



CHEMISTRY

BOOKS - GRB CHEMISTRY (HINGLISH)

GASEOUS STATE

Exercise

1. If pressure of a gas contained in a closed vessel is increased by 0.4 % when heated by $1^{\circ}C$, the initial temperature must be

- A. 250K
- B. $250^{\circ}C$
- C. $25^{\circ}C$
- D. 25K

Answer: a



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2. For an ideal gas number of moles per litre in terms of its pressure P gas constant R and temperature T is .

A. $\frac{PT}{R}$

B. PRT

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

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

Answer: c



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3. A thin balloon filled with air at $47^{\circ}C$ has a volume of 3 litre. If on placing it in a cooled room its volume becomes 2.7 litre, the temperature of room is:

A. $42^{\circ}C$

B. $100^{\circ}C$

C. $15^{\circ}C$

D. $200^{\circ}C$

Answer: c



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4. If a mixture of 3 mol of H_2 and 1 mole of N_2 is completely converted into NH_3 , what would be the ratio of the initial and final volume at same temperature and pressure?

A. 3:1

B. 1:3

C. 2:1

D. 1:2

Answer: c



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5. SO_2 at STP contained in a flask was replaced by O_2 under identical conditions of pressure, temperature and volume. Then the weight of O_2 will be.... Of SO_2

- A. half
- B. one fourth
- C. twice
- D. four times

Answer: a



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6. Assuming that O_2 molecule is spherical in shape with radius $2\overset{\circ}{A}$, the percentage of the volume of O_2 molecules to the total volume of gas at S.T.P. is :

- A. 0.0009
- B. 0.009
- C. $9.0E-5$
- D. 0.00045

Answer: a



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7. Two flasks of equal volume connected by a narrow tube (of negligible volume) are at $27^\circ C$ and contain 0.70 mole of H_2 to 0.5atm One of the flask is then immersed into a bath kept at $127^\circ C$ while the other remains at $27^\circ C$ Calculate the final pressure and the number of mole of H_2 in each flask .

A. 0.5714 atm

B. 1.5714 atm

C. 0.5824atm

D. none of the above

Answer: a

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8. Two flasks of equal volume connected by a narrow tube (of negligible volume) are at $27^{\circ}C$ and contain 0.70 mole of H_2 to 0.5atm One of the flask is then immersed into a bath kept at $127^{\circ}C$ while the other remains at $27^{\circ}C$ Calculate the final pressure and the number of mole of H_2 in each flask .

A. Moles in flask 1=0.4, Moles in flask 2=0.3

B. Moles in flask 1=0.2, Moles in flask 2=0.5

C. Moles in flask 1=0.3, Moles in flask 2=0.4

D. Moles in flask 1=0.4, Moles in flask 2=0.2

Answer: a



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9. A gas is heated from $0^{\circ}C$ to $100^{\circ}C$ at 1.0 atm pressure. If the initial volume of the gas is 10.0L, its final volume would be:

A. 7.32L

B. 10.00L

C. 13.66L

D. 20.00L

Answer: c



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10. Under what conditions will a pure sample of an ideal gas not only exhibit a pressure of 1 atm but also a concentration of 1 mol litre^{-1}

$$[R = 0.082 \text{ litre atm mol}^{-1} \text{ K}^{-1}]$$

- A. At STP
- B. When $V=22.42\text{ L}$
- C. When $T=12\text{ K}$
- D. Impossible under any condition

Answer: c



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11. A and B are two identical vessels. A contains 15 g ethane at 1 atm and 298 K . The vessel B contains 75 g of a gas X_2 at same temperature and pressure. The vapour density of X_2 is :

- A. 75

B. 150

C. 37.5

D. 45

Answer: a



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12. The density of neon will be highest at

A. STP

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

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

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

Answer: b



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13. A $0.5dm^3$ flask contains gas A and $1dm^3$ flask contains gas B at the same temperature. If density of $A = 3g/dm^3$ and that of $B = 1.5g/dm^3$ and the molar mass of $A = 1/2$ of B , the ratio of pressure exerted by gases is:

A. $\frac{P_A}{P_B} = 2$

B. $\frac{P_A}{P_B} = 1$

C. $\frac{P_A}{P_B} = 4$

D. $\frac{P_A}{P_B} = 3$

Answer: c



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14. If molecular mass of O_2 and SO_2 are 32 and 64 respectively. If one litre of O_2 at $15^\circ C$ and 759mm pressure contains N molecules, the number of molecules in two litre of SO_2 under the same conditions of temperature and pressure will be:

A. 2N

B. N

C. N/2

D. 4N

Answer: a

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15. Lithium reacts with water to produce hydrogen gas and lithium hydroxide. What volume of hydrogen collected over water at $22^{\circ}C$ and 750mm Hg pressure is produced by the reaction of 0.208g of Li?

$$[VP_{H_2O} = 19.8mmHg][Li = 7]$$

A. 367 mL

B. 378 mL

C. 735mL

D. 755mL

Answer: b



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16. Two flasks of equal volume is connected by a narrow tube (of negligible volume) contains a certain amount of N_2 gas at 2 atm and $27^\circ C$. The 1st flask is then immersed into a bath kept at $47^\circ C$ while the 2nd flask is immersed into a bath kept at $127^\circ C$. the ratio of the number of moles of N_2 in 1st flask to the 2nd flask after sometime will be?

A. 5 : 4

B. 2 : 3

C. 3 : 2

D. 4 : 5

Answer: a



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17. A gas of volume 100cc is kept in a vessel at pressure 10^4 Pa maintained at temperature $24^\circ C$. If now the pressure is increased to 10^5 Pa, keeping the temperature constant, then the volume of the becomes:

- A. 10cc
- B. 100cc
- C. 1cc
- D. 1000cc

Answer: a



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

- A. $100^\circ C$ and 1 atm
- B. $0^\circ C$ 1 atm
- C. $0^\circ C$ and 0.5 atm

D. 100°C and 0.5 atm

Answer: c



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19. 2.5L of a sample of a gas at 27°C and 1 bar pressure is compressed to a volume of 500mL keeping the temperature constant, the percentage increase in pressure is:

A. 1

B. 4

C. 5

D. 0.8

Answer: b



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20. A bottle is heated with mouth open to have a final temperature as five times its original value at $25^{\circ}C$. The fraction of air originally present in the bottle that is expelled, is:

- A. 0.5
- B. 0.25
- C. 0.33
- D. 0.4

Answer: b

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21. The density of a gas A is twice that of a gas B at the same temperature. The molecular mass of gas B is thrice that of A . The ratio of the pressure acting on A and B will be

- A. 6 : 1
- B. 7 : 6

C. 2:5

D. 1:4

Answer: a

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22. The air contains 78% and 22% O_2 by volume. The volume occupied by 40g air at $20^\circ C$ and 745 mm Hg pressure approximately:

A. 34L

B. 34mL

C. 3.4kL

D. 3.4L

Answer: a

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23. A cylinder containing cooking gas can withstand a pressure of 15atm . The pressure gauge of the cylinder indicates 12atm at 27°C . Due to a sudden fire in the building, the temperature starts rising. At what temperature will the cylinder explode?

- A. 372K
- B. 99.5°C
- C. 199°C
- D. 472.5K

Answer: b

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24. At 100°C and 1atm , if the density of the liquid water is 1.0gcm^{-3} and that of water vapour is 0.0006gcm^{-3} , then the volume occupied by water molecules in 1L steam at this temperature is

- A. 6cm^3

B. 60cm^3

C. 0.6cm^3

D. 0.06cm^3

Answer: c



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25. A 2.00 litre evacuated container has a mass of 1050.0g. When the container is filled with an unknown gas at 800mm Hg pressure and 25.0°C the mass is 1052.4g. What is the molar mass of the gas (in g mol^{-1})?

A. 28

B. 31

C. 54

D. 56

Answer: a



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26. A sample of oxygen gas and a sample of an unknown gas are weighed separately in the same evacuated flask. Use the data given below to find the molar mass of the unknown gas (assume experiments are carried out at the same pressure and temperature).

∴ (Mass of evacuated flask, , $124.46g$), (Mass of flask+oxygen, , $125.10g$),

A. 22 g/mol

B. 38g/mol

C. 44g/mol

D. 84g/mol

Answer: c



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27. Value of gas constant R is .

- A. 0.082 litre-atm
- B. $0.987 \text{ cal mol}^{-1} \text{ K}^{-1}$
- C. $8.3 \text{ J mol}^{-1} \text{ K}^{-1}$
- D. $83 \text{ erg mol}^{-1} \text{ K}^{-1}$

Answer: c

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28. Which of the following parameteres would be expected to have the same values for C_2H_5OH and CH_3OCH_3 ?

