and $710mmHg$. Compare the densities of air at the foot and top of the mountain.

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41. 2.9 g of a gas at $95^{\circ}C$ occupied the same volume as 0.184 g of dihydrogen at $17^{\circ}C$, at the same pressure. What is the molar mass of the gas?

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42. Density of a gas is found to be $5.46g/dm^3$ at $27.^\circ C$ and 2 bar pressure . What will be its density at STP ?

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43. The density of a gas is found to be $1.56gL^{-1}$ at $745mm$ pressure and $60^\circ C$. Calculate the molecular mass of the gas.

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44. At which of the following four conditions will the density of nitrogen be the largest?

A. STP

B. $273K$ and $2atm$

C. $546K$ and $1atm$

D. $546K$ and $2atm$

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45. When 2g of a gas A is introduced into an evacuated flask kept at $25^{\circ}C$, the pressure is found to be one atmosphere. If 3 g of another gas B are then added to the same flask, the total pressure becomes 1.5 atm. Assuming ideal gas behaviour, calculate the ratio of molecular weights $M_A : M_B$.

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46. Calculate the weight of methane in a 9.00 litres cylinder at 16 atm and $27^{\circ}C$.

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47. Calculate the volume occupied by $5.0g$ of acetylene gas at $50^{\circ} C$ and $740mm$ pressure.

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48. An open vessel at $27^{\circ} C$ is heated until three fifth of the air in it has been expelledI Assuming volume of vessel constant find the temperature to which the vessel has been heated

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49. What percent of a sample of nitrogen must be allowed to escape if its temperature, pressure, and volume are to be changed from $220^{\circ} C, 3atm$, and $1.65L$ to $110^{\circ} C, 0.7atm$, and $1L$, respectively?

A. 41.4%

B. 8.18%

C. 4.14%

D. 81.8%

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50. Isobutane (C_4H_{10}) undergoes combustion in oxygen according to the following reaction:

$2C_4H_{10}(g) + 13O_2(g) \rightarrow 8CO_2(g) + 10H_2O(e)$

When $10.00L$ of isobutane is burnt at $27^\circ C$ and 1^- pressure, calculate the volume of CO_2 produced at $120^\circ C$ and 4.0^- pressure.

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51. What mass of potassium chlorate must be decomposed to produce $2.40L$ of oxygen at 0.82bar and $300K$?

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52. Calculate the number of gaseous molecules left in a volume of $1mm^3$ if it is pumped out to give a vacuum of $10^{-6} mmHg$ at $298K$.

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53. What volume of air containing 21% of oxygen by volume is required to completely burn $1Kg$ of sulphur (S_8) which contains 4% incombustible material? Sulphur burns according to the reaction

$$\frac{1}{2}S_8 + O_2 \rightarrow SO_2$$

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54. A gas cylinder contains oxygen gas at $25^\circ C$ and 15.0 atm. If the temperature of the surroundings rises to $42^\circ C$, what would be the pressure of the gas in the cylinder ?

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55. A refrigeration tank holding $5.00L$ feron gas $(C_2Cl_2F_4)$ at $25^\circ C$ and $3.00atm$ pressure developed a leak. When the leak was discovered and repaired, the tank has lost $76.0g$ of the gas. What was the pressure of the gas remaining in the tank at $25^\circ C$?

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56. A quantity of hydrogen gas occupies a volume of $30.0mL$ at a certain temperature and pressure. What volume would half of this mass of hydrogen occupy at triple the initial temperature, if the pressure was one-ninth that of the original gas?

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57. A $10.0L$ cylinder of oxygen at $4.0atm$ pressure and $17^\circ C$ developed a leak. When the leak was repaired, $2.50atm$ of oxygen remained in the cylinder, still at $17^\circ C$. How many moles of gas escaped?

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58. A certain quantiy of gas occupies a volume of $0.8L$ collected over water at $300K$ and a pressure 0.92bar. The same gas occupies a volume of $0.08L$ at STP in dry conditions. Calculate the aqueous tension at $300K$.

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59. At sea level, the composition of dry air is approximately $N_2 = 75.5\%$, $O_2 = 23.2\%$, and $Ar = 1.3\%$ by mass. If the total pressure at sea level is 1bar, what is the partial pressure of each component?

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60. A $2L$ flask contains $1.6g$ of methane and $0.5g$ of hydrogen at $27^\circ C$. Calculate the partial pressure of each gas in the mixture and hence calculate the total pressure.

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61. $20g$ of hydrogen and $128g$ of oxygen are contained in a $20L$ flask at $200^\circ C$. Calculate the total pressure of the mixture. If a spark ignites the mixture, what will be the final pressure?

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62. A container of 1 L capacity contains a mixture of 4 g of O_2 and 2 g H_2 at $0.^\circ C$. What will be the total pressure of the mixture ? (a) 50 . 42 atm (b) 25 . 21 atm (C) 15 . 2 atm (d) 12 . 5 atm

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63. Equal molecules of N_2 and O_2 are kept in closed container at pressure P. If N_2 is removed from the system, then what will be the pressure of the container?

A. P

B. $2P$

C. $P/2$

D. P^2

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64. At room temperature Dalton's law of partial pressure is not applicable to :

A. Mixture of H_2 and N_2

B. Mixture of H_2 and Cl_2

C. Mixture of H_2 and CO_2

D. None

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65. Equal volumes of all gases under the same conditions of temperature and pressure contain equal number of

A. Atoms

B. Molecules

C. Radicals

D. Compound atoms

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66. $0.5 mol$ of H_2, SO_2, and CH_4 is kept in a container. A hole was made in the container. After $3 hours$, the order of partial pressure in the container will be

A. $P_{SO_2} > P_{CH_4} > P_{H_2}$

B. $P_{H_2} > P_{SO_2} > P_{CH_4}$

C. $P_{CH_4} > P_{SO_2} > P_{H_2}$

D. $P_{CH_4} > P_{H_2} > P_{SO_2}$

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67. Why dry air is heavier than moist air?

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68. A vessel of $4.00L$ capacity contains $4.00g$ of methane and $1.00g$ of hydrogen at $27^{\circ}C$. Calculate the partial pressure of each gas and also the total pressure in the container.

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69. Compare the rates of diffusion of $'^{235}UF_6$ and $'^{238}UF_6$

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70. The relative densities of oxygen and carbon dioxide are 16 and 22 ,respectively. If $25cm^3$ of carbon dioxide effuses out in $75s$, What volume of oxygen will effuse out in $96s$ under similar condition?

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71. A mixture of $50mL$ of H_2 and $50mL$ of O_2 is allowed to effuse through an effusiometer till the residual gas occupies $90mL$. What is the composition of (a) effused gas, (b) the residual gas?

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72. A straight glass tube has two inlets X and Y at the two ends. The length of the tube is 200 cm. HCl gas through inlet X and NH_3 gas through inlet Y are allowed to enter the tube at the same time. White fumes first appear at a point Pinside the tube. Find the distance of P from X.

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73. One mole of nitrogen gas at $0.8atm$ takes $38s$ to diffuse through a pinhole, while $1mol$ of an unknown fluoride of xenon at $1.6atm$ takes $57s$ to diffuse through the same hole. Calculate the molecular formation of the compound.

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74. A balloon filled with ethylene is pricked with a needle and quickly dropped in a tank of H_2 gas under identical conditions. After a while, the balloon will

A. Shrunk

B. Enlarge

C. Completely collapse

D. Remain unchanged in size

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75. A 4: 1 molar mixture of He and CH4 is contained in a vessel at 20 bar pressure. Due to a hole in the vessel, the gas mixture leaks out. What is the composition of the mixture effusing out initially?

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76. The volumes of ozone and chlorine diffusing in the same time are $35mL$ and $29mL$, respectively. If the molecular weight of chlorine is 71, calculate the molecular weight of ozone.

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77. At $20^{\circ}C$, two balloons of equal volume and porosity are filled to a pressure of $2atm$, one with $14kgN_2$ and the other with $1Kg$ of H_2.The N_2 balloon leaks to a pressure of $1/2atm$ in $1hour$. How long will it take for the H_2 balloon to reach a pressure of $1/2atm$?

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78. Two balloon are filled with equal moles of hydrogen and helium. Which balloon will contract first if holes of same size are made in them?

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79. A bottle of dry NH_3 and another bottle of dry HCl connected through a long tube are opened simultaneously at both ends of the tube. The white ring (NH_4Cl) first formed will be

A. At the centre of the tube

B. Near the HCl bottle

C. Near the ammonia bottle

D. Throughout the length of the tube

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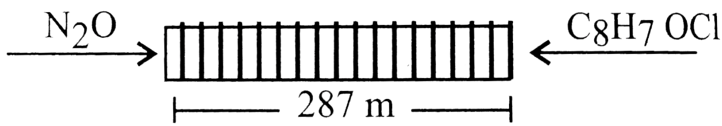
80. A cinema hall has equidistant rows $1m$ apart. The length of the cinema hall is $287m$ and it has 287 rows. From one side of the cinema hall, laughing gas (N_2O) is released and from the other side, weeping gas $(C_6H_5COCH_2Cl)$ is released. In which rows, spectors will be laughing and weeping simultaneously?



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81. Calculate the average kinetic energy in joules of the molecules in 8.0 g of methane at $27^\circ C$.

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82. For a gas containing 10^{23} molecules (each having mass $10^{-22}g$) in a volume of $1dm^3$, calculate the total kinetic energy of molecules if their root mean square speed is $10^5 cms^{-1}$. What will be its temperature?

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83. Calculate the pressure exerted by 10^{23} gas molecules each of mass $10^{-22}g$ in a container of volume 1 litre the rms speed is $10^5 cms^{-1}$

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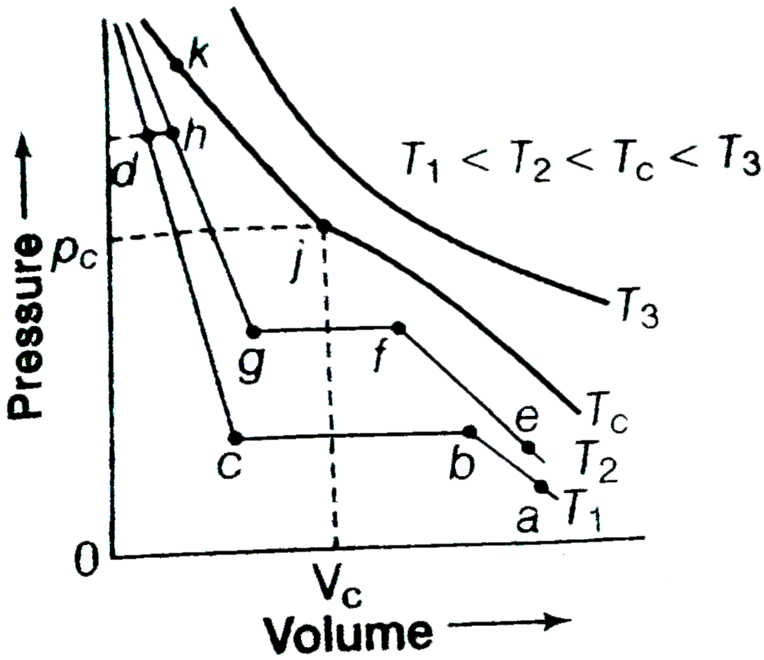
84. Isotherms of carbon dioxide at various temperatures are repersented in figure. Answer the following questions based on this figures.



(i) In which state will CO_2 exist between the points a and b at temperature T_1 ?

(ii) At what point will CO_2 start liquefyinh when temperature is T_1 ?

(iii) At what point will CO_2 be completely liquefued when temperature is T_2 ?

(iv) Will condensation take place when the temperature is T_3 ?

(v) What portion of the isotherm at T_1 represent liquid and gaseous CO_2 at equilibrium ?

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85. The energy of an ideal gas is

A. Completely Kinetic

B. Completely potential

C. $KE + PE$

D. All of the above

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86. Calculate the temperature at which the root mean square velocity, the average velocity, and the most proable velocity of oxygen gas are all equal to $1500 ms^{-1}$.

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87. Calculate the temperature at which the average velocity of oxygen equals that of hydrogen at $20K$.

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88. Which of the following gases will have the highest RMS velocity at $25^\circ C$?

A. O_2

B. CO_2

C. SO_2

D. CO

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89. Which of the following expressions correctly represents the relationship between the average molar kinetic energy, $\overline{KE}$ of CO and N_2 molecules at the same temperature?

A. $\overline{KE}_{CO} = \overline{KE}_{N_2}$

B. $\overline{KE}_{CO} > \overline{KE}_{N_2}$

C. $\overline{KE}_{CO} < \overline{KE}_{N_2}$

D. All of the above

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90. The ratio between the root mean square velocity of H_2 at 50 K and that of O_2 at 800 K is:

A. 4

B. 2

C. 1

D. $\frac{1}{4}$

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91. If for two gases of molecular weights M_A and M_B at temperature T_A and T_B, respectively, $T_A M_B = T_B M_A$, then which property has the same magnitude for both the gases?

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92. Arrange the following in order of increasing density:

(a) Oxygen at $25^\circ C, 1atm$, (b) Oxygen at $0^\circ C, 2atm$, (c) Oxygen at $273^\circ C, 1atm$

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93. How is the pressure of a gas in a mixture related to the total pressure of the mixture?

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94. What would have happened to the pressure of a gas if the collisions of its molecules had not been elastic?

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95. Two bulbs A and B of equal capacity are filled with He and SO_2, respectively, at the same temperature.

(a) If the pressures in the two bulbs are same, what will be the ratio of the velocities of the molecules of the two gases?

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96. Calculate the root mean square velocity of nitrogen at $27^{\circ} C$ and $70 cm$ pressure. The density of Hg is $13.6 g cm^{-3}$.

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97. Calculate the RMS velocity of chlorine molecules at $17^{\circ} C$ and $800 mm$ pressure.

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98. What is the value of b (van der Waals constant) if the diameter of a molecule is $2.0 A$

A. $\approx 2.4 m L mol^{-1}$

B. $\approx 4.8 m L mol^{-1}$

C. $\approx 7.2 m L mol^{-1}$

D. $\approx 9.6 m L mol^{-1}$

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99. Two flasks 'A' and B' have equal volumes. Flask 'A' contains H_2 and is maintained at 300 K while 'B' contains equal mass of CH_4 gas and is maintained at 600 K. Which flask contains greater number of molecules? How many times more?

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100. Two flasks A and B of equal volume are at temperature $100K$ and $200K$ containing H_2 and CH_4, respectively. Which of the following is true about KE per mole ($KE =$ Kinetic energy).

A. KE per mole of H_2 is twice that of CH_4

B. KE per mole of CH_4 is twice that of H_2

C. KE per mole of H_2 is equal to that of CH_4

D. KE per mole of CH_4 is thrice that of H_2

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101. Two flasks A and B of equal volume containing equal masses of H_2 & CH_4 gases are at $100K$ and $200K$ temperature, respectively. Which of the following is true about the total KE (Kinetic energy)?

A. Total KE of H_2 is four times that of CH_4.

B. Total KE of CH_4 is four times that of H_2.

C. Total KE of H_2 is two times that of CH_4.

D. Total KE of CH_4 is two times that of H_2.

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102. The kinetic energy of molecules at constant tempreature in gaseous state is

A. More than those in the liquid state

B. Less than those in the liquid state

C. Equal to those in the liquid state

D. None of these

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103. $1 mol$ of SO_2 occupies a volume of $350 mL$ at $300 K$ and $50 atm$ pressure. Calculate the compressibility factor of the gas.

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104. Calculate the pressure exerted by $8.5g$ of ammonia (NH_3) contained in a $0.5L$ vessel at $300K$. For ammonia, $a = 4.0atmL^2mol^{-2}$, $b = 0.036Lmol^{-1}$.

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105. $20mol$ of chlorine gas occupies a volume of $800mL$ at $300K$ and $5 \times 10^6 Pa$ pressure. Calculate the compressibility factor of the gas. $\left(R = 0.083L\text{bar}K^{-1}mol^{-1}\right)$. Comment, whether the gas is more compressible or less compressible under these conditions.

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106. Can we use Boyle's law to calculate the volume of a real gas from its initial state to final state during adiabatic expansion?

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107. The compressibility factor of gases is less than unity at STP. Therefore,

A. $V_m > 22.4L$

B. $V_m < 22.4L$

C. $V_m = 22.4L$

D. $V_m = 4.8L$

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108. The density of steam at $100^\circ C$ and $10^5 Pa$ pressure is $0.6Kgm^{-3}$. Calculate the compressibility factor of steam.

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109. The compressibility factor for N_2 at 223 K and 81.06 Mpa is 1.95 , and at 373 K and 20 . 265 Mpa , it is 1.10 . A certain mass of N_2 occupies a volume of 1.0 dm^3 at 223 K and 81.06 Mpa . What is the volume occupied by the same quantity of N_2 at 373 K and 20.265 MPa?

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110. Calculate the pressure exerted by $22g$ of CO_2 in $0.5dm^3$ at $300K$ using (a) the ideal gas law and (b) the van der Waals equation. Given $a = 300.0kPadm^6mol^{-2}$ and $b = 40.0cm^3mol^{-1}$.

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111. Two van der Waals gases have the same value of b but different values of a. Which of these will occupy greater volume under identical conditions. If the gases have the same value of a but different values of b, which of them will be more compressible?

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112. Calculate the molecular diameter of helium from its van der Waals constant b. $(b = 24 cm^3 mol^{-1})$

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113. The internal pressure loss of $1 mol$ of van der Waals gas over an ideal gas is equal to

A. Zero

B. b^2

C. $\frac{a}{V^2}$

D. $b - \frac{a}{RT}$

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114. The van der Waals equation for CH_4 at low pressure is

A. $PV = RT - Pb$

B. $PV = RT - \frac{a}{V}$

C. $PV = RT + \frac{a}{V}$

D. $PV = RT + Pb$

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115. Which of the following can be most readily liquefied? The given value of a for NH_3 is 4.17, CO_2 is 3.59, SO_2 is 6.71, and Cl_2 is 6.49.

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116. Out of NH_3 and N_2, which will have

(a) larger value of a

(b) larger value of b

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117. One way of writing the equation of state for real gases is

$$PV = RT\left[1 + \frac{B}{V} + \dots\right]$$

where B is a constant. Derive an approximate expression for B in terms of the van der Waals constants a and b.

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118. If volume occupied by CO_2 molecules is negligible, then what will be the pressure $\left(\frac{P}{5.277}\right)$ exerted by one mole of CO_2 gas at 300 K? $\left(a = 3.592 \text{atm L}^2 mol^{-2}\right)$

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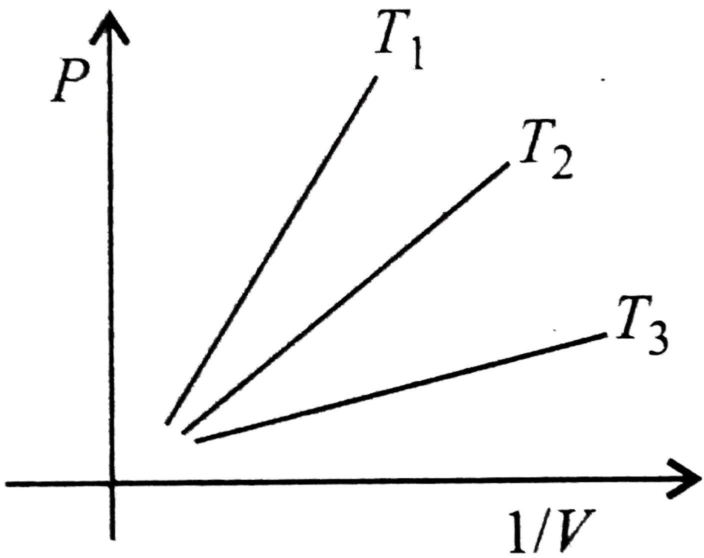
119. The curve drawn below shows the variations of P as a function of $1/V$ for a fixed mass and temperature of an ideal gas. It follows from the curve that:



A. $T_3 > T_2 > T_1$

B. $T_1 > T_2 > T_3$

C. $T_1 = T_2 = T_3$

D. Nothing can be predicted about temperatures

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120. The critical constants for water are $647K$, $22.09MPa$, and $0.0566dm^3mol^{-1}$. Calculate the values of a, b and R and explain the abnormal value of R.

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121. The critical temperature (T_c) and pressure (P_c) of NO are $177K$ and $6.48MPa$, respectively, and that of $\mathbb{C}l_4$ are $550K$ and $4.56MPa$, respectively. Which gas (a) has the smaller value for the van der Waals constant b, (b) has the smaller value for constant a, (c) has the larger critical volume, and (d) is most nearly ideal in behaviour at $300K$ and $1.013MPa$.

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122. Calculate the volume occupied by $2.0mol$ of N_2 at $200K$ and $10.1325MPa$ pressure if $\dfrac{P_cV_c}{RT_c} = \dfrac{3}{8}$ and $\dfrac{P_rV_r}{T_r} = 2.21$.

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123. The van der Waals constants for a substance are $a = 300.003 kPa dm^6 mol^{-2}$ and $b = 40.8 cm^3 mol^{-1}$. Find the critical constants of this substance.

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124. The temperature below which a gas does not obey ideal gas laws is

A. Critical temperature

B. Inversion temperature

C. Boyle temperature

D. Reduced temperature

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125. An ideal gas obeying the kinetic theory of gases can be liquefied if

A. Its temperature is more than its critical temperature (T_c)

B. Its pressure is more than its critical pressure (P_c)

C. Its pressure is more than P_c at a temperature less than T_c

D. It cannot be liquefied at any value of P and T

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126. Which of the following relation is incorrect?

