CHEMISTRY

BOOKS - NARENDRA AWASTHI

GASEOUS STATE

Exercise

1. Which of the following statements is not correct about the three states of matter, i.e., solid, liquids and gas?

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

B. The density of solids is highest whereas that of gases is lowest

C. Gases and liquids possess definite volumes

D. Molecules of a solids possess vibratory motion

Answer: c

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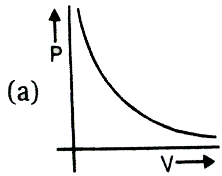
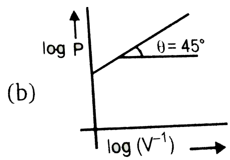
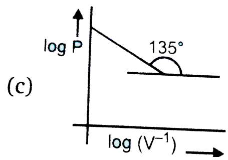
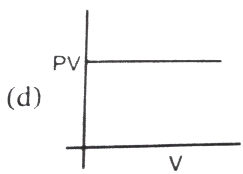
2. Which of the following plots does not represent Boyle's law?

A. 

B. 

C. 

D. 

Answer: B

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3. A sample of gas has a volume of 0.2 lit measured at 1 atm pressure and $0^\circ C$. At the same pressure, but at $273^\circ C$, its volume will become

A. 0.4 litre

B. 0.8 litre

C. 27.8 litres

D. 55.6 litres

Answer: a

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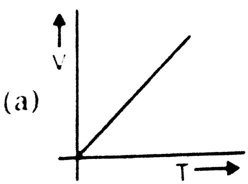
4. Among the following curves, which is not according to Charle's law ?



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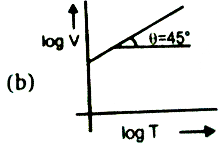
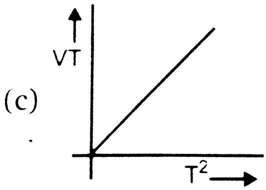
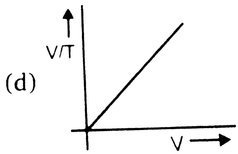
B. 

C. 

D. 

Answer: d

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5. Initial temperature of an ideal gas is $75^\circ C$. At what temperature, the sample of neon gas would be heated to double its pressure, if the initial volume of gas is reduced by 15%?

A. $319^\circ C$

B. $592^{\circ} C$

C. $128^{\circ} C$

D. $60^{\circ} C$

Answer: a

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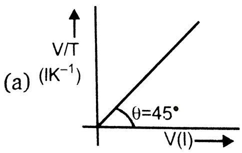
6. Which is correct curve for Charle's law, when the curve is plotted at 0.821 atm pressure for 10 mole ideal gas?



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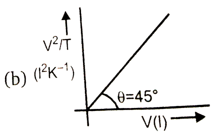

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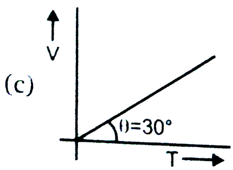

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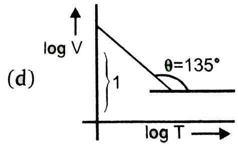
D. 

Answer: b

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7. At constant volume, for a fixed number of moles of a gas, the pressure of the gas increases with a rise in temperature, due to

A. increase in the average molecular speed

B. decrease in rate of collision amongst molecules

C. increase in molecular attraction

D. decrease in mean free path

Answer: a

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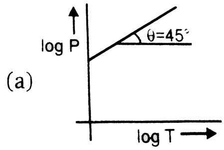
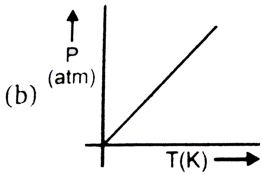
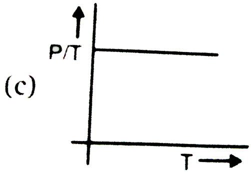
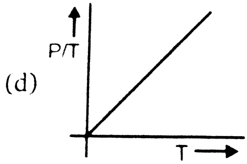
8. which in not correct curve for Gay-luacc's law ?

A. 

B. 

C. 

D. 

Answer: d

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9. Three flasks of equal volumes contain $CH_4, CO_2,$ and Cl_2 gases respectively. They will contain equal number of molecules if :

A. the mass of all the gases is same

B. the mass of all the gas is same but temperature is different

C. temperature and pressure of all the flasks are same

D. temperature, pressure and masses same in the flasks

Answer: C

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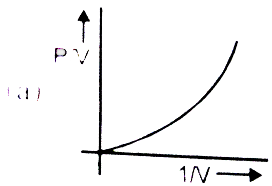
10. Which is incorrect curve for Boyle's law ?



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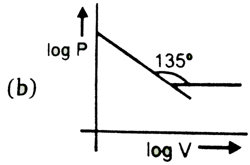

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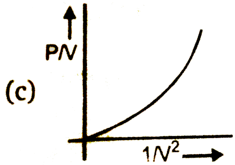

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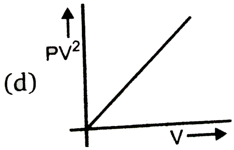

D.

Answer: c

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11. Equal volumes of gases at the same temperature and pressure contain equal number of particles. This statement is a direct consequence of

A. Avogadro's law

B. Charle's law

C. ideal gas equation

D. law of partial pressure

Answer: a

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12. A 2.24 litre cylinder of oxygen at NTP is found to develop a leakage. When the leakage was plugged the pressure dropped to 570 mm of Hg. The number of moles of gas that escaped will be:

A. 0.025

B. 0.05

C. 0.075

D. 0.09

Answer: a

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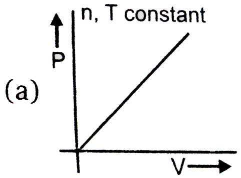
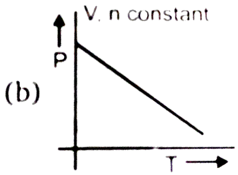
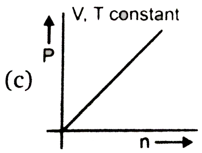
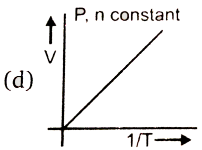
13. Which of the following curve is correct for an ideal gas ?

A. 

B. 

C. 

D. 

Answer: c

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14. In the equation of state of an ideal gas PV =nRT , the value of the universal gas constant is not correct :

A. $8.314\ \mathrm{JK}^{-1}\mathrm{mol}^{-1}$

B. $0.0821\quad \mathrm{atm\,L\,mol}^{-1}K^{-1}$

C. $0.8314\quad \mathrm{bar\,L\,mol}^{-1}K^{-1}$

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

Answer: c

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15. At $0^{\circ}C$ and one atm pressure, a gas occupies 100 cc. If the pressure is increased to one and a half-time and temprature is increased by one-third of absolute temperature, then final volume of the gas will be:

A. 80 cc

B. 88.9 cc

C. 66.7 cc

D. 100 cc

Answer: b

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16. 10 g of a gas at 1 atm and 273 K occupies 5 litres. The temperature at which the volume becomes double for the same mass of gas at the same pressure is:

A. 273 K

B. $-273^{\circ}C$

C. $273^{\circ}C$

D. $546^{\circ}C$

Answer: c

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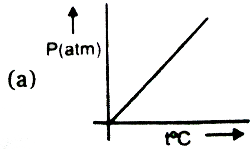
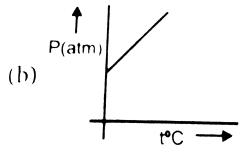
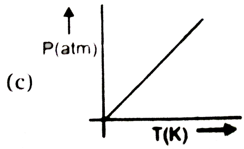
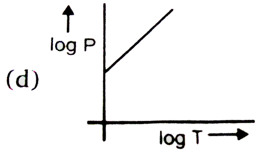
17. Which of the following curve does not represent Gay-lusacc's law?

A. 

B. 

C. 

D. 

Answer: a

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18. Densities of two gases are in the ratio $1:2$ and their temperatures are in the ratio $2:1$, then the ratio of their respective pressure is

A. $1:1$

B. $1:2$

C. $2:1$

D. $4:1$

Answer: a

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19. Two separate bulbs contain ideal gas A and B. The density of a gas A is twice that of a gas B. The molecular mass of A is half that of gas B. The two gases are at the same temperature. The ratio of the pressure of A to that gas B is

A. 2

B. $1/2$

C. 4

D. $1/4$

Answer: c

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20. Volume of the air that will be expelled from a vessel of $300cm^3$ when it is heated from $27^\circ C$ to $37^\circ C$ at the same pressure will be

A. 310 cm^3

B. 290 cm^3

C. 10 cm^3

D. 37 cm^3

Answer: c

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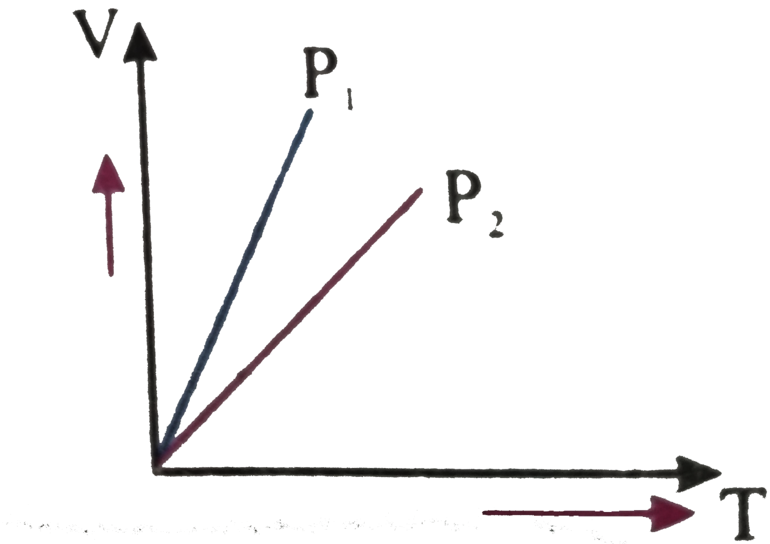
21. For an ideal gas $V - T$ curves at constant pressure P_1 & P_2 are shown in figure, from the figure



A. $P_1 > P_2$

B. $P_1 < P_2$

C. $P_1 = P_2$

D. All of these

Answer: b

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22. Two flasks A and B of 500 mL each are respectivelly filled with O_2 and SO_2 at 300 K and 1 atm. Pressure . The flasks will contain:

A. the same number of atoms

B. the same number of molecules

C. more number of moles of molecules in flask A as compared to flask B

D. the same amount of gases

Answer: b

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23. 2.8 g of a gas at 1atm and 273K occupies a volume of 2.24 litres. The gas can not be:

A. O_2

B. CO

C. N_2

D. C_2H_4

Answer: a

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24. Five grams each of the following gases at $87^\circ C$ and 750 mm pressure are taken. Which of them will have the least volume ?

A. HF

B. HCL

C. HBr

D. HI

Answer: d

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25. At what pressure a quantity of gas will occupy a volume of 60 mL, if it occupies a volume of 100mL at a pressure of 720 mm (while temperature is constant) :

A. 700 mm

B. 800 mm

C. 100 mm

D. 1200 mm

Answer: d

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26. At 1 atm and 273 K the density of gas, whose molecular weight is 45, is:

A. 44.8 g/L

B. 11.4 g/L

C. 2 g/L

D. 3 g/L

Answer: c

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27. A small bubble rises from the bottom of a lake, where the temperature and pressure are $8^\circ C$ and $6.0 atm$, to the water's surface, where the temperature is $25^\circ C$ and pressure is $1.0 atm$. Calculate the final volume of the bubble if its initial volume was $2 mL$.

A. 14 mL

B. 12.72 mL

C. 11.31 mL

D. 15 mL

Answer: b

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28. Argon is an inert gas used in light bulbs to retard the vaporization of the filament. A certain light-bulb containing argon at 1.25 atm and $18^\circ C$ is heated to $85^\circ C$ at constant volume. Calculate its final pressure.

A. 1.53 atm

B. 1.25 atm

C. 1.35 atm

D. 2 atm

Answer: a

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29. Calculate the volue of O_2 at 1 atm and 273 K required for the complete combustion of 2.64 L of acetylene (C_2H_2) at 1 atm and 273 K.

$2C_2H_2(\mathrm{g}) + 5O_2(\mathrm{g}) \rightarrow 4CO_2(\mathrm{g}) + 2H_2O(l)$

A. 3.6 L

B. 1.056 L

C. 6.6 L

D. 10 L

Answer: c

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30. The density of $O_2(\mathrm{g})$ is maximum at :

A. STP

B. 273 K and 2 atm

C. 546 K and 1 atm

D. 546 K and 2 atm

Answer: b

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31. At $27^{\circ}C$ a sample of ammonia gas exerts a pressure of 5.3 atm. What is the pressure when the volume of the gas is reduced to one-tenth of the original value at the same temperature ?

A. 0.53 atm

B. 5.3atm

C. 53 atm

D. None of these

Answer: c

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32. A certen amount of gas at $2.5^\circ C$ and at a pressure of 0.80 atm is kept in a glass vessel. Suppose that the vessel can withstand a pressure of 2.0 atm. How high can you raise the temperature of the gas without bursting the vessel?

A. $745^\circ C$

B. $472^\circ C$

C. $500^\circ C$

D. None of these

Answer: b

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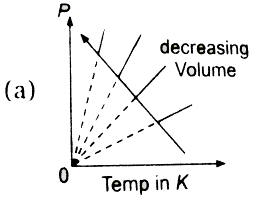
33. Which one of these graphs for an ideal gas havinga fixed amount, the arrow indication, is incorrectly marked ?



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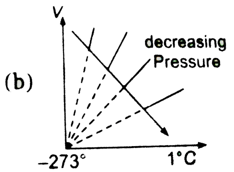

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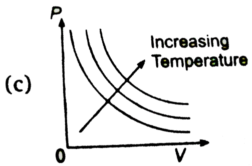

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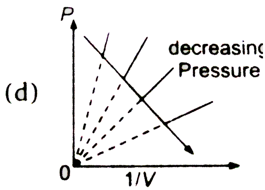

D.

Answer: b

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34. The pressure of sodium vapour in a 1.0 L container is 10 torr at $1000^{\circ}C$. How many atoms are in the container?

A. 9.7×10^{17}

B. 7.6×10^{19}

C. 4.2×10^{17}

D. 9.7×10^{19}

Answer: b

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35. An ideal gaseous mixture of ethane (C_2H_6) and ethene (C_2H_4) occupies 28 litre at 1 atm and $273K$. The mixture reacts completely with $128gO_2$ to produce CO_2 and H_2O. Mole fraction at C_2H_6 in the mixture is :

A. 0.6

B. 0.4

C. 0.5

D. 0.8

Answer: a

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36. A certain hydrate has the formula $\mathrm{MgSO}_4 .\ xH_2O$. A quantity of 54.2 g of the compound is heated in an oven to drive off the water. If the steam generated exerts a pressure of 24.8 atm in a 2.0 L container at $120^\circ C$, calculate x.

A. 2

B. 5

C. 6

D. 7

Answer: d

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37. Air entering the lungs ends up in tiny sacs called alveoli.From the alveoli, the oxygen diffuses into the blood. The average radius of the alveoli is 0.0050 cm and the air inside contains 14 per cent oxygen. Assuming that the pressure in the alveoli is 1.0 atm and the temperature is $37^\circ C$, calculate the number of oxygen molecules in one of the alveoli.

A. 6×10^{13}

B. 10^{24}

C. 1.7×10^{22}

D. 1.7×10^{12}

Answer: d

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38. Starting out on a trip into the mountains, you inflate the tires on your automobile to a recommended pressure of 3.21×10^5 Pa on a day when the temperature is -$5.0^\circ C$. You drive to the beach, where the temperature is $28.0^\circ C$. Assume that the volume of the tire has increased by 3%. What is the final pressure in the tyres?

A. 350 Pa

B. 3500 Pa

C. 3.5×10^5 Pa

D. None of these

Answer: c

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39. A compressed cylinder of gas contains 1.50×10^3 g of N_2 gas at a pressure of 2.0×10^7 Pa and a temperature of $17.1^\circ C$. What volume of gas has been released into the atmosphere if the final pressure in the cylinder is 1.80×10^5 Pa ? Assume ideal behaviour and that the gas temperature is unchanged.

A. 1264 L

B. 126 L

C. 12600 L

D. 45 L

Answer: a

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40. A high-altitude balloon is filled with $1.41 \times 10^4 L$ of hydrogen at a temperature of $21^\circ C$ and a pressure of 745 torr. What is the volume of the balloon at a height of 20 km, where the temperature is $-48^\circ C$ and the pressure is 63.1 torr?

A. $1.274 \times 10^5 L$

B. $1.66 \times 10^5 L$

C. $1.66 \times 10^4 L$

D. None of these

Answer: a

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41. The atmospheric pressure on Mars is 0.61 kPa. What is the pressure in mm Hg?

A. 0.63

B. 4.6

C. 6.3

D. 3.2

Answer: b

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42. The density of liquid gallium at $30^{\circ} C$ is 6.095 g/mL. Because of its wide liquid range (30 to $2400^{\circ} C$), gallium is used as a barometer fluid at high temperature. What height (in cm) of gallium will be observed on a day when the mercury barometer reads 740 torr? (The density of mercury is 13.6 g/mL.)

A. 322

B. 285

C. 165

D. 210

Answer: c

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43. A weather balloon is inflated with helium. The balloon has a volume of 100 m^3 and it must be inflated to pressure of 0.10 atm. If 50 L gas cylinders of helium at a pressure of 100 atm are used, how many cylinders are needed? Assume that the temperature is constant.

A. 2

B. 3

C. 4

D. 1

Answer: a

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44. A balloon contains 14.0 L of air at 760 torr. What will be the volume of the balloon when it is taken to a depth of 10 ft. in a swimming pool? Assume that the temperature of the air and water are equal. (density : Hg=13.6g/mL.)

A. 11

B. 11.3

C. 10

D. 10.8

Answer: d

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45. 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?

A. 505

B. 450

C. 625

D. 560

Answer: a

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46. Equal volumes of oxygen gas and a second gas weigh 1.00 and 2.375 grams respectively under the same experimental conditions. Which of the following is the unknown gas?