- A. Heat of vaporization
- B. Vapour pressure at the same temperature
- C. Boiling points

D. Gaseous denitites at the same temperature and pressure

(Assuming ideal behaviour)

Answer: d

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29. Which of the following is not the correct set of pressure and volume at constant temperature and constant moles of gas?

A. P V
 $1atm$ $200mL$

B. P V
 $760mm$ $0.2L$

C. P V
 $0.5atm$ $100L$

D. P V
 $2atm$ $100mL$

Answer: c

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30. Just below this temperature gaases would theroretically have a negative volume (which is however not possible):

A. absolute zero

B. $-100^{\circ}C$

C. $100^{\circ}C$

D. $100K$

Answer: a



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31. The volume of a gas increases by a factor of 2 while the pressure decrease by a factor of 3 Given that the number of moles is unaffected, the factor by which the temperature changes is :

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

B. 3×2

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

D. $\frac{1}{2} \times 3$

Answer: c



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32. If V_0 is the volume of a given mass of gas at 273K at constant pressure, then according to Charles's law, the volume at $10^\circ C$ will be:

A. $10V_0$

B. $\frac{2}{273}(V_0 + 10)$

C. $V_0 + \frac{10}{273}$

D. $\frac{283}{273}V_0$

Answer: d



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33. On a ship sailing in pacific ocean, where temperature is $22^{\circ}C$, a balloon is filled with 2L air. What will be the voume of balloon when the ship reaches Indian ocean, where temperature is $27^{\circ}C$? The atmospheric pressure is same over pacific ocean and Indian ocean.

A. 2L

B. $\frac{600}{295}L$

C. $\frac{54}{22}L$

D. $\frac{590}{300}L$

Answer: b



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34. At constant volume, the temperature (in $^{\circ}C$) of certain mass of a gas is increased by 20%. The pressure of gas:

A. will increase by 20%

B. will increase by $\frac{2000}{273}$ %

C. will increase by $\frac{20t}{273 + t}$ % where $t^\circ C$ is the initial temperature of gas

D. will increase by $\frac{20t}{273 + t}$ %, where $t^\circ C$ is the final temperature of gas

Answer: c



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35. 0.1 mole of argon has pressure P and temperature $7K$ in the vessel. On keeping the vessel at $50^\circ C$ higher temperature, 0.8g of argon was given out to maintain same pressure. The original temperature was: [Ar=40]

A. 273K

B. 200K

C. 100K

D. 300K

Answer: b



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36. A weather balloon filled with hydrogen at 1 atm and 300 K has volume equal to 12000 liters. On ascending it reaches a place where temperature is 250 K and pressure is 0.5 atm. The volume of the balloon is :

A. 24000 liters

B. 20000 liters

C. 10000 liters

D. 12000 liters

Answer: B



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37. Four one litre flasks are separately filled with the gases, O_2 , F_2 , CH_4 and CO_2 under the same conditions. The ratio of number of molecules its these gases:

A. 2:2:4:3

B. 1:1:1:1

C. 1:2:3:4

D. 2:3:3:4

Answer: b



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38. At 0.821 atm and at $177^\circ C$, gas SO_3 occupies 45L Moles of neutrons present in SO_3 are: (Take $N_A = 6 \times 10^{23}$)

A. 40

B. 24×10^{24}

C. 24×10^{23}

D. 6×10^{24}

Answer: a



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39. A gas sample in a flexible container is maintained at constant pressure while its temperature is increased from $25^{\circ}C$ to $75^{\circ}C$. If the initial volume of the gas is 4.2L, what is the change in volume due to the temperature increase?

A. 0.7L

B. 4.9L

C. 8.4L

D. 12.6L

Answer: a



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40. A sample of an ideal gas has volume of 0.500L at 25°C and 1.20 atm pressure. What is its volume at 75°C and 3.60 atm?

- A. 0.143L
- B. 0.195L
- C. 0.500L
- D. 1.75L

Answer: b

41. A sample of gas occupies a volume of 9.23L at 345K and 1.40atm. What is its volume at 525K and 3.20 atm?

- A. 2.65L

B. 6.14L

C. 13.9L

D. 32.1L

Answer: b

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42. When 0.25L of liquid nitrogen ($d=0.807\text{g/mL}$) is vaporized, what volume does the resulting gas occupy at 25°C and 5.00 atm?