A. $a = 3P_cV_c^2$

B. $b = V_c/3$

C. $T_c = 8a/27Rb$

D. $b = 3V_c$

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127. The critical temperature of a substance is

A. The temperature above which a substance can exist only as a gas

B. Boiling point of the substance

C. Temperature above which substance undergoes decomposition

D. All are wrong

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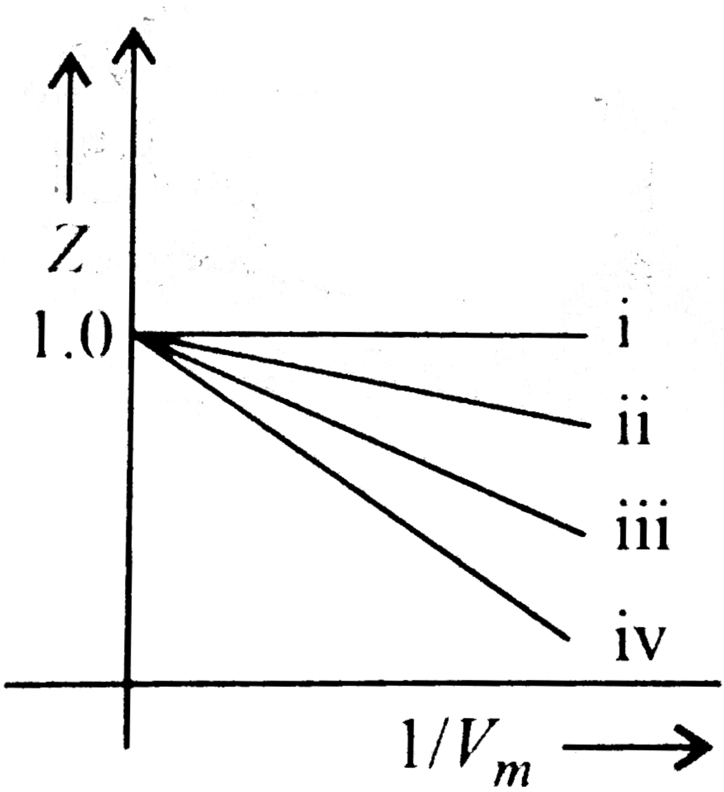
128. Considering the graph, which of the following gases have the highest critical temperature T_c?



A. i

B. ii

C. iii

D. iv

129. Calculate the values of σ, l (mean free path),Z_1 and Z_{11} for oxygen at $300K$ at a pressure of $1atm$. Given $b = 3.183 \times 10^{-2} dm^3 mol^{-1}$.

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130. Which of the following has the maximum value of mean free path?

A. H_2

B. N_2

C. O_2

D. Cl_2

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131. The average free path at $1atm$ pressure is L. What should be its value at $5atm$ pressure?

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132. If X is the total number of collisions that a gas molecule registers with other molecules per unit time under particular conditions, then what is the collision frequency of the gas containing N molecules per unit volume is ?

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133. Two flasks A and B have equal volumes. The molecules in flask A are moving two times faster than the molecules in flask B. The number of molecules in flask A is eight times the number of molecules in flask B. Which of the following is true about the number of collisions with the walls?

A. The number of collisions with the walls in flask A is four times that in flasks B.

B. The number of collisions with the walls in flask B ia four times that in flask A.

C. The number of collisions with the walls in flask A is $16 \times$ that in flask B.

D. The number of collisions with the walls in flask B is $16 \times$ that in flask A.

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134. Two flasks A and B have equal volume at $100K$ and $200K$ and have $4atm$ and $1atm$ pressures, respectively. The flasks A contains H_2 gas and B contains CH_4 gas. The collision diameter of CH_4 is twice that of H_2 .Which of the following is true about the mean free path (λ) of the molecules?

(a) λ of H_2 is twice that of CH_4.

(b) λ of CH_4 is twice that of H_2.

(c) λ of H_2 is four times that of CH_4.

(d) λ of CH_4 is four times that H_2.

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135. Two equal volume flasks cotaining equal masses of H_2 and CH_4 are at $100K$ and $200K$, respectively. The molecular diameter of CH_4 is twice that of H_2. Which of the following statement about Z_1 (number of collisions per molecule per cm^3 per second) is true? (a) Z_{11} of $H_2 = 2Z_1$ of CH_4

(b) Z_{11} of $H_2 = 4Z_1$ of CH_4

(c) Z_{11} of $H_2 = Z_1$ of CH_4

(d) Z_{11} of $H_2 = 8Z_1$ of CH_4

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136. Two equal-volume flasks A and B containing equal masses of H_2 and CH_4 are at $100K$ and $200K$, respectively. Assuming ideal behaviour, which of the following statements about the compressibility factor (Z) is true?

A. Z of $H_2 = Z$ of CH_4

B. Z of $H_2 = 4Z$ of CH_4

C. Z of $H_2 = 16Z$ of CH_4

D. Z of $H_2 = 2Z$ of CH_4

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137. The mean free path of the molecules of a certain gas at $300K$ is $2.6 \times 10^{-5}m$. The collision diameter of the molecule is $0.26m$. Calculate (a) the pressure of the gas and (b) the number per unit volume of the gas.

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138. By now much will the mean free path of a gas molecule in a vessel at constant T change if the pressure is reduced by 10% ?

A. 10% increase

B. 10% decrease

C. 11.1% increase

D. 11.1% decrease

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139. By how much will the mean free path of a gas molecule is a vessel at constant P change if the temperature is reduced by 20% ?

A. 12.5% decrease

B. 12.5% increase

C. 80% decrease

D. 80% increase

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140. If the pressure of a gas is doubled and the temperature is tripled, by how much will the mean free path of a gas molecule in a vessel change?

A. Increase 3 times

B. Decrease 3 times

C. Increase 1.5 times

D. Decrease 1.5 times

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141. If P is doubled and T is reduced to half at constant volume, what will be its effect on the mean free path (λ) of a gas molecule?

A. λ will decrease

B. λ will increase

C. no effect on λ

D. Cannot predict

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142. The number of collisions made by a single molecule with other molecules per cm^3 per second. Is Z_1. At constant temperature by how much will Z_1 change if the pressure is doubled in the vessel.

A. Increase 2 times

B. Decrease 2 times

C. Increase 0.5 times

D. Decrease 0.5 times

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143. The number of bimolecular collisions per cm^3 per second is Z_{11}. At constant temperature, by how much will Z_{11} change if the pressure is tripled in the vessel?

A. Increase 3 times

B. Decrease 3 times

C. Increase 9 times

D. Decrease 9 times

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144. If two gases have the same value of b but different values of a (a and b are van der Waals constants), which of the following statements is wrong?

A. The gas having a larger value of a will occupy less volume.

B. The gas having a larger value of a will occupy more volume.

C. The gas having a larger value of a will have higher forces of attraction.

D. The gas having a larger value of a will have lesser distance between the molecules.

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145. If two gases have the same value of b but different values of a (a and b are van der Waals constants), which of the following statements is wrong?

A. The gas having a smaller value of b has larger compressibility.

B. The gas having a smaller value of b will occupy lesser volume.

C. The gas having a smaller value of b has lesser compressibility.

D. Both (a) and (b).

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146. Which gas will liquefy easily (a and b are van der Waals constants)?

A. Larger values of a and b

B. Smaller value of a but larger value of b

C. Smaller values of a and b

D. Larger value of a but smaller value of b

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147. The rise is compressibility factor (Z) with increasing pressure of a gas is due to

A. van der Waals constant a

B. van der Waals constant b

C. Both (a) and (b)

D. Not related to either a or b

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148. At which of the following conditions can a gas be liquified? T_c and P_c are critical temperature and pressure.

A. $T = T_c$ and $P < P_c$

B. $T < T_c$ and $P = P_c$

C. $T > T_c$ and $P < P_c$

D. $T < T_c$ and $P < P_c$

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149. A monoatomic ideal gas undergoes a process in which the ratio of P to V at any istant is constant and equal to unity. The molar heat capacity of the gas is

A. $\frac{5R}{2}$

B. $\frac{3R}{2}$

C. $\frac{4R}{2}$

D. Zero

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150. Why liquids have a definite volume but no definite shape?

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151. At a particular temperature why is the vapour pressure of acetone less than that of ether?

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152. A liquid is transferred from a smaller vessel to a bigger vessel at the same temperature. What will be the effect on the vapour pressure?

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153. Why vegetables are cooked with difficulty at a hill station?

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154. What is the approximate relationship between the heat of vaporisation and the boiling point of a liquid?

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155. What is the effect of temperature on surface tension?

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156. Why are falling liquid drops spherical?

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157. Why liquids diffuse slowly as compared to gases?

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158. What is the binding force between molecules if a subsatance is a gas under ordinary conditions of temperature and pressure?

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159. $100mL$ of hydrogen was confined in a diffusion tube and exposed to air, and at equilibrium, a volume of $26.1mL$ of air was measured in the tube. Again, when $100mL$ of CO_2 was placed in the same tube and exposed to air, $123mL$ of air was measured in the tube at the equilibrium. Find the molecular weight of CO_2.

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160. A given volume of oxygen containing 20% by volume of ozone required $175s$ to effuse when an equal volume of oxygen took $167s$ only, under similar conditions. Find the density of ozone.

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161. A gas- filled freely collapsible balloon is pushed from the surface level of a lake to a depth of $100m$. Approximately what percentage of its original volume will the balloon finally have? Assume that the gas behaves ideally

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162. $1L$ of a gaseous mixture is effused in $5 \text{ min } 11s$, while $1L$ of oxygen takes 10 min . The gaseous mixture contains methane and hydrogen. Calculate

(a) The density of gaseous mixture.

(b) The percentage by volume of each gas in mixture.

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163. Two flasks A and B have equal volumes. Flask A containing H_2 gas is maintained at $27^\circ C$ while B containing an equal mass of C_2H_6 gas is maintained at $627^\circ C$. In which flask and by how many times are molecules moving faster, assuming ideal behaviour for both the gases?

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164. The compression factor (compressibility factor) for $1mol$ of a van der Waals gas at $0^{\circ} C$ and $100atm$ pressure is found to be 0.5. Assuming that the volume of a gas molecule is neligible, calculate the van der Waals constant a.

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165. Calculate the pressure exerted by one mole of CO_2 gas at $273K$ van der Waals constant $a = 3.592dm^6 atmmol^{-2}$. Assume that the volume occupied by CO_2 molecules is negligible.

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166. One mole of nitrogen gas at $0.8atm$ takes $38s$ to diffuse through a pinhole, while $1mol$ of an unknown fluoride of xenon at $1.6atm$ takes $57s$ to diffuse through the same hole. Calculate the molecular formation of the compound.

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167. An evacuated glass vessel weighs $50.0g$ when empty, $148.0g$ when filled with a liquid of density $0.98gmL^{-1}$, and $50.5g$ when filled with an ideal gas at $760mmHg$ at $300K$. Determine the molar mass of the gas.

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168. Using van der Waals' equation, find the constant 'a' (in atm L^2mol^{-2}) when two moles of a gas confined in 4 L flask exerts a pressure of 11.0 atmospheres at a temperature of 300 K. The value of b is 0.05 L mol^{-1} .(R = 0.082 atm.L/K mol)

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169. For the equation

$N_2O_5(g) = 2NO_2(g) + (1/2)O_2(g)$, calculate the mole fraction of $N_2O_5(g)$ decomposed at a constant volume and temperature, if the initial pressure is $600 mmHg$ and the pressure at any time is $960 mmHg$. Assume ideal gas behaviour.

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170. At a constant temperature, a gas occupies a volume of $200 mL$ at a pressure of 0.720bar. It is subjected to an external pressure of 0.900bar. What is the resulting volume of the gas?

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171. What is the increase in volume, when the temperature of $600 mL$ of air increases from $27^{\circ} C$ to $47^{\circ} C$ under constant pressure?

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172. Calculate the number of nitrogen molecules present in $2.8 g$ of nitrogen gas.

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173. If the density of a gas at the sea level at $0^{\circ} C$ is $1.29 kg m^{-3}$, what is its molar mass? (Assume that pressure is equal to 1bar.)

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174. A $2.5 L$ flask contains $0.25 mol$ each of sulphur dioxide and nitrogen gas at $27^{\circ} C$. Calculate the partial pressure exerted by each gas and also the total pressure.

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175. Which of the two gases, ammonia and hydrogen chloride, will diffuse faster and by what factor?

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176. What volume of air will be expelled from a vessel containing $400cm^3$ at $7^\circ C$ when it is heated to $27^\circ C$ at the same pressure?

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177. Calculate the root mean square, average, and most proable speeds of H_2 molecules. The density of the gas at $101.325kPa$ is $0.09gdm^{-3}(0.09kgm^{-3})$. Assume ideal behaviour.

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178. Calculate the pressure excerted by $5mol$ of CO_2 in $1L$ vessel at $47^\circ C$ using van der Waals equation.

$(a = 3.592atmL^2mol^{-2}, b = 0.0427Lmol^{-1})$

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179. The van der Waals constant b of Ar is $3.22 \times 10^{-5} m^3 mol^{-1}$.

Calculate the molecular diameter of Ar.

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180. Two gases in adjoining vessels were brought into correct by opening a stopcock between them. The one vessel measured $0.25L$ and contained NO gas at 800 torr and $220K$, the other measured $0.1L$ contained O_2 gas at 600 torr and $220K$. The reaction to form $N_2O_4(s)$ exhausts the limiting reagent completely,

(a) Neglacting the vapour pressure of N_2O, what is the pressure of the gas remaining at $220K$ after complection of the reaction?

(b) What weight of N_2O is formed?

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181. A mixture of H_2O vapour, CO_2 and N_2 was trapped in a glass apparatus with a volume of $0.731mL$. The pressure of the total mixture was $1.74 atm$ at $27^\circ C$. The sample was transferred to a bulb in contact with dry ice $(-75^\circ C)$ so that the H_2O vapour was frozen out. When the sample was returned to the measured volume, the pressure was $1.32 mmHg$. The sample was then transferred to a bulb in contact with liquid nitrogen $(-95^\circ C)$ to freeze out the CO_2. On the measured volume, the pressure was $0.53 mmHg$. How many moles of each constituent there are in the mixture?

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182. Find the temperatures at which methane and ethane will have the same rms speed as carbon dioxide at $400^\circ C$. Also calculate the mean velocity and most probable velocity of methane molecules at $400^\circ C$.

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183. A gas bulb of $1L$ capacity contains 2.0×10^{11} molecules of nitrogen exerting a pressure of $7.57 \times 10^3 Nm^{-2}$. Calculate the root mean square (rms) speed and the temperature of the gas molecules. If the ratio of the most probable speed to the root mean square is 0.82, calculate the most probable speed for these molecules at this temperature.

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184. A mixture of ethane (C_2H_6) and ethene (C_2H_4) occupies $40L$ at $1.00atm$ and at $400K$. The mixture reacts completely with $130g$ of O_2 to produce CO_2 and H_2O. Assuming ideal gas behaviour, calculate the mole fractions of C_2H_4 and C_2H_6 in the mixture.

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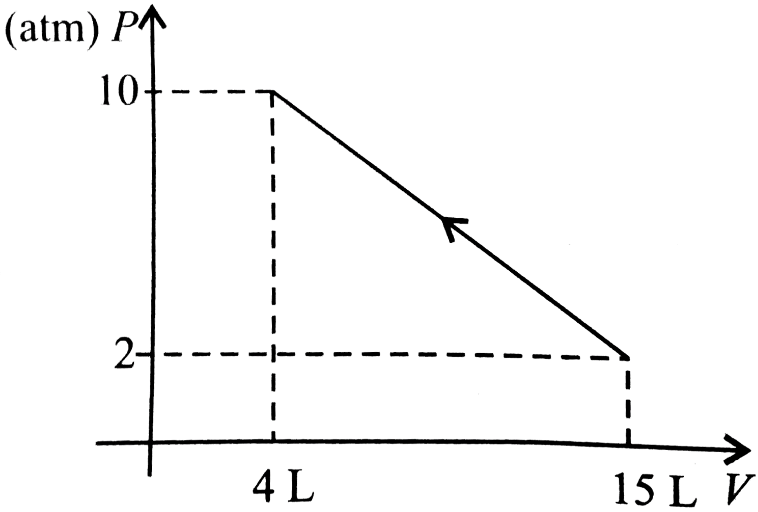
185. $1mol$ of a gas is changed from its initial state $(15L, 2atm)$ to final state $(4L, 10atm)$. If this change can be represented by a straight line in

$P - V$ curve, calculate the maximum temperature that, the gas attained.



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186. $1g$ of an alloy of Al and Mg reacts with excess HCl to form $AlCl_3$, $MgCl_2$, and H_2. The evolved H_2 collected over mercury at $0^\circ C$ occupied $1200mL$ at $699mmHg$. What is the composition of alloy?

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187. A gasesous mixture of helium and oxygen is found to have a density of $0.518 gdm^{-3}$ at $25^{\circ} C$ and 720 torr. What is the precent by mass of helium in this mixture?

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188. $1 mol$ of CCl_4 vapours at $77^{\circ} C$ occupies a volume of $35.0 L$. If van der Waals constants are $a = 20.39 L^2 atm mol^{-2}$ and $b = 0.1383 L mol^{-1}$, calculate compressibility factor Z under

(a) Low pressure region

(b) High pressure region

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189. At $20^{\circ} C$, two balloons of equal volume and porosity are filled to a pressure of $2 atm$, one with $14 kg N_2$ and the other with $1 Kg$ of H_2.The N_2 balloon leaks to a pressure of $1/2 atm$ in $1 hour$. How long will it take for the H_2 balloon to reach a pressure of $1/2 atm$?

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190. The density of the vapour of a substance at $1atm$ pressure and $500K$ is $0.36kgm^{-3}$. The vapour effuses through a small hole at a rate of 1.33 times faster than oxygen under the same condition.

(a) Determine (i) the molecular weight, (ii) the molar volume

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191. A $100dm^3$ flask contains $10mol$ each of N_2 and H_2 at $700K$. After equilibrium was reached, partial pressure of H_2 was $1atm$. At this point, $5L$ of $H_2O(l)$ was injected and gas mixture was cooled to $298K$. Find out the gas pressure.

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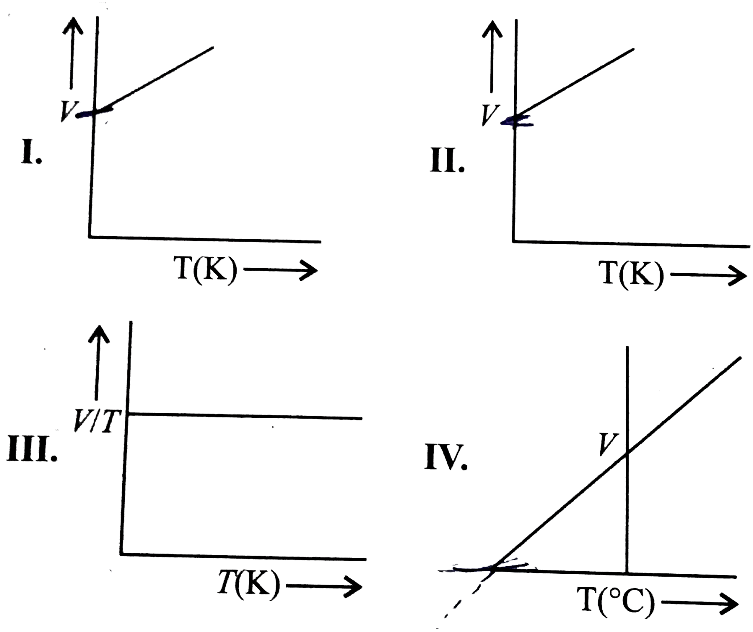
Illustration

1. For a fixed mass of gas and constant pressure, which of the following graphs is / are correct?



A. (1) I

B. (2) I, II, IV

C. (3) I, II, III

D. (4) II, III, IV

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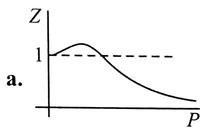
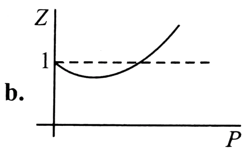
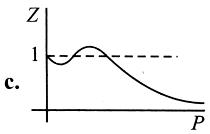
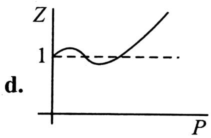
2. According to the real gas equation, Z is equal to 1 for an ideal gas and Z is variable for a real gas. Suppose, in order to easy our calculation, we fixed $Z = 1$ for real gas and for ideal gas Z will become variable, Z vs P for an ideal gas will be similar to:

A. 

B. 

C. 

D. 

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Exercises

1. $100mL$ of gas is collected at $750mm$ pressure. What volume will it occupy at $745mm$ pressure?

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2. $5L$ of nitrogen measured at $750mm$ have to be compressed into an iron cylinder of $1L$ capacity. If temperature is kept constant, calculate the pressure in atmospheres required to do so.

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3. The temperature of a given mass of air was changed from $15^\circ C$ to $-15^\circ C$. If the pressure remains unchanged and the initial volume was $100mL$, what should be the final volume?

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4. The density of a gas at $27^{\circ} C$ and $760 mm$ pressure is 24. Calculate the temperature at which it will be 18, the pressure remaining constant.

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5. Calculate kinetic energy of $4 g N_2$ at $-13^{\circ} C$.

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6. What volume will a sample of gas occupy at $87^{\circ} C$ and $720 mm$ pressure if its volume at $27^{\circ} C$ and $750 mm$ pressure is $250 mL$?