A. NO

B. SO_2

C. CS_2

D. CO

Answer: c

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47. A high altitude balloon contains 6.81 g of helium in 1.16×10^4 L at $-23^\circ C$. Assuming ideal gas behaviour, how many

grams of helium would have to be added to increase the pressure to 4.0×10^{-3} atm?

A. 1.27 g

B. 1.58 g

C. 2.68 g

D. 2.23 g

Answer: d

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48. A 4.40 g piece of solid CO_2 (dry ice) is allowed to sublime in a balloon. The final volume of the balloon is 1.00 L at 300 K. What is the pressure (atm) of the gas?

A. 0.122

B. 2.46

C. 122

D. 24.6

Answer: b

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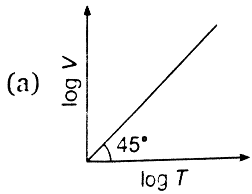
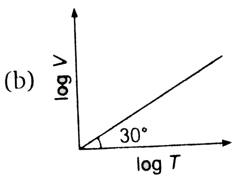
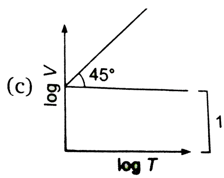
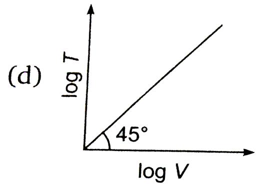
49. For a closed container containing 10 moles of an ideal gas, at constant pressure of 0.82 atm, which graph correctly represent, variation of log V us log T where volume is in litre and temp. in kelvin :

A. 

B. 

C. 

D. 

Answer: a

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50. The intercept on y-axis and slope of curve plotted between P/T vs. T (For an ideal gas having 10 moles in a closed rigid container of volume 8.21 L. (P= Pressure in atm and T = Temp. in K, $\log_{10} 2 = 0.30)$) are respectively :

A. 0.01, 0

B. 0.1, 0

C. 0.1, 1

D. 10, 1

Answer: b

Watch Video Solution

51. A He atom at 300 K is released from the surface of the earth to travel upwards. Assuming that it undergoes no collision with other molecules, how high will it be before coming to the rest?

A. 9.53 m

B. 9.5 m

C. 953 m

D. 9.53×10^4 m

Answer: d

Watch Video Solution

52. The density of gas A is twice that of 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. $1:1$

C. $4:1$

D. $1:4$

Answer: c

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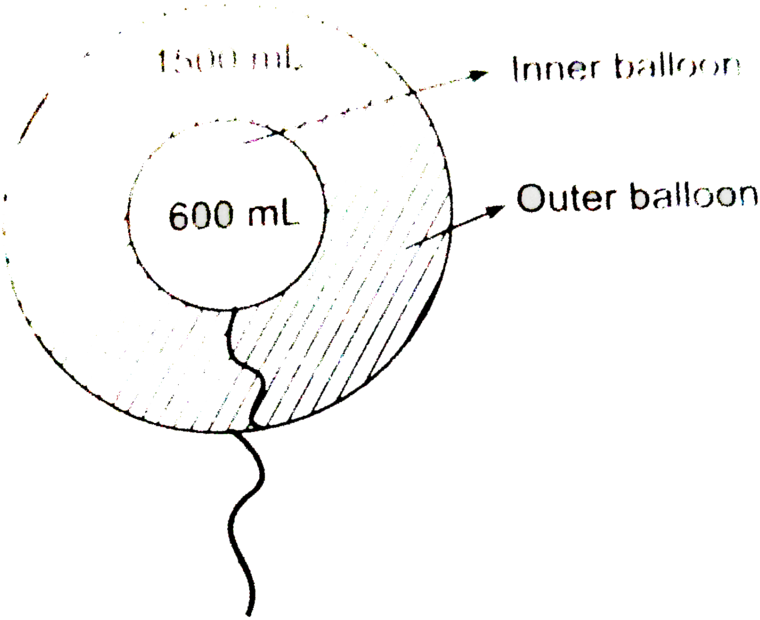
53. Two inflated ballons I and II (thin skin) having volume 600 mL and 1500 mL at 300 K are taken as shown in diagram. If maximum volume of inner and outer balloons are 800 mL and 1800 mL respectively then find the balloon which will burst first on gradual heating.



A. inner balloon

B. outer balloon

C. both simultaneously

D. unpredictable

Answer: b

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54. An open flask containing air is heated from 300 K to 500 K. What percentage of air will be escaped to the atmosphere, if pressure is keeping constant?

A. 80

B. 40

C. 60

D. 20

Watch Video Solution

55. An open flask containing air is heated from $300K$ to $500K$. What percentage of air will be escaped to the atmosphere, if the pressure is kept constant ?

A. 80

B. 40

C. 60

D. 20

Watch Video Solution

56. The value of the universal gas constant R depends upon the

A. temperature of gas

B. volume of gas

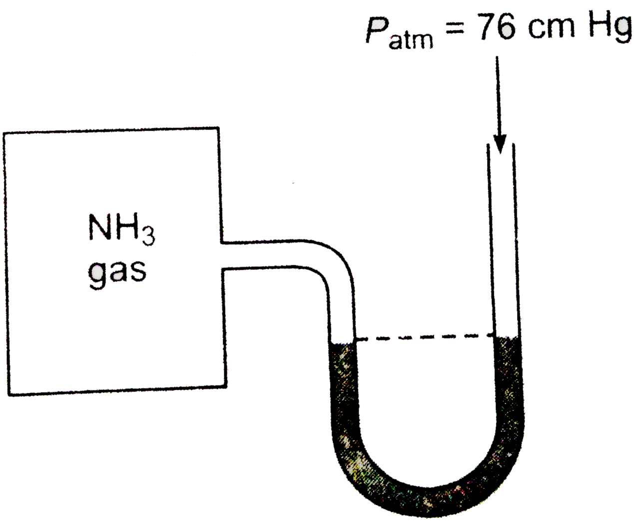
C. number of moles of gas

D. units of volume and pressure

Answer: d

Watch Video Solution

57. A manometer attached to a flask contains with ammonia gas have no difference in mercury level initially as shown in diagram. After sparking into the flask, ammonia is partially dissociated as $2NH_3$ (g) $\rightarrow N_2$ (g) $+ 3H_2$ (g) now it have difference of 6 cm in mercury level in two columns, what is partial pressure of H_2 (g) at equilibrium?



A. 9 cm Hg

B. 18 cm Hg

C. 27 cm Hg

D. None of these

Answer: a

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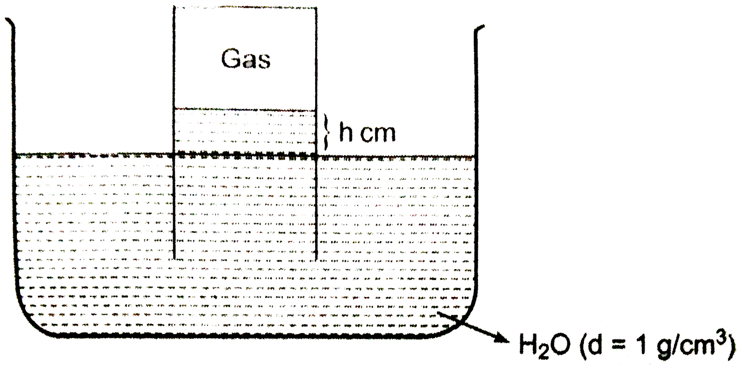
58. An ideal gas is collected by downward displacement of water. Select the correct expression for P_{gas} according to the diagram $\left[d_{Hg} = 13.6g/cm^3\right]$:



A. $P_{\text{gas}} = P_{\text{atm}} - \left[\text{aq. Tension} + \frac{h}{13.6}\right]$

B. $P_{\text{gas}} = P_{\text{atm}} - \text{hdg}$

C. $P_{\text{gas}} = P_{\text{atm}} + \text{hdg}$

D. $P_{\text{gas}} = P_{\text{atm}} - \text{aq. Tension} + \frac{h}{13.6}$

Answer: a

Watch Video Solution

59. A bubble of gas released at the bottom of a lake increases to four times its original volume when it reaches the surface. Assuming that atmospheric pressure is equivalent to the pressure exerted by a column of water 10 m high, what is the depth of the lake?

A. 20 m

B. 10 m

C. 30 m

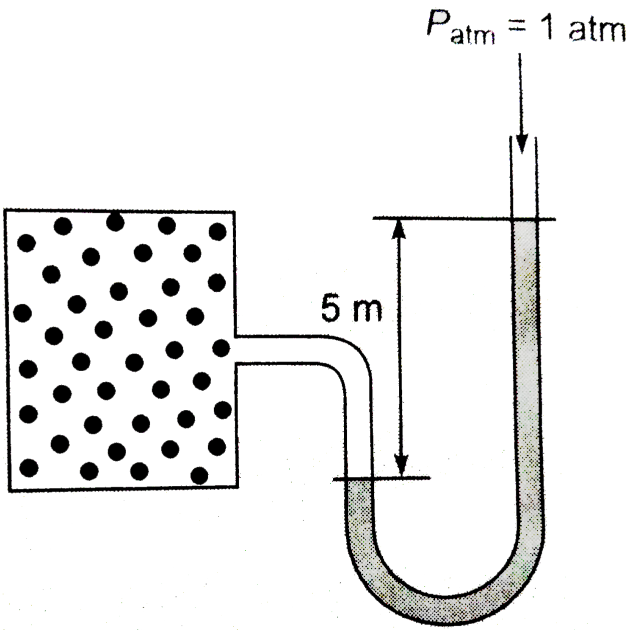
D. 40 m

Answer: c

Watch Video Solution

60. Calculate the number of moles of gas present in the container of volume 10 L at 300 K, if the manometer containing glycerine shows 5 m difference in level as shown diagram.

(Given : $d_{\text{glycerin}} = 2.72 g/mL, \quad d_{\text{mercury}} = 13.6 g/mL$)



A. 0.94 mole

B. 0.49 mole

C. 0.64 mole

D. none of these

Answer: a

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61. A rigid vessel of volume $0.50m^3$ containing H_2 at $20.5^\circ C$ and a pressure of 611×10^3 Pa is connected to a second rigid vessel of volume 0.75m^3 containing Ar at $31.2^\circ C$ at a pressure of 433×10^3 Pa. A value separating the two vessels is opened and both are cooled to a temperature of $14.5^\circ C$. What is the final pressure in the vessels?

A. 2×10^5

B. $3.22 \times 10^5 \text{ Pa}$

C. 4840 pa

D. $4.84 \times 10^5 \text{ Pa}$

Answer: d

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62. Two glass bulbs A and B are connected by a very small tube having a stop cock. Bulb A has a volume of 100 cm^3 and contained the gas, while bulb B was empty. On opening th stop cock. The pressure fell down to 40%. The volume of the bulb B must be:

A. $100cm^3$

B. $200cm^3$

C. $250cm^3$

D. $400cm^3$

Answer: d

Watch Video Solution

63. A mixture of C_2H_2 and C_3H_8 occupied a certain volume at 80 mm Hg. The mixture was completely burnt to CO_2 and $H_2O(l)$. When the pressure of Co_2 was found to be 230 mm Hg at the same temperature and volume, the mole fraction of CO_3H_8 in the mixture is :

A. 0.125

B. 0.875

C. 0.6

D. 0.8

Answer: b

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64. The total pressure of a mixture of oxygen and hydrogen is 1.0 atm. The mixture is ignited and the water is removed. The remaining gas is pure hydrogen and exerts a pressure of 0.40 atm when measured at the same values of T and V as the original mixture. What was the composition of the original mixture in mole fraction ?

A. $x_{o_2} = 0.2, x_{H_2} = 0.8$

B. $x_{o_2} = 0.4, x_{H_2} = 0.6$

C. $x_{o_2} = 0.6, x_{H_2} = 0.4$

D. $x_{o_2} = 0.8, x_{H_2} = 0.2$

Answer: a

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65. Two closed vessel A and B of equal volume of 8.21 L are connected by a narrow tube of negligible volume with open valve. The left hand side container is found to contain 3 mole CO_2 and 2 mole of He at 400 K. What is the partial pressure of He in vessel B at 400 K?

A. 2.4 atm

B. 8 atm

C. 12atm

D. None of these

Answer: b

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66. At STP a contains has 1 mole of H_2 2 mole Ne, 3 mole O_2 and 4 mole N_2. Without changing total pressure if 2 mole of O_2 is removed, the partial pressure of O_2 will be decreased by

A. $26\ \%$

B. $40\ \%$

C. $58.33\ \%$

D. $66.66\ \%$

Answer: c

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67. $821 mL N_2(g)$ was collected over liquid water at 300 K and 1 atm.If vapour pressure of H_2O is 30 torr then moles of $N_2(g)$ in moist gas mixture is :

A. 0.39

B. 0.032

C. 0.96

D. 0.0013

Answer: b

Watch Video Solution

68. Let P and P_s be the partial pressure of $H_2O(g)$ and vapour pressure of $H_2O(l)$ respectively. Then the % relative humidity is given by:

A. $\frac{P_s + P}{P_s} \times 100$

B. $\frac{P}{P_s} \times 100$

C. $\frac{P_s}{P} \times 100$

D. $(P + P_s) \times 100$

Answer: b

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69. The vapour pressure of water at $80^{\circ} C$ is 355 mm of Hg. 1 L vessel contains O_2 at $80^{\circ} C$, which is saturated with water and the total pressure being 760 mm of Hg. The contents of the vessel were pumped into 0.3 L vessel at the same temperature. What is the partial presure of O_2?

A. 1350 Hg

B. 2178.3 Hg

C. 121.5 Hg

D. 355 Hg

Answer: a

Watch Video Solution

70. Which of the following gaseous mixture does not follow Dalton's law of partial pressure?

A. SO_2 and Cl_2

B. CO_2 and N_2

C. CO and CO_2

D. CO and N_2

Answer: a

Watch Video Solution

71. Equal weights of methane and oxygen are mixed in an empty container at 250C. The fraction of the total pressure exerted by oxygen is

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

B. $\frac{1}{3} \times \frac{273}{298}$

C. $\frac{1}{3}$

D. $\frac{1}{2}$

Answer: c

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72. A box of 1 L capacity is divided into two equal compartments by a thin partition which are filled with 2g H_2 and 16 gCH_4 respectively. The pressure in each compartment is reorded as P atm. The total pressure when partition is removed will be:

A. P

B. 2P

C. $P/2$

D. $P/4$

Answer: a

Watch Video Solution

73. If $10^{-4} dm^3$ of water is introduced into a 1.0 dm^3. Flask at 300 K, calculate the number of moles of water is in vapour phase when

equililbrium is established ? (V.P. of H_2O at 300 K is 3170 Pa)

A. 1.27×10^{-3}mole

B. 5.56×10^{-3}mole

C. 1.53×10^{-2}mole

D. 4.46×10^{-2}mole

Answer: a

Watch Video Solution

74. Dalton's law of partial pressures is not applicable to

A. H_2 and N_2 mixture

B. H_2 and Cl_2 mixture

C. H_2 and CO_2 mixture

D. none of these

Answer: b

Watch Video Solution

75. 56 g of nitrogen and 96 g of oxygen are mixed isothermaly and at a total pressure of 10 atm. The partial pressures of oxygen and nitrogen (in atm) are respectively :

A. 4,6

B. 5,5

C. 2,8

D. 6,4

Answer: d

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76. The closed containers of the same capacity and at the same temperature are filled with 44 g of H_2 in one and 44 g of CO_2 in the other . If the pressure of carbon dioxide in the second container is 1 atm , then pressure of hydrogen in the first container would be :

A. 1 atm

B. 10 atm

C. 22 atm

D. 44 atm

Answer: c

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77. A jar contains a gas and a few drops of water at TK The pressure in the jar is $830mm$ of Hg The temperature of the jar is reduced by 1% The vapour pressure of water at two temperatures are 300 and 25 mm of Hg Calculate the new pressure in the jar .

A. 792 mm of Hg

B. 817 mm of Hg

C. 800 mm of Hg

D. 840 mm of Hg

Answer: b

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78. O_2 and SO_2 gases are filled in ratio of 1 : 3 by mass in a closed container of 3 L at temperature of $27^\circ C$. The partial pressure of O_2 is 0.60 atm, the concentration of SO_2 would be

A. 0.36

B. 0.036

C. 3.6

D. 36

Answer: b

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79. A gaseous mixture of three gases A, B and C has a pressure of 10atm. The total number of moles of all the gases is 10. The partial pressure of A and B are 3 and I am respectively. If C has a molecular weight of 2, what is the weight of C in grams present in the mixture?

A. 8 g

B. 12 g

C. 3 g

D. 6 g

Answer: b

Watch Video Solution

80. A rigid container contains 5 mole H_2 gas at some pressure and temperature. The gas has been allowed to escape by simple process from the container due to which pressure of the gas becomes half of its initial pressure and temperature become $(2/3)^{rd}$ of its initial. The mass of gas remaining is :

A. 7.5 g

B. 1.5 g

C. 2.5 g

D. 3.5 g

Answer: a

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81. Pressure of 1 g ideal gas X at 300 K is 2 atm. When 2 g of another gas Y is introduced in the same vessel at same temperature, the pressure become 3 atm. The correct relationship between molar mass of X and Y is :

A. $M_Y = 2M_X$

B. $M_Y = 4M_X$

C. $M_X = 4M_Y$

D. None of these

Answer: b

Watch Video Solution

82. Dry ice is solid carbon dioxide. A 0.050 g sample of dry ice is placed in an evacuated 4.6 L vessel at $30^\circ C$. Calculate the pressure inside the vessel after all the dry has been converted to CO_2 gas.

A. 6.14 atm

B. 0.614 atm

C. 0.0614 atm

D. 6.14×10^{-3} atm

Answer: d

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83. A mixture of helium of neon gases is collected over water at $28.0^{\circ} C$ and 745 mmHg. If the partial pressure of helium is 368 mmHg, what is the partial pressure of neon?