A. 71L

B. 54L

C. 35L

D. 32L

Answer: c

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43. A sample of He gas in a flexible container at room temperature exhibits a certain pressure. What will be the new pressure when the absolute temperature and volume of the container are both halved? The pressure of the He will be:

- A. the same
- B. doubled
- C. halved
- D. quadrupled

Answer: a



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44. A 3.0L sample of helium gas is stored in a rigid, sealed container at $25^{\circ}C$ and 1.0 atm pressure. The temperature is increased to $125^{\circ}C$. What is the new pressure of the gas?

A. 0.20atm

B. 0.75atm

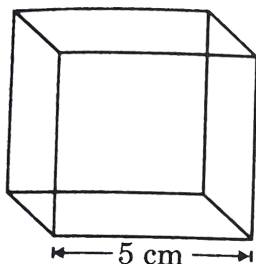
C. 1.33atm

D. 5.0atm

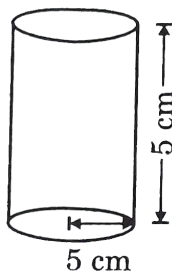
Answer: c

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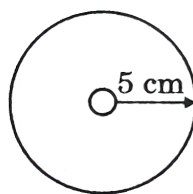
I-Cube



II-Cylinder



III-Sphere



45.

There are three closed containers in which equal moles of gas is filled if the containers are placed at the same temperature, then which of the following is correct?

A. Pressure in I is the maximum.

B. Pressure in II is the maximum.

C. Pressure in III is the maximum.

D. All in III is the maximum.

Answer: a



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46. Value of absolute zero of temperature in degree Celsius ($^{\circ}C$) can be determined by given data. The density of an ideal gas at $25^{\circ}C$ and $100^{\circ}C$ are 1.5 and 1.2g/L, respectively, both at the same pressure. The value of absolute zero of temperature in degree Celsius ($^{\circ}C$):

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

B. $-275^{\circ}C$

C. $-200^{\circ}C$

D. $-0^{\circ}C$

Answer: b



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47. Which gas has a density of 0.71 gL^{-1} at 0°C and 1 atm?

A. Ar

B. Ne

C. CO

D. CH_4

Answer: d



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48. A 2.00L balloon at 20.0°C and 7.45mm Hg floats an altitude where the temperature is 10.0°C and the air pressure is 700mm Hg. What is the new volume of the balloon?

A. 0.94L

B. 1.06L

C. 2.06L

D. 2.20L

Answer: c

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49. A sample of gas at 273K has a pressure of P_1 and a volume of V_1 .

When the pressure is changed to P_2 , what is the volume V_2 ? (Assume the temperature remains constant)

A. $\frac{P_1 P_2}{V_1}$

B. $\frac{P_1 V_1}{P_2}$

C. $\frac{P_2 V_1}{P_1}$

D. $\frac{P_2}{P_1 V_1}$

Answer: b



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50. A gas in a closed, flexible container is slowly cooled from $50^{\circ}C$ to $25^{\circ}C$. What is the ratio of the final volume of the gas to its initial volume? (Assume ideal behaviour).

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

B. $\frac{1.08}{1}$

C. $\frac{0.923}{1}$

D. $\frac{0.5}{1}$

Answer: c



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51. A sample of C_2H_6 gas initially at $50^\circ C$ and 720 mm Hg is heated to $100^\circ C$ in a container of constant volume. What is the new pressure (in mmHg)?

- A. 360
- B. 623
- C. 831
- D. 1440

Answer: c



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52. What is the molar mass of a gas if 10.0 grams of it occupy 4.48 litres at 273K and 101.3 kPa (1.00 atm)?

- A. 2.00 g/mol
- B. 25.0g/mol

C. 50.0g/mol

D. 100g/mol

Answer: c

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53. Which gas has the same density at $546^{\circ}C$ and 1.50 atm as that of O_2 gas at 1 atm and $0(^{\circ})C$?

A. N_2

B. NH_3

C. SO_2

D. SO_3

Answer: c

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54. A gas has a volume of 6.0L at a pressure of 0.80 atm. What is the volume if the pressure is changed to 0.20atm at constant temperature?