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7. $152 mL$ of a gas at STP was taken to $20^{\circ} C$ and $729 mm$ pressure. What was the change in volume of the gas?

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8. A certain mass of dry gas at $27^\circ C$ and $760mm$ pressure has density 28. What will be its density at $7^\circ C$ and $740mm$?

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9. It is desired to fill a cylinder of $1L$ capacity at $82atm$ and $27^\circ C$ with hydrogen. What will be the volume of hydrogen under standard conditions of temperature and pressure?

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10. Hydrogen gas obtained by electrolysis of $18g$ of water is heated to $127^\circ C$ at a pressure of $2atm$. Calculate the volume it would occupy.

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11. Calculate the volume in mL hydrogen peroxide labelled 10 volume required to liberate $600mL$ of oxygen at $27^{\circ}C$ and $760mm$.

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12. Exactly $100mL$ of oxygen is collected over water of $23^{\circ}C$ and $800mm$ pressure. Calculate the volume of dry oxygen at NTP. (Vapour pressure of water at $23^{\circ}C$ is $21mm$.)

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13. $250mL$ of nitrogen gas maintained at $720mm$ pressure and $380mL$ of oxygen gas maintained at $650mm$ pressure are put together in $1L$ flask. If temperature is kept constant, what will be the final pressure of the mixture?

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14. A mixture of gases in a cyliner at $760 mm$ pressure contains 65% nitrogen, 15% oxygen, and 20% carbon dioxide by volume. What is the partial pressure of each gas in mm?

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15. Calculate the total pressure in a mixture of $4g$ of oxygen and $2g$ of hydrogen confined in a total volume of $1L$ at $0^{\circ} C$.

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16. When 2g of a gas A is introduced into an evacuated flask kept at $25^{\circ} C$, the pressure is found to be one atmosphere. If 3 g of another gas B are then added to the same flask, the total pressure becomes 1.5 atm. Assuming ideal gas behaviour, calculate the ratio of molecular weights $M_A : M_B$.

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17. A certain quantity of gas occupies $50mL$ when collected over water at $15^{\circ}C$ and $750mm$ pressure. It occupies $45.95mL$ in the dry state at NTP. Find the partial pressure of water vapour at $15^{\circ}C$.

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18. The relative rates of diffusion of ozone as compared to chlorine is $6:5$. If the density of Cl_2 is 35.5, find out the density of ozone.

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19. $127mL$ of a certain gas diffuses in the same time as $100mL$ of chlorine under the same conditions. Calculate the molecular weight of the gas.

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20. 50 volumes of hydrogen take 20 min of diffuse out of a vessel. How long will 40 volumes of oxygen take to diffuse out from the same vessel under the same conditions?

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21. Calculate the molecular weight of a gas which diffuses four times as fast as another gas Y, which in turn diffuses twice as fast as another gas Z [All under identical conditions]. Molecules weight of Z is 128.

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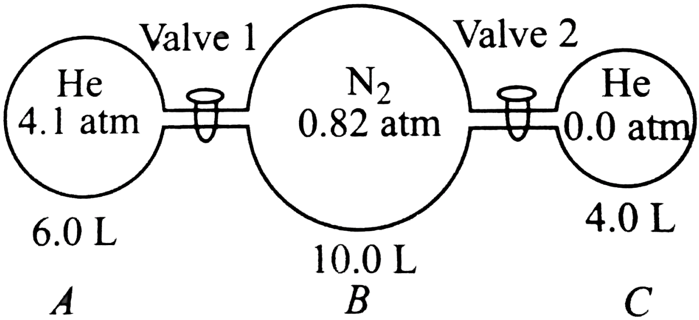
Exercises (Linked Comprehensive)

1. The figure given below shows three glass chambers that are connected by valves of negligible volume. At the outset of an experiment, the valves are closed and the chambers contain the gases as detailed in the diagram. All the chambers are at the temperature of $300 K$ and external pressure of $1.0 atm$.



What is the total pressure in chamber B after valve 1 is opened?

A. $8.2 L atm$

B. $-8.2 atm$

C. 0

D. $3.28 L atm$

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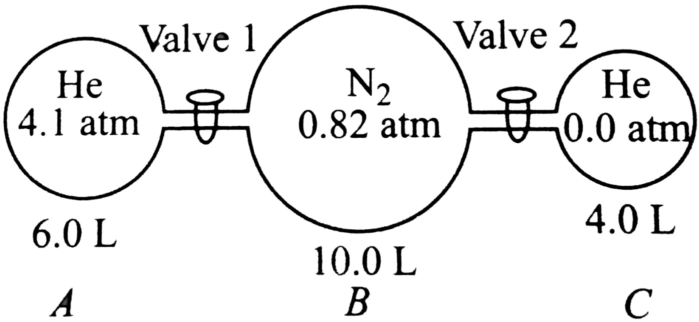
2. The figure given below shows three glass chambers that are connected by valves of negligible volume. At the outset of an experiment, the valves are closed and the chambers contain the gases as detailed in the diagram. All the chambers are at the temperature of $300K$ and external pressure of $1.0atm$.



Which of the following represents the total kinetic energy of all the gas molecules after both valves are opened?

$(R = 0.082atmLK^{-1}mol^{-1} = 8.314JK^{-1}mol^{-1})$

A. $2836.2J$

B. $3280.0J$

C. $4520.6J$

D. $4988.4J$

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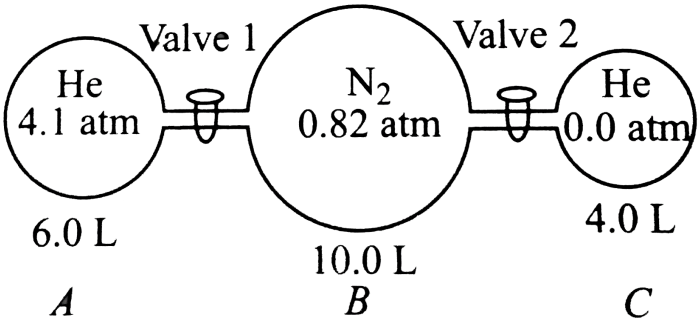
3. The figure given below shows three glass chambers that are connected by valves of negligible volume. At the outset of an experiment, the valves are closed and the chambers contain the gases as detailed in the diagram. All the chambers are at the temperature of $300K$ and external pressure of $1.0 atm$.



What is the total pressure in chamber B after valve 1 is opened?

A. $0.31 atm$

B. $2.05 atm$

C. $2.46 atm$

D. $3.10 atm$

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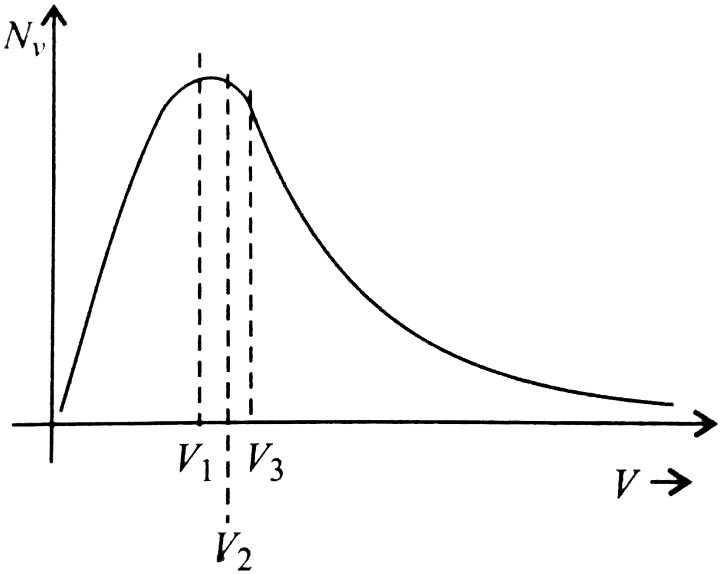
4. The distribution of the molecular velocities of gas molecules at any temperature T is shown below. (The plot below is known as Maxwell's distribution of molecular speeds.)



where

v is molecular velocity

n is number of molecules having velocity v

Let us define ΔN_v, which is equal to the number of molecules between the velocity range v and $v + \Delta v$, given by

$\Delta N_v = 4\pi N a^3 e^{-bv^2} v^2 \Delta v$

where

N is total number of molecules

$$a = \sqrt{\frac{M_0}{2\pi RT}} \text{ and } b = \frac{M_0}{2RT}$$

R is universal gas constant

T is temperature of the gas

M_0 is molecular weight of the gas

Answer the following question:

SI units of a are

A. M^3

B. $m^{-1}s$

C. $m^2 s^{-2}$

D. ms^2

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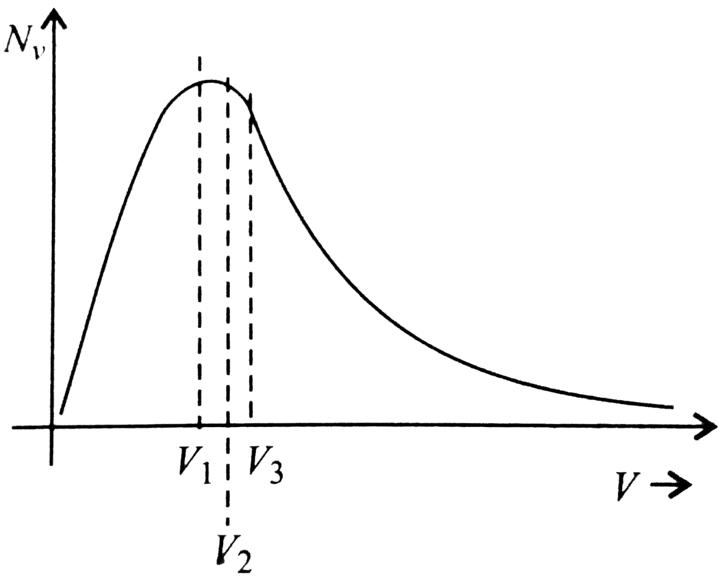
5. The distribution of the molecular velocities of gas molecules at any temperature T is shown below. (The plot below is known as Maxwell's distribution of molecular speeds.)



where

v is molecular velocity

n is number of molecules having velocity v

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$$\Delta N_v = 4\pi N a^3 e^{-bv^2} v^2 \Delta v$$

where

N is total number of molecules

$$a = \sqrt{\frac{M_0}{2\pi RT}} \text{ and } b = \frac{M_0}{2RT}$$

R is universal gas constant

T is temperature of the gas

M_0 is molecular weight of the gas

Answer the following question:

SI units of b are

A. $m^{-2}s^{-2}$

B. m^2s^2

C. m^2s^{-2}

D. ms^{-1}

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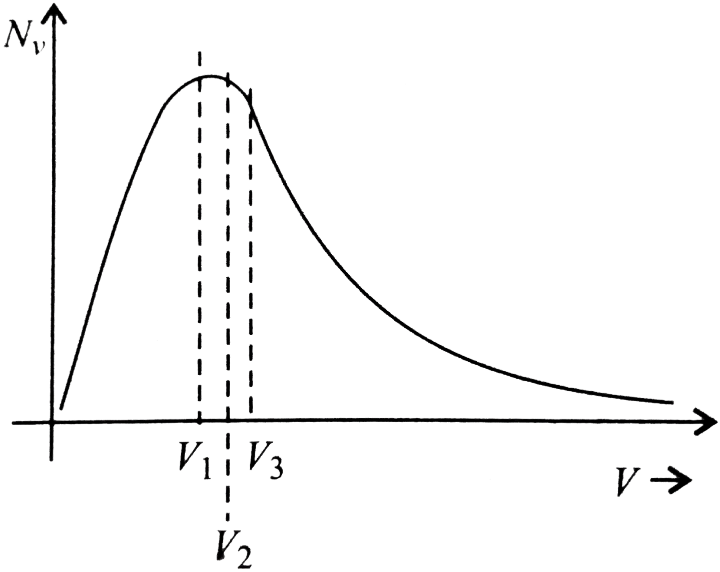
6. The distribution of the molecular velocities of gas molecules at any temperature T is shown below. (The plot below is known as Maxwell's distribution of molecular speeds.)



where

v is molecular velocity

n is number of molecules having velocity v

Let us define ΔN_v, which is equal to the number of molecules between the velocity range v and $v + \Delta v$, given by

$$\Delta N_v = 4\pi N a^3 e^{-bv^2} v^2 \Delta v$$

where

N is total number of molecules

$$a = \sqrt{\frac{M_0}{2\pi RT}} \text{ and } b = \frac{M_0}{2RT}$$

R is universal gas constant

T is temperature of the gas

M_0 is molecular weight of the gas

Answer the following question:

SI units of a are

A. P_r ia reduced pressure, P_c is critical pressure

B. T_r ia reduced temperature, T_c is critical temperature

C. V_r is reduced volume, V_c is critical volume

D. then the temperature of state (or van der Waals equation), only in terms of P_r, T_r, and V_r is

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7. Two flasks 'A' and B' have equal volumes. Flask 'A' contains H_2 and is maintained at 300 K while 'B' contains equal mass of CH_4 gas and is maintained at 600 K. Which flask contains greater number of molecules? How many times more?

A. A

B. B

C. Both A and B

D. None

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8. Two flasks A and B have equal volume. A is maintained at $300K$ and B at $600K$. While A contains H_2 gas, B has an equal mass of CH_4 gas. Assuming ideal behaviours for both the gases, answer the following:

Flask in which pressure is higher

A. A

B. B

C. Both A and B

D. None

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9. Two flasks A and B have equal volume. A is maintained at $300K$ and B at $600K$. While A contains H_2 gas, B has an equal mass of CH_4 gas. Assuming ideal behaviours for both the gases, answer the following:

Flask in which the compressibility factor is greater

A. A

B. B

C. Both A and B

D. None

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10. Two flasks A and B have equal volumes. A is maintained at 300 K and B at 600 K. A contains H_2 gas, B has an equal mass of CO_2 gas. Find the ratio of total K.E. of gases in flask A to that of B.

A. A

B. B

C. Both A and B

D. None

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11. Two flasks A and B have equal volume. A is maintained at $300K$ and B at $600K$. While A contains H_2 gas, B has an equal mass of CH_4 gas. Assuming ideal behaviours for both the gases, answer the following:

Flask with greater molar kinetic energy

A. A

B. B

C. Both A and B

D. None

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12. Two flasks A and B have equal volume$A$ is maintained at $300K$ and B at $600K$. While A contains H_2 gas, B has an equal mass of CH_4 gas. Assuming ideal behaviours for both the gases, answer the following:

Flask in which molecules are moving faster

A. A

B. B

C. Both A and B

D. None

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13. The van der Waals constant for gases A, B, and C are as follows

Answer the following:

Which gas has the highest critical temperature?

A. A

B. B

C. C

D. None

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14. The van der Waals constant for gases A, B, and C are as follows

Which gas has the largest molecular volume?

A. A

B. B

C. C

D. None

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15. The van der Waals constant (a, b) for gases A, B, and C are as follows : A(405.3,0.027), B(1215,0.03), C(607,0.032). Which gas has the most ideal behavior around STP?

A. A

B. B

C. C

D. None

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16. For the given ideal gas equation $PV = nRT$, answer the following questions:

In the above equation, the value of universal gas constant depends only upon

A. The nature of the gas

B. The pressure of the gas

C. The temperature of the gas

D. The units of measurement

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17. For the given ideal gas equation $PV = nRT$, answer the following questions:

At constant temperature, in a given mass of an ideal gas

A. The ratio of pressure and volume always remains constant

B. Volume always remains constant

C. Pressure always remain constant

D. The product of pressure and volume always remains constant

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18. For the given ideal gas equation $PV = nRT$, answer the following questions:

Which of the following does not represent ideal gas equation?

A. $PV = \frac{1}{3}mNv$

B. $PV = nRT$

C. $P = \rho\frac{RT}{M}$

D. $PV = RT$

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19. For the given ideal gas equation $PV = nRT$, answer the following questions:

An ideal gas will have maximum density when

A. $P = 1atm, T = 300K$

B. $P = 2atm, T = 150K$

C. $P = 0.5atm, T = 600K$

D. $P = 1.0atm, T = 500K$

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20. For the given ideal gas equation $PV = nRT$, answer the following questions:

which of the following is incorrect according to the ideal gas equation?

A. $V \propto T$

B. $P \propto \frac{1}{T}$

C. $P \propto V$

D. $V \propto n$

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21. Using van der Waals equation $\left(P + \frac{a}{V^2}\right)(V - b) = RT$, answer the following questions:

The van der Waals equation explains the behaviour of

A. Ideal gases

B. Real gases

C. Vapours

D. Non-real gases

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22. Using van der Waals equation $\left(P+\frac{a}{V^2}\right)(V-b)=RT$, answer the following questions:

The term that accounts for intermolecular forces in the van der Waals equation for non-ideal gas is

A. RT

B. $V-b$

C. $\left(P+\frac{a}{V^2}\right)$

D. RT^{-1}

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23. Using van der Waals equation $\left(P+\frac{a}{V^2}\right)(V-b)=RT$, answer the following questions:

The term that accounts for effective volume in the van der Waals equation for non-ideal gas is

A. RT

B. $V - b$

C. $\left(P + \frac{a}{V^2}\right)$

D. RT^{-1}

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24. Using van der Waals equation $\left(P + \frac{a}{V^2}\right)(V - b) = RT$, answer the following questions:

At high pressure, the van der Waals equation gets reduced to

A. $\left(P + \frac{a}{V^2}\right)V = RT$

B. $P(V - b) = RT$

C. $PV = RT$

D. $\left(P + \frac{a}{V^2}\right)(V - b) = RT$

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25. Compressibility factor $Z = \frac{PV}{RT}$. Considering ideal gas, real gas, and gases at critical state, answer the following questions:

The cpmpressibility factor of an ideal gas is

A. 0

B. 1

C. 2

D. 3

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26. Compressibility factor $Z = \frac{PV}{RT}$. Considering ideal gas, real gas, and gases at critical state, answer the following questions:

The cpmpressibility factor of an ideal gas is

A. 0

B. 1

C. $\neq 1$

D. None

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27. Compressibility factor $Z = \frac{PV}{RT}$. Considering ideal gas, real gas, and gases at critical state, answer the following questions:

The cpmpressibility factor of a gas is less than unity at STP, therefore

A. $V_m > 22.4L$

B. $V_m < 22.4L$

C. $V_m = 22.4L$

D. $V_m = 4.8L$

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28. Compressibility factor $Z = \frac{PV}{RT}$. Considering ideal gas, real gas, and gases at critical state, answer the following questions:

Z_c at T_c, P_c, and V_c is

A. $3/8$

B. $4/8$

C. 1

D. 0

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29. Two gaseous molecules A and B are traveling towards each other. Let the mean free path of the molecule be σ and Z be the collision number with other molecules at pressure $1atm$. Answer the following questions

The free path of gas molecule is the distance

A. Between the two opposite walls of the container

B. That molecules travel in one second

C. Through which a molecule moves between two successive collisions

D. None of these

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30. Two gaseous molecules A and B are traveling towards each other. Let the mean free path of the molecule be σ and Z be the collision number with other molecules at pressure $1atm$. Answer the following questions

If the mean free path is σ at $1atm$ pressure, then its value at $5atm$ pressure is

A. 5σ

B. $\frac{2}{5}\sigma$

C. $\frac{\sigma}{5}$

D. None

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31. Two gaseous molecules A and B are traveling towards each other. Let the mean free path of the molecule be σ and Z be the collision number with other molecules at pressure $1atm$. Answer the following questions

If Z is the total number of collisions which a gas molecule registers with others per unit time under particular conditions, then the collision frequency of the gas containing N molecules per unit volume is

A. $\frac{Z}{N}$

B. NZ

C. $2NZ$

D. $\frac{NZ}{2}$

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32. Two gaseous molecules A and B are traveling towards each other. Let the mean free path of the molecule be σ and Z be the collision number with other molecules at pressure $1atm$. Answer the following questions

If the collision frequency of a gas at $1atm$ pressure is Z, then its collision frequency at $0.5atm$ is

A. $1.0Z$

B. $0.707Z$

C. $2Z$

D. $0.5Z$

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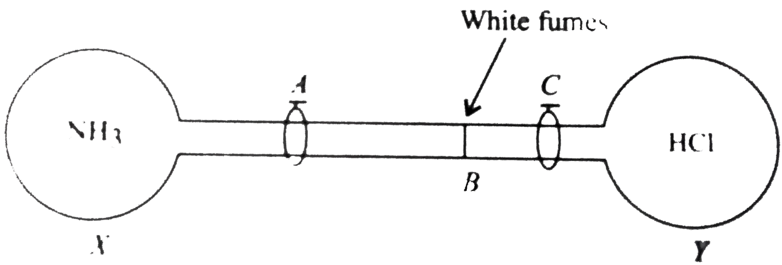
33. The constant motion and high velocities of gas particles lead to some important practical consquences. One such consquences is that gases mix rapidly when they come in contact. Take the stopper off a bottle of perfume, for instance, and the odour will spread rapidly through the room as perfume molecules mix with the molecules in the air. This mixing of different gases by random molecular motion and with frequent collision is called diffusion. A similar process in which gas molecules escape without collision through a tiny hole into a vacuum is called effusion. Both the processes follow Graham's law which is mathematically put as $r \propto \sqrt{1/d}$. The average distance travelled by molecules between successive collisions is called mean free path.