A. 348.7 mmHg

B. 377 mmHg

C. 384.7 mmHg

D. none of these

Answer: a

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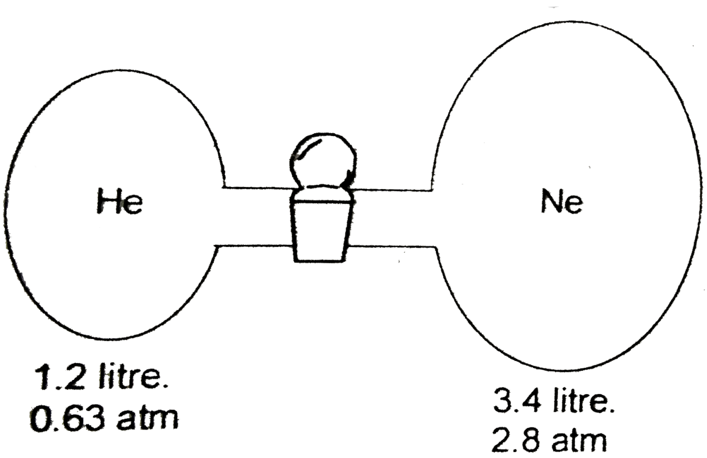
84.



Consider the following apparatus. Calculate the partical pressure of He after opening the valve. The temperature is remain constant at $16^\circ C$

A. 0.164 atm

B. 1.64 atm

C. 0.328 atm

D. 1 atm

Answer: a

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85. Oxygen gas generated by the decomposition of potassium chlorate is collected. The volume of oxygen collected at $24^{\circ} C$ and atmospheric pressure of $760 mmHg$ is $128 mL$. Calculate the mass (in grams) of oxygen gas obtained. The pressure of water vapour at $24^{\circ} C$ is $22.4 mmHg$.

A. 1.36 g

B. 1.52 g

C. 0.163 g

D. 1.63 g

Answer: c

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

A. number of particles of the gas

B. mass of the gas

C. number of moles of the gas

D. translation energy of the gas

Answer: a

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87. Which of the following statements about kinetic energy (K.E.) is true?

A. All objects moving with the same velocity have the same K.E.

B. The K.E. of a body will quadruple if its velocity doubles

C. As the velocity of a body increases, its K.E. decreases

D. The K.E. of a body is independent of its mass

Answer: b

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88. The Ne atom has 10 times the mass of H_2. Which of the following statements is true?

I) At $25^\circ C$ the both have the same kinetic energy

II) Ten moles of H_2 would have the same volume as 1 mole of Ne at same temperature and pressure

III) One mole of Ne exerts the same pressure as one mole of H_2 at STP.

IV) AH_2 molecule travels 10 times faster than Ne atom at same temperature.

V) At STP, one litre of Ne has 10 times the density of 1 litre of H_2

A. II, IV, V

B. I, III, V

C. I, II, III

D. I, II

Answer: b

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89. Which of the following is NOT a postulate of the kinetic molecular theory of gases ?

A. The gas molecules possess a volume that is negligibly small compared to the container

B. The pressure and volume of a gas are inversely related

C. Gases consist of discrete particles that are in constant chaotic motion

D. The average kinetic energy of the molecules is directly proportional to the absoute temperature

Answer: B

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90. Which one of the following relationships when graphed does not give a straight line for helium gas?

I. K.E. and T at constant pressure and volume

II. P v/s V at constant temperature for a constant mass

III. V v/s 1/T at constant pressure for a constant mass

A. II

B. II and III

C. III

D. I

Answer: b

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91. Consider three one-litre flasks labeled A, B and C filled with the gases NO, NO_2 and N_2O respectively, each at 1 atm and 273 K. In which flask do the molecules have the highest average kinetic energy?

A. Flask C

B. All are the same

C. Flask A

D. None

Answer: b

Watch Video Solution

92. Which of the following statements is false?

A. The product of pressure and volume of fixed amount of a gas is independent of temperature.

B. Molecules of different gasses have the same kinetic energy at a given temperature.

C. The gas equation is not valid at high pressure and low temperature.

D. The gas constant per molecule is known as Boltzmann's constant.

Answer: a

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93. Which is not correct in terms of kinetic theory of gases?

A. Gaseous particles are considered as point mass.

B. The gaseous molecules are in random motion.

C. When gaseous molecules collide, they lose energy.

D. When the gas is heated, the molecules moves faster.

Answer: c

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94. Two flasks A and B have equal volumes. A is maintained at 300 K and B at 600 K, while 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. $1:2$

B. $11:1$

C. $33:2$

D. $55:7$

Answer: b

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95. Kinetic energy and pressure of a gas of unit volume are related as:

A. $P=\frac{2}{3}E$

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

C. $P=\frac{E}{2}$

D. P=2E

Answer: a

Watch Video Solution

96. Two flask A and B of equal volumes maintained at temperature $300K$ and $700K$ contain equal mass of $He(g)$ and $N_2(g)$ respectively. What is the ratio of total translational kinetic energy of gas in flask A to that of flask B ?

A. $1:3$

B. $3:1$

C. $3:49$

D. None of these

Answer: b

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97. Which of the following change is observed occurs when a substance X is converted from liquid to vapour phase at the standard boiling point?

I. Potential energy of the system cecreases

II. The distance between molecules increases

III.The average kinetic energy of the molecules in both phases are equal

A. I only

B. II only

C. III only

D. II and III only

Answer: d

Watch Video Solution

98. A mixture of Ne and Ar kept in a closed vessel at 250 K has a total K.E.=3 kJ. The total mass of Ne and Ar is 30 g. Find mass % of Ne in gaseous mixture at 250 K.

A. 61.63

B. 38.37

C. 0.5

D. 28.3

Answer: d

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99. In two vessels of 1 litre each at athe same temperature 1g of H_2 and 1g of CH_4 are taken. For these gases:

A. V_{rms} values will be same

B. Kinetic energy per mol will be same

C. Total kinetic energy will same

D. Pressure will be same

Answer: b

Watch Video Solution

100. Four particles have speed 2,3,4 and 5 cm/s respectively. Their rms speed is :

A. 3.5 cm/s

B. (27/2) cm/s

C. $\sqrt{54}$ cm/s

D. $\sqrt{54}/2$ cm/s

Answer: d

Watch Video Solution

101. A gaseous mixture contains 4 molecules with a velocity of 6 cm $\sec^{-1}$, 5 molecules with a velocity of 2 cm $\sec^{-1}$ and 10 molecules with a velocity of 3 cm $\sec^{-1}$. What is the RMS velocity of the gas :

A. 2.5 cm $\sec^{-1}$

B. 1.9 cm $\sec^{-1}$

C. 3.6 cm $\sec^{-1}$

D. 4.6 cm $\sec^{-1}$

Answer: c

Watch Video Solution

102. The ratio between the root mean square speed of H_2 at $50K$ and that of O_2 at $800K$ is

A. 4

B. 2

C. 1

D. $1/4$

Answer: c

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103. If $C_1, C_2, C_3.....$ represent the speeds on $n_1, n_2, n_3.....$ molecules, then the root mean square speed is

A. $\sqrt{\dfrac{n_1C_1^2 + n_2C_2^2 + n_3C_3^2 + \ldots}{n_1 + n_2 + n_3 + \ldots}}$

B. $\sqrt{\dfrac{(n_1 + n_2 + n_3 + \ldots)^2}{n_1C_1^2 + n_2C_2^2 + n_3C_3^2 + \ldots}}$

C. $\sqrt{\dfrac{(n_1C_1)}{n_1} + \dfrac{(n_2C_2)}{n_2} + \dfrac{(n_3C_3)}{n_3}}$

D. $\sqrt{\dfrac{(n_1C_1 + n_2C_2 + n_2C_3 + \ldots)^2}{n_1 + n_2 + n_3 + \ldots}}$

Answer: a

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104. The root mean square speed of hydrogen is $\sqrt{5}$ times than that of nitrogen. If T is the temperature of the gas, then :

A. $T_{H_2} = T_{N_2}$

B. $T_{H_2} > T_{N_2}$

C. $T_{H_2} < T_{N_2}$

D. $T_{H_2} = \sqrt{7} T_{N_2}$

Answer: c

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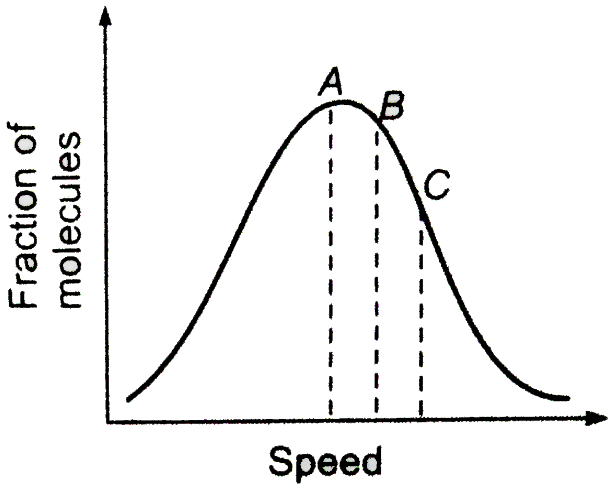
105. At a definit temperature (T), the distribution of speeds is given by the curve. In the curve points A, B and C indicates the speeds corresponding to :



A. most probable, average and root mean square speeds

B. average, root mean square and most probable speeds

C. root mean square, average and most probable speeds

D. most probable, root mean square and average speeds

Answer: a

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106. The most probable speed of 8 g of $H_2 200 ms^{-1}$ average kinetic energy (neglect rotational and vibrational energy) of H_2 gas is :

A. 480 J

B. 240 J

C. 120 J

D. none of these

Answer: b

Watch Video Solution

107. At what temperature will average speed of the molecules of the second member of the series C_nH_{2n} be the same to that of Cl_2 at $627^\circ C$?

A. 259.4 K

B. 400 K

C. 532.4 K

D. None of these

Answer: c

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108. If U_{RMS} of a gas is 30 $R^{1/2} ms^{-1}$ [at 27ºC then the molar mass of gas is]

A. 0.02 kg/mol

B. 0.001 kg/mol

C. 0.003 kg/mol

D. 1 kg/mol

Answer: d

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109. 6×10^{22} gas molecules each of mass $10^{-34} kg$ are taken in a vessel of 10 litre. What is the pressure exerted by gas molecules ? The root mean square speed of gas molecules is $100 m/s$.

A. 20 Pa

B. $2 \times 10^{4} Pa$

C. $2 \times 10^{5} Pa$

D. $2 \times 10^{7} Pa$

Answer: b

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110. At what temperature will most probable speed of the molecules of the second member of homologous series C_nH_{2n-2} be the same as that of SO_2 at $527^\circ C$.

A. $500^\circ C$

B. $727^\circ C$

C. $227^\circ C$

D. None of these

Answer: c

Watch Video Solution

111. The root mean square speed of 8 g of He is 300 ms 1. Total kinetic energy of He gas is :

A. 120 J

B. 240 J

C. 360 J

D. None of these

Answer: c

Watch Video Solution

112. If T_1, T_2 and T_3 are the temperatures at which the $u_{\text{rms}}, u_{\text{average}}, u_{\text{mp}}$ of oxygen gas are all equal to 1500 m/s then the correct statement is :

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

Answer: b

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113. The density of a gas filled electric lamp is 0.75 kg/m^3. After the lamp has been switched on, the presure in it increases from 4×10^4 Pa t 9×10^4 Pa. What is increases in U_{RMS}

A. 100

B. 200

C. 300

D. None of these

Answer: b

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114. The root mean square speed of an ideal gas at constant pressure varies with density d as .

A. d^2

B. d

C. $\sqrt{d}$

D. $1 / \sqrt{d}$

Answer: d

Watch Video Solution

115. Define RMS, mean and most probable velocities. Write the ratio of these velocities for a given gas.

A. $1 : 2 : 3$

B. $1 : \sqrt{2} : \sqrt{3}$

C. $\sqrt{2} : \sqrt{3} : \sqrt{8 / \pi}$

D. $\sqrt{2} : \sqrt{8 / \pi} : \sqrt{3}$

Answer: d

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116. The average speed at temperature $T^{\circ}C$ of $CH_4(g)$ is $\sqrt{\frac{28}{88}} \times 10^3 ms^{-1}$. What is the value of T ?

A. $240.55^{\circ}C$

B. $-32.45^{\circ}C$

C. $3000^{\circ}C$

D. $-24.055^{\circ}C$

Answer: b

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117. At what temperature most probable speed of SO_2 molecule have the same value as root mean square speed of O_2 molecules at 300 K?

A. 150 K

B. 600 K

C. 750 K

D. 900 K

Answer: d

Watch Video Solution

118. The rms speed of N_2 molecules in a gas is u. If the temperature is doubled and the nitrogen molecules dissociate into nitrogen atoms, the rms speed becomes :

A. u/2

B. 2u

C. 4u

D. 14u

Answer: b

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119. The rate of diffusion of a gas is proportional to

A. $\frac{P}{\sqrt{d}}$

B. $\frac{P}{d}$

C. $\sqrt{\frac{P}{d}}$

D. $\frac{\sqrt{P}}{d}$

Answer: a

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120. At constant volume and temperature conditions, the rates of diffusion r_A and r_B of gases A and B having densities P_A and P_B are related by the expression :

A. $r_A = r_B . (p_A / p_B)^2$

B. $r_A = r_B (p_A / p_B)^{1/2}$

C. $r_A = (r_B . p_A / p_B)^{1/2}$

D. $r_A = r_B (p_A / p_B)^{1/2}$

Answer: b

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121. What is the ratio of diffusion rate of oxygen to hydrogen?

A. $1:4$

B. $4:1$

C. $1:8$

D. $8:1$

Answer: a

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122. The molecular weight of a gas which diffuses through a porous plug at $1/6^{th}$ of the speed of hydrogen under identical condition is:

A. 27

B. 72

C. 36

D. 48

Answer: b

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123. X ml of H_2 gas effuses through a hole in a container in 5 sec. The time taken for the effusion of same volume of gas specified below under identical conditions is

A. 10 sec : He

B. 20 sec : O_2

C. 25 sec : CO

D. 55 sec : CO_2

Answer: b

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124. At identical temperature and pressure the rate of diffusion of hydrogen gas is $3\sqrt{3}$ times that of a hydrocarbon having molecular formula C_nH_{2n-n} What is the value of n ? .

A. 1

B. 4

C. 3

D. 8

Answer: b

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125. Calculate relative rate of effusion of O_2 to CH_4 from a container container containing O_2 and CH_4 in 3 :2 mass ratio.

A. $\frac{3\sqrt{2}}{4}$

B. $\frac{3}{4\sqrt{2}}$

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

D. none of these

Answer: b

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126. Calculate relative rates of effusion of SO_2 to CH_4 in the mixture obtained by effusing out a mixture with initial molar ratio $\frac{n_{SO_2}}{n_{CH_4}} = \frac{8}{1}$ for three effusing steps.

A. $2:1$

B. $1:4$

C. $1:2$

D. none of these

Answer: c

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127. A gaseous mixture containing He, CH_4 and SO_2 in $1:2:3$ mole ratio, calculate the molar ratio of gases effusing out initially.

A. $2:2:3$

B. $6:6:1$

C. $\sqrt{2}:\sqrt{2}:3$

D. $4:4:3$

Answer: d

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128. 80 mL of O_2 takes 2 minutes to pass through the hole. What volume of SO_2 will pass through the hole in 3 minute?

A. $\frac{120}{\sqrt{2}}$ mL

B. $120 \times \sqrt{2}$ mL

C. $\frac{12}{\sqrt{2}}$ mL

D. None of these

Answer: a

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129. When two cotton plugs, one moistened with ammonia and the other with hydrochloric acid, are sumulataneously inserted into opposite ends of a glass tube 87.0 cm long, a white ring of NH_4Cl forms where gaseous NH_3 and gaseous HCl first come into contact.

$NH_3(g) + HCl(g) \rightarrow NH_4Cl(s)$

At what distance from the ammonis-moistened plug does this occur?

A. 51.7 cm from NH_3 end

B. 51.7 cm from HCl end

C. 43.5 at mid point

D. None of these

Answer: a

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130. 4 gm of sulphur dioxide gas diffuses from a container in 8 min. Mass of helium gas diffusing from the same container over the same time interval is :

A. 0.5 g

B. 1 g

C. 2 g

D. None of these

Answer: b

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131. Under identical conditions of pressure and temperature, 4 L of gaseous mixture (H_2 and CH_4) effuses through a hole in 5 min whereas 4 L of a gas X of molecular mass 36 takes to 10 min to effuse through the same hole. The mole ratio of $H_2 : CH_4$ in the mixture is:

A. $1:2$

B. $2:1$

C. $2:3$

D. $1:1$

Answer: d

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132. A ballon weighing $50kg$ is filled with $685kg$ of helium at $1atm$ pressure and $25^{\circ}C$. What will be its pay load if it displaced $5108kg$ of air ?

A. 4373 kg

B. 4423 kg

C. 5793 kg

D. none of these

Answer: a

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

A. $\frac{1}{3}K_BT$

B. $\frac{1}{2}K_BT$

C. $K_B T$

D. $\frac{3}{2} K_B T$

Answer: b

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134. Calculate γ (ratio of C_p and C_v) for triatomic linear gas at high temperature. Assume that the contribution of vibrational degree of freedom is 75% :

A. 1.222

B. 1.121

C. 1.18

D. 1.33

Answer: c

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135. If one mole each of a monoatomic and diatomic gases are mixed at low temperature then C_p / C_v ratio for the mixture is :

A. 1.4

B. 1.428

C. 1.5

D. 1.33

Answer: c

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136. One mole of a monoatomic gas is mixed with one mole of a diatomic gas. What will be the γ for the mixture?

A. 1.4

B. 1.5

C. 1.53

D. 3.07

Answer: b

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137. Select the correct statement :

A. Internal energy of a real gas at a given temperature increases as the volume increases

B. Internal energy of an ideal gas at given temperature increase as the volume increases

C. Internal energy of an ideal gas molecules is not a function of temperature

D. The internal energy of a real gas at a constant temperature is independent of change in volume

Answer: a

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138. Which gas shows real behaviour?

A. 16 g O_2 at 1 atm & 273 K occupies 11.2 L

B. 1 g H_2 in 0.5 L flask exerts pressure of 24.63 atm at 300 K

C. 1 mole NH_3 at 300 K and 1 atm occupies volume 22.4 L

D. 5.6 L of CO_2 at 1 atm & 273 K is equal to 11 g

Answer: c

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139. Consider an ideal gas contained in a vessel If the intermolecular interaction suddenly begins to act which of the following will happen ?.