- A. 1.5L
- B. 3.0L
- C. 12L
- D. 24L

Answer: d



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55. What pressure (in atm) will be exerted by a 1.00g sample of methane, CH_4 in a 4.25L flask at $115^\circ C$?

- A. 0.139
- B. 0.33
- C. 0.467

D. 7.5

Answer: c



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56. A sample of neon gas has a volume of 248 mL at $30^{\circ}C$ and a certain pressure. What volume would it occupy if it were heated to $60^{\circ}C$ at the same pressure?

A. 226mL

B. 273mL

C. 278mL

D. 496mL

Answer: b



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57. In an experiment, it was found that for a gas at constant temperature,

$PV=C$. The value of C depends on:

- A. atmospheric pressure
- B. quantity of gas
- C. molecular weight of gas
- D. volume of chamber

Answer: b

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58. A quantity of hydrogen gas occupies a volume of 30.0mL at a certain temperature and pressure what volume would half this mass of hydrogen occupy at triple the above temperature if the pressure were one-ninth that of the original gas?

- A. 270mL
- B. 90mL

C. 405mL

D. 135mL

Answer: c



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59. A spherical air bubble is rising from the depth of a lake when pressure is P atm and temperature is T K. The percentage increase in its radius when it comes to the surface of lake will be: (Assume temperature and pressure at the surface to be respectively $2TK$ and $\frac{P}{4}$)

A. 1

B. 0.5

C. 0.4

D. 2

Answer: a



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60. For one mole of ideal gas if $P = \frac{P_0}{1 + \left(\frac{V}{V_0}\right)}$ where P_0 and V_0 are constant, then temperature of gas when $V = V_0$ is:

A. $\frac{P_0 V_0}{R}$

B. $\frac{P_0 V_0}{4R}$

C. $\frac{P_0 V_0}{2R}$

D. $\frac{P_0 V_0}{3R}$

Answer: c

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61. A gas at a pressure of 5.0 atm is heated from $0^\circ C$ to $546^\circ C$ and simultaneously compressed to one-third of its original volume. Hence, final pressure is:

A. 10atm

B. 30atm

C. 45atm

D. 5 atm

Answer: c



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62. A motorist inflates the tyres of her car to a pressure of 180 kPa on a day when the temperature is $-8^{\circ}C$. When she arrives at her destination, the tyres pressure increased to 245 kPa. What is the temperature of the tyres if we assume that the tyres expand by 7%?

A. 265K

B. 360.1K

C. 385.9K

D. 383.55K

Answer: c

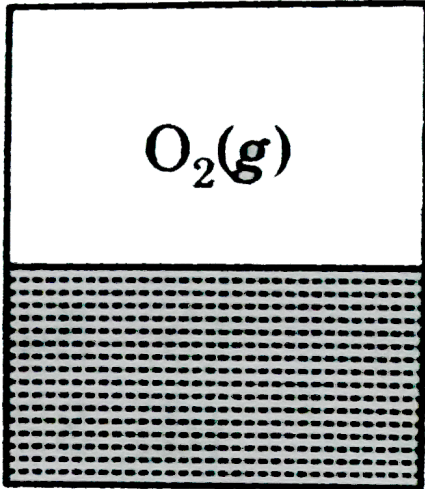


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63. O_2 gas is placed in a 4 litre container containing 3 L of liquid water as shown and total pressure exerted by gases is 720mm Hg.

What will be the pressure of $O_2(g)$ if given container is attached to a empty container of 3 litre at same temperature?

Given : [V.P. of H_2O at $27^\circ C = 20mm$ of Hg]



$V = 1$ litre

$H_2O(l)$

A. 175 mm of Hg

B. 350 mm of Hg

C. 200 mm of Hg

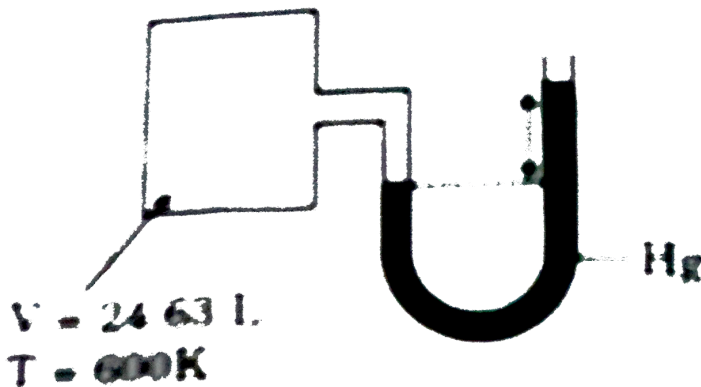
D. 800 mm of Hg

Answer: a

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64. From the following set-up, calculate moles of the gas present in the container of volume 24.63 litre at 600K if the level of mercury in the open tube of the manometer is 36cm higher.