Answer the following questions on the basis of the above information:

The stop cocks of the bulbs X (containing NH_3) and Y (containing HCl), both under indentical conditions, are opened simultaneously. White fumes of NH_4Cl, are formed at point B. If $AB = 36.5cm$, then BC is approximately



A. $18.0cm$

B. $25.0cm$

C. $20.0cm$

D. $36.5cm$

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34. The constant motion and high velocities of gas particles lead to some important practical consquences. One such consquences is that gases mix rapidly when they come in contact. Take the stopper off a bottle of perfume, for instance, and the odour will spread rapidly through the room as perfume molecules mix with the molecules in the air. This mixing of different gases by random molecular motion and with frequent collision is called diffusion. A similar process in which gas molecules escape without collision through a tiny hole into a vacuum is called effusion. Both the processes follow Graham's law which is mathematically put as $r \propto \sqrt{1/d}$. The average distance travelled by molecules between successive collisions is called mean free path.

Answer the following questions on the basis of the above information:

Select the correct statement(s).

A. The larger the size of the molecules, the smaller the mean free path

B. The greater the number of molecules per unit volume, smaller the mean free path

C. The larger the temperature, the larger the mean free path

D. The larger the temperature, the smaller the mean free path.

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35. The constant motion and high velocities of gas particles lead to some important practical consquences. One such consquences is that gases mix rapidly when they come in contact. Take the stopper off a bottle of perfume, for instance, and the odour will spread rapidly through the room as perfume molecules mix with the molecules in the air. This mixing of different gases by random molecular motion and with frequent collision is called diffusion. A similar process in which gas molecules escape without collision through a tiny hole into a vacuum is called effusion. Both the processes follow Graham's law which is mathematically put as $r \propto \sqrt{1/d}$. The average distance travelled by molecules between successive collisions is called mean free path.

Answer the following questions on the basis of the above information:

Select the correct statement(s).

A. All gases diffuse spontaneously into one another when they are brought into contact.

B. Diffusion into a vacuum will take place much more rapidly than diffusion into another gas

C. The rates of diffusion and effusion of a goes depend on its molar mass.

D. All of the above statements are correct.

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36. X mL Hydrogen gas effuses through a hole in a container in $5s$. The time taken for the effusion of the same volume of the gas specified below under identical conditions is

A. $10s : He$

B. $20s : O_2$

C. $25s : CO$

D. $55s : CO_2$

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37. The constant motion and high velocities of gas particles lead to some important practical consquences. One such consquences is that gases mix rapidly when they come in contact. Take the stopper off a bottle of perfume, for instance, and the odour will spread rapidly through the room as perfume molecules mix with the molecules in the air. This mixing of different gases by random molecular motion and with frequent collision is called diffusion. A similar process in which gas molecules escape without collision through a tiny hole into a vacuum is called effusion. Both the processes follow Graham's law which is mathematically put as $r \propto \sqrt{1/d}$. The average distance travelled by molecules between successive collisions is called mean free path.

Answer the following questions on the basis of the above information:

Select the correct statement(s).

A. The gas does work pushing back the atmosphere using kinetic energy of molecules and thus lowering the temperature

B. The volume of the gas is decreased rapidly, hence, temperature is lowered

C. Both (a) and (b) are correct reasons.

D. Neither (a) nor (b) is the correct reason.

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38. The behaviour of ideal gas is goverened by various gas laws which are described by mathematical statements as given below:

(i) $PV = k$ (constant) at constant n and T

(ii) $V/T = k_2$ (constant) at constant n and P

(iii) $V/n = k_3$ (constant) at constant T and P

(iv) $PV = nRT$

(v) $P/T = k_4(cons\tan t)atcons\tan t$n and V

$Answerthe follow \in gThevalueof$k_(2)` is

A. Independent of nature and amount of gas

B. Depends on temperature and pressure conditions

C. Depends on pressure and amount of gas

D. Depends only on nature of gas

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39. The behaviour of ideal gas is goverened by various gas laws which are described by mathematical statements as given below:

(*i*) $PV = k$ (constant) at constant n and T

(*ii*) $V/T = k_2$ (constant) at constant n and P

(*iii*) $V/n = k_3$ (constant) at constant T and P

(*iv*) $PV = nRT$

(*v*) $P/T = k_4(cons\tan t)atcons\tan tn$ and V`

Answer the following

Avogadro's law is represented by the expression

A. (i)

B. (iii)

C. (v)

D. (ii)

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40. The behaviour of ideal gas is goverened by various gas laws which are described by mathematical statements as given below:

(i) $PV = k$ (constant) at constant n and T

(ii) $V/T = k_2$ (constant) at constant n and P

(iii) $V/n = k_3$ (constant) at constant T and P

(iv) $PV = nRT$

(v) $P/T = k_4$ (constant) at constant n and V

Answer the following

A cylinder of $10L$ capacity at $300K$ containing the gas is used to fill balloons till finally the cylinder recorded a pressure of $10m$ bar. The number of He atoms still present in the cylinder is

A. 4.82×10^{21}

B. 2.41×10^{23}

C. 2.41×10^{21}

D. 4.82×10^{23}

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41. The behaviour of ideal gas is goverened by various gas laws which are described by mathematical statements as given below:

(i) $PV = k$ (constant) at constant n and T

(ii) $V/T = k_2$ (constant) at constant n and P

(iii) $V/n = k_3$ (constant) at constant T and P

(iv) $PV = nRT$

(v) $P/T = k_4$ (constant) at constant n and V

Answer the following

The expression (ii) represents

A. Charles's law

B. Amonton's law

C. Dalton's law

D. Boyle's law

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42. The behaviour of ideal gas is goverened by various gas laws which are described by mathematical statements as given below:

(i) $PV = k$ (constant) at constant n and T

(ii) $V/T = k_2$ (constant) at constant n and P

(iii) $V/n = k_3$ (constant) at constant T and P

(iv) $PV = nRT$

(v) $P/T = k_4$ (constant) at constant n and V

Answer the following

If we plot a graph between volume (L) and temperature $(-273.15^\circ C)$ by studying their variation for $2.0g$ of certain ideal gas at 1^- pressure, the graph obtained is a straight line which is

A. Parallel to the temperature axis

B. Parallel to the volume axis

C. Meets the temperature axis where $T = 0, V = 0$

D. Meets the temperature axis where $V = 0, T = -273.15$

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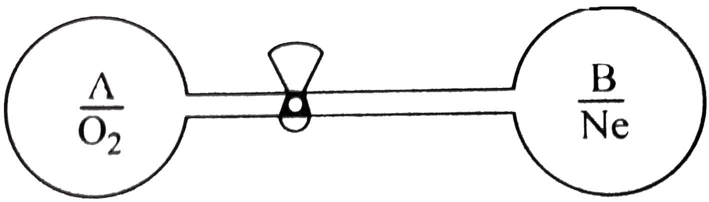
43. Consider the adjacent diagram. Initially, flask A contained oxygen gas at $27^{\circ} C$ and $950 mm$ of Hg, and flask B contained neon gas at $27^{\circ} C$ and $900 mm$. Finally, two flask were joined by means of a narrow tube of negligible volume equipped with a stopcock and gases were allowed to mixup freely. The final pressure in the combined system was found to be $910 mm$ of Hg.



Which of the following statements concerning oxygen and neon gas is true in the begining, when the stopcock was just opened?

A. O_2 moved at faster rate toward flask B.

B. Ne moved at faster rate towards flask A.

C. Both O_2 and Ne gases moves at equal rate.

D. Insufficient information to compare the rate of effusion.

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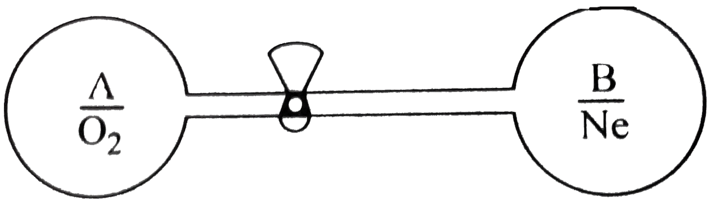
44. Consider the adjacent diagram. Initially, flask A contained oxygen gas at $27^\circ C$ and $950 mm$ of Hg, and flask B contained neon gas at $27^\circ C$ and $900 mm$. Finally, two flask were joined by means of a narrow tube of negligible volume equipped with a stopcock and gases were allowed to mixup freely. The final pressure in the combined system was found to be $910 mm$ of Hg.



What is the correct relationship between volumes of the two flasks?

A. $V_B = 2V_A$

B. $V_B = 4V_A$

C. $V_B = 5V_A$

D. $V_B = 5.5V_A$

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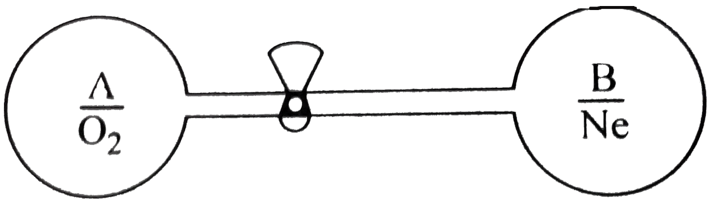
45. Consider the adjacent diagram. Initially, flask A contained oxygen gas at $27^\circ C$ and $950mm$ of Hg, and flask B contained neon gas at $27^\circ C$ and $900mm$. Finally, two flask were joined by means of a narrow tube of negligible volume equipped with a stopcock and gases were allowed to mixup freely. The final pressure in the combined system was found to be $910mm$ of Hg.



If flask B were heated to $127^\circ C$, maintaining flask A at constant temperature of $27^\circ C$, final pressure (in $mmHg$) in the combined system would have been

A. 1007

B. 1250

C. 1137.5

D. 1990

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46. The system shown in the figure is in equilibrium, where A and B are isomeric liquids and form an ideal solution at TK. Standard vapour pressures of A and B are P_A^0 and P_B^0, respectively, at TK. We collect the vapour of A and B in two containers of volume V, first container is maintained at $2TK$ and second container is maintained at $3T/2$. At the temperature greater than TK, both A and B exist in only gaseous form.

We assume than collected gases behave ideally at $2TK$ and there may take place an isomerisation reaction in which A gets converted into B by first-order kinetics reaction given as:

$A \xrightarrow{k} B$, where k is a rate constant.

In container (II) at the given temperature $3T/2$, A and B are ideal in nature and non reacting in nature. A small pin hole is made into container. We can determine the initial rate of effusion of both gases in vacuum by the expression

$$r = K.\frac{P}{\sqrt{M_0}}$$

where $P =$ pressure differences between system and surrounding

$K =$ positive constant

$M_0 =$ molecular weight of the gas

If partial vapour pressure of A is twice that of partial vapour pressure of B and total vapour pressure 2 atm at TK, where $T = 50K$ and $V = 8.21L$, then the number of moles of A and B in vapour phase is:

A. $\frac{8}{3}, \frac{4}{3}$

B. $\frac{4}{3}, \frac{1}{3}$

C. $\frac{2}{3}, \frac{1}{4}$

D. $\frac{10}{3}, \frac{4}{3}$

47. The system shown in the figure is in equilibrium, where A and B are isomeric liquids and form an ideal solution at TK. Standard vapour pressures of A and B are P_A^0 and P_B^0, respectively, at TK. We collect the vapour of A and B in two containers of volume V, first container is maintained at $2TK$ and second container is maintained at $3T/2$. At the temperature greater than TK, both A and B exist in only gaseous form. We assume than collected gases behave ideally at $2TK$ and there may take place an isomerisation reaction in which A gets converted into B by first-order kinetics reaction given as:

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In container (II) at the given temperature $3T/2$, A and B are ideal in nature and non reacting in nature. A small pin hole is made into container. We can determine the initial rate of effusion of both gases in vacuum by the expression

$$r = K.\ \frac{P}{\sqrt{M_0}}$$

where $P =$ pressure differences between system and surrounding

$K =$ positive constant

$M_0 =$ molecular weight of the gas

Vapours of A and B are passed into a container of volume $8.21L$, maintained at $2TK$, where $T = 50K$ and after 5 min, moles of $B = 8/3$. The pressure developed into the cotainer after two half lives is

A. $3atm$

B. $4atm$

C. $5atm$

D. $0.5atm$

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48. The system shown in the figure is in equilibrium, where A and B are isomeric liquids and form an ideal solution at TK. Standard vapour pressures of A and B are P_A^0 and P_B^0, respectively, at TK. We collect the vapour of A and B in two containers of volume V, first container is maintained at $2TK$ and second container is maintained at $3T/2$. At the temperature greater than TK, both A and B exist in only gaseous form.

We assume than collected gases behave ideally at $2TK$ and there may take place an isomerisation reaction in which A gets converted into B by first-order kinetics reaction given as:

$A \xrightarrow{k} B$, where k is a rate constant.

In container (II) at the given temperature $3T/2$, A and B are ideal in nature and non reacting in nature. A small pin hole is made into container. We can determine the initial rate of effusion of both gases in vacuum by the expression

$$r = K.\ \frac{P}{\sqrt{M_0}}$$

where $P =$ pressure differences between system and surrounding

$K =$ positive constant

$M_0 =$ molecular weight of the gas

If vapours are collected in a container of volume $8.21L$ maintained at $3T/2K$, where $T = 50K$, then the ratio of initial rate of effusion of gases A and B is given as

A. $2:1$

B. $1:1$

C. $4:3$

D. $2:4$

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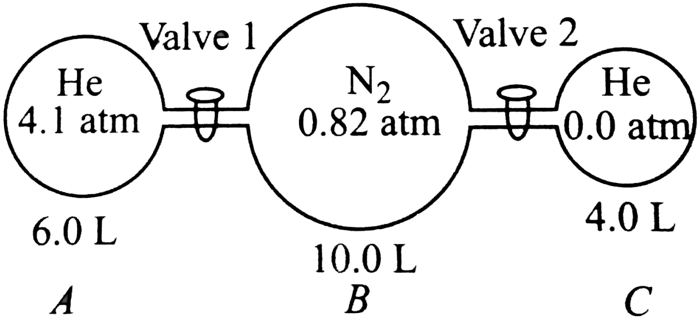
Linked Comprehensive

1. The figure given below shows three glass chambers that are connected by valves of negligible volume. At the outset of an experiment, the valves are closed and the chambers contain the gases as detailed in the diagram. All the chambers are at the temperature of $300K$ and external pressure of $1.0atm$.



What is the total pressure in chamber B after valve 1 is opened?

A. $0.40 atm$

B. $0.35 atm$

C. $0.30 atm$

D. $0.25 atm$

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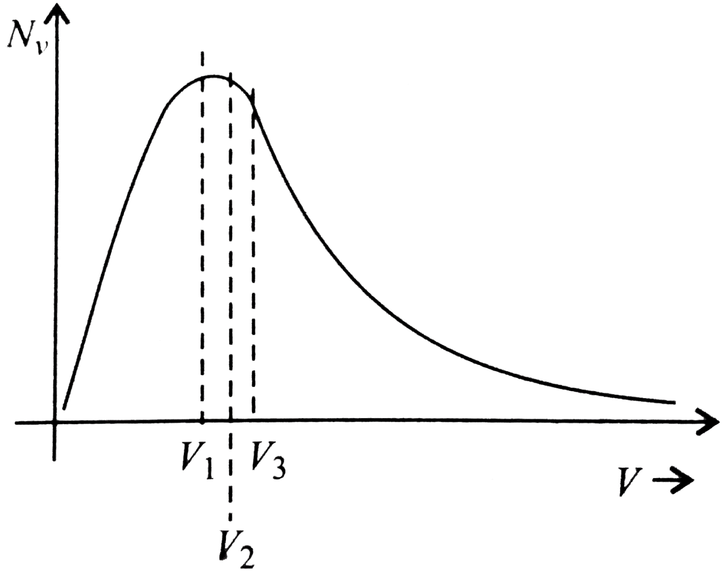
2. The distribution of the molecular velocities of gas molecules at any temperature T is shown below. (The plot below is known as Maxwell's distribution of molecular speeds.)



where

v is molecular velocity

n is number of molecules having velocity v

Let us define ΔN_v, which is equal to the number of molecules between the velocity range v and $v + \Delta v$, given by

$$\Delta N_v = 4\pi N a^3 e^{-bv^2} v^2 \Delta v$$

where

N is total number of molecules

$$a = \sqrt{\frac{M_0}{2\pi RT}} \text{ and } b = \frac{M_0}{2RT}$$

R is universal gas constant

T is temperature of the gas

M_0 is molecular weight of the gas

Answer the following question:

SI units of a are

A. $v_1 = v_{mp}, v_2 = v_{av}, v_3 = v_{rms}$

B. $v_1 = v_{mp}, v_2 = v_{rms}, v_3 = v_{av}$

C. $v_1 = v_{av}, v_2 = v_{mp}, v_3 = v_{rms}$

D. $v_1 = v_{av}, v_2 = v_{rms}, v_3 = v_{mp}$

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Exercises (Multiple Correcttype)

1. Which of the following statements is/are correct?

A. The van der Waals constant a is a measure of attractive force.

B. The van der Waals constant b is also called co- volume or excluded volume.

C. b is expressed in $Lmol^{-1}$.

D. b is one-third of ciritical volume.

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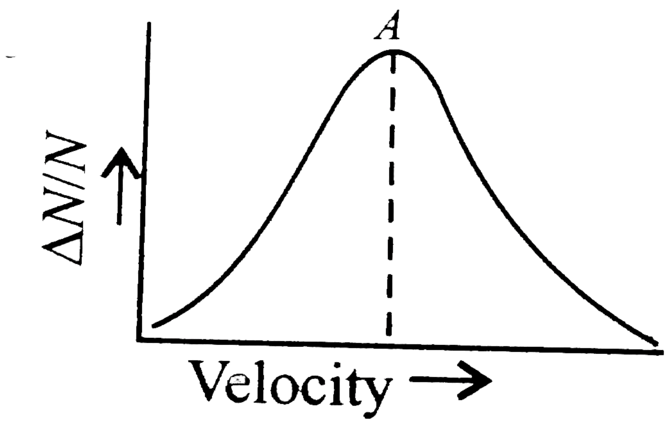
2. Point A in the given curve shifts to higher value of velocity if



A. T is increased

B. P is decreased

C. V is decreased

D. Molecular weight M is decreased

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3. Which of the following processes would lead to an increase in the average speed of the molecules of an ideal gas system?

A. Decreasing the temperature of the system

B. Compressing the gas with a piston

C. Expanding the gas into a vacuum

D. Heating the system keeping V and P constant.

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4. According to the kinetic theory of gases

A. Pressure of a gas is due to collisions of molecules with each other

B. Kinetic energy is proportional to square root of the temperature

C. Pressure of a gas is due to collisions of molecules against the sides of the container

D. There is no force of attraction between gas molecules

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5. For two gases A and B with molecular weights M_A and M_B, respectively, it is observed that at a certain temperature T, the mean velocity of A is equal to the V_{rms} of B. Thus, the mean velocity of A can be made equal to the mean velocity of B, if

A. A is at temperature T and B is at T' such that $T > T'$

B. Temperature of A is lowered to T_2 while B is at T such that $T_2 < T$

C. Both A and B are raised to a higher temperature

D. Heat energy supplied to A

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6. Which of the following statements is/are true?

A. The ratio of the mean speed to the rms speed is independent of the temperature.

B. Square of the mean speed of the molecules is equal to the square of the rms speed at a certain temperature.

C. Mean kinetic energy of the gas molecules at any given temperature is independent of the mean speed.

D. The difference between the rms speed and the mean speed at any temperature for different gases diminishes as larger, and yet larger molar masses are considered.

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7. If for two gases of molecular weights M_A and M_B at temperature T_A and T_B, respectively, $T_A M_B = T_B M_A$, then which property has the same magnitude for both the gases?

A. Pv if mass of gases taken are same

B. Pressure

C. KE per mole

D. V_{rms}

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8. Molecular attraction and size of the molecules in a gas are not negligible at

A. Critical point

B. High pressure

C. High temperature and low pressure

D. Low temperature and high pressure

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9. If $10g$ of a gas at 1 atmospheric pressure is cooled from $273^{\circ} C$ to $0^{\circ} C$, keeping the volume constant, its pressure would become

A. $1/273atm$

B. $2atm$

C. $\frac{1}{2}atm$

D. 273 atm

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10. The compressibility factor of a gas is greater than unity at STP. Therefore

A. $V_m > 22.4L$

B. $V_m < 22.4L$

C. $V_m = 22.4L$

D. The gas will become less liquefiable

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11. Select the correct statements

A. Vapour may be condensed to liquid by the application of pressure.

B. To liquefy a gas one must lower the temperature below T_c apply pressure.

C. At T_c, there is no distinction between liquid and vapour states.

D. At the T_c, density of liquid is very high as compared to its gaseous state.

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12. Which of the following statement is/are correct ?

A. All real gases are less compressible than ideal gases at high pressure.

B. Hydrogen and helium are more compressible than ideal gases for all values of pressure.

C. Except H_2 and He, the compressibility factor $Z\left(=\frac{PV}{nRT}\right)<1$ for all gases at low pressure.

D. The compressibility factor of real gases is independent of temperature.

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13. Precisely $1mol$ of helium and $1mol$ of neon are placed in a container. Indicate the correct statements about the system.

A. Molecules of the two gases strike the wall of the container with same frequency.

B. Molecules of helium strike the wall more frequently.

C. Molecules of helium have greater average molecular speed.

D. Helium exerts larger pressure.

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14. Which of the following statements is/are true?