A. Pressure decreases

B. Pressure increases

C. Pressure remains unchanged

D. Gas collapses

Answer: b

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140. The pressure of real gas is less than the pressure of an ideal gas because of

A. increase in number of collisions

B. finite size of molecule

C. increase in KE of molecules

D. intermolecular forces of attraction

Answer: d

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141. When does a real gas behave like an ideal gas?

A. high pressure and low temperature

B. low pressure and high temperature

C. high pressure and high temperature

D. low pressure and low temperature

Answer: b

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142. If temperature and volume are same, the pressure of a gas obeying van der Waal's equation is :

A. less than that of an ideal gas

B. more than that of an ideal gas

C. same as that of an ideal gas

D. none of these

Answer: a

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143. 1 mole of each of X_1, X_2, X_3 with van der Waal's constants a (in atm $L^3 mol^{-2}$) 1.0, 3.8, 2.1 respectively is kept separately in three different vessels of equal volume at identical temperature. Their pressures are observed to $P_1, P_2,$ and P_3 respectively. On the basis of this data alone, select the correct option (neglect the effect of 'b') :

A. $P_1 < P_2 < P_3$

B. $P_2 < P_1 < P_3$

C. $P_2 < P_3 < P_1$

D. $P_1 = P_2 = P_3$

Answer: c

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144. A gas obeys $P(V-b)=RT$. Then which of the following are correct

A. negative

B. zero

C. R/(V - b)

D. R/P

Answer: c

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145. For helium vander Waals parameter bis 0.024 lit/mol. The diameter of helium is nearly

A. $1.335\times 10^{-10}\text{cm}$

B. $1.335 \times 10^{-8} \mathrm{cm}$

C. $2.67 \times 10^{-8} \mathrm{cm}$

D. $4.34 \times 10^{-8} \mathrm{cm}$

Answer: c

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146. Which of the following can be must 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.

A. NH_3

B. Cl_2

C. SO_2

D. CO_2

Answer: c

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147. For which of the following gasses should the correction for the molecular volume be largest :

CO, CO_2, NH_3 or SF_6 ?

A. CO

B. CO_2

C. NH_3

D. SF_6

Answer: d

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148. Under which one of the following conditions do real gases approach the ideal gas behaviour?

A. only I

B. only II

C. only III

D. I and III both

Answer: d

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149. For a certain gas which deviates a little from ideal behaviour, a plot between P/p vs P was found to be non- linear . The intercept on y-axis will be :

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

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

C. $\frac{MZ}{RT}$

D. $\frac{R}{\text{TM}}$

Answer: a

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150. At low pressure, the van der Waal's equation become :

A. $PV_m = RT$

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

C. $\left(P + \frac{a}{V_M^2}\right)V_m = RT$

D. $P = \frac{RT}{V_m} + \frac{a}{V_m^2}$

Answer: c

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151. At low pressure, if $RT = 2\sqrt{a.\,p}$, then the volume occupied by a real gas is :

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

B. $\frac{2P}{RT}$

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

D. $\frac{2RT}{P}$

Answer: c

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152. A real gas deviates most from ideal behaviour at

A. $0^{\circ}C$ and 1.0 atm

B. $100^{\circ}C$ and 2.0 atm

C. $-13^{\circ}C$ and 1.0 atm

D. $-13^{\circ}C$ and 2.0 atm

Answer: d

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153. At low pressures, the 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. $\left(1+\frac{RTV}{a}\right)$

Answer: a

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154. The compressibility factor for a real gas at high pressure is .

A. 1

B. $1+\frac{Pb}{RT}$

C. $1-\frac{Pb}{RT}$

D. $1 + \frac{RT}{Pb}$

Answer: b

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155. The compressibillity of a gas is greater than unity at 1 atm and 273 K. Therefore :

A. $V_m > 22.4L$

B. $V_m < 22.4L$

C. $V_m = 22.4L$

D. $V_m = 44.8L$

Answer: a

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156. At 273 K temperature and 9 atm pressure, the compresibility for a gas is 0.9. The volume of 1 milli- moles of gas at this temperature and pressure is

A. 2.24 litre

B. 0.020 mL

C. 2.24 mL

D. 22.4 mL

Answer: c

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157. The compressibility factor for nitrogen at $330K$ and $800atm$ is 1.90 and at $570K$ and $200atm$ is 1.10. A certain mass of N_2 occupies a volume of $1dm^3$ at $330K$ and $800atm$ calculate volume occupied by same quantity of N_2 gas at $570K$ and $200atm$

A. 1 L

B. 2 L

C. 3 L

D. 4 L

Answer: d

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158. Consider the equation $Z = \frac{PV}{RT}$. Which of the following statements is correct?

A. When Z $>$ 1, real gasses are easier to compress than the ideal gas

B. When Z = 1, real gases get compressed easily

C. When Z $>$ 1, real gases are defficult to compress

D. When Z = 1, real gases are difficult to compress

Answer: c

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159. What is the compressibility facto (Z) for 0.02 mole of a van der Waal's gas at pressure of 0.1 atm. Assume the size of gas molecules is neligible.

Given : RT = 20 L. atm mol^{-1} and α = 1000 atm $L^2 mol^{-2}$

A. 2

B. 1

C. 0.02

D. 0.5

Answer: d

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160. Consider the following statements If the van der Waals' parameters of two gases are given as

	$a / dm^6 \text{bar} mol^{-2}$	$b / dm^3 mol^{-1}$
$Gas A$	6.5	0.056
$Gas B$	18.0	0.011

then which of the following statements is//are correct ? .

Critical volume of Gas A < Critical volume of Gas B

Critical pressure of Gas A < Critical pressure of Gas B

Critical temperature of Gas A < Critical temperature of Gas B

A. 1 alone

B. 1 and 2

C. 1, 2 and 3

D. 2 and 3

Answer: c

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161. The van der Waals parameters for gases W, X, Y and Z are

Gas	$a(\text{atm}L^2mol^{-2})$	$b\left(L\text{mol}^{-1}\right)$
W	4.0	0.027
X	8.0	0.030
Y	6.0	0.032
Z	12.0	0.027

Which one of these gases has the highest critical temperature?

A. W

B. X

C. Y

D. Z

Answer: d

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162. Pressure remaining the constant, the volume of a given mass of an ideal gas increases for every degree centigrade rise in temperature by definite fraction of its volume at:

A. $0^\circ C$

B. its critical temperature

C. absolute zero

D. its Boyle temperature

Answer: a

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163. The critical temperature of a substance is defined as :

A. the temperature above which the substance undergoes decomposition

B. the temperature above which a substance can exist only in gaseous state

C. boiling point of the substance

D. all are wrong

Answer: b

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164. The excluded volume of a gas will be larger, if $\frac{T_c}{P_c}$ is:

A. small

B. large

C. equal to 1

D. less than unity

Answer: b

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165. Select incorrect statement (s) :

A. we can condense vapour simply by applying pressure

B. to liquefy a gas one must lower the temperature below T_C and also apply pressure

C. at T_C there is no distinction between liquid and vapour state hence density of the liquid is nearly equal to density of the vapour

D. However great the pressure applied, a gas cannot be liquified below it's critical temp.

Answer: d

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166. The correct order of temperature of a real gas is :

(I) Boyle's temperature

(II) Critical temperature

(III) Inversion temperature

A. $III > I > II$

B. $I > II > III$

C. $II > I > III$

D. $I > III > II$

Answer: a

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167. The temperature at which the second virial coefficient of a real gas is zero is called .

A. Critical temperature

B. Triple point

C. Boiling point

D. Boyle's temperature

Answer: d

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168. The van der Waals' equation for one mole may be expressed as

$$V_M^3 - \left(b + \frac{RT}{P}\right)V_m^2 + \frac{aV_m}{P} - \frac{ab}{P} = 0$$

where V_m is the molar volume of the gas. Which of the followning is incorrect?

A. For a temperature less than T_C, V has three real roots

B. For a temperature less than T_C, V has three imaginary roots

C. For a temperature equal to T_C all three roots of V are real and identical

D. On increasing the temp. $(T < T_C)$, the three roots become closer to one another

Answer: b

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169. For a gas obeying the van der Waals' equation, at the critical point

A. both $\left(\frac{\partial P}{\partial V}\right)_T$ and $\left(\frac{\partial^2 P}{\partial V^2}\right)_T$ are zero

B. only $\left(\frac{\partial^2 P}{\partial V^2}\right)_T$ is not zero

C. $\left(\frac{\partial P}{\partial V}\right)_T$ is zero but $\left(\frac{\partial^2 P}{\partial V^2}\right)_T$ is non-zero

D. $\left(\frac{\partial P}{\partial V}\right)_T$ is non-zero but $\left(\frac{\partial^2 P}{\partial V^2}\right)_T$ is zero

Answer: a

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170. The temperature above which a gas cannot be liquified even on application of high pressure is called

A. Boyle temperature

B. Inversion temperature

C. Critical temperature

D. Room temperature

Answer: c

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171. Inversion temperature (Ti=2aRb) is defined as the temperature above which if gas is expanded adiabatically it gets warm up but if temperature of gas is lower than Ti then it will cool down. What will happen to gas if it is adiabatically expanded at 50∘C if its Boyle's temperature is 20∘C

A. Heating

B. Cooling

C. Constant

D. None

Answer: a

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172. The. van der Waal's equation of law of corresponding states for 1 mole of gas is :

A. $\left(P_r + \frac{3}{V_r^2}\right)(3V_r - 1) = 8T_r$

B. $\left(P_r - \frac{3}{V_r^2}\right)(3V_r - 1) = 8T_r$

C. $\left(P_r + \frac{3}{V_r^2}\right)(3V_r + 1) = 8\pi T_r$

D. $\left(P_r + \frac{3}{V_r^2}\right)(3V_r + 1) = 8$

Answer: a

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173. Calculate the volume occupied by 16 grm O_2 at 300 K and 8.31 MPa if $\frac{P_cV_c}{RT_c} = \frac{3}{8}$ and $\frac{P_tV_t}{T_t} = 2.21$ (Given : R = 8.314 Mpa/K-mol)

A. 125.31 mL

B. 124.31 mL

C. 248.62 mL

D. none of these

Answer: b

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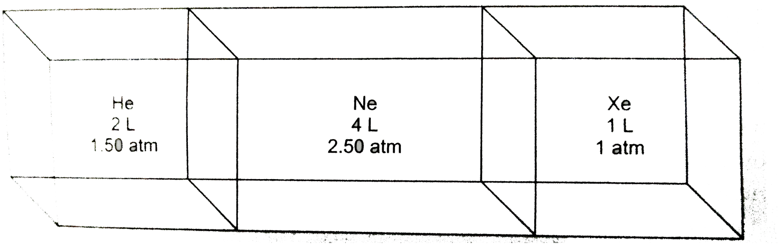
174. Consider the composite system, which is held at 300 k , shown in the following figure. Assuming ideal gas behavior, calculate the total pressure if the barriers sparating the compartments are removed. Assume that the volume of the barriers is negligible. (Given : R =0.082 atm L/mol. K)



A. 1 atm

B. 2 atm

C. 2.3 atm

D. 3.2 atm

Answer: b

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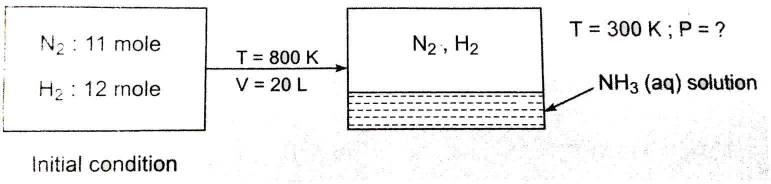
175. 11 moles of N_2 and 12 moles of H_2 mixture reacted in 2.0 litre vessel at 800 K. After equilibrium was reached, 6 mole of H_2 was present. 3.58 litre of liquid water is injected in equibrium mixture and resultant gaseous mixture suddenly cooled to 300K. What is the final pressure of gaseous mixture? Neglect vapour pressure of liquid solution. Assume (i) all NH_3 dissolved in water (ii) no change in volume of liquid (iii) At 300 K no reaction takes place between N_2 and H_2



A. 18.47 atm

B. 60 atm

C. 22.5 atm

D. 45 atm

Answer: c

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176. Two vessels are connected by a valve of negligible volume. One container, A has 2.8 g N_2 at $T_1 K$. The other container, B is completely evacuated. The container A is heated to $T_2 K$, while container B is maintained at $\frac{T_2}{3} K$. Volume of A is half that of B. If the valve is opened, then

A. $1:2$

B. $1:3$

C. $1:6$

D. $3:1$

Answer: c

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177. A mixture of $NH_{3(g)}$ and $N_2H_{4(g)}$ is placed in a sealed container at $300K$. The total pressure is $0.5 atm$. The container is heated to $1200K$, at which time both substances decompose completely according to the equations:

$2NH_{3(g)} \rightarrow N_{2(g)} + 3H_{2(g)}$

$N_2H_{4_{(g)}} \rightarrow N_{2(g)} + 2H_{2(g)}$

After decomposition is complete, the total pressure at $1200K$ is found to be $4.5atm$. Find the amount (mole) per cent of $N_2H_{4(g)}$ in the original mixture.

A. 20%

B. 25%

C. 50%

D. 75%

Answer: b

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178. Correct expression for density of an ideal gas mixture of two gases 1 and 2, where m_1 and m_2 are masses and n_1 and n_2 are moles and M_1 and M_2 are molar masses.

A. $d = \frac{(m_1 + m_2)}{(M_1 + M_2)}$

B. $d = \frac{(m_1 + m_2)}{(n_1 + n_2)} \frac{P}{RT}$

C. $d = \frac{(n_1 + n_2)}{(m_1 + m_2)} \times \frac{P}{RT}$

D. None of these

Answer: b

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179. Two closed vessels of equal volume containing air at pressure P_1 and temperature T_1 are connected to each other through a narrow tube. If the temperature in one of the vessels is now maintained at T_1 and that in the other at T_2, what will be the pressure in the vessels?

A. $\frac{T_1}{2P_1T_2}$

B. $\frac{2P_1T_2}{T_1 + T_2}$

C. $\frac{2P_1T_2}{T_1 - T_2}$

D. $\frac{2P_1}{T_1 + T_2}$

Answer: b

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180. A balloon containing 1 mole air at 1 atm initially is filled further with air till pressure increases to 4 atm. The intial diameter of the ballon is 1 m and the pressure at each stage is proportional to diameter of the balloon. How many moles of air added to change the pressure from 1 atm to 4 atm.

A. 80

B. 257

C. 255

D. 256

Answer: c

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181. If Pd vs. P(where P denotes pressure in atm and d denotes density in gm/L) is plotted for He gas (assume ideal) at a particular temperature. If $\left[\frac{d}{dP}(pd)\right]_{P=8.21\text{atm}} = 5,$ then the temperature wil be

A. 160 K

B. 320 K

C. 80 K

D. none of these

Answer: a

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182. What is the density of wet air with 75% relative humidity at 1 atm and 300 K? Given : vapour pressure of H_2O is 30 torr and average molar mass of air is 29 g mol^{-1} .

A. 1.614 g/L

B. 0.96 g/L

C. 1.06 g/L

D. 1.164 g/L

Answer: d

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183. 7 moles of a tetra-atomic non-linear gas 'A' at 10 atm and T K are mixed with 6 moles of another gas B at $\frac{T}{3}K$ and 5 atm in a closed, rigid vessel without energy transfer with surroundings. If final temperature of mixture was $\frac{5T}{6}K$, then gas B is ? (Assuming all modes of energy are active)

A. monoatomic

B. diatomic

C. triatomic

D. tetra atomic

Answer: b

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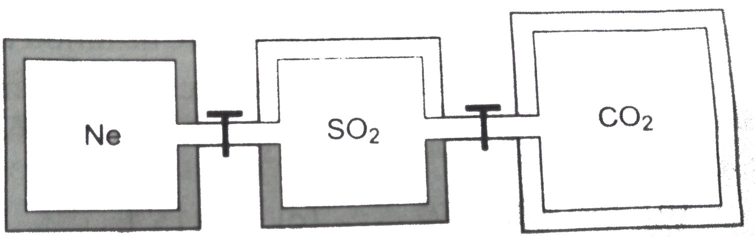
184. Three closed rigid vessels, A, B and C, which initially contain three different gases at different temperatures are connected by tube of negligible volume, without any energy transfer with surroundings. The vessel A contain 2 mole Ne gas, at 300 K, vessel 'B' contain 2 mole SO_2 gas at 400 K and vessel 'C' contain 3 mole CO_2 gas at temperature 500 K. What is the final pressure (in atm) attained by gases when all valves of connecting three vessels are opened and additional 15.6 kcal hear supplied to vessels through valve. The volume of A, B and C vessel is 2, 2 and 3 litre respectively



Given :R =2 calorie/mol-K,

$C_v(Ne) = 3/2R, C_v(CO) = 5/2R$ and $C_v(SO_2) = 3R$

A. 73.89 atm

B. 67.31 atm

C. 80 atm

D. none of these

Answer: a

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185. Gas molecules each of mass 10^{-26} kg are taken in a container of volume $1dm^3$. The root mean square speed of gas molecules is 1 km $\sec^{-1}$ .What is the temperature fo gas molecules.

(Given : $N_A = 6 \times 10^{23}, R = 8J/mol.K$)

A. 298 K

B. 25 K

C. 250 K

D. 2500 K

Answer: c

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186. A balloon of diameter 21 meter weight 100 kg. Calculate its pay-load, if it is filled with He at 1.0 atm and 27°C. Density fair is 1.2 kgm^{-3} (Given : R = 0.0821 L atm $K^{-1}mol^{-1}$)

A. 4952.42 kg

B. 4932.42 kg

C. 493.242 kg

D. none of these

Answer: b

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187. A given volume of ozonised oxygen (containing 60% oxygen by volume) required 220 sec to effuse while an equal volume of oxygen took 200 sec only under identical conditions. If density of O_2 is 1.6 g/L then find density of O_3.