[Given: Atmospheric pressure=78cm of mercury]



A. 1.5 moles

B. 0.73 moles

C. 3 moles

D. 1 mole

Answer: b



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65. If air is assumed to be at temperature 290K with molar mass 29 gm/mol and $g=10m/s^2$ then change in pressure at height 8.314km and ground level as a fraction of pressure at ground level is given by:

A. $1/e$

B. $(e-1)$

C. $\frac{e-1}{e}$

D. $\frac{e}{e-1}$

Answer: c

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66. On the surface of the earth at 1 atm pressure, a balloon filled with H_2 gas occupies 500mL. This volume is $\frac{5}{6}$ of its maximum capacity. The balloon is left in air. It starts rising. The height above which the balloon will burst if temperature of the atmosphere remains constant and the pressure decreases 1 mm for every 100cm rise of height is:

- A. 120m
- B. 136.67m
- C. 126.67m
- D. 100m

Answer: c

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67. A quantity of gas is collected in a graduated tube over the mercury. The volume of gas at $18^{\circ}C$ is 50 mL and the level of mercury in the tube is 100mm above the outside mercury level. The barometer reads 750 torr. Hence, volume of gas 1 atm and $0^{\circ}C$ is approximately:

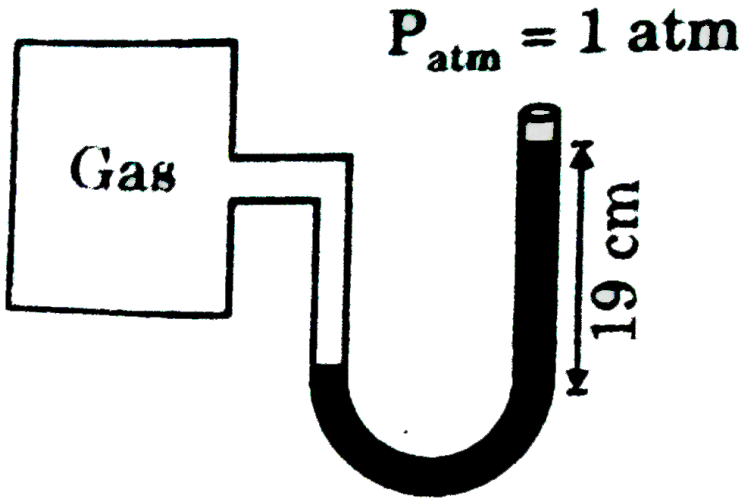
- A. 22 mL
- B. 40mL
- C. 20mL
- D. 44mL

Answer: b

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68. A gas A_x having mass of 100g is confined in a container of volume 16L maintained at 300K and a manometer is attached as shown, value of x is:
($R=0.08 \text{ atm-L/mole-K}$)

(Atomic mass of A=24)



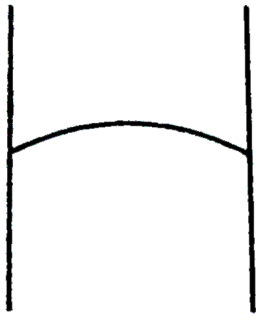
- A. 2
- B. 8
- C. 4
- D. 5

Answer: d

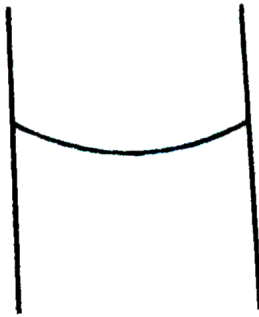


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69. In a glass tube columns of water and mercury appear as shown.



Mercury



Water

This is best attributed to the differences in their:

- A. densities
- B. molar masses
- C. surface tensions
- D. viscosities

Answer: c



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70. Moist air is less dense than dry air at the same temperature and barometric pressure. Which is the best explanation for this observation?