A. Hydrogen diffuses four times faster than oxygen.

B. The temperature of a real gas changes when it expands adiabatically in vacuum.

C. An ideal gas undergoes cooling effect when it suffers an adiabatic expansion in vacuum

D. The Joule-Thomson coeffcient $\left(\frac{dT}{dP}\right)_H$ of an ideal gas is zero.

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15. The root mean square velocity of an ideal gas in a closed container of fixed volume is increased from $5 \times 10^4 cms^{-1}$ to $10 \times 10^4 cms^{-1}$. Which of the following statements correctly explains how the change is accomplished?

A. By heating the gas, the temperature is doubled.

B. By heating the gas, the pressure is quadrupled.

C. By heating the gas, the temperature is quadrupled.

D. By heating the gas, the pressure is doubled.

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16. In the equation $PV = RT$, the value of R will not depend upon

A. The nature of the gas

B. The temperture of the gas

C. The pressure of the gas

D. Units of measurement

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17. Which is the value of R?

A. $1.99 cal deg^{-1} mol^{-1}$

B. $0.0821 L atm deg^{-1} mol^{-1}$

C. $9.8 k cal deg^{-1} mol^{-1}$

D. $8.3 J deg^{-1} mol^{-1}$

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18. Boyle's law may be expressed as

A. $(dP/dV)_T = K/V$

B. $(dP/dV)_T = -K/V^2$

C. $(dP/dV)_T = -K/V$

D. $V \propto 1/P$

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19. Which forces of attraction are responsible for liquefaction of H_2?

A. Coulombic forces

B. Dipole forces

C. Hydrogen bonding

D. van der Waals forces

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20. According to Charles's law

A. $(dV/dT)_P = K$

B. $(dV/dT)_P = -K$

C. $(dV/dT)_P = -K/T$

D. $V \propto T$

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21. In van der Waals equation of gases, the kinetic equation for gas is modified with respect to

A. Repulsive forces

B. Attractive forces between the gaseous molecules

C. Actual volume of the gas

D. Pressure of the molecules

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22. Which of the following is/are correct about Charles's law?

A. $(\partial V / \partial T)_P = Cons\tan t$

B. $V \propto T$ at constant P and n

C. $V \propto P$ at constant T, n

D. $V \propto T$ is constant at constant P, n

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23. Which of the following gases is/are heavier than dry air?

A. Moist air

B. Oxygen

C. Moist nitrogen

D. Hydrogen sulphide

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24. One mole of which of the following will have $22.7L$ at STP (1 bar, $273.15K$)?

A. SO_2

B. He

C. H_2O

D. CCl_4

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25. The gas constant has units

A. $LatmK^{-1}mol^{-1}$

B. $Latm^{-1}K^{-1}mol^{-1}$

C. $atmcm^3K^{-1}mol^{-1}$

D. $ergK^{-1}$

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26. Which of the following pair of gases will have same rate of diffusion under similar conditions?

A. H_2 and He

B. CO_2 and N_2O

C. CO and C_2H_4

D. NO and CO

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27. Which of the following statements is/are correct about real gases?

A. The molecules do cause attractive forces on each another.

B. They obey gas laws at low temperature and high pressure.

C. They show deviations from ideal behaviour.

D. The molecules have negligible mass.

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28. At very high pressure, the van der Waals equation reduces to

A. $PV = RT + Pb$

B. $PV = \frac{aRT}{V^2}$

C. $P = \frac{RT}{V - b}$

D. $PV = RT - \frac{a}{V}$

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29. To which of the following mixture Dalton's law of partial pressure is not applicable ?

A. CO_2 and CO at room temperature

B. Ammonia and hydrogen chloride at room temperature

C. NH_3 and steam at room temperature

D. He and H_2

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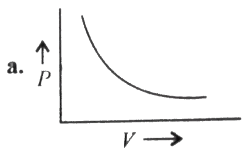
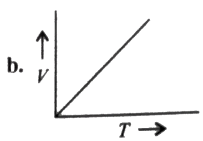
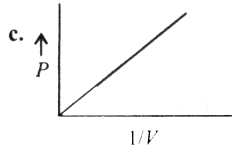
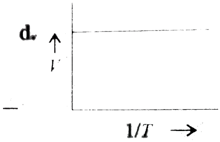
30. Which of the following plots is/are correct?

A. 

B. 



C.



D.

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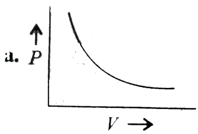
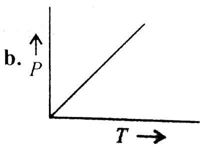
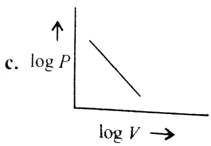
31. Which of the following plots is/are correct?



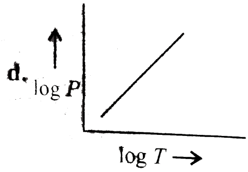
A.



B.



C.

D. 

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32. A quantity of heat is confined in a chamber of constant volume. When the chamber is immersed in a bath of melting ice, the pressure of the gas is $1000 \rightarrow rr$. Final temperature when the pressure manometer indicates an absolute pressure of $400 \rightarrow rr$ is

A. $109K$

B. $273K$

C. $373K$

D. $0K$

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Exercises (Single Correct)

1. At what temperature do the Celsius and Fahrenheit readings have the same numerical value ? a) 273 b) −273 c) −40 d) 40

A. $100^{\circ} C$

B. $180^{\circ} C$

C. $40^{\circ} C$

D. $-40^{\circ} C$

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2. At the top of the mountain, the thermometer reads $0^{\circ} C$ and the barometer reads $710 mmHg$. At the bottom of the mountain the temperature is $30^{\circ} C$ and the pressure is $760 mmHg$. The ratio of the density of air at the top with that at the bottom is

A. $1:1$

B. $1.04:1$

C. $1:1.04$

D. $1:1.5$

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3. A quantity of gas is collected in a gradutated tube over the mercury. The volume of the gas at $20^{\circ}C$ is $50.0mL$ and the level of the mercury in the tube is $100mm$ above the outside mercury level. The barometer reads $750mm$. Volume at STP is

A. $39.8mL$

B. $40mL$

C. $42mL$

D. $60mL$

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4. Which of the following contains gretest number of N atoms?

A. $22.4L$ nitrogen gas at STP

B. $500mL$ of $2.00MNH_3$

C. $1.00mol$ of NH_4Cl

D. 6.02×10^{23} molecules of NO_2

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5. What weight of hydrogen at STP could be contained in a vessel that holds $4.8g$ oxygen at STP?

A. $4.8g$

B. $3.0g$

C. $0.6g$

D. $0.3g$

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6. At low pressures, van der Waals' equation is written as $\left(P+\frac{a}{V^2}\right)V=RT$.The compressibility factor is then equal to:

A. $\left(1-\frac{a}{RTV}\right)$

B. $\left(1-\frac{RTV}{a}\right)$

C. $\left(1+\frac{a}{RTV}\right)$

D. $\left(1+\frac{RTV}{a}\right)$

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7. Ideal gas equation in terms of KE per unit volume, E, is

A. $\frac{3}{2}RT$

B. $\frac{2}{3}E$

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

D. $\frac{3}{2}E$

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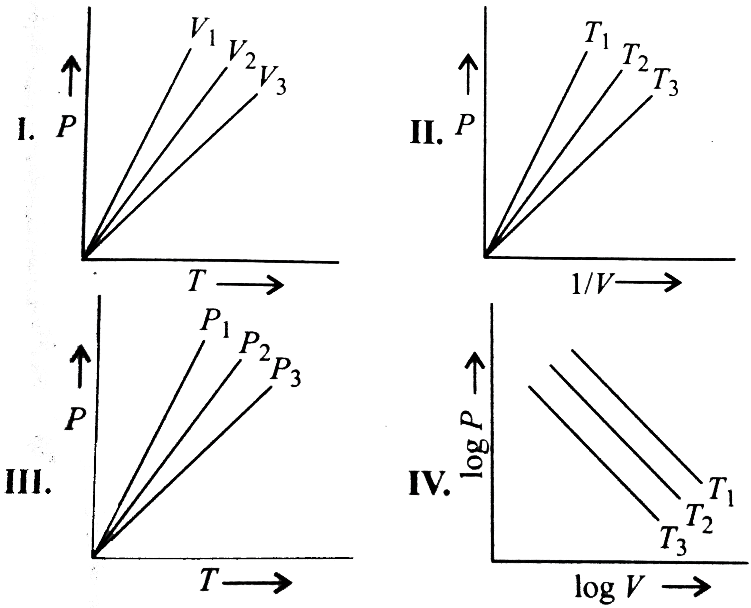
8. For $1mol$ of an ideal gas, $V_1 > V_2 > V_3$ in fig. (I),$T_1 > T_2 > T_3$ in fig. (II), $P_1 > P_2 > P_3$ in fig. (III), and $T_1 > T_2 > T_3$ in fig. (IV) , then which curves are correct.



A. I, II

B. I, II, III

C. II, IV

D. I, III, IV

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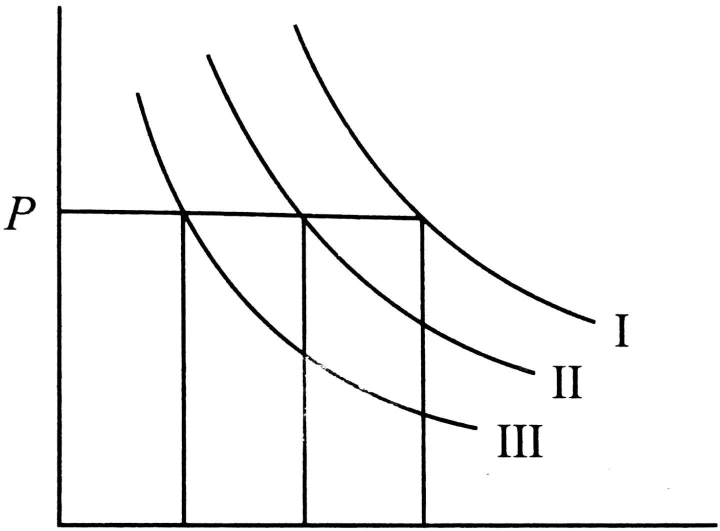
9. I, II, and III are three istherms, respectively, at T_1, T_2, and T_3. Temperature will be in order



A. $T_1 = T_2 = T_3$

B. $T_1 < T_2 < T_3$

C. $T_1 > T_2 > T_3$

D. $T_1 > T_2 = T_3$

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10. A quantity of hydrogen gas occupies a volume of $30.0 mL$ at a certain temperature and pressure. What volume would half of this mass of hydrogen occupy at triple the initial temperature, if the pressure was one-ninth that of the original gas?

A. $270 mL$

B. $90 mL$

C. $405 mL$

D. $137 mL$

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11. A gas in an open container is heated from $27^{\circ} C$ to $127^{\circ} C$ The fraction of the original amount of gas remaining in the container will be .

A. $3/4$

B. $1/2$

C. $1/4$

D. $1/8$

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12. The density of neon gas will be highest at

A. STP

B. $0^{\circ}C, 2atm$

C. $273^{\circ}C, 1atm$

D. $273^{\circ}C, 2atm$

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13. A mixture of SO_2 and O_2 in the molar ratio $16:1$ is diffused through a pin hole for successive effusion three times to give a molar ratio $1:1$ of diffused mixture. Which one are not correct if diffusion is made at same P and T in each operation?

(I) Eight operation are needed to get $1:1$ molar ratio.

(II) Rate of diffusion for $SO_2 : O_3$ after eight operations in 0.707.

(III) Six operations are needed to get $2:1$ molar ratio for SO_2 and O_2 in diffusion mixture.

(IV) Rate of diffusion for SO_2 and O_2 after six operations is 2.41.

A. I, II, III

B. II, III

C. I, III

D. IV

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14. A graph is plotted between $\log V$ and $\log T$ for $2mol$ of gas at constant pressure of $0.0821atm. V$ and T are in litre and K. Which of the following statements are not correct?

(I) The curve is straight line with slope -1.

(II) The curve is straight line with slope $+1$.

(III) The intercepet on $Y-$ axis is equal to 2.

(IV) The intercepet on $Y-$ axis is equal to 0.3010.

A. I, II

B. III, IV

C. II, IV

D. I, III

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15. A gas obeys $P(V-b)=RT$. Which of the following are correct about this gas?

(I) Isochoric curves have slop $= \frac{R}{V-b}$.

(II) Isobaric curves have slope $\frac{R}{P}$ and intercept b.

(III) For the gas compressibility factor $= 1 + \frac{Rb}{RT}$.

(IV) The attraction forces are overcome by repulsive forces.

A. I

B. II, III

C. III

D. I, II, III, IV

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16. The pressure of a real gas is less than the pressure of an ideal gas because of :

A. Increase in collisions

B. Increase in intermolacular forces

C. Infinite size of molecules

D. Statement is incorrect

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17. O_2 gas at STP contained in a flask was replaced by SO_2 under same conditions. The weight of SO_2 will be

A. Equal to that of O_2

B. Half that of O_2

C. Twice that of O_2

D. One-fourth of O_2

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18. At what temperature will hydrogen molecules have the same KE as nitrogen molecules at $280K$?

A. $280K$

B. $40K$

C. $400K$

D. $50K$

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19. Select the correct statements.

(I) Greater is humidity, lesser will be rate of evaporation of water.

(II) Greater is humidity, lesser will be density of air.

(III) If room temperature $=$ dew point, realtive humidity $= 100\%$.

(IV) Dew point is the temperature at which the gas a given atmospheric condition becomes staturted with $H_2O\ (v)$

A. I, II

B. II, IV

C. All

D. None

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20. The temperature to which a gas must be cooled before it can be liquified by compression is called

A. Boyle's temperature

B. Critical temperature

C. Liquefaction temperature

D. Inversion temperature

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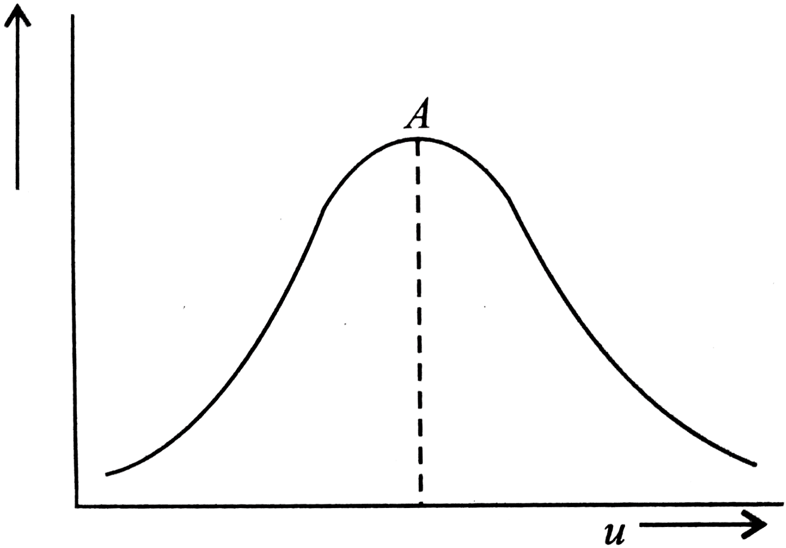
21. Distribution of molecules with velocity is represented by the curve



Velocity corresponding to point A is

A. $\sqrt{\frac{3RT}{M}}$

B. $\sqrt{\frac{2RT}{M}}$

C. $\sqrt{\frac{8RT}{\pi M}}$

D. $\sqrt{\frac{RT}{M}}$

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22. The volume of helium is $44.8L$ at

A. $100^{\circ}C$ and $1atm$

B. $0^{\circ}C$ and $1atm$

C. $0^{\circ}C$ and $0.5atm$

D. $100^{\circ}C$ and $0.5atm$

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23. Which gas shows real behaviour?

A. $8gO_2$ at STP occupies $5.6L$.

B. $1gH_2$ in $0.5L$ flask exerts a pressure of $24.63atm$ at $300K$.

C. $1molNH_3$ at $300K$ and $1atm$ occupies volume $22.4L$.

D. $5.6L$ of CO_2 at STP is equal to $11g$.

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24. For the non-zero volume of the molecules, real gas equation for n mol of the gas will be

A. $\left(P+\frac{a}{V^2}\right)V=RT$

B. $PV=nRT+nbP$

C. $P(V-nb)=nRT$

D. Both (b) and (c) are true.

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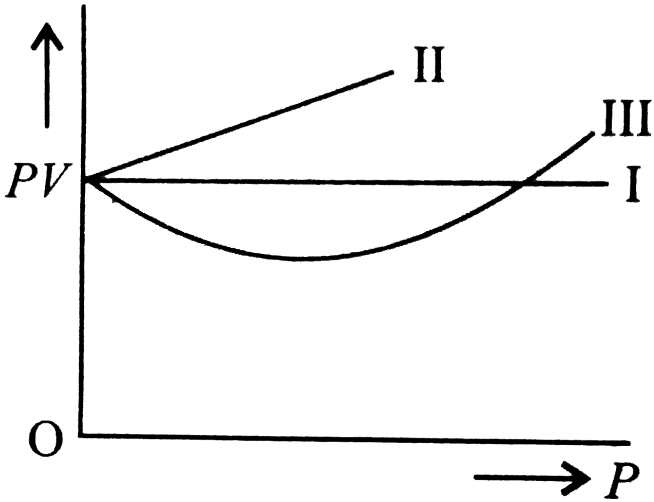
25. Actual graph for the given parameters in (Q.25) will be



A. I, III

B. I, II

C. II

D. I

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26. For non-zero value of force of attraction between gas molecular at large volume, gas equation will be :

(a) $PV = nRT - \frac{n^2 a}{V}$

(b) $PV = nRT + nbP$

(c) $P = \frac{nRT}{V - b}$

(d) $PV = nRT$

A. $PV = nRT - \frac{n^2 a}{V}$

B. $PV = nRT + nbP$

C. $PV = nRT$

D. $P = \frac{nRT}{V - b}$

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27. If X_M, X_P, and X_V are mole fraction, pressure fraction and volume fraction respectively of a gaseous mixture, then:

A. $X_M = \frac{1}{X_P} = \frac{1}{X_V}$

B. $X_M = (X_P) = \frac{1}{X_V}$

C. $X_M = X_P = X_V$

D. $\frac{1}{X_M} = \frac{1}{X_P} = \frac{1}{X_V}$

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28. The average molecular speed is gretest in which of the following gas samples?

A. $1.0 mol N_2$ at $560 K$

B. $0.50 mol$ of Ne at $500 K$

C. $0.20 mol$ of CO_2 at $440 K$

D. $2.0 mol$ of He at $140 K$

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29. A gas in an open container is heated from $27^{\circ} C$ to $127^{\circ} C$. The fraction of the original amount of the gas remaining in the container will be

A. $3/4$

B. $1/2$

C. $1/4$

D. $1/8$

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30. Virial equation is: $PV_M = RT\left[A + \frac{B}{V_M} + \frac{C}{V_{M^2}} + \dots\right]$, where A, B, C, ... are first second,third, ... virial coefficent, respectively, For an ideal gas

A. $A =$ unity and B, C are zero.

B. A, B, C are all equal to unity.

C. A is dependent of temperature.

D. All A, B, C depend on temperature.

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31. A balloon filled with ethylene is pricked with a needle and quickly dropped in a tank of H_2 gas under identical conditions. After a while, the balloon will

A. Shrink

B. Enlarge

C. Completely collapse

D. Remain unchanged in size

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32. A flask containing $12g$ of a gas relative molecular mass $120at$ a pressure of $100atm$ was evacuated by means of a pump until the pressure was $0.01atm$. Which of the following in the best estimate of the number of molecules left in the flask $\left(N_0 = 6 \times 10^{23} mol^{-1}\right)$?

A. 6×10^{9}

B. 6×10^{18}

C. 6×10^{17}

D. 6×10^{13}

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33. The value of compressibility factor for an ideal gas is equal to 1.

A. 0

B. 1

C. $>$

D. Between 0 and 1

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34. NH_3 gas is liquefied more easily than N_2. Hence

A. van der Waals constant a and b of $NH_3 >$ that of N_2

B. van der Waals constant a and b of $NH_3 <$ that of N_2

C. $a(NH_3) > a(N_2)$ but $b(NH_3) < b(N_2)$

D. $a(NH_3) < a(N_2)$ but $b(NH_3) > b(N_2)$

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35. The van der Waals equation for one mol of CO_2 gas at low pressure will be

A. $\left(P+\frac{a}{V^2}\right)V=RT$

B. $P(V-b)=RT-\frac{a}{V^2}$

C. $P=\frac{RT}{V-b}$

D. $P=\left(\frac{RT}{V-b}-\frac{a}{V^2}\right)$

Watch Video Solution

36. If v is the volume of one molecule of a gas under given conditions, then van der Waals constant b is

A. $4v$

B. $4v/N_0$

C. $N_0/4v$

D. $4vN_0$

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37. Which of the following gas molecules has the largest mean free path?

A. CO_2

B. H_2

C. O_2

D. N_2

Watch Video Solution

38. The compression factor (compressibility factor) for $1 mol$ of a van der Waals gas at $0^{\circ} C$ and $100 atm$ pressure is found to be 0.5. Assuming that the volume of a gas molecule is neligible, calculate the van der Waals constant a.