A. 1.963 g/L

B. 2.16 g/L

C. 3.28 g/L

D. 2.24 g/L

Answer: d

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188. If 250 mL of N_2 over water at $30^\circ C$ and a total pressure of 740 torr is mixed with 300 mL of Ne over water at $25^\circ C$ and a total pressure of 780 torr, what will be the total pressure if the mixture is in a 500 mL vessel over water at $35^\circ C$.

(Given : Vapour pressure (Aqueous tension)of H_2O at $25^\circ C$ and $35^\circ C$ are 23.8, 31.8 and 42.2 torr respectively. Assume volume of $H_2O(l)$ is negligible in final vessel)

A. 760 torr

B. 828.4 torr

C. 807.6 torr

D. 870.6 torr

Answer: d

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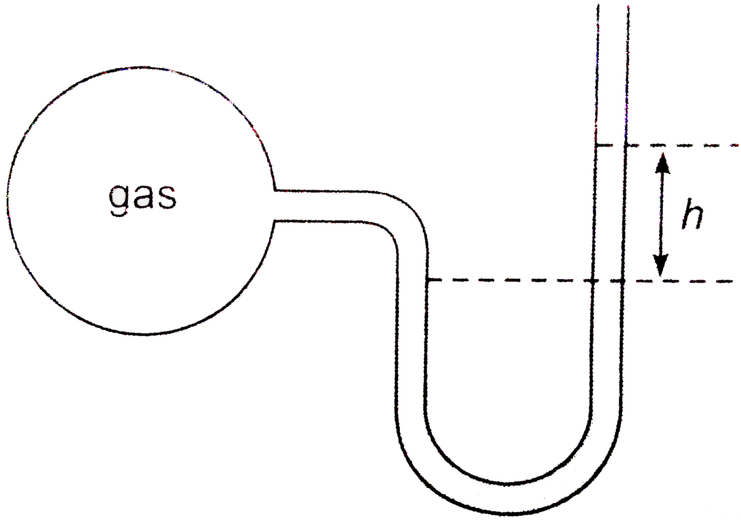
189. A bulb of constant volume is attached to a manometer tube open at other end as shown in figure. The manometer is filled with a liquid of density $(1/3)^{\text{rd}}$ that of mercury. Initially h was 228 cm.



Through a small hole in the bulb gas leaked assuming pressure decreases as $\frac{dP}{dt} = -kp$. If value of h is 114 cm after 14 minutes, what is the value of k (in hour^{-1})?

[Use : In (4/3) =0.28 and density of Hg =13.6 g/mL.].

A. 0.6

B. 1.2

C. 2.4

D. none of these

Answer: b

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190. A mixture of nitrogen and water vapours is admitted to a flask at 760 torr which contains a sufficient solid drying agent. After long time the pressure attained a steady value of 722 torr.

If the experiment is done at $27^{\circ}C$ and drying agent increase in mass by 0.9 gm, what is the volume of the flask? Neglect any possible vapour pressure of drying agent and volume occupied by drying agent.

A. 443.34 L

B. 246.3 L

C. 12.315 L

D. 24.63 L

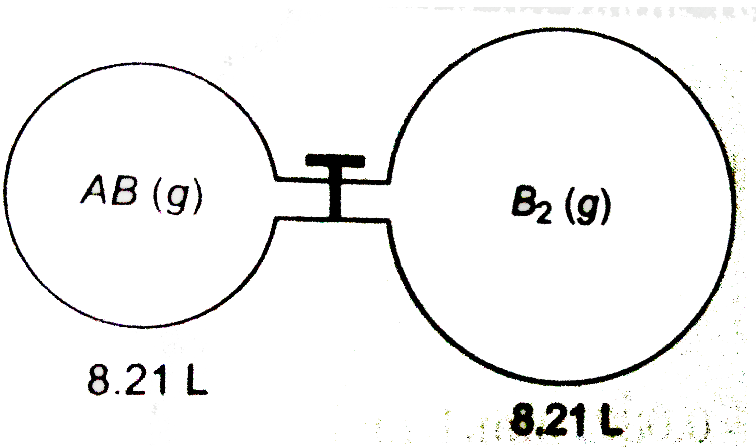
Answer: d

Watch Video Solution

191. At room temperature following traction goes to completion

$2AB(g) + B_2(g) \rightarrow 2AB_2(s)$

AB_2 is solid with negligble vapour pressure below $0^\circ C$. At 300 K, the AB in the smaller flask exerts a pressure of 3 atm and in the larger flask B_2 exerts a pressure of 1 atm at 400 K when they are separated out by a close valve, The gases are mixed by opening the stop cock and after the end of the reaction the flask are cooled to 250 K



The final pressure is :

A. 0.156 atm

B. 0.3125 atm

C. 0.625 atm

D. 3.2 atm

Answer: c

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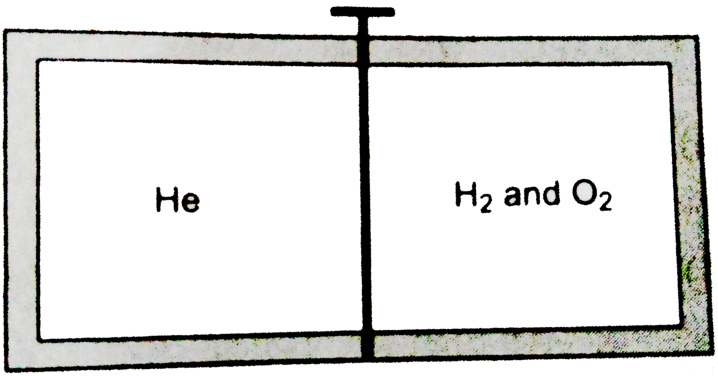
192. A vessel of uniform cross-section of length 500 cm as shown in figure is divided in two parts by a weightless and frictionless piston one part contains 5 moles of He(g) and other part 2 moles of $H_2(g)$ and 4 moles of $O_2(g)$ added at the same temperature and pressure in which reaction takes place finally vessel cooled to 300 K and 1 atm. What is the length of He compartment?

(Assume volume of piston and vol. of $H_2O(l)$ formed are negligible)



At initial stage

A. 187.5 cm

B. 300 cm

C. 312.5 cm

D. none of these

Answer: c

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193. For a real gas (mol.mass =60) if density at critical point is $0.80g/cm^{-3}$ and its $T_c = \frac{4 \times 10^5}{821} K,$ then van der Waals' constant a (in atm $L^2 mol^{-2}$) is

A. 0.3375

B. 3.375

C. 1.68

D. 0.025

Answer: b

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194. The van der Waals' constant 'b' of a gas is $4\pi \times 10^{-4} L/mol.$ How near can the centeres of the two molecules approach each other? [Use : $N_A = 6 \times 10^{23}$]

A. 10^{-7} m

B. 10^{-10} m

C. 5×10^{-11} m

D. 5×10^{-9} m

Answer: b

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195. The density of vapour of a substance (X) at 1 atm pressure and 500 K is $0.8kg/m^3$. The vapour effuse through a small hole at a rate of $4/5$ times slower than oxygen under the same condition. What is the compressibility factor (z) of the vapour ?

A. 0.974

B. 1.35

C. 1.52

D. 1.22

Answer: c

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196. van der Waal's gas equation can be reduced to virial eqation and virial equation (in terms of volume) is $Z = A + \frac{B}{V_m} + \frac{C}{V_m^2} + \ldots\ldots.$ where A =first virial coefficient, B=second virial coefficient ,C = third virial coefficient. The third virial coeffdient of Hg(g) is 625 $(cm^2/\text{mol})^2$. What volume is available for movement of 10 moles He(g) atoms present in 50 L vessel?

A. 49.75 L

B. 49.25 L

C. 25 L

D. 50 L

Answer: a

Watch Video Solution

197. If the slope of 'Z' (compressibility factor) vs. 'p' curve is constant $\left(\text{slope} = \frac{\pi}{492.6} atm^{-1}\right)$ at a particular temperature (300 K) abd very high pressure, then calculate diameter of the molecules.

(Given : $N_A = 6.0 \times 10^{23}$, $R = 0.0821 atm. Lmol^{-1} K^{-1}$)

A. 7.5 Å

B. 5 Å

C. 2.5 Å

D. 1.25 Å

Answer: b

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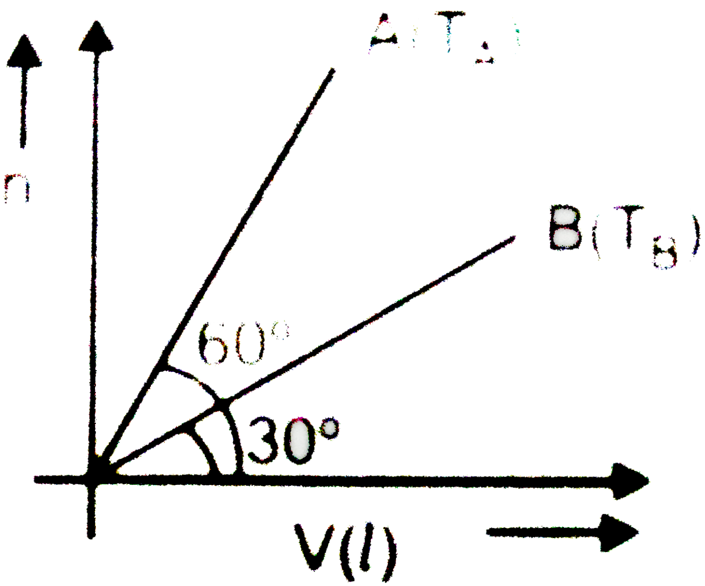
198. For two samples of ideal gases A and B curves are plotted n vs V (volume of container) at 16.42 atm pressure. Then temperature of A and B respectively are:



A. $\frac{200}{\sqrt{3}}K, 200\sqrt{3}K$

B. $\frac{200}{\sqrt{3}}\ ^{\circ}C\ , (200\sqrt{3})^{\circ}C$

C. $200\sqrt{3}K, \frac{200}{\sqrt{3}}K$

D. $200K, \frac{\sqrt{3}}{200}K$

Answer: a

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199. At a constant temperature what should be the percentage increase in pressure for a $10\ \%$ decrease in the volume of gas ? .

A. $10\ \%$

B. $20\ \%$

C. $5\ \%$

D. $50\ \%$

Answer: a

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200. 6 litre H_2O is placed in a closed evacuted room of volume 8.27 litre at the temperature 300K. The density of liquid water at 300 K is 1.0 gm/ml. the vapour pressure of water at 300 K is 22.8 mm Hg. Neglect the change in volume of liquid water by vaporization.

List I	List II
(P) Mass of watwer vapour formed (in gm)	(1) 6
(Q) Moles of water vapour fomed	(2) 18
(R) Approx. mass of liquid water left (in kg)	(3) 3
(S) Total moles of atoms in vapour form	(4) 1

A. $\begin{matrix} P & Q & R & S \\ 1 & 2 & 4 & 3 \end{matrix}$

B. $\begin{matrix} P & Q & R & S \\ 4 & 3 & 2 & 1 \end{matrix}$

C. $\begin{matrix} P & Q & R & S \\ 2 & 4 & 1 & 3 \end{matrix}$

D. $\begin{matrix} P & Q & R & S \\ 1 & 2 & 3 & 4 \end{matrix}$

Answer: c

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201. Match the items of colums I and II.

	Column-I		Column-II
(P)	Z for ideal gas behaviour	(1)	3/8
(Q)	Z for real gas at low pressure	(2)	$\left(1+\frac{Pb}{RT}\right)$
(R)	Z for real gas at high pressure	(3)	1
(S)	Z for critical state	(4)	$\left(1-\frac{a}{RTV}\right)$

A. $\begin{matrix} P & Q & R & S \\ 1 & 2 & 4 & 3 \end{matrix}$

B. $\begin{matrix} P & Q & R & S \\ 3 & 4 & 2 & 1 \end{matrix}$

C. $\begin{matrix} P & Q & R & S \\ 2 & 1 & 4 & 3 \end{matrix}$

D. $\begin{matrix} P & Q & R & S \\ 1 & 2 & 3 & 4 \end{matrix}$

Answer: b

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202. Match the following columns

List-I (Conditions for real gas)		List-II	
(P)	If force of attraction among gas particles are negligible	(1)	$PV_m = RT$
(Q)	At 1 atm and 273 K	(2)	$PV_m = RT - \frac{a}{V_m}$
(R)	If the volume of gas particles is negligible	(3)	$\left(P + \frac{a}{V_m^2}\right)(V_m - b) = RT$
(S)	At low pressure and high temperature	(4)	$PV_m = RT + Pb$

A. $\begin{matrix} P & Q & R & S \\ 4 & 1 & 3 & 2 \end{matrix}$

B. $\begin{matrix} P & Q & R & S \\ 4 & 3 & 2 & 1 \end{matrix}$

C. $\begin{matrix} P & Q & R & S \\ 2 & 1 & 4 & 3 \end{matrix}$

D. $\begin{matrix} P & Q & R & S \\ 1 & 2 & 3 & 4 \end{matrix}$

Answer: b

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203. van der Waal's equation for calculating the pressure of a non ideal gas is

$$\left(P + \frac{an^2}{V^2}\right)(V - nb) = nRT$$

van der Waal's suggested that the pressure exerted by an ideal gas , P_{ideal} , is related to the experiventally measured pressure, P_{ideal} by the equation

$$P_{\text{ideal}} = \underset{\text{observed pressure}}{\underset{\uparrow}{P_{\text{real}}}} + \underset{\text{currection term}}{\underset{\uparrow}{\frac{an^2}{V^2}}}$$

Constant 'a' is measure of intermolecular interaction between gaseous molecules that gives rise to nonideal behavior. It depends upon how frequently any two molecules approach each other closely. Another correction concerns the volume occupied by the gas molecules. In the ideal gas equation, V represents the volume of the container. However, each molecule does occupy a finite, although small, intrinsic volume, so the effective volume of the gas vecomes (V-nb), where n is the number of moles of the gas and b is a constant. The term nb represents the volume occupied by gas particles present in n moles of the gas .

Having taken into account the corrections for pressure and volume, we can rewrite the ideal gas equation as follows :

$$\underset{\text{corrected pressure}}{\left(P + \frac{an^2}{V^2}\right)} \underset{\text{corrected volume}}{(V - nb)} = nRT$$

AT relatively high pressures, the van der Waals' equation of state reduces to

A. $PV = RT - a/V_m$

B. $PV = aRT / V_m^2$

C. $P = RT - a / V_m^2$

D. $PV_m = RT + Pb$

Answer: d

Watch Video Solution

204. van der Waal's equation for calculating the pressure of a non ideal gas is

$$\left(P + \frac{an^2}{V^2}\right)(V - nb) = nRT$$

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Having taken into account the corrections for pressure and volume, we can rewrite the ideal gas equation as follows :

$$\underbrace{\left(P+\frac{an^2}{V^2}\right)}_{\text{corrected pressure}}\underbrace{(V-nb)}_{\text{corrected volume}}=nRT$$

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

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

B. $PV = nRT + nbP$

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

D. $PV = nRT$

Answer: a

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205. van der Waal's equation for calculating the pressure of a non ideal gas is

$$\left(P + \frac{an^2}{V^2}\right)(V - nb) = nRT$$

van der Waal's suggested that the pressure exerted by an ideal gas , P_{ideal} , is related to the experiventally measured pressure, P_{ideal} by the equation

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Constant 'a' is measure of intermolecular interaction between gaseous molecules that gives rise to nonideal behavior. It depends upon how frequently any two molecules approach each other closely. Another correction concerns the volume occupied by the gas molecules. In the ideal gas equation, V represents the volume of the container. However, each molecule does occupy a finite, although small, intrinsic volume, so the effective volume of the gas vecomes (V-nb), where n is the number of moles of the gas and b is a constant. The term nb represents the volume occupied by gas particles present in n moles of the gas .

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$$\underbrace{\left(P + \frac{an^2}{V^2}\right)}_{\text{corrected pressure}} \underbrace{(V - nb)}_{\text{corrected volume}} = nRT$$

The van der Waals' constant 'a' for CO_2 gas is greater than that of H_2 gas. Its mean that the

A. strength of van der Waals' force of CO_2 gas is less than that of H_2 gas

B. strength of van der Waals' force of CO_2 gas is equal to that of H_2 gas

C. CO_2 gas can be more easily liquified

D. H_2 gas can be more easily liquified

Answer: c

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206. van der Waal's equation for calculating the pressure of a non ideal gas is

$$\left(P + \frac{an^2}{V^2}\right)(V - nb) = nRT$$

van der Waal's suggested that the pressure exerted by an ideal gas , P_{ideal} , is related to the experiventally measured pressure, P_{ideal} by the equation

$$P_{\text{ideal}} = \underset{\text{observed pressure}}{\underset{\uparrow}{P_{\text{real}}}} + \underset{\text{curréction term}}{\underset{\uparrow}{\frac{an^2}{V^2}}}$$

Constant 'a' is measure of intermolecular interaction between gaseous molecules that gives rise to nonideal behavior. It depends upon how frequently any two molecules approach each other closely. Another correction concerns the volume occupied by the gas molecules. In the ideal gas equation, V represents the volume of the container. However, each molecule does occupy a finite, although small, intrinsic volume, so the effective volume of the gas vecomes (V-nb), where n is the number of moles of the gas and b is a constant. The term nb represents the volume occupied by gas particles present in n moles of the gas .

Having taken into account the corrections for pressure and volume, we can rewrite the ideal gas equation as follows :

$$\underset{\text{corrected pressure}}{\left(P + \frac{an^2}{V^2}\right)} \underset{\text{corrected volume}}{(V - nb)} = nRT$$

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)

A. 2.62

B. 2.64

C. 6.24

D. 6.46

Answer: d

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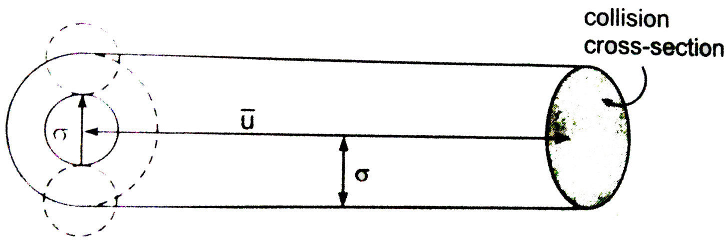
207. Collision cross-section is an area of an imaginary sphere of radius σ around the molecule within which the centre of another molecule cannot penetrate.