- A. H_2O is a polar molecule but N_2 and O_2 are not.
- B. H_2O has a higher boiling point than N_2 or O_2 .
- C. H_2O has a lower molar mass than N_2 or O_2 .
- D. H_2O has a higher heat capacity than N_2 or O_2 .

Answer: c



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71. What is the major reason for using mercury (rather than water) in barometers?

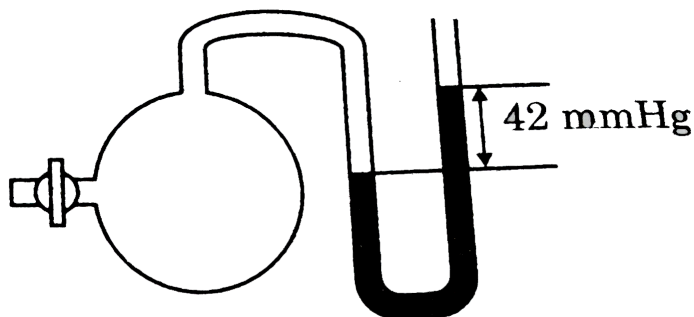
- A. Mercury is much denser than water.
- B. Mercury has a higher boiling point than water.
- C. Mercury is chemically unreactive compared with water.

D. Mercury expands with a decrease in air pressure, water does not.

Answer: a

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72. A gas is collected in the flask shown here. What is the pressure exerted by the gas if the atmospheric pressure is 735 mmHg?

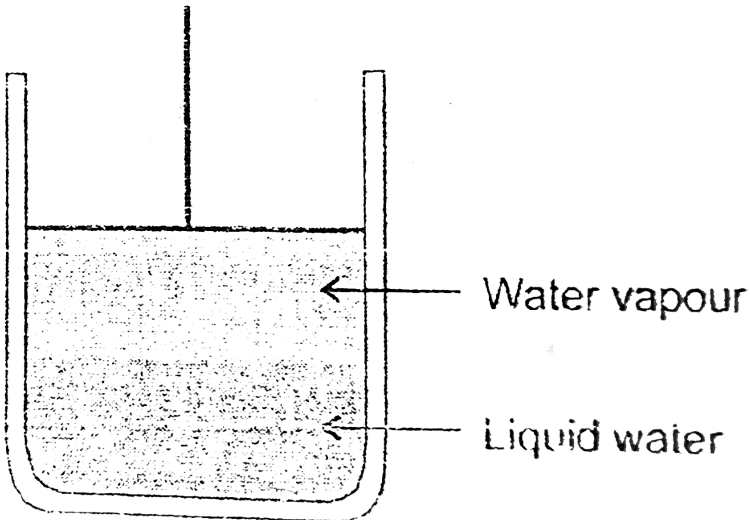


- A. 42mmHg
- B. 693mmHg
- C. 735mmHg
- D. 777mmHg

Answer: d

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73. The vapour pressure of water at $20^{\circ}C$ is 17.54mmHg . What will be the vapour pressure of the water in the apparatus shown after the piston is lowered, decreasing the volume of the gas above the liquid to one half of its initial volume (assume temperature is constant).



A. 8.77 mmHg

B. 17.54 mmHg

C. 35.08mmHg

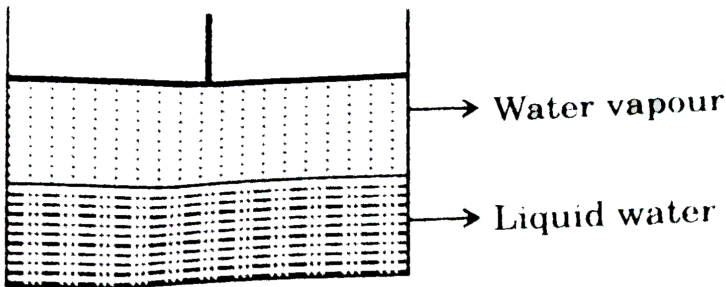
D. Between 8.77 and 17.54 mmHg

Answer: b



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74. At 20°C vapour pressure of $\text{H}_2\text{O}(l)$ is recorded as 28.57m bar. The initial and final vapour pressure of $\text{H}_2\text{O}(l)$, if volume of container containing ($\text{H}_2\text{O}(l)$) is increased from 5 litre to 10litre, are:



A. 57.14 m bar, 57.14 m bar

B. 14.28 m bar, 28.57 m bar