A. $1.256 L^2 mol^{-2} atm$

B. $0.256 L^2 mol^{-2} atm$

C. $2.256L^2mol^{-2}atm$

D. $0.0256L^2mol^{-2}atm$

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39. The critical temperature of water is higher than that of O_2 because the H_2O molecule has

A. Fewer electrons than O_2

B. Two covalent bonds

C. V- shape

D. Dipole moment

Watch Video Solution

40. The pressure exerted by $1mol$ of CO_2 at $273K$ is $34.98atm$. Assuming that volume occupied by CO_2 molecules is negligible, the value of van der Waals constant for attraction of CO_2 gas is

A. $3.59dm^6 atmmol^{-2}$

B. $2.59dm^6 atmmol^{-2}$

C. $1.25dm^6 atmmol^{-2}$

D. $1.59dm^6 atmmol^{-2}$

Watch Video Solution

41. Relative humidity of air is $60^\circ C$ and the saturation vapour pressure of water vapour in air is $3.6kPa$. The amount of water vapours present in $2L$ air at $300K$ is

A. $52g$

B. $31.2g$

C. $26g$

D. $5.2g$

Watch Video Solution

42. A $3:2$ molar mixture of N_2 and CO is present in a vessel at 500bar pressure. Due to hole in the vessel, the gas mixture leaks out. The composition of mixture effusing out initially is

A. $n_{N_2} : n_{CO} : : 1 : 2$

B. $n_{N_2} : n_{CO} : : 6 : 1$

C. $n_{CO} : n_{N_2} : : 1 : 2$

D. $n_{CO} : n_{N_2} : : 2 : 3$

Watch Video Solution

43. Number of N_2 molecules present L vessel at NTP when compressibility factor is 1.2 is

A. 2.23×10^{24}

B. 2.23×10^{22}

C. 2.7×10^{22}

D. 2.7×10^{24}

Watch Video Solution

44. A spherical air bubble is rising from the depth of a lake when pressure is $Patm$ and temperature is TK. The percentage increase in the radius when it comes to the surface of a lake will be (Assume temperature and pressure at the surface to be, respectively, $2TK$ and $P/4$.)

A. $100\ \%$

B. $50\ \%$

C. $40\ \%$

D. $200\ \%$

Watch Video Solution

45. If temperature increases, the surface tension of a liquid

A. Increases

B. Decreases

C. Remains constant

D. Shows irregular behaviour

Watch Video Solution

46. The Boltzmann constant k is given by k = ...

A. $k = R \times N_A$

B. $k = 1.3807 \times 10^{-21} JK^{-1}$

C. $k = N_A / R$

D. $k = R / N_A$

Watch Video Solution

47. It is eaiser to liquefy oxygen than hydrogen because.

A. Oxygen has a higher critical temperature and lower inversion temperature than hydrogen.

B. Oxygen has a lower critical temperature and higher inversion temperature than hydrogen.

C. Oxygen has a higher critical temperature and higher inversion temperature than hydrogen.

D. The critical temperature and inversion temperature of oxygen is very low.

Watch Video Solution

48. $2mol\ 'H_2$ is mixed with $2gm$ of H_2. The molar heatr capacity at constant pressure for the mixture is

A. $\frac{17R}{6}$

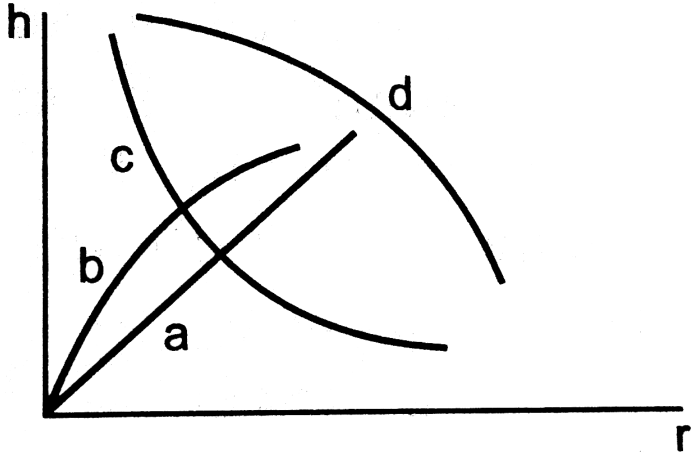
B. $\frac{11R}{6}$

C. $4R$

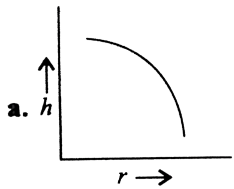
D. $\frac{3R}{2}$

Watch Video Solution

49. Which of the following graphs may represent the relation between the capillary rise h and the radius r of the capillary?



A.



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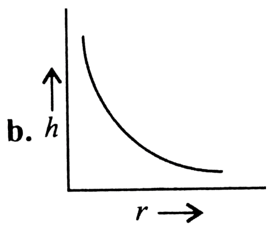

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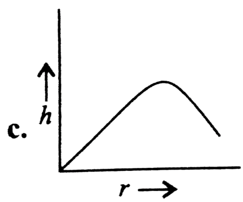
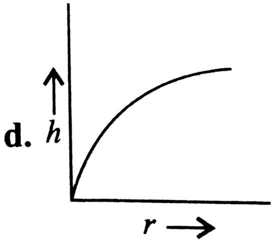


D. 

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50. There is a depression in the surface of the liquid in a capillary when

A. The cohesive force is smaller than the adhesive force.

B. The cohesive force is greater than the adhesive force.

C. The cohesive and adhesive forces are equal.

D. None of the above is true.

Watch Video Solution

51. Surface tension does not very with

A. Temperture

B. Vapour pressure

C. The size of surface

D. Concentration

Watch Video Solution

52. Which among of the following has least surface tension?

A. Benzene

B. Acetic acid

C. Diethyle ether

D. Chlorobenzene

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53. Units of coefficient of viscosity are

A. $Ns^{-1}m^{-1}$

B. Nsm^{-2}

C. $Ns^{-2}m^{-2}$

D. $Ns^{-1}m^{-2}$

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54. The quantity $\frac{PV}{k_BT}$ represents the (k_B : Boltzmann constant)

A. Number of molecules in the gas

B. Mass of the gas

C. Number of moles of the gas

D. Translational energy of the gas

Watch Video Solution

55. 1.0 litre of N_2 and 7/8 litre of O_2 at the same temperature and pressure were mixed together. What is the relation between the masses of the two gases in the mixture ?

A. $M_{N_2} = 3M_{O_2}$

B. $M_{N_2} = 8M_{O_2}$

C. $M_{N_2} = M_{O_2}$

D. $M_{N_2} = 16M_{O_2}$

Watch Video Solution

56. The value of PV for $5.6L$ of an ideal gas is .... RT at NTP.

A. 0.25

B. 0.30

C. 1.0

D. 0.45

Watch Video Solution

57. If a gas expands at contant temperature, it indicates that :

A. The pressures decreases

B. The kinetic energy of the molecules remains the same

C. The kinetic energy of the molecules decreases

D. The number of molecules of the gas increases

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58. The density of gas A is twice that to B at the same temperature. The molecular weight of gas B is twice that of A. The ratio of pressure of gas A and B will be :

A. $1:6$

B. $7:8$

C. $2:5$

D. $1:4$

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59. Which of the following expression at constant pressure represents Charles's law?

A. $V \propto \frac{1}{T}$

B. $V \propto \frac{1}{T^2}$

C. $V \propto T$

D. $V = d$

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60. A gas volume 100 cc is kept in a vessel at pressure $10.4 Pa$ maintained at temperature $24^{\circ} C$. Now, if the pressure is increased to $105 Pa$, keeping the temperature constant, then the volume of the gas becomes

A. 10

B. 100

C. 1

D. 1000

Watch Video Solution

61. A sample of gas occupies $100mL$ at $27^\circ C$ and $740mm$ pressure. When its volume is changed to $80mL$ at $740mm$ pressure, the temperature of the gas will be

A. $21.6^\circ C$

B. $240^\circ C$

C. $-33^\circ C$

D. $89.5^\circ C$

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62. At $25^\circ C$ and $730mm$ pressure, $730mL$ of dry oxygen was collected. If the temperature is kept constant what volume will oxygen gas occupy at $760mm$ pressure?

A. $701mL$

B. $449mL$

C. $569mL$

D. $621mL$

Watch Video Solution

63. The density of a gas at $27^{\circ}C$ and $1atm$ is d. Pressure remaining constant, at which of the following temperture will its density become $0.75d$?

A. $20^{\circ}C$

B. $30^{\circ}C$

C. $400K$

D. $300K$

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64. The kinetic theory of gases predicts that total kinetic energy of a gaseous assembly depends on

A. Pressure of the gas

B. Temperature of the gas

C. Volume of the gas

D. Pressure, temperature, and volume of the gas

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65. At STP, the order of mean square velocity of molecules of H_2, N_2, O_2, and HBr is

A. $H_2 > N_2 > O_2 > HBr$

B. $HBr > O_2 > M_2 > H_2$

C. $HBr > H_2 > O_2 > N_2$

D. $N_2 > O_2 > H_2 > HBr$

Watch Video Solution

66. Which of the following statements is wrong for gases?

(a)Gases do not gave a definite shape and volume

(b)Volume of the gas is equal to volume of container confining the gas

(c)Confined gas exerts uniform pressure on the walls of its container in all directions

(d)Mass of gas cannot be determined by weighing a container in which it is enclosed

A. Gases do not have a definite shape and volume.

B. Volume of the gas is equal to volume of container confining the gas.

C. Confining gas exerts uniform pressure on the walls of container in all directions

D. Mass of gas cannot be determined by weighing a container in which it is enclosed.

Watch Video Solution

67. $3.2g$ oxygen is diffused in 10 min . In similar conditions, $2.8g$ nitrogen will diffuse in

A. (a) 9.3 min

B. (b) 8.2 min

C. (c) 7.6 min

D. (d) 11.8 min

Watch Video Solution

68. At what temperature will the molar kinetic energy of 0.3 mol of He be the same as that of 0.4 mol of argon at 400 K ?

A. (a) $700K$

B. (b) $500K$

C. (c) $800K$

D. (d) $400K$

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69. Which one of the following statements is not correct about the three states of matter i.e., solid, liquid and gaseous ?

A. Molecules of solid posses least energy whereas those of a gas posses highest energy.

B. The density of a solid is highest whereas that of gases is lowest.

C. Gases like liquids posses definite volumes.

D. Molecules of a solid possess vibratory motion.

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70. Which of the following is true about gaseous state?

A. Thermal energy $=$ Molecular attraction

B. Thermal energy $> >$ Molecular attraction

C. Thermal energy $< <$ Molecular attraction

D. Molecular forces $> >$ Those in liquids

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71. Which of the following is not a correct postulate of kinetic theory of gases?

A. The molecules of a gas are continously moving in different directions with different velocities.

B. The average kinetic energy of the gas molecules is directly porportional to the absolute temperature of the gas.

C. The volume of the gas is due to the large number of molecules present in it.

D. The pressure of the gas is due to the collision of the molecules on the walls of the container.

Watch Video Solution

72. In the van der Waals equation

A. b is the volume occupied by the gas molecules

B. b is four times the volume occupied by the gas molecules

C. b is the correction factor for intermolecular attraction

D. None of these

Answer: B

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73. According to kinetic theory of gases, for a datomic molecule.

A. The pressure exerted by the gas is proportional to the mean velocity of the molecule.

B. The pressure exerted by the gas is proportional to the root mean velocity of the molecule.

C. The root mean square velocity of the molecule is inversely proportional to the temperature.

D. The mean translational kinetic energy of the molecule is proportional to the absolute temperature.

Watch Video Solution

74. A vessel is filled with a mixture of oxygen and nitrogen. At what ratio of partial pressures will the mass of gases be identical?

A. $P(O_2) = 0.785P(N_2)$

B. $P(O_2) = 8.75P(N_2)$

C. $P(O_2) = 11.4P(N_2)$

D. $P(O_2) = 0.875P(N_2)$

Watch Video Solution

75. Select the correct statement. In the gas equation, $PV = nRT$

A. n is the number of molecules of a gas.

B. n moles of the gas have a volume V.

C. V denotes volume of one mole of the gas.

D. P is the pressure if the gas when only one mole of gas is present.

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76. When is the deviation more in the behaviour of a gas from the ideal gas equation pV = nRT?

A. At high temperature and low pressure.

B. At low temperature and high pressure.

C. At high temperature and high pressure.

D. At low temperature and low pressure.

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77. An ideal gas obeying the kinetic theory of gases can be liquefied if

A. Its temperature is more than its critical temperature (T_c)

B. Its pressure is more than its critical pressure (P_c)

C. Its pressure is more than P_c at a temperature less than T_c

D. It cannot be liquefied at any value of P and T

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78. Which of the following expressions correctly represents the relationship between the average molar kinetic energy, $\overline{KE}$ of CO and N_2 molecules at the same temperature?

A. $KE_{CO} = KE_{N_2}$

B. $KE_{CO} > KE_{N_2}$

C. $KE_{CO} < KE_{N_2}$

D. Cannot be predicted unless volumes of the gases are given

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79. Which expression gives average speed of gas molecules?

A. $\sqrt{\frac{8RT}{M}}$

B. $\frac{3RT}{M}$

C. $\left[\frac{8RT}{\pi M}\right]^{1/2}$

D. $\frac{8RT}{3.14M}$

Answer: C

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80. Under similar conditions, which of the following gas will have same value of μ_{rms} as CO_2?

A. NO

B. C_3H_8

C. CO

D. N_2

Watch Video Solution

81. $15L$ of gas at STP is subjected to four different conditions of temperature and pressure as shown below. In which case the volume will remain unaffected?

A. $273K, 2\text{bar}$ pressure

B. $273^\circ C, 0.5atm$ pressure

C. $546^\circ C, 1.5atm$ pressure

D. $273^\circ C, 2atm$ pressure

Watch Video Solution

82. A gaseous mixture contains oxygen and nitrogen in the ratio $1:4$ by weight. Therefore, the ratio of the number of molecules is:

A. $1:8$

B. $1:1$

C. $7:64$

D. $1:2$

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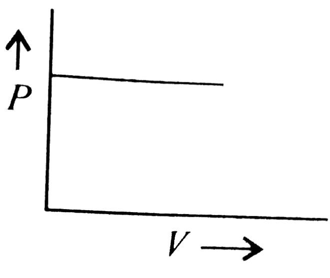
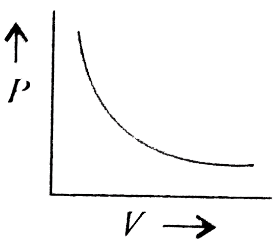
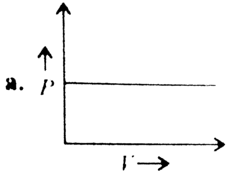
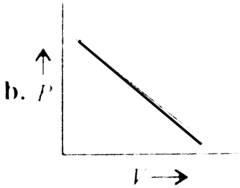
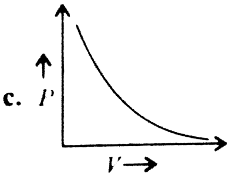
83. Among the plots of $P vs V$ given below, which one corresponds to Boyle's law?

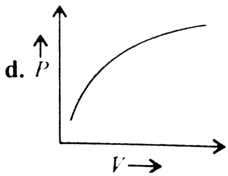
a. 

b. 

A. 

B. 

C. 

D. 

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84. The pressure of a gas is due to .... exerted by its molecules per .... of the walls of the container.

A. Rapid intermolecular collisions

B. Molecular impacts against the walls of vessel

C. Voids between the gas molecules

D. Ideal behaviour of gases

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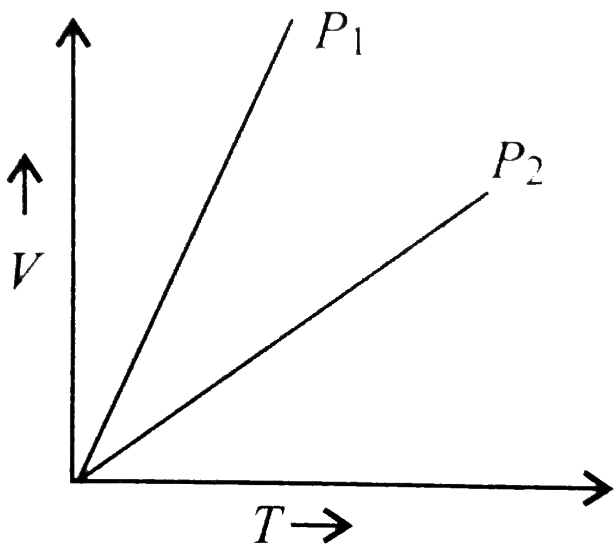
85. V vs T curves at different pressures P_1 and P_2 for an ideal gas are shown below:



Which one of the following is correct?

A. $P_1 > P_2$

B. $P_1 < P_2$

C. $P_1 = P_2$

D. $P_2 / P_1 = 1/2$

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Exercises (Assertion-Reasoning)

1. Assertion: The heat absorbed during the isothermal expansion of an ideal gas against vacuum is zero.

Reason: The volume occupied by the molecules of an ideal gas is zero.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: A::B::C::D

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2. Assertion: The pressure of a fixed amount of an ideal gas is proportional to its temperature.

Reason: Frequency of collisions and their impact both increase in proportion of the square root of temperature.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: A::B::C::D

Watch Video Solution

3. Assertion: $C_P - C_V = R$ for an ideal gas.

Reason: $\left(\frac{\partial E}{\partial V}\right)_T = 0$ for an ideal gas.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: A::B::C::D

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4. Assertion: A lighter gas diffuses more rapidly than heavier gas.

Reason: At a given temperature and pressure, the rate of diffusion of a gas is inversely proportional to the square root of its density.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: A::B::C::D

Watch Video Solution

5. Assertion: On cooling, the brown colour of nitrogen dioxide disappears.

Reason: On cooling, NO_2 undergoes dimerisation resulting in the pairing of the odd electron in NO_2.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: A::B::C::D

Watch Video Solution

6. Assertion (A): SO_2 and Cl_2 are both bleaching agents.

Reason (R): Both are reducing agents.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: A::B::C::D

Watch Video Solution

7. Assertion: Nitrogen is unreactive at room temperature but becomes reactive at elevated temperature (on heating or in the presence of catalysts).

Reason: In nitrogen molecule, there is extensive delocalisation of electrons.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: A::B::C::D

Watch Video Solution

8. Assertion: Noble gases can be liquefied.

Reason: Attractive forces can exist between nonpolar molecules.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: A::B::C::D

Watch Video Solution

9. Assertion: Under similar conditions of temperature and pressure,O_2 diffuses 1.4 times faster than SO_2.

Reason: Density of SO_2 is 1.4 times greater than that of O_2.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: A::B::C::D

Watch Video Solution

10. Assertion: On compressing a gas to half the volume, the number of molecules is halved.

Reason: The number of moles present decreases with decrease in volume keeping the pressure and temperature constant.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: A::B::C::D

Watch Video Solution

11. Assertion: The plot of volume (V) versus pressure (P) at constant temperature is a hyperbola in the first quadrant.

Reason: $V \propto 1/P$ at constant temperature.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: A::B::C::D

Watch Video Solution

12. Assertion: At constant temperature, if pressure on the gas is doubled, density is also doubled.

Reason: At constant temperature, molecular mass of a gas is directly proportional to the density and inversely proportional to the pressure

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: A::B::C::D

Watch Video Solution

13. Assertion: If H_2 and Cl enclosed separately in the same vessel exert pressure of 100 and $200mm$ respectively, their mixture in the same vessel at the same temperature will exert a pressure of $300mm$

Reason: Dalton's law of partial pressures states that total pressure is the sum of partial pressures.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: A::B::C::D

Watch Video Solution

14. STATEMENT-1 : Most probable speed is the speed possessed by maximum fraction of molecules at the same temperature.

STATEMENT-2 : On collision, more and more molecules acquire higher speed at the same temperature.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: A::B::C::D

Watch Video Solution

15. Assertion: Compressibility factor (Z) for non ideal gases is always greater than 1.

Reason: Non-ideal gases always exert higher pressure than expected.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. Both (A) and (R) are incorrect.

Answer: A::B::C::D

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16. Assertion: van der Waals equation is applicable only to non-ideal gases.

Reason: Ideal gases obey the equation $PV = nRT$.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: A::B::C::D

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17. STATEMENT-1 : Helium shows only positive deviation from ideal behaviour at room temperature.

STATEMENT-2 : Helium is an inert gas.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: A::B::C::D

Watch Video Solution

18. Assertion: Gases are easily adsorbed on the surface of metals, especially transition metals.

Reason: Transition metals have free valencies

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: A::B::C::D

Watch Video Solution

19. Assertion: SO_2 gas is easily liquefied while H_2 is not.

Reason: SO_2 has low critical temperature while H_2 has high critical temperature.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: A::B::C::D

Watch Video Solution

20. Assertion: Molecules of air in a room do not all fall and settle on the ground due to gravity.

Reason: Air molecules move with high speed and there is incressant collision of air molecules.

A. (a) If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: A::B::C::D

Watch Video Solution

21. Assertion: In van der Waals equation $\left(P+\frac{a}{V^2}\right)(V-b)=RT$ pressure correction $\left(a/V^2\right)$ is due to the force of attraction between molecules.

Reason: Volume of gas molecule cannot be neglected due to force of attraction.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: A::B::C::D

Watch Video Solution

22. STATEMENT-1 : A lighter gas diffuses mor rapidly than a heavier gas.

STATEMENT-2 : At a given temperature, the rate of diffusion of a gas is inversely proportional to density.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: A::B::C::D

Watch Video Solution

23. Assertion: A gas can be easily liquefied at any temperature below is critical temperature.

Reason: Liquification of a gas takes place when the average kinetic energy of the molecules is low.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: A::B::C::D

Watch Video Solution

24. Assertion: At absolute zero temperature, vapour pressure, kinetic energy, and heat content of the gas reduce to zero.

Reason: At absolute zero, temperature velocity reduces to zero.