The volume swept by a single molecule in unit time is



$V = (\pi\sigma^2)\bar{u}$ where $\bar{u}$ is the average speed

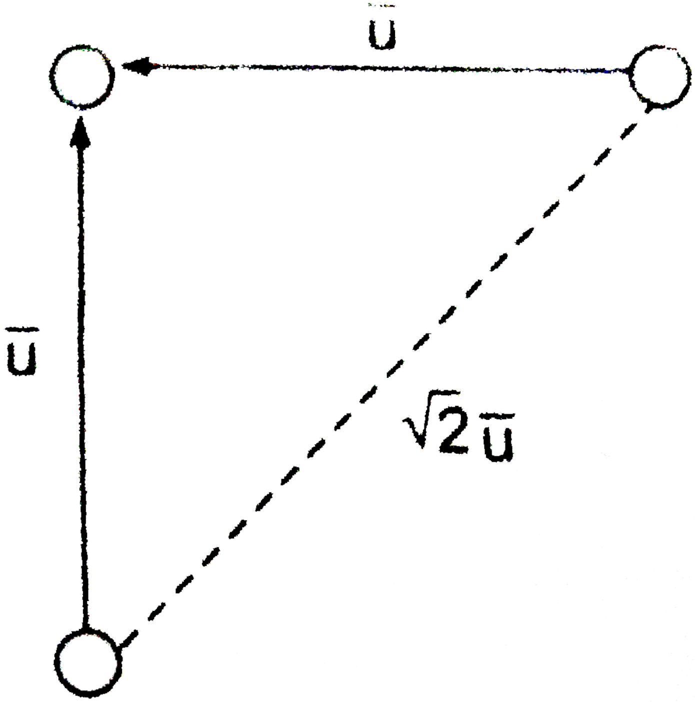
If N^* is the number of molecules per unit volume, then the number of molecules within the volume V is

$N = VN^* = (\pi\sigma^2\bar{u})N^*$

Hence, the number of collision made by a single molecule in unit time will be

$Z = N = (\pi\sigma^2\bar{u})N^*$

In order to account for the movements of all molecules, we must consider the average velocity along the line of centres of two coliding molecules instead of the average velocity of a single molecule . If it is assumed that, on an average, molecules collide while approaching each other perpendicularly, then the average velocity along their centres is $\sqrt{2}\bar{u}$ as shown below.



Number of collision made by a single molecule with other molecule per unit time is given by

$Z_1 = \pi\sigma^2(\bar{u}_{\text{rel}})N^* = \sqrt{2}\pi\sigma^2\bar{u}N^*$

The total number of bimolecular collisions Z_{11} per unit volume per unit time is given by

$Z_{11} = \frac{1}{2}(Z_1N^*) \text{or} Z_{11} = \frac{1}{2}\left(\sqrt{2}\pi\sigma^2\bar{u}N^*\right)N^* = \frac{1}{\sqrt{2}}\pi\sigma^2\bar{u}N^{*2}$

If the collsion involve two unlike molecules then the number of collisions Z_{12} per unit volume per unit time is given as

$$Z_{12} = \pi\sigma_{12}^2\left(\sqrt{\frac{8kT}{\pi\mu}}\right)N_1N_2$$

where N_1 and N_2 are the number of molecules per unit volume of the two types of molecules, σ_{12} is the average diameter of the two molecules and μ is the reduced mass. The mean free path is the average distance travelled by a molecule between two successive collisions. We can express it as follows :

$$\lambda = \frac{\text{Average distance travelled per unit time}}{\text{NO. of collisions made by a single molecule per unit time}} = \frac{\bar{u}}{Z_1}$$

or $$\lambda = \frac{\bar{u}}{\sqrt{2}\pi\sigma^2\bar{u}N*} \Rightarrow \frac{1}{\sqrt{2}\pi\sigma^2\bar{u}N*}$$

Three ideal gas samples in separate equal volume containers are taken and following data is given :

	Pressure	Temperature	Mean free paths	Mol.wt.
Gas A	$1atm$	$1600K$	$0.16nm$	20
Gas B	$2atm$	$200K$	$0.16nm$	40
Gas C	$4atm$	$400K$	$0.04nm$	80

Calculate ratio of collision frequencies $(Z_{11})(A:B:C)$ of following for the three gases.

A. $1:2:4$

B. $4:2:1$

C. $1:4:16$

D. $16:4:1$

Answer: c

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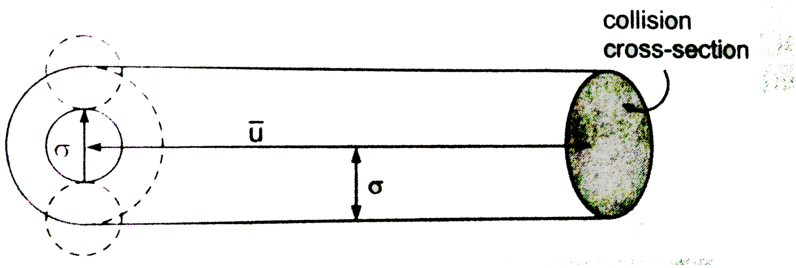
208. Collision cross-section is an area of an imaginary sphere of radius σ around the molecule within which the centre of another molecule cannot penetrate.

The volume swept by a single molecule in unit time is



$V = (\pi\sigma^2)\bar{u}$ where $\bar{u}$ is the average speed

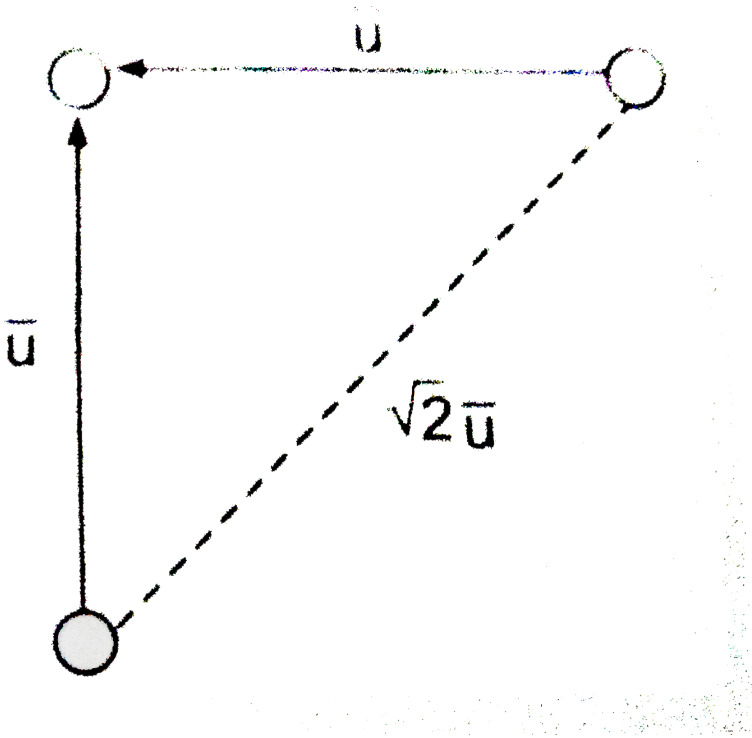
If N^* is the number of molecules per unit volume, then the number of molecules within the volume V is

$N = VN^* = (\pi\sigma^2\bar{u})N^*$

Hence, the number of collision made by a single molecule in unit time will be

$$Z = N = \left(\pi\sigma^2\bar{u}\right)N^*$$

In order to account for the movements of all molecules, we must consider the average velocity along the line of centres of two coliding molecules instead of the average velocity of a single molecule . If it is assumed that, on an average, molecules collide while approaching each other perpendicularly, then the average velocity along their centres is $\sqrt{2}\bar{u}$ as shown below.



Number of collision made by a single molecule with other molecule per unit time is given by

$Z_1 = \pi\sigma^2(\bar{u}_{\text{rel}})N^* = \sqrt{2}\pi\sigma^2\bar{2}N^*$

$The \to tal\nu mber of bimo \leq c\underline{a}r collisions$Z_(1)

$per unit volume per unit time is given by$Z_(1)=(1)/(2)(Z_(1)N^(**))or Z_(11)=

(1)/(2)(sqrt(2)pisigma^(2)overline(u)N^(**))N^(**)=

(1)/(sqrt(2))pisigma^(2)overline(u)N^(**2)

$If the collsion \in volve two unlike mo \leq c\underline{e}s then the \nu mber of collisions$

Z_(12)$per unit volume per unit time is given as$Z_(12)= pisigma _(12)^(2)

(sqrt((8kT)/(pimu)))N_(1)N_(2)$where$N_(1) and N_(2)

$are the \nu mber of mo \leq c\underline{e}s per unit volume of the two types of mo \leq c\underline{e}s,$

sigma_(12)$is the avera \geq diameter of the two mo \leq c\underline{e}s$ and mu

$is the reduced mass. The mean ⅇ path is the avera \geq dis\tan ce travel \leq dby$

lambda=("Average distance travelled per unit time")/("NO. of collisions made by a single molecule per unit time")=(overline(u))/(Z_(1))or" "lambda=

(overline(u))/(sqrt(2)pisigma^(2)overline(u)N^(**))implies(1)/(sqrt(2)pisigma^(2

$Three ideal gas samp \leq s \in separate equal volume conta \in ers are taken$ a

	Pressure	Temperature	Mean free paths	Mol.wt.
Gas A	$1 atm$	$1600 K$	$0.16 nm$	20
Gas B	$2 atm$	$200 K$	$0.16 nm$	40
Gas C	$4 atm$	$400 K$	$0.04 nm$	80

Calculate number of collision by one molecule per sec (Z_1).

A. $4:1:4$

B. $1:4:4$

C. $4:3:2$

D. $1:2:4$

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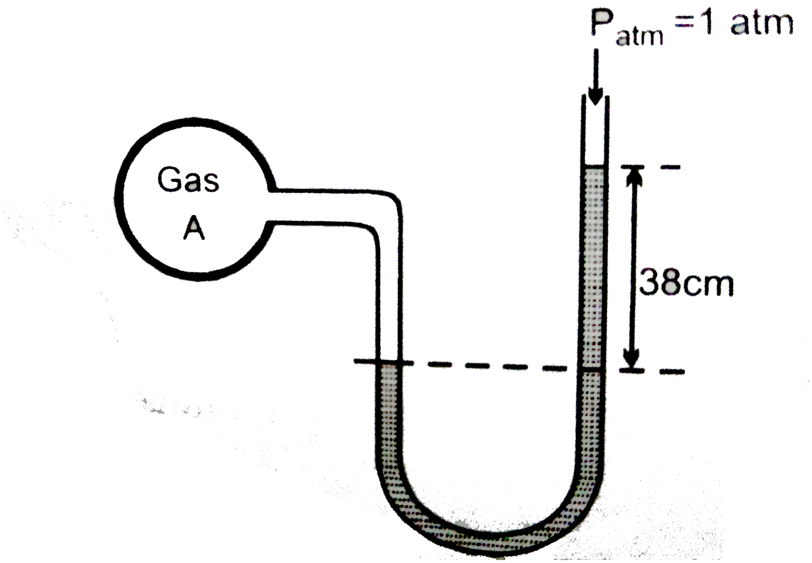
209. A monometer contains a liquid of density $5.44 g/cm^3$ is attached to a flask containing gas 'A' as follows



The initial pressure of gas A in th flask is:

A. 190 cm

B. 76 cm

C. 30.4 cm

D. 266 cm

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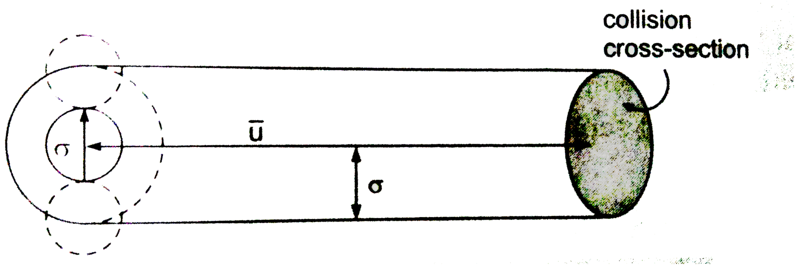
210. Collision cross-section is an area of an imaginary sphere of radius σ around the molecule within which the centre of another molecule cannot penetrate.

The volume swept by a single molecule in unit time is



$V = (\pi\sigma^2)\bar{u}$ where $\bar{u}$ is the average speed

If N^* is the number of molecules per unit volume, then the number of molecules within the volume V is

$N = VN^* = (\pi\sigma^2\bar{u})N^*$

Hence, the number of collision made by a single molecule in unit time will be

$Z = N = (\pi\sigma^2\bar{u})N^*$

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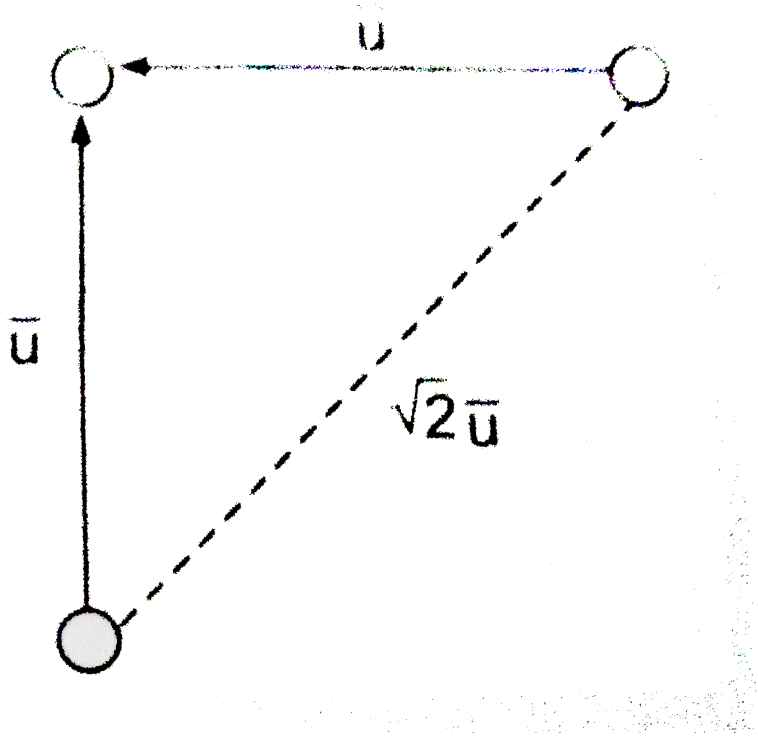


Number of collision made by a single molecule with other molecule per unit time is given by

$Z_1 = \pi\sigma^2(\bar{u}_{\text{rel}})N^* = \sqrt{2}\pi\sigma^2\bar{2}N^*$

$The \to tal\nu mberofbimo \leq \underline{ca}rcollisions$Z_(1)

$perunitvolumeperunittimeisgivenby$Z_(1)=(1)/(2)(Z_(1)N^(**))or Z_(11)= (1)/(2)(sqrt(2)pisigma^(2)overline(u)N^(**))N^(**)= (1)/(sqrt(2))pisigma^(2)overline(u)N^(**2)

$Ifthecollsion \in volvetwounlikemo \le \underline{ce}sthenthe\nu mberofcollisions$

Z_(12)$perunitvolumeperunittimeisgivenas$Z_(12)= pisigma _(12)^(2)

(sqrt((8kT)/(pimu)))N_(1)N_(2)$where$N_(1) and N_(2)

$arethe\nu mberofmo \le \underline{ce}sperunitvolumeofthetwotypesofmo \le \underline{ce}s,$

sigma_(12)$istheavera \ge diameterofthetwomo \le \underline{ce}s$ and mu

$isthereducedmass. Themean\mathfrak{e}epathistheavera \ge dis\tan cetravel \le dby$

lambda=("Average distance travelled per unit time")/("NO. of collisions

made by a single molecule per unit time")=(overline(u))/(Z_(1))or"

"lambda=

(overline(u))/(sqrt(2)pisigma^(2)overline(u)N^(**))implies(1)/(sqrt(2)pisigma^(2

$Threeidealgassamp \le s \in separateequalvolumeconta \in ersaretaken$ a

	Pressure	Temperature	Mean free paths	Mol.wt.
Gas A	$1atm$	$1600K$	$0.16nm$	20
Gas B	$2atm$	$200K$	$0.16nm$	40
Gas C	$4atm$	$400K$	$0.04nm$	80

Calculate number of collision by one molecule per sec (Z_1).