A. (a) If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. (b) If both (A) and (R) are correct, but(R) is not the correct explanation of(A).

C. (c) If (A) is correct, but (R) is incorrect.

D. (d) If (A) is incorrect, but (R) is correct.

Answer: A::B::C::D

Watch Video Solution

Exercises (Integer)

1. The ratio of the inversion temperature of a gas to its Boyle temperature is

A. 1

B. 2

C. 3

D. 4

Watch Video Solution

2. A certain gas is at a temperature of $350K$.If temperature is raised to $700K$,average translational kinetic energy of the gas will increase by

A. 2

B. 3

C. 4

D. 5

Watch Video Solution

3. The value of compressibility factor (Z) for an ideal gas is

A. 2

B. 1

C. 3

D. 4

Watch Video Solution

4. The ratio of excluded volume (b) to molar volume of a gas molecule is

A. 1

B. 2

C. 3

D. 4

Watch Video Solution

5. What is the ratio of rate of diffusion of gas A and B. The molecular mass of A is 11 and molecular mass of B is 44.

A. (a) 1

B. (b) 2

C. (c) 3

D. (d) 4

Watch Video Solution

6. Initial volume of a gas is $1L$ at temperature $100K$. What is the volume of a gas at $300K$.

A. (a) 1

B. (b) 2

C. (c) 3

D. (d) 4

Watch Video Solution

7. What is the average speed of a molecule, having a molecular mass of $529.5 gmol^{-1}$ at temperature $100K$

A. (a) 1

B. (b) 2

C. (c) 3

D. (d) 4

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8. Calculate the moles of an ideal gas at pressure $2atm$ and volume $1L$ at a temperature of $97.5K$

A. 1

B. 2

C. 3

D. 4

Watch Video Solution

9. A $10L$ box contains $41.4g$ of a mixture of gases C_xH_8 and C_xH_{12}. The total pressure at $44^\circ C$ in flask is $1.56atm$. Analysis revelated that the gas mixture has 87% total C and 13% total H. Find out the value of x

A. 1

B. 3

C. 5

D. 2

Watch Video Solution

10. The rate of diffusion of methane is twice that of X. The molecular mass of X is divided by 32. What is value of x is ?

A. 1

B. 2

C. 3

D. 4

Watch Video Solution

Archives (Multiple Correct)

1. If a gas expands at constant temperature:

A. The pressure decreases

B. The kinetic energy of the molecules remains the same

C. The kinetic energy of the molecules decreases

D. The number of molecules of the gas increases

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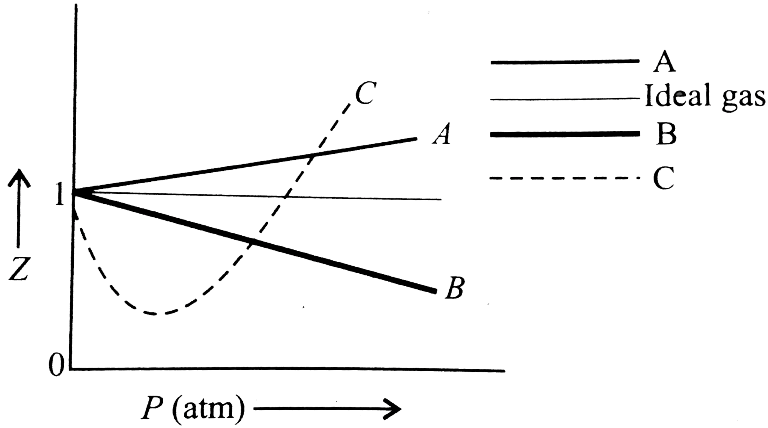
2. The given graph represents the variations of compressibility factor $Z = PV/nRT$ vs P for three real gases A, B, and C.



Identify the incorrect statements.

A. For gas $A, a = 0$ and its dependence on p is linear at all pressures.

B. For gas $B, b = 0$ and its dependence on p is linear at all pressures.

C. For gas C, which is a typical real gas, neither a nor $b = 0$. By knowing the minima and power of intersection with $Z = 1, a$ and b can be calculated.

D. At high pressure, the slope is positive for all real gases.

Watch Video Solution

3. A gas described by van der Waals equation

A. (a) behaves similar to an ideal gas in the limit of large molar volumes.

B. (b) behaves similar to an ideal gas in the limits of large pressures.

C. (c) is characterised by van der Waals coefficients that are dependent on the identity of the gas but are independent of the temperature.

D. (d) has pressure that is lower than the pressure exerted by the same gas behaving ideally.

Watch Video Solution

Archives (Single Correct)

1. The ratio of root mean square velocity of average velocity of a gas molecule at a particular temperture is

A. $1.086:1$

B. $1:1.086$

C. $2:1.086$

D. $1.086:2$

Watch Video Solution

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

(a)Critical temperature

(b)Inversion temperature

(c)Boyle temperature

(d)Reduced temperature

A. Critical temperature

B. Boyle temperature

C. Inversion temperature

D. Reduced temperature

Watch Video Solution

3. Equal mass of methane and oxygen are mixed in an empty container at 25°C. The fraction of the total pressure exerted by oxygen is:

A. $\frac{1}{3}$

B. $\frac{1}{2}$

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

D. $\frac{1}{3} \times \frac{273}{298}$

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4. Helium atom is two times heavier than a hydrogen molecule. At 289 K, the average kinetic energy of a helium atom is

A. Two times that of a hydrogen molecule

B. Same as that of a hydrogen molecule

C. Four times that of a hydrogen molecule

D. Half that of a hydrogen molecule

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5. When an ideal gas undergoes unrestrained expansion, no cooling occurs because the molecules

A. Are above the inversion temperature

B. Exert no attractive forces on each other

C. Do work equal to loss in kinetic energy

D. Collide without losing energy

Watch Video Solution

6. Equal weights of methane and hydrogen are mixed in an empty container at $25^\circ C$. The fraction of the total pressure exerted by hydrogen is

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

B. $\frac{8}{9}$

C. $\frac{1}{9}$

D. $\frac{16}{17}$

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7. A liquid is in equilibrium with its vapour at its boiling point. On average, the molecules in the two phases have equal

A. Intermolecular forces

B. Potential energy

C. Kinetic energy

D. Total energy

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8. The rate of diffusion of a gas is

A. Directly proportional to its density

B. Directly proportional to its molecular weight

C. Directly proportional to the square root of its molecular weight

D. Inversely proportional to the square root of its molecular weight

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9. The average velociy of an ideal gas molecule at $27^{\circ} C$ is $0.3 ms^{-1}$. The average velocity at $927^{\circ} C$ will be

A. $0.6 ms^{-1}$

B. $0.3 ms^{-1}$

C. $0.9 ms^{-1}$

D. $3.0 ms^{-1}$

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10. In van der Waals equation for non - ideal gas , the term that accounts for intermolecular force is

A. $V - b$

B. RT

C. $p+\frac{a}{V^2}$

D. $(RT)^{-1}$

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11. A bottle of dry ammonia and a bottle of dry hydrogen chloride connected through a long tube are opened simultaneously at both ends. The white ammonium chloride ring first formed will be

A. (a) At the center of the tube

B. (b) Near the hydrogen chloride bottle

C. (c) Near the ammonia bottle

D. (d) Throughout the length of the tube

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12. The values of van der Waals' constant 'a' for O_2, N_2, NH_3 and CH_4 are $1.360, 1.390, 4.170$ and $2.253 L^2$ atm mol

respectively. The most easily liquefiable gas among these is

A. O_2

B. N_2

C. NH_3

D. CH_4

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13. The density of neon gas will be highest at

A. STP

B. $0^\circ C, 2atm$

C. $273^\circ C, 1atm$

D. $273^\circ C, 2atm$

Watch Video Solution

14. The rate of diffusion of methane is twice that of X. The molecular mass of X is divided by 32. What is value of x is ?

A. 64.0

B. 32.0

C. 4.0

D. 8.0

Watch Video Solution

15. Accoring to the kinetic theory of gases, for a diatomic molecule

A. The pressure exerted by the gas is proportional to the mean velocity of the molecule.

B. The pressure exerted by gas is proportional to the root mean velocity of the molecule.

C. The root mean square velocity of the molecule is inversely proportional to the temperature.

D. The mean translational kinetic energy of the molecule is proportional to the absolute temperature.

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16. At constant volume, for a fixed number of moles of a gas, the pressure of the gas increases with increase in temperature due to:

A. Increase in average molecular speed

B. Increase in the rate of collisions among the molecules

C. Increase in the molecular attraction

D. Decrease in the mean free path

Watch Video Solution

17. Equal mass of methane and oxygen are mixed in an empty container at 25° C. The fraction of the total pressure exerted by oxygen is:

A. $1:2$

B. $1:1$

C. $1:16$

D. $15:16$

Watch Video Solution

18. The ratio between the root mean square velocity of H_2 at 50 K and that of O_2 at 800 K is:

A. 4

B. 2

C. 1

D. $1/4$

Watch Video Solution

19. X mL of H_2 gas effuses through a hole in a container in 5 seconds. The time taken for the effusion of the same volume of the gas specified below under identical condition is:

A. $10s, He$

B. $20s, O_2$

C. $25s, CO$

D. $55s, CO_2$

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20. The value of compressibility factor for an ideal gas is equal to 1.

A. 1.5

B. 1.0

C. 2.0

D. ∞

Answer: B

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21. According to Graham's law, at a given temperature the ratio of diffusion $\frac{r_A}{r_B}$ of gases A and B is given by

(where P and M are pressures and molecular weights of gases A and B respectively)

A. $\left(\frac{P_A}{P_B}\right)\left(\frac{M_A}{M_B}\right)^{1/2}$

B. $\left(\frac{M_A}{M_B}\right)\left(\frac{P_A}{P_B}\right)^{1/2}$

C. $\left(\frac{P_A}{P_B}\right)\left(\frac{M_B}{M_A}\right)^{1/2}$

D. $\left(\frac{M_A}{M_B}\right)\left(\frac{P_B}{P_A}\right)^{1/2}$

Watch Video Solution

22. A gas will approach ideal behaviour at

A. Low temperature and low pressure

B. Low temperature and high pressure

C. High temperature and low pressure

D. High temperature and high pressure

Watch Video Solution

23. The RMS velocity of hydrogen is $\sqrt{7}$ times the RMS velocity of nitrogen. If T is the temperature of the gas

A. $T_{H_2} = T_{N_2}$

B. $T_{H_2} > T_{N_2}$

C. $T_{H_2} < T_{N_2}$

D. $T_{H_2} = \sqrt{7}T_{N_2}$

Watch Video Solution

24. The compressibility of a gas is less than unity at STP. Therefore,

A. $V_m > 22.4L$

B. $V_m < 22.4L$

C. $V_m = 22.4L$

D. $V_m = 44.8L$

Watch Video Solution

25. At 100°C and 1 atm, if the density of liquid water is $1.0gcm^{-3}$ and that of water vapour is 0.0006 gcm-3 , then the volume occupied by water molecules in 1 litre of steam at that temperature is:

A. 6

B. 60

C. 0.6

D. 0.06

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26. The root mean square velocity of an ideal gas at constant pressure varies with density d as

A. d^2

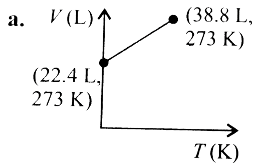
B. d

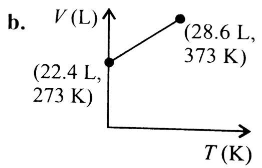
C. $\sqrt{d}$

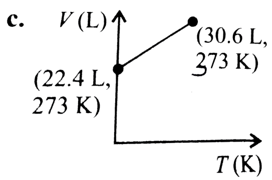
D. $1/\sqrt{d}$

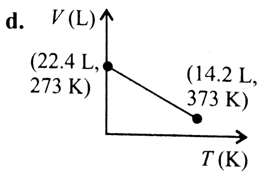
Watch Video Solution

27. Which of the following volume-temperature $(V - T)$ plots represents the behaviour of 1mole of an ideal gas at the atmospheric pressure?

A. 

B. 

C. 

D. 

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28. If temperature increases, the surface tension of a liquid

A. Increases

B. Decreases

C. Remains constant

D. Shows irregular behaviour

Watch Video Solution

29. Positive deviation from ideal behaviour takes place because of

A. (a) The molecular interaction between atom and $PV/nRT > 1$

B. (b) The molecular interaction between atom and $PV/nRT < 1$

C. (c) The finite size of atoms and $PV/nRT > 1$

D. (d) The finite size of atoms and $PV/nRT < 1$

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30. For a monatomic gas, kinetic energy $= E$. The relation with rms velocity is

A. $u = \left(\frac{2E}{m}\right)^{1/2}$

B. $u = \left(\frac{3E}{2m}\right)^{1/2}$

C. $u = \left(\frac{E}{2m}\right)^{1/2}$

D. $u = \left(\frac{E}{3m}\right)^{1/2}$

Watch Video Solution

31. The ratio of the rate of diffusion of helium and methane under indentical conditions of pressure and temperature will be

A. (a) 4

B. (b) 2

C. (c) 1

D. (d) 0.5

Watch Video Solution

32. The term that is correct for the attractive forces present in a real gas in the van der Waals equation is

A. nb

B. $\frac{an^2}{V^2}$

C. $-\frac{an^2}{V^2}$

D. $-nb$

Watch Video Solution

Archives (Assertion-Reasoning)

1. Assertion: The value of van der Waals constant a is larger for ammonia than for nitrogen.

Reason: Hydrogen bonding is present in ammonia.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

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2. Assertion: The pressure of a fixed amount of an ideal gas is proportional to its temperature.

Reason: Frequency of collisions and their impact both increase in proportion of the square root of temperature.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

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Archives (Integer)

1. At $400K$, the root mean square (rms) speed of a gas X (molecular weight $= 40$) is equal to the most probable speed of gas Y at $60K$. Calculate the molecular weight of the gas Y.

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Archives (Subjective)

1. 3.7 g of a gas at 25°C occupies the same volume as 0.184 g of hydrogen at 17°C and at the same pressure. What is the molecular mass of the gas ?

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2. Calculate the density of NH_3 at $30^\circ C$ and $5 atm$ pressure.

Watch Video Solution

3. 4.215 g a metallic carbonate was heated in a hard glass tube and CO_2 evolved was found to measure 1336 mL at 27°C and 700 mm pressure. What is the equivalent mass of the metal ?

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4. A hydrocarbon contains $10.5g$ of carbon per gram of hydrogen. $1L$ of vapour of the hydrocarbon at $127^{\circ}C$ and 1 atm pressure weighs $2.8g$. Find the molecular formula of the hydrocarbon.

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5. The pressure in a bulb dropped from 2000 to $1500mmHg$ in $47 \min$ when the contained oxygen leaked through a small hole. The bulb was then evacuated. A mixture of oxygen and another gas of molecular weight 79 in the molar ratio of $1:1$ at a total pressure of $4000mm$ of mercury was introduced. Find the molar ratio of the two gases remaining in the bulb after a period of $74 \min$.

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6. At room temperature, ammonia gas at 1 atm pressure and hydrogen chloride gas at P atm pressure are allowed to effuse through identical pin

holes from opposite ends of a glass tube of one metre length and of uniform cross section. Ammonium chloride is first formed at a distance of 60 cm from the end through which HCl gas is sent in. What is the value of P?

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7. Calculate the average kinetic energy in joules of the molecules in 8.0 g of methane at $27^{\circ} C$.

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8. Oxygen is present in a 1 litre flask at a pressure of $7.6 \times 10^{-10} mm$ of Hg. Calculate the number of oxygen molecules in the flask at $0^{\circ} C$

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9. When 2g of a gas A is introduced into an evacuated flask kept at $25^{\circ} C$, the pressure is found to be one atmosphere. If 3 g of another gas B are then added to the same flask, the total pressure becomes 1.5 atm. Assuming ideal gas behaviour, calculate the ratio of molecular weights $M_A : M_B$.

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10. The density of mercury is 13.6 g/mL. The diameter of an atom of mercury assuming that each atom is occupying a cube of edge length equal to the diameter of the mercury atom is approximately

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11. Give reasons for the following in one or two sentences.

(a) A bottle of liquor ammonia should be cooled before opening the stopper.

(b) Equal volumes of gases contain equal number of moles.

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12. Calculate the root mean square velocity of ozone kept in a closed vessel at $20^{\circ}C$ and $82 cmHg$ pressure.

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13. A balloon of 21 cm diameter is to be filled with hydrogen gas at S.T.P. from a cylinder containing hydrogen gas at 20 atm and 300 K. The capacity of the cylinder is 2.82 litres at S.T.P. How many balloons can be filled in ?

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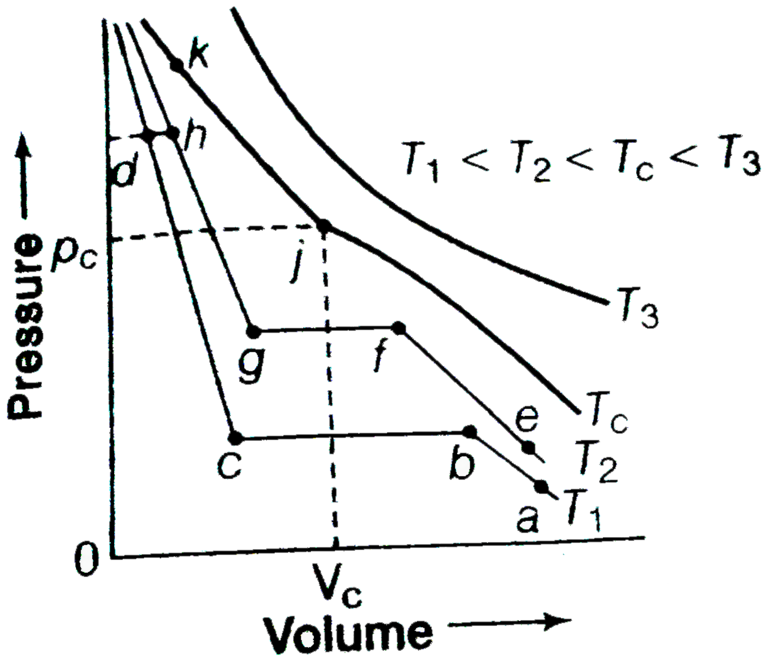
14. Isotherms of carbon dioxide at various temperatures are repersented in figure. Answer the following questions based on this figures.



(i) In which state will CO_2 exist between the points a and b at temperature T_1 ?

(ii) At what point will CO_2 start liquefyinh when temperature is T_1 ?

(iii) At what point will CO_2 be completely liquefued when temperature is T_2 ?

(iv) Will condensation take place when the temperature is T_3 ?

(v) What portion of the isotherm at T_1 represent liquid and gaseous CO_2 at equilibrium ?

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15. Calculate the volume occupied by $5.0g$ of acetylene gas at $50^{\circ}C$ and $740mm$ pressure.

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16. At room temperature, the following reaction proceeds nearly to completion:

$2NO + O_2 \rightarrow 2NO_2 \rightarrow N_2O_4$

The dimer, N_2O_4, solidfies at $262K$. A $250mL$ flask and a $100mL$ flask are separated by a stopcock. At $300K$, the nitric oxide in the larger flask exerts a pressure of $1.053atm$ and the smaller one contains oxygen at $0.789atm$. The gase are mixed by opening the stopcock and after the end of the reaction the flasks are cooled to $220K$. Neglecting the vapour pressure of the dimer, find out the pressure and composition of the gas remaining at $220K$. (Assume the gases to behave ideally)

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17. At $27^{\circ}C$, hydrogen is leaked through a tiny hole into a vessel for 20 min . Another unknown gas at the same temperature and pressure as that of hydrogen is leaked through the same hole for 20 min . After the effusion of the gases, the mixture exerts a pressure of $6atm$. The hydrogen content of the mixture is $0.7mol$. If the volume of the container is $3L$, what is the molecular weight of the unknown gas?

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18. A gas bulb of $1L$ capacity contains 2.0×10^{11} molecules of nitrogen exerting a pressure of $7.57 \times 10^{3} Nm^{-2}$. Calculate the root mean square (rms) speed and the temperature of the gas molecules. If the ratio of the most probable speed to the root mean square is 0.82, calculate the most probable speed for these molecules at this temperature.

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19. An LPG cylinder weighs $14.8kg$ when empty. When full it weighs $29.0kg$ and the weight of the full cylinder reduces to $23.2kg$. Find out the volume of the gas in cubic metres used up at the normal usage conditions Assume LPG to be n-butane with normal boiling point of $0^{\circ} C$.

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20. A 4: 1 molar mixture of He and CH4 is contained in a vessel at 20 bar pressure. Due to a hole in the vessel, the gas mixture leaks out. What is the composition of the mixture effusing out initially?

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21. A mixture of ethane and ethene occupies $40mL$ at $1.0atm$, and $400K$. The mixture reacts completely with $130g$ of O_2 to produce CO_2 and H_2O. Assuming ideal gas behaviour, calculate the mole fractions of C_2H_4 and C_2H_6 in the mixture.

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22. The composition of the equilibrium mixture (Cl_2 $2Cl$) , which is attained at $1200^{\circ} C$, is determined by measuring the rate of effusion through a pin hole. It is observed that a $1.80 mmHg$ pressure, the mixture effuses $1.16 \times$ as fact as krypton effuses under the same conditions. Calculate the fraction of chlorine molecules dissociated into atoms (atomic weight of Kr is 84).

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23. A mixture of ideal gases is cooled up to liquid helium temperature $4.22 K$ to form an ideal solution. Is this statement true or false?