A. $4:1:4$

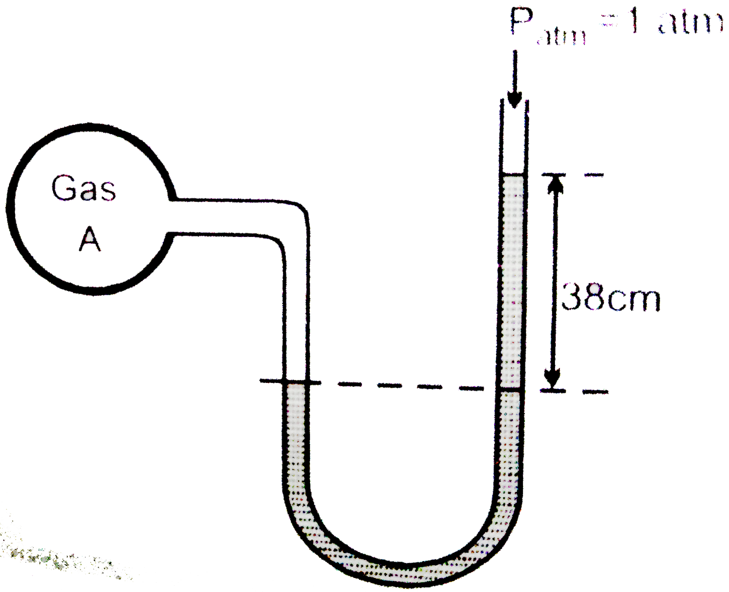
B. $1:4:4$

C. $4:3:2$

D. $1:2:4$

Watch Video Solution

211. A monometer contains a liquid of density $5.44 g / cm^3$ is attached to a flask containing gas 'A' as follows



If the same liquid is used in barometer to measure the atmospheric pressure, then what will be the lengh of the liquid columnm which exerts pressure equal to 1 atm ? (density of $Hg = 13.6 g / cm^3$)

A. 1. 190 cm

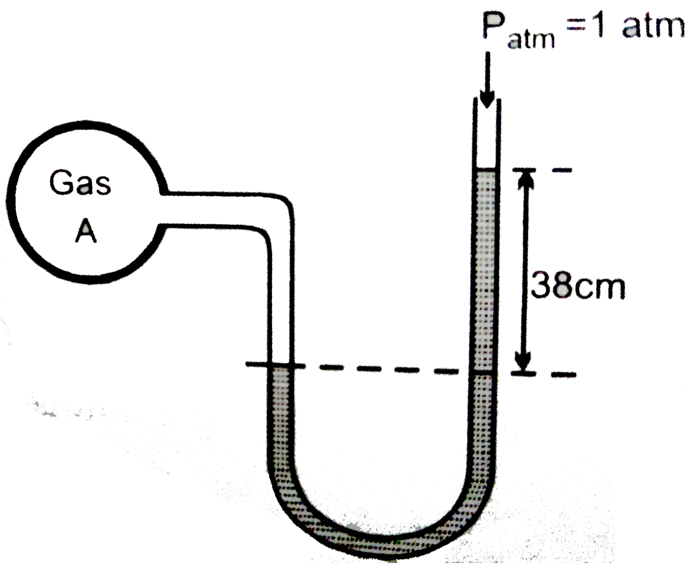
B. $2.$ 76 cm

C. $3.$ 30.4 cm

D. $4.$ 266 cm

Watch Video Solution

212. A monometer contains a liquid of density $5.44g/cm^3$ is attached to a flask containing gas 'A' as follows



The initial pressure of gas A in th flask is:

A. 1.5 atm

B. 1 atm

C. 1.3 atm

D. 1.2 atm

Answer: d

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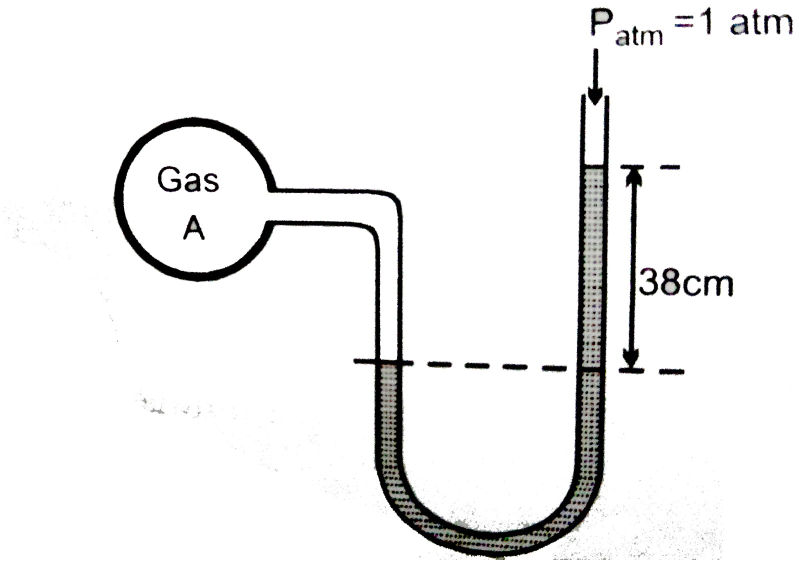
213. A monometer contains a liquid of density $5.44g/cm^3$ is attached to a flask containing gas 'A' as follows



If gas A undergoes 30% trimerisation $[3A(g) < \Rightarrow A_3(g)]$ then the difference in height of the liquid level in two columns is:

A. 38 cm

B. 7.6 cm

C. 3.04 cm

D. 15.1 cm

Answer: b

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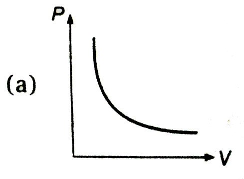
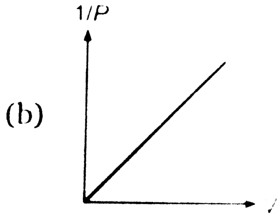
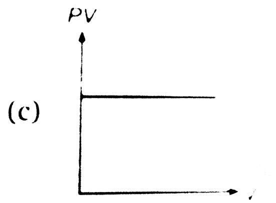
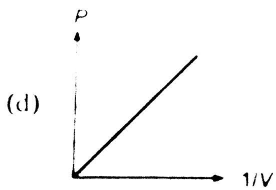
214. Which of the following curves represent(s) Boyle's law?

A. 

B. 

C. 

D. 

Answer: a,b,c,d

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215. If a gas expands at constant temperature.

A. the pressure decreases

B. the kinetic energy of the molecules remains the same

C. the K.E. of the molecules decrease

D. the number of molecules of the gas increase

Answer: a,b

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216. Which of the following statements are correct ?

A. It is not possible to compress a gas at a temperature below T_C

B. At a temperature below T_C the molecules ar close enough for the attractive forces to act, and condensation occurs

C. No condensation takes place above T_C

D. Due to higher kinetic energy of the gas molecules above T_C, it is considered as super critical fluid

Answer: b,c,d

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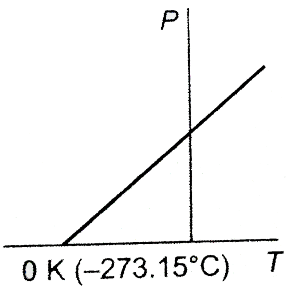
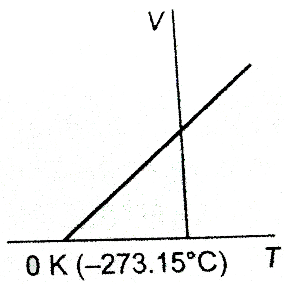
217. What conclusion would you draw from the following graphs for an ideal gas?





A. As the temperature is reduced, the volume as well as the pressure increase

B. As the temperature is reduced, the volumebecomes zero and the pressure reaches infinity

C. As the temperature is reduced, the pressure decrease

D. A point is reached where, theoretically, the volume become zero

Answer: c,d

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218. Which of the following is a character of a gas at Boyle temperature?

A. the effects of the repusive and attractive intermolecular forces just offset each other

B. the repulsive intermolecular forces ar stronger than the attractive intermolecular forces

C. the repulsive intermolecular forces ar weaker than the attractive intermolecular forces

D. $b - \frac{a}{RT} > 0$

Answer: a

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219. Indicate the correct statement for equal volumes of $N_2(g)$ and $CO_2(g)$ at $25^\circ C$ and 1 atm.

A. The average translational K.E. per molecule is the same for N_2 and CO_2

B. The rms speed is same for both N_2 and CO_2

C. The density of N_2 is less than that of CO_2

D. The total translational K.E. of both N_2 and CO_2 is the same

Answer: a,c,d

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220. Which of the following is correct for critical temperature ?

A. It is the highest temperature at which liquid and vapour can coexist

B. Boyond this temperature, there is no distinction between the two phases and a gas cannot be liquefied by compression.

C. At this temperature, the gas the liquid phases have different critical densities

D. All are correct

Answer: a,b

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221. Consider the following statement regarding Maxwell's distribution of speeds. The correct statement(s) is/are :

A. as temperature increases, the peak (maxima) of a curve is shifted towards right side

B. as temperature increases, the most probable speed of molecules increases but fraction of molecules of maximum speed decreases

C. the area under the curve at all the temperatures is the same because it rpresents the number of gaseous molecules

D. the fractions of molecules having different speeds are different at a given temperature

Answer: a,b,c,d

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222. If an inert gas expands at constant pressure by providing heat

A. the temperature increases

B. the kinetic energy of the gaseous molecules remains same

C. the kinetic energy of gaseous molecules decreases

D. the number of molecules of the gas decreases

Answer: a

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223. Select the incorrect statement(s) :

A. The product of pressure and volume of fixed amount of a gas is independent of temperature.

B. The value of universal gas constant depends upon temperature, volume and number of gaseous molecules

C. The gas constant also known as Boltzmann's constant

D. The average kinetic energy of molecules depends only on temperature

Answer: a,b,c

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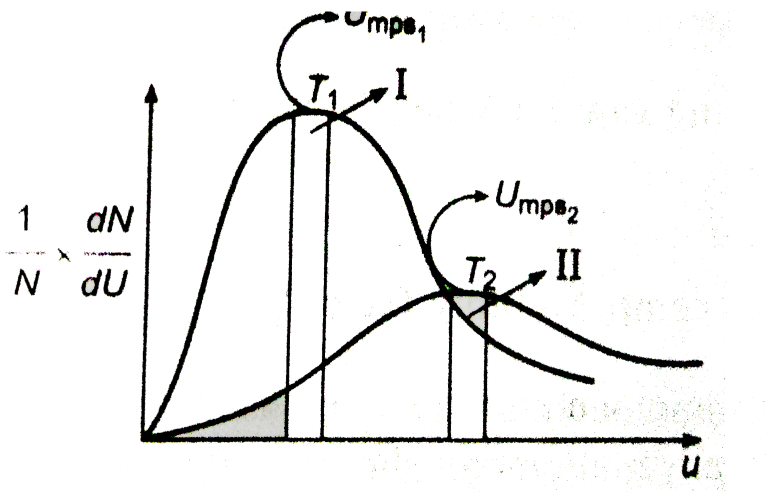
224. Following represents the Maxwell distribution curve for an ideal gas at two temperature T_1 and T_2 . Which of the following option(s) is/are true?



A. Total area under the two curves is independent to moles of gas

B. u_{mp} decrease as temperature decreases

C. $T_1 > T_2$ and hence higher the temperature, sharper the curve

D. The fraction of molecules having speed u_{mp} decreases as temperature increases

Answer: a,b,d

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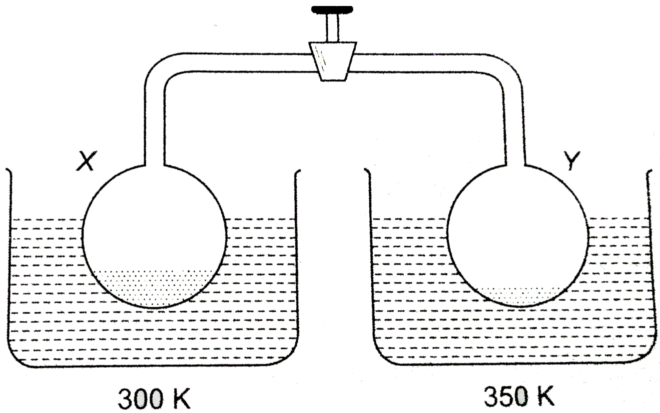
225. Two container each containing liquid water are connected as shown in diagram.



Given that vapour pressure of $H_2O(l)$ at 300 K and 350 K are 20 torr and 40 torr, select correct statement(s) :

A. The final pressure in each container if valve is opened while keeping the containers at the given temperature is 22 torr

B. The final pressure in each container if valve is opened while keeping the containers at the given temperature is 40 torr

C. Mass of $H_2O(l)$ is decreased in container X

D. Mass of $H_2O(l)$ is decreased in container Y

Answer: a,d

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226. Select the correct statement(s) :

A. At Boyle's temperature a real gas behaves like an ideal gas at low pressure

B. Above critical conditions, a real gas behave like an ideal gas

C. For hydrogen gas 'b' domainates over 'a' at all temperatures

D. AT high pressure van der Waals' constant 'b' domainates over 'a'

Answer: a,b,d

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227. Select the correct statement :

A. The value of compressibility factor 'Z' for H_2 gas is greater than one at room temperature

B. The real gas behaves as an ideal gas at Boyle's temperature.

C. For a real gas following van der Waals' equation of state, the expression of critical temperature is $\frac{8a}{27R.b}$

D. AT low pressure, the compressibility factor 'Z'=1+$\frac{P.b}{RT}$ for a van der Waals' gas.

Answer: a,b,c

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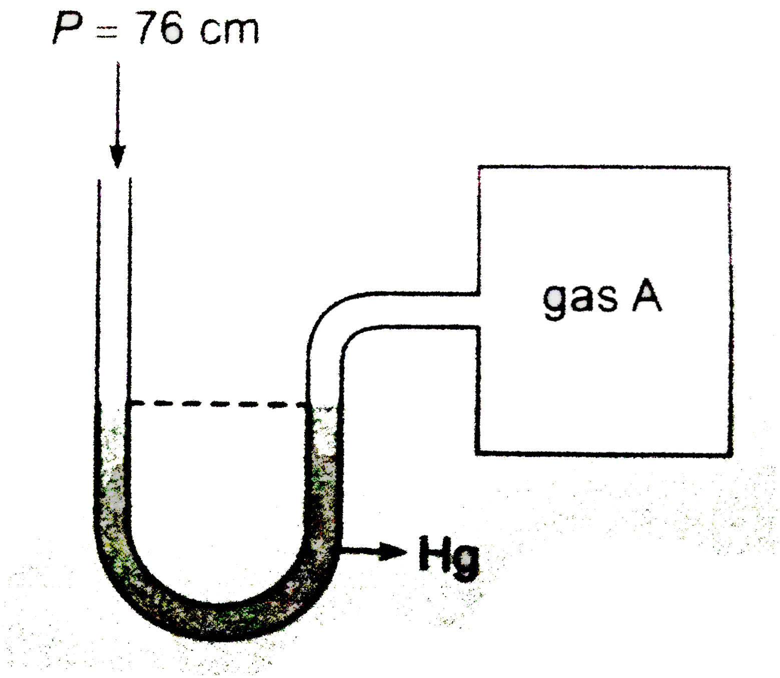
228. A open ended mercury manometer is used to measure the pressure exerted by a trapped gas as shown in the figure. Initially manometer shows no difference in mercury level in both columns as shown in diagram.



After sparking 'A' dissociates according to following reaction

$A(g) \rightarrow B(g) + 3C(g)$

If pressure of Gas "A" dissociates to 0.9 atm, then (Assume temperature to be constant and is 300 K)

A. 1. total pressure increases to 1.3 atm

B. 2. total pressure increases by 0.3 atm

C. 3. total pressure increases by 22.3 cm of Hg

D. 4. difference in mercury level is 228 mm.

Answer: a,b,d

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229. Select incorrect statement for real gases :

A. In low pressure region repulsive forces dominates

B. Volume of gas particles is not negligible in low pressure region

C. Gases behaves as an ideal gas at low pressure and low temperature

D. In high pressure region attractive forces dominates

Answer: a,b,c,d

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230. Select correct statements:

A. A real gas can be liquified at critical temperature

B. Critical pressure is the maximum pressure at which a substance is present in its liquid state at T_C

C. Ideal gas can be liquified below T_C

D. Critical volume is the molar volume of substance in gaseous state at T_C and P_C

Answer: a,d

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231. Which is/are correct for real gases?

A. $\lim_{P \to 0} (PV_m) =$ constant at constant high temperature

B. $\lim_{V_m \to 0} (PV_m) =$ constant at constant low temperature

C. $\lim_{P \to 0} \left(\frac{PV_m}{RT}\right) = 1$ at high temperature

D. $\lim_{V \to 0} \left(\frac{PV_m}{RT}\right) = R$

Answer: a,c

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232. Select incorrect statement (s)

A. At very low pressure real gases show minimum deviation from ideal behaviour.

B. The compressibility factor for an ideal gas is zero.

C. At Boyle temperature real gas behave as ideal gas in high pressure region.

D. Real gas show maximum deviation at high pressure and low temperature.

Answer: b.c

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233. If an ideal gas is heated at constant pressure :

A. the volume increases

B. the mass of gas remains same

C. the kinetic energy of the molecules increases

D. attraction forces between gas particles increases

Answer: a,b,c

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234. Match the following columns

Column I		Column II
(A) Boyle's temperature	(P)	a/Rb
(B) Inversion temperature	(Q)	$8a/27Rb$
(C) Critical temperature	(R)	$2a/Rb$
(D) Critical pressure	(S)	$a/27b^2$

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235. Match the following columns

Column I	Column II
(A) Root mean square speed	(P) $\frac{3}{2}RT$
(B) Most probable speed	(Q) $\sqrt{\frac{8P}{\pi d}}$
(C) Average speed	(R) $\sqrt{\frac{3P}{d}}$
(D) K.E. of gas mol^{-1}	(S) $\sqrt{\frac{2RT}{M}}$

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236. Match the following columns

Column I	Column II
(A) If force of attraction among the gas molecules be negligible	(P) $\left(P+\frac{a}{V^2}\right)(V-b)=RT$
(B) If the volume of the gas molecules be negligible	(Q) $PV=RT-\frac{a}{V}$
(C) At STP	(R) $PV=RT+Pb$
(D) At low pressure and at high temperature	(S) $PV=RT$

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237. Match gases under specified condition listed in Column I with their proerties/laws in Column II.

Column I	Column II
(A) Hydrogen gas ($P = 200$ atm, $T = 273$K)	(P) Compressibility factor $\neq 1$
(B) Hydrogen gas ($P \sim 0, T = 273$ K)	(Q) Attractive forces are dominant
(C) CO_2 ($P = 1$ atm, $T = 273$ K)	(R) $PV = nRT$
(D) Real gas with very large molar volume	(S) $P(V - nb) = nRT$

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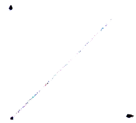
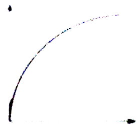
Column I	Column II
(A) $\frac{1}{V}$ vs. P for ideal gas at constant T and n.	(P) 
(B) V vs. $\frac{1}{T}$ for ideal gas at constant P and n.	(Q) 
(C) PT vs. T^2 for ideal gas at constant V and n.	(R) 
(D) V vs. $\frac{1}{P^2}$ for ideal gas at constant T and n.	(S) 

238.

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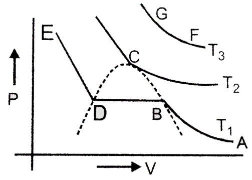
239. Match the correct column from list-1 to list -2 on the basis of following Andrew's isotherm of real gas.