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24. One way of writing the equation of state for real gases is

$$PV = RT\left[1 + \frac{B}{V} + \dots\right]$$

where B is a constant. Derive an approximate expression for B in terms of the van der Waals constants a and b.

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25. An evacuated glass vessel weighs $50.0g$ when empty, $148.0g$ when filled with a liquid of density $0.98gmL^{-1}$, and $50.5g$ when filled with an ideal gas at $760mmHg$ at $300K$. Determine the molar mass of the gas.

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26. For the equation

$N_2O_5(g) = 2NO_2(g) + (1/2)O_2(g)$, calculate the mole fraction of $N_2O_5(g)$ decomposed at a constant volume and temperature, if the initial pressure is $600mmHg$ and the pressure at any time is $960mmHg$. Assume ideal gas behaviour.

Watch Video Solution

27. Using van der Waals' equation, find the constant 'a' (in atm $L^2 mol^{-2}$) when two moles of a gas confined in 4 L flask exerts a pressure of 11.0 atmospheres at a temperature of 300 K. The value of b is 0.05 L mol^{-1} .(R = 0.082 atm.L/K mol)

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28. One mole of nitrogen gas at $0.8 atm$ takes $38 s$ to diffuse through a pinhole, while $1 mol$ of an unknown fluoride of xenon at $1.6 atm$ takes $57 s$ to diffuse through the same hole. Calculate the molecular formation of the compound.

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29. The pressure exerted by $12 g$ of an ideal gas at temperature $t^\circ C$ in a vessel of volume $V litre$ is $1 atm$. When the temperature is increased by

$10^{\circ} C$ at the same volume, the pressure increases by 10%. Calculate the temperature t and volume V. (Molecular weight of the gas is 120).

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30. The compression factor (compressibility factor) for $1 mol$ of a van der Waals gas at $0^{\circ} C$ and $100 atm$ pressure is found to be 0.5. Assuming that the volume of a gas molecule is neligible, calculate the van der Waals constant a.

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31. The density of the vapour of a substance at $1 atm$ pressure and $500 K$ is $0.36 kg m^{-3}$. The vapour effuses through a small hole at a rate of 1.33 times faster than oxygen under the same condition.

(a) Determine (i) the molecular weight, (ii) the molar volume

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32. The average velocity of gas molecules is $400 ms^{-1}$. Calculate their rms velocity at the same temperature.

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33. Which of the following statement is/are true? According to kinetic theory of gases

A. Collisions are always elastic.

B. Heavier molecules transfer more momentum to the wall of the container.

C. Only a small number of molecules have very high velocity.

D. Between collisions, the molecules move in straight lines with constant velocities.

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34. To an evacuated vessel with movable piston under external pressure of 1 atm 0.1 mole of He and 1.0 mole of an unknown compound vapour pressure 0.68 atm at $0^{\circ}C$ are introduced Considering the ideal gas behaviour the total volume (in litre) of the gases at $0^{\circ}C$ is close to .

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Ex 5.1

1. At a constant temperature, a gas occupies a volume of $200mL$ at a pressure of 0.720bar. It is subjected to an external pressure of 0.900bar. What is the resulting volume of the gas?

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2. A vessel of 120 mL capacity contains a certain amount of gas at $35^{\circ}C$ and 1.2 bar pressure. The gas is transferred to another vessel of volume 180 mL at $35^{\circ}C$. What would be its pressure?

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3. $200cm^2$ of a ga at 800 mm pressure is allowed to expand till the pressure is 0.9 atm keeping ath temperature constant. Calculate the volume of the gas.

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4. A thin glass bulb of 100 mL capacity is evacuated and kept in 2.0 L container at $27^\circ C$ and 800 mm pressure. If the bulb implodes isothermally, calculate the new pressure in the container in kilopascals (kPa)

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5. A bulb A containing gas at 1.5 bar pressure was connected to an evacuated vessel of 1.0 dm^3 capacity through a stopcock. The final pressure of the system dropped to 920 mbar at the same temperature. What is the volume of the container A?

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6. Draw a graph of log P vs log (1/V) for a fixed amount of a gas at constant temperature.

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7. On a ship sailing in pacific ocean where temperature is $23.4^{\circ}C$, a balloon is filled with $2L$ air. What will be the volume of the balloon when the ship reaches Indian ocean, Where temperature is $26.1^{\circ}C$?

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8. A sample of gas occupies of 10 L at $127^{\circ}C$ and I bar Pressure. The gas is cooled to $-73^{\circ}C$ at the same pressure. What will be the volume of the gas?

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9. A gas occupies 100.0 mL at $50^\circ C$ and I atm pressure. The gas is cooled at constant pressure so that its volume is reduced to 50.0 mL. what is the final temperautre?

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10. A vessel of capacity $400cm^3$ contains hydrogen gas at 1 atm pressure at $7^\circ C$. In order to expel $28.57cm^3$ of the gas at the same pressure, to what temperature the vessel should be heated ?

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11. $2.25dm^3$ of chlorine at 283 K is heated until the volume becomes $30dm^3$. To what temperature the gas must be raised to accomplish the change ?

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12. 1 L of air weighs 1.293 g at $0^{\circ} C$ and 1 atm pressure. At becomes $30 dm^{3}$. To what temperature the gas must be raised to accomplish the change ?

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13. A sample of CO with volume 500 mL at a pressure of 760 mm is to be compressed to a volume of 450 mL. What additional pressure is required to accomplish the change if the temperature is kept constant?

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14. A flask having a volume of 250.0 mL and containing air is heated to $100^{\circ} C$ and sealed. Then the flask is cooled to $25^{\circ} C$, immersed in water, and opened. What volume of water will be drawn back into the flask, assuming the pressure remaining constant ?

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15. A flask containing 250 mg of air at $27^{\circ} C$ is heated till 25.5% of air by mass is expelled from it. What is the final temperature of the flask ?

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Ex 5.2

1. Assuming ideal behaviour, calculate Boyle's law constant for each of the following gase at $25^{\circ} C$

a. 10g of O_2 in 2 L container

b. 8g of CH_4 in 5 L container

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2. A sample of gas is taken in a closed vessel at $20^{\circ} C$. The gas is heated until the pressure and volume is doubled. What is the final temperature?

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3. What volume of O_2 at 2.00 atm pressure and $27^{\circ} C$ is required to burn 10.0 g of heptane (C_7H_{16}) ?

$C_7H_{16} + 11O_2 \rightarrow 7CO_2 + 8H_2O$

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4. The mass of 525 cm^3 of a gaseous compound at $28^{\circ} C$ and 730 torr was found to be 0.900 g. Calculate the molar mass of the compound.

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5. At the top of the mountain, the thermometer reads $0^{\circ} C$ and the barometer reads $710 mmHg$. At the bottom of the mountain the temperature is $30^\circ C$ and the pressure is $760 mmHg$. The ratio of the density of air at the top with that at the bottom is

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6. Two flasks A and B have equal volume. Flask A contains hydrogen at 300 K while flask B has an equal mass of CH_4 at 600 K.

which flask contains larger number of molecules?

b. In which flask is the pressure greater and by how many times?

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7. 2.9 g of a gas at $90^\circ C$ occupies the same volume as 0.184 g of H_2 at $17^\circ C$ at the same pressure. What is the molar mass of the gas ?

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8. Calculate the temperature of 4.0 mol of a gas occupying $5dm^3$ at 3.32 bar pressure. (R = 0083 bar $dm^3K^{-1}mol^{-1}$)

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9. Calculate the pressure exerted by 56 g of an ideal gas (with molar mass 28 g mol^{-1}) enclosed in a vessel of volume $0.1m^3$ at 300 K (R = 8.314 N m $mol^{--1}K^{-1}$)

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10. An air bubble has a radius of 0.50 cm at the bottom of a water tank where the temperature is 280 K and the pressure is 280 kPa. When the bubble rises to the surface, the temperature changes to 300 K and pressure to 300 K and pressure to 100 kPa. Calculate the radius of the bubble at the surface

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11. A gas cylinder having a volume of 25.0 L contains a mixtue of butane $CH_3(CH_2)_2CH_3$ and isobutane $(CH_3)_3CH$ in the ratio of 3 : 1 by moles. If the pressure inside the cylinder is 6.78×10^6 pa and the temperature is 298 K, calculate the number of molecular of each gas assuming ideal gas behaviour. (1 atm = 101325 Pa)

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12. 600 mL of nitrogen at 30 K is cooled to 5 K at the same pressure. Calculate the new volume.

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13. 300 L of ammonia gas at $20^\circ C$ and 20 atm pressure is allowed to expand in a space of 600 L capacity and to a pressure of 1 atm. Calculate the drop in temperature.

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14. A 1 L flask containing vapours of methyl alcohol (molar mass 32) at a pressure of 1atm and $25^{\circ} C$ was evacuated till the fill was 10^{-3} mm. How many molecules of methyl alcohol are left in the flask ?

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15. At the top of the mountain, the thermometer reads $0^{\circ} C$ and the barometer reads $710 mmHg$. At the bottom of the mountain the temperature is $30^{\circ} C$ and the pressure is $760 mmHg$. The ratio of the density of air at the top with that at the bottom is

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16. A large flask fitted with a stopcock is evacuated and weighted. Its mass is found to be 134.567 g. The volume of the flask was 500ml. It is then filled at a pressure of 735 mm and $131^{\circ} C$ with a gas of unknown molecular mass and then reweighed. Its mass is 137.456 g. Assuming that the gas is ideal, calculate the molar mass of the gas.

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Ex 5.3

1. 200 mL of hydrogen and 250 mL of nitrogen, each measured at $15^{\circ} C$ and 760 mm pressure . What is the composition of the mixture?

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2. 400 mL of N_2 gas at 700 mm and 300 mL of H_2 gas at 800 mm are introduced into a vessel of 2 L at the same temperature. Calculate the final pressure of the gas mixture.

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3. 400 mL of N_2 gas at 700 mm and 300 mL of H_2 gas at 800 mm are introduced into a vessel of 2 L at the same temperature. Calculate the final pressure of the gas mixture.

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4. A diver uses noen- oxygen mixture containing 70.4 g dioxygen and 167.5 g neon for respiration under water. If the total pressure is 25 bar then find partial pressures of oxygen and neon in the mixture? Atomic mass of oxygen is 16 u and that of neon is 20.2 u.

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5. A sample of O_2 is collected over water at $22^\circ C$ and 748 torr pessure. The volume of the gas collected is 82.0 cm^3. How many grams of oxygen are present in the gas?. The vapour pressure of water at $22^\circ C$ is 19.8 torr.

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6. A cylinder containing nitrogen gas and some liquid water at a temperature of $25^\circ C$. The total pressure in the cylinder is 600 mm. The piston is moved into the cylinder till the volume is halved keeping the temperature constant. If the aqueous tension at $25^\circ C$ is 23.8 mm, calculate the final total pressure in the cylinder.

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7. A gaseous mixture containing 8g of O_2 and 227 mL of N_2 at STPis enclosed in flask of 5 L capacity at $0^\circ C$. Find the partial pressure of each gas and calculate the total pressure in the vessel.

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8. A flask of 1.5 L capacity contains 400 mg of O_2 and 60 mg of H_2 at $100^\circ C$. Calculate the total pressure of the gaseous mixture. If the mixture is permitted to react to form water vapour at $100^\circ C$, what materials will be left and what will be their partial pressures?

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9. 50 g of dinotrogen (N_2) and 2.0 g of helium are enclosed in a vessel already containing 2.0 g of oxygen. Calculated the total pressure and the fraction of the total pressure exerted by He. The volume of the vessel is $10cm^3$ and the temperature is 300 K

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10. A gaseous mixture containing 8g of O_2 and 227 mL of N_2 at STPis enclosed in flask of 5 L capacity at $0^\circ C$. Find the partial pressure of each gas and calculate the total pressure in the vessel.

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11. At room temperature, ammonia gas at $1atm$ pressure and hydrogen chloride gas at $Patm$ pressure are allowed to effuse through identical pin holes from opposite ends of a glass tube of $1m$ length and of uniform cross- section. Ammonium chloride is first formed at a distance of $60cm$ from the end through which HCl gas is sent in. What is the value of P?

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12. The volumes of ozone and chlorine diffusing in the same time are $35mL$ and $29mL$, respectively. If the molecular weight of chlorine is 71, calculate the molecular weight of ozone.

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13. Which will diffuse faster, ammonia of CO_2 ? What are their relative rates of diffusion?

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14. A $4:1$ molar mixture of He and CH_4 is contained in a vessel at 20 bar pressure. Due to a hole in the vessel, the gas mixture leaks out. What is the composition of the mixture effusing out initially?

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15. 20 dm^3 of SO_2 diffuse through a porous partition in 60 s. what volume of O_2 will diffuse under similar conditions in 30 s ?

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16. One mole of nitrogen gas at $0.8 atm$ takes $38 s$ to diffuse through a pinhole, while $1 mol$ of an unknown fluoride of xenon at $1.6 atm$ takes $57 s$ to diffuse through the same hole. Calculate the value of n in the compound if formula is XeF_n.

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Concept Application 5.3

1. A 2 L flask containing nitrogen at 60 cm pressure is connected to a 4 L flask containing carbon monoxide at 48 cm pressure. If the temperature is kept constant, calculate the final pressure of the mixture.

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Ex 5.4

1. Write the kinetic gas equation and express it as $P = \frac{2}{3}E$, where E is the kinetic energy per unit volume.

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2. Calculate the root mean square velocity of ozone kept in a closed vessel at $20^{\circ}C$ and $82 cmHg$ pressure.

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3. The density of steam at $100^{\circ}C$ and $10^{5}Pa$ pressure is $0.6Kgm^{-3}$. Calculate the compresibility factor of steam.

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4. The average velocity of CO_2 at the temperature T_1K and maximum (most) proable velocity of CO_2 at the temperature T_2K is $9 \times 10^{4}cms^{-1}$. Calculate the values of T_1 and T_2.

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5. 20 mol of chlorine gas occupies a volume of 800 ml at 300 K and 5×10^{6} Pa pressure. Calculate the compressibility factor of the gas (R = 0.083 L bar $K^{-1}mol^{-1}$). Comment whether the gas is more compressible or less compressible under the conditions

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6. Calculate the pressure of 154 g carbon dioxide in a vessel of 2.0 L capacity at $30^{\circ}C$, a = 648 L bar atm $K^{-1}mol^{-1}, b = 0.0427 Lmol^{-1}$

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7. At what temperature will 128 g of SO_2 confined in a vessel of $5dm^3$ capacity exhibit a pressure of 10.0 bar? The van der waals constants for SO_2 are a = 6.7 bar $L^2mo \leq^{-2}$ and b = 0.0564 $Lmol^{-1}$.

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8. Given that the co-volume of O_2 gas is $0.318 Lmol^{-1}$. Calculate the radius of O_2 molecule.

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9. when a tyre is pumped up rapidly, its temperature rises, would you expect the same effect if air were an ideal gas?

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10. Can we use Boyle's law to calculate the volume of a real gas from its initial state to final state during adiabatic expansion?

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11. Which postulate of kinetic theory can be used to justfy Dalton's law of partial pressures ?

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12. A porpous cup is filled with H_2 gas at the atmospheric pressure and is connected to a thin glass tube a vertical position. The second end of the tube is immersed in water below it. After some time, water rises in the glass tube. Explain giving reasons.

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13. What is the meaning of pressure of the gas?

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14. What is the difference between barometer and manometer?

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15. Based upon Boyle's law, draw the plot of PV vs P.

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16. If a plot a V vs $.^{\circ} C$ at constant pressure is drawn, at what temperatures will it cut the volume and temperature axes?

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17. Why do we add 273 to the temperature while dealing with problems on gas equation?

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18. Given the relationship between the molar volume of a gas and its molar mass.

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19. What would have happened to the pressure of a gas if the collisions of its molecules had not been elastic?

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20. Which postulate of kinetic theory are invalid at low temperature of high pressure?

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21. What is the relation between three types of molecular speeds at a given temperature?

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22. In the plot of Z (compressibility factor) vs P,Z attains a value of unity at a particular pressure. What does it signify?

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23. Draw the plot log P vs log V for Boyle's law.

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24. Draw the plot log V vs log T.

Watch Video Solution

25. Is it possible to cool the gas to 0 K?

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26. Why excluded volume v is four times the actual volume of molecules?

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27. What is the ratio of average molecular KE of CO_2 to that of SO_2 at $27^{\circ}C$?

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28. Point out the difference between London dispersion forces and dipole-dipole forces.

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29. Why are falling liquid drops spherical?

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30. Give the relationship between pressure and density of gas.

Watch Video Solution

31. What happens if a liquid is heated to the critical temperature of its vapour?

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32. Can a gas with a = 0 be liquefied?

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Exercises (Fill In The Blanks)

1. Aqueous tension is the vapour pressure of .... And depends only upon ....

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2. Boiling point is the temperature at which the vapour pressure becomes equal to..........

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3. Unit of visocity of liquids is ....

Watch Video Solution

4. For real gases, $\frac{PV}{nRT}$........

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5. The law describing realtionship between P and V of ideal gas at constant temperature is called..........

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6. Vapor pressure of a liquid decreases with increases in ....

Watch Video Solution

7. The larger the molecular size..........should be the value of b.

Watch Video Solution

8. Density of the gas is......... Proportioanl to pressure.

Watch Video Solution

9. Temperature above which gas cannot be liquefied is called ....

Watch Video Solution

10. Volume occupied by gas at T_c and P_c is called........

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11. The gas molecule can be liquefied and solidified due to the pressure of ...... Force of attraction.

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12. The numerical value of b is ......times the actual volume occupied by one mole of gas molecule.

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13. The ratio of molar volume to ideal molar volume is called ....

Watch Video Solution

14. For hydrogen gas, Z is ......unity at all pressure.

Watch Video Solution

15. SI Unit of pressure would be.........

Watch Video Solution

16. Real gases behave ideal at ....and ....

Watch Video Solution

17. Z for ideal gas is..........

Watch Video Solution

18. Surface tension decreases with increase in ....

Watch Video Solution

19. Viscosity of liquid decreases with increase in........

Watch Video Solution

20. Total pressure of gases is ....to the sum of partial pressure of all gases.

Watch Video Solution

21. The equation of state is PV = ...

Watch Video Solution

22. Rate of diffusion is directly proportional to.........

Watch Video Solution

23. Total kinetic energy of gas depends only upon........

Watch Video Solution

24. According to Charles's law, volume of gas is related to pressure as ....

Watch Video Solution

25. The equation of $\dfrac{P_cV_c}{RT_c}$ = ...

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Exercises (Ture False)

1. In the van der Waals equation

$$\left(P+\frac{n^2a}{V^2}\right)(V-nb)=nRT$$

the constant a reflects the actual volume of the gas molecules.

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2. Kinetic energy of a molecule is zero at $0^{\circ} C$

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3. Gas in a closed container will exert much higher pressure due to gravity at the bottom than at the top.

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4. The graph between PV vs P at constant temperature is linear parallel to the pressure axis.

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5. Real gases show deviation from ideal behavior at low temperature and high pressure.

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6. All the molecules in a given sample of gas move with same speed.

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7. Small value of a means, gas can be easily liqueifed.

Watch Video Solution

8. Small value of a means, gas can be easily liqueifed.

Watch Video Solution

9. Rate of diffusion is directly proportional to the square root of molecular mass of substance.

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10. For ideal gases, $Z = 1$ at all temperature and pressure.

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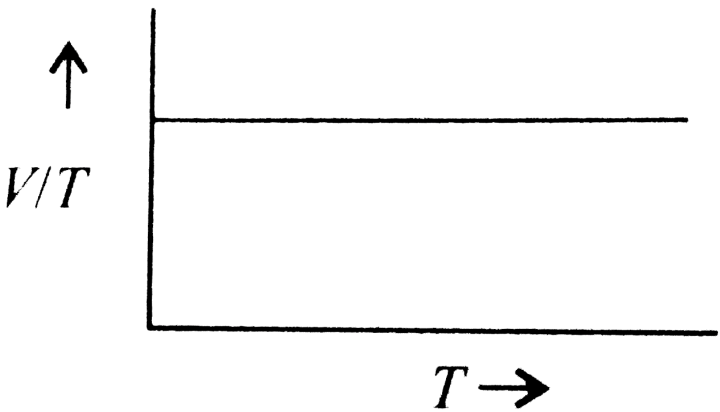
11. According to charles's law,



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12. The pressure of moist gas is higher than pressure of dry gas.

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13. Gases do not occupy volume and do not have force of attraction.

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14. The van der Waal equation of gas is

$$\left(P+\frac{n^2a}{V^2}\right)(V-nb)=nRT$$

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15. Surface tension and surface energy have different dimensions.

Watch Video Solution

16. The plot of PV vs P at particular temperature is called isovbar.

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17. Give reasons for the following in one or two sentences.

(a) A bottle of liquor ammonia should be cooled before opening the stopper.

(b) Equal volumes of gases contain equal number of moles.

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18. Can a gas with a = 0 be liquefied?

Watch Video Solution

19. The van der waals constants have same values for all the gases.

Watch Video Solution

20. All the molecules in a given sample of gas move with same speed.

Watch Video Solution

21. The observed pressure of real gas is more than the ideal pressure.

Watch Video Solution

22. Heat capacity of a diatomic gas is higher than that of a monoatomic gas.

Watch Video Solution

23. Dry O_2 is heavier than moist O_2.

Watch Video Solution

24. Why excluded volume v is four times the actual volume of molecules?

Watch Video Solution

25. The gas above T_c cannot be liquefied.

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