Column-I	Column-II
(A) Substance exist in both liquid and gas state	(P) At AB part
(B) Only liquid state exist	(Q) At BD part
(C) Substance exist in gas state only	(R) At DE part
(D) Real gas is called super critical fluid	(S) At point C
	(T) At GF curve

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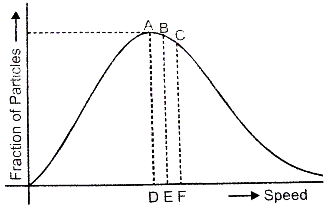
240. Match the following columns



Column-I	Column-II
(A) Speed at point 'A' is	(P) $\sqrt{\frac{8RT}{\pi M}}$
(B) Speed at point 'B' is	(Q) $\sqrt{\frac{3RT}{M}}$
(C) Speed at point 'C' is	(R) U_{rms}
(D) The speed possessed by maximum fraction of the gas particles	(S) $\sqrt{\frac{2RT}{M}}$

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241. (A): The heat absorbed during isothermal expansion of an ideal gas against vacuum is zero.

(R): The volume occupied by the molecules is zero.

A. If both the statement are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-1

B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1

C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE

D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

Answer: B

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242. 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 the statement are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-1

B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1

C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE

D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

Answer: C

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243. STATEMENT -1: The value of van der Waals constant a is larger for ammonia than for nitrogen.

STATEMENT -2: Hydrogen bonding is present in ammonia.

A. If both the statement are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-1

B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1

C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE

D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

Answer: A

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244. Assertion: Helium shows only positive deviations from ideal behaviour.

Reason: Helium is an inert gas.

A. If both the statement are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-1

B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1

C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE

D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

Answer: B

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245. Assertion (A): The Joules -Thomon coefficient for an ideal gas is zero.

Reason (R) : There are no intermlecular attactive forces in an ideal gas.

A. If both the statement are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-1

B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1

C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE

D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

Answer: A

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

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

A. If both the statement are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-1

B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1

C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE

D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

Answer: C

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247. STATEMENT-1 : On increasing the temperature, the height of the peak of the Maxwell distribution curve decreases.

STATEMENT-2 : The fraction of molecules is very less at the higher speeds.

A. If both the statement are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-1

B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1

C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE

D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

Answer: B

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248. STATEMENT-1 : The gases He and H_2 are very different in their behaviour at any temperature and pressure but their compressibility factors are nearly the same at the critical point.

STATEMENT-2 : They have nearly the same critical constant.

A. If both the statement are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-1

B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1

C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE

D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

Answer: C

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249. STATEMENT -1: Most probable velocity is the velocity 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 the statement are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-1

B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1

C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE

D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

Answer: C

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250. STATEMENT-1 : Plot of P vs 1/V (volume) is a straight line for an ideal gas.

STATEMENT-2 : Pressure is directly proportional to volume for an ideal gas.

A. If both the statement are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-1

B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1

C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE

D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

Answer: C

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251. Molar gas constant is the same for all gases because at the same temperature and pressure, equal volumes of all gases have the same

A. If both the statement are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-1

B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1

C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE

D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

Answer: A

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252. STATEMENT-1 : Reacting gases react to form a new gas having pressure equal to the sum of their partial pressure.

STATEMENT-2 : Pressure exerted by a mixture of non-reacting gases present in a container is equal to the sum of their partial pressures.

A. If both the statement are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-1

B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1

C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE

D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

Answer: D

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253. STATEMENT-1 : $1/4^{th}$ of the initial mole of the air is expelled, if air present in an open vessel is heated from $27^\circ C$ to $127^\circ C$.

STATEMENT-2 : Rate of diffusion of a gas is inversely proportional to the square root of its molecular mass.

A. If both the statement are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-1

B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1

C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE

D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

Answer: B

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254. Assertion (A): Compressibility factor for hydrogen varies with pressure with positive slope at all pressures

Reason (R): Even at low pressures, repulsive forces dominate in hydrogen gas.

A. If both the statement are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-1

B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1

C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE

D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

Answer: A

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255. (A) : Sodium metals is stored in kerosene

(R): The density of sodium is less than water

A. If both the statement are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-1

B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1

C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE

D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

Answer: D

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256. An air bubble released at the bottom of a lake, rises and on reaching the top, its radius found to be doubled. If the atmospheric pressure is equivalent to H metre of water column, find the depth of the lake (Assume that the temperature of water in the lake is uniform)

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257. A gaseous mixture containing equal mole sof H_2, O_2 and He is subjected to series of effusion steps. The composition (by moles) of effused mixture after 4 effusion steps is $x : 1 : y$ rspectively. Then find the value of $\left(\frac{x}{y}\right)$.

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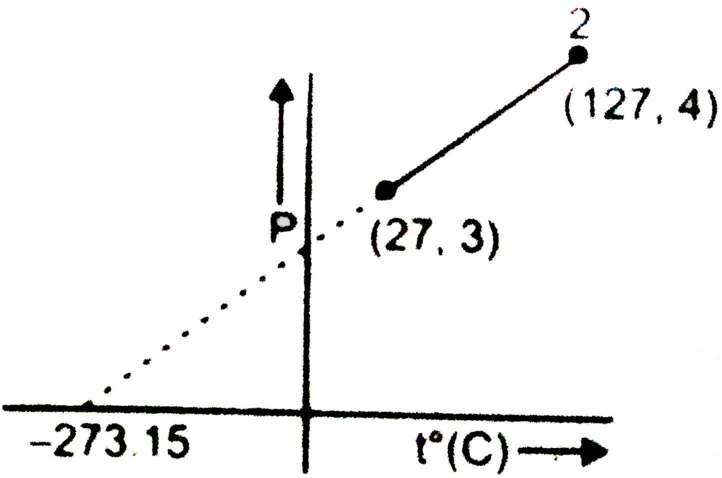
258. Two moles of an ideal gas undergoes the following process. Given that $\left(\frac{\partial P}{\partial T}\right)_V$ is $x \times 10^{-y}$, then calculate the value of (Y-X)



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259. 1 mole of a ciatomic gas present in 10 L vessel at certain temperature exert a pressure of 0.96 atm. Under similar conditions an ideal gas exerted 1.0 atm pressure. If volume of gas molecule is negligible, then find the value of van der Waals' constant "a" (in atm L^2/mol^2).

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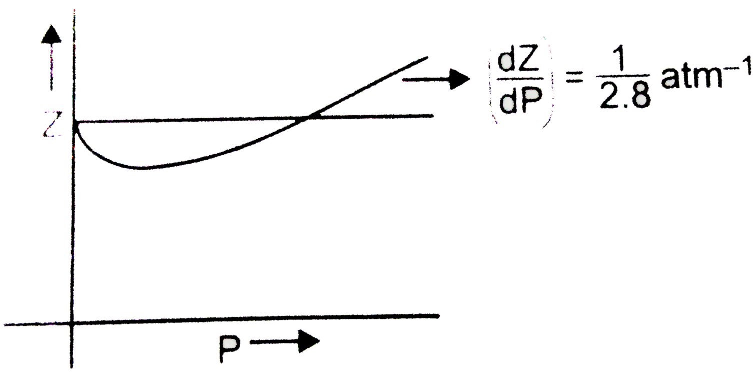
260. The graph of compressibility factor (Z) vs. P for one mole of a real gas is shown in following diagram. The graph is plotted at constant temperature 273K. If the slope of graph at very high pressure $\left(\frac{dZ}{dP}\right)$ is $\left(\frac{1}{2.8}\right)atm^{-1}$, then calculate volume of one mole of real gas molecules (in L/mol)

Given : $N_A = 6 \times 10^{23}$ and $R = \frac{22.4}{273} LatmK^{-1}mol^{-1}$



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261. Under the identical conditions of temperature, the density of a gas X is two times to that of gas Y while molecular mass of gas Y is three times that of X. Calculate the ratio of pressure of X and Y.

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262. The time for a certain volume of a gas A to diffuse through a small hole is 2 minute If takes 5.65 minute for oxygen to diffuse under similar conditions Find the molecualr weight of A .

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263. Excess $F_2(g)$ reacts at $150^\circ C$ and 1.0 atm pressure with $Br_2(g)$ to give a compound BrF_n. If 423 mL of $Br_2(g)$ at the same temperature and pressure produced 4.2 g of BrF_n, what is n? [Atomic mass Br =80, F =19]

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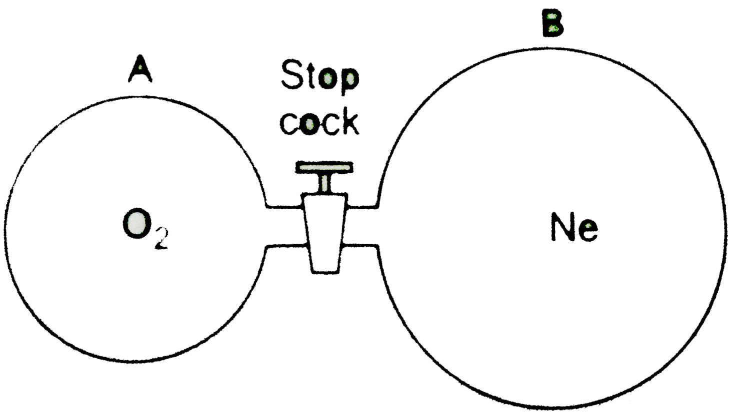
264. Initially bulb "a" contained oxygen gas at $27^{\circ} C$ and 950 mm of Hg and bulb "B" contained neon gas at $27^{\circ} C$ and 900 mm of Hg. These bulbs are connected by a narrow tube of negligible volume equipped with a stopcock and gases were allowed to mix-up freely. The pressure obtained in the combined system was found to be 910 mm of Hg.



If volume of bulb B was measured to be 10 L, then find the volume of oxygen gas present initially in bulb "A" .

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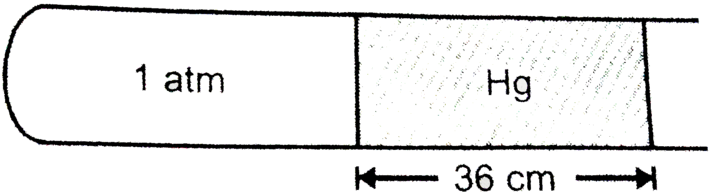
265. Air is trapped in a horizontal glass tube by 36 cm mercury column as shown below :



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

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266. A flask containing air at $107^{\circ}C$ and 722 mm of Hg is cooled to 100 K and 760 mm of Hg. If density in the initial condition $1g/cm^3$, then what is the final density (g/cm^3)?

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267. If an ideal gas at 100 K is heated to 109 K in a rigid container, the pressure increases by X%. What is the value of X?

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268. The van der Waals' constantes for a gas are $a = 3.6 atm L^2 mol^{-2}, b = 0.6 L mol^{-1}$ .If $R = 0.08 L atm K^{-1} mol^{-1}$ and the Boyle's temperature (K) is T_B of this gas, then what is the value of $\frac{T_B}{15}$?

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269. A flask has 10 molecules out of which four molecules are moving at $7 ms^{-1}$ and the remaining ones are moving at same speed of $X ms^{-1}$. If rms of the gas is $5 ms^{-1}$, what is X ?

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Level 1 (Q.31 To Q.60)

1. Nitrogen forms several gaseous oxides. One of them has a density of 1.33 g/L measured 764 mmHg and $150^{\circ}C$. Write the formula of the compound.

A. NO

B. N_2O

C. NO_2

D. N_2O_5

Answer: c

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Level 1 (Q.121 To Q.150)

1. Dimethyl ether decomposes as

$$CH_3OCH_3(g) \rightarrow CH_4(g) + CO(g) + H_2(g)$$

When $CH_3OCH_3(g)$ decomposes to 20% extent under certain conditions, what is the ratio of diffusion of pure $CH_3OCH_3(g)$ with methane?

A. $0.59 : 1$

B. $1.18 : 1$

C. $2.356 : 1$

D. $1.77 : 1$

Answer: c

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Level 1 (Q.151 To Q.176)

1. 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

Answer: c

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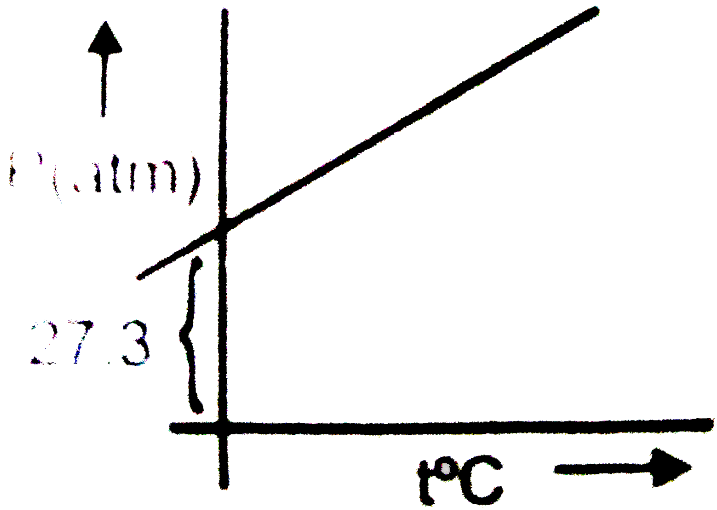
Level 2

1. A graph is plotted between p (atm) vs $t^{\circ}C$ for 10 mol of an ideal gas as follows:

Then slope of curve and volume of container (L) respectively, are:



A. 0.1,8.21

B. 8.21,0.1

C. 27.3,8.21

D. 8.21,27.3

Answer: a

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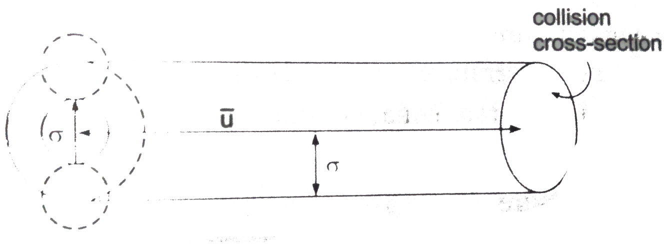
Level 3 - Passage

1. Collision cross-section is an area of an imaginary sphere of radius σ around the molecule within which the centre of another molecule cannot penetrate.

The volume swept by a single molecule in unit time is



$V = (\pi\sigma^2)\bar{u}$ where $\bar{u}$ is the average speed

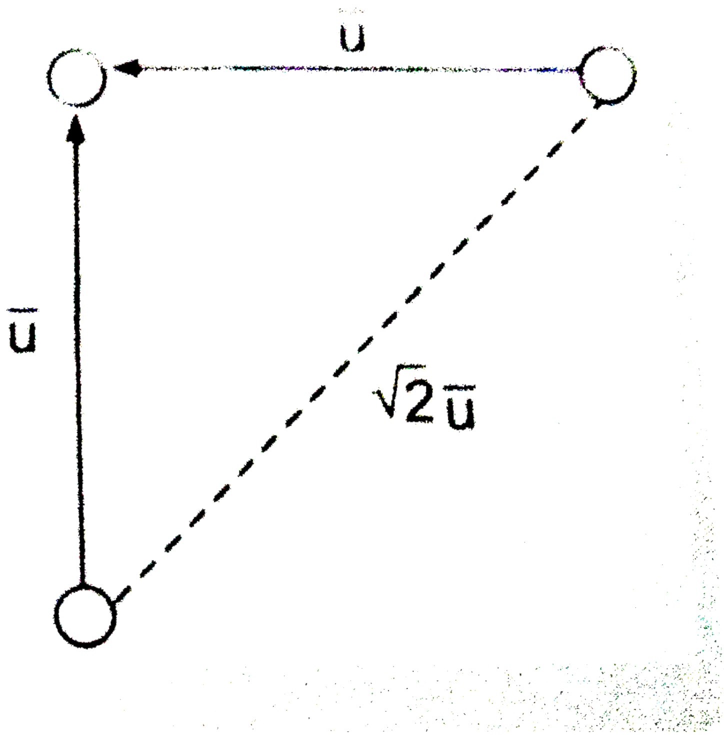
If N^* is the number of molecules per unit volume, then the number of molecules within the volume V is

$N = VN^* = (\pi\sigma^2\bar{u})N^*$

Hence, the number of collision made by a single molecule in unit time will be

$Z = N = (\pi\sigma^2\bar{u})N^*$

In order to account for the movements of all molecules, we must consider the average velocity along the line of centres of two coliding molecules instead of the average velocity of a single molecule . If it is assumed that, on an average, molecules collide while approaching each other perpendicularly, then the average velocity along their centres is $\sqrt{2}\bar{u}$ as shown below.



Number of collision made by a single molecule with other molecule per unit time is given by

$Z_1 = \pi\sigma^2(\bar{u}_{\mathrm{rel}})N^* = \sqrt{2}\pi\sigma^2\bar{u}N^*$

The total number of bimolecular collisions Z_{11} per unit volume per unit time is given by

$Z_{11} = \frac{1}{2}(Z_1N^*) \text{or} Z_{11} = \frac{1}{2}\left(\sqrt{2}\pi\sigma^2\bar{u}N^*\right)N^* = \frac{1}{\sqrt{2}}\pi\sigma^2\bar{u}N^{*2}$

If the collsion involve two unlike molecules then the number of collisions

Z_{12} per unit volume per unit time is given as

$$Z_{12} = \pi\sigma_{12}^2\left(\sqrt{\frac{8kT}{\pi\mu}}\right)N_1N_2$$

where N_1 and N_2 are the number of molecules per unit volume of the two types of molecules, σ_{12} is the average diameter of the two molecules and μ is the reduced mass. The mean free path is the average distance travelled by a molecule between two successive collisions. We can express it as follows :

$$\lambda = \frac{\text{Average distance travelled per unit time}}{\text{NO. of collisions made by a single molecule per unit time}} = \frac{\bar{u}}{Z_1}$$

$$\text{or} \qquad \lambda = \frac{\bar{u}}{\sqrt{2}\pi\sigma^2\bar{u}N^*} \Rightarrow \frac{1}{\sqrt{2}\pi\sigma^2\bar{u}N^*}$$

For a given gas the mean free path at a particular pressure is :

A. independent to temperature

B. decreases with rise in temperature

C. increases with rise in temperature

D. directly proportional to T^2

Answer: c

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Level 3 - Subjective Problems

1. One mole of a gas changed from its initial state (15L,2 atm) to final state (4L,10 atm) reversibly. If this change can be represented by a straight line in P - V curve maximum temperature (approximate), the gas attained is $x \times 10^2 K$. Then find the value of x.

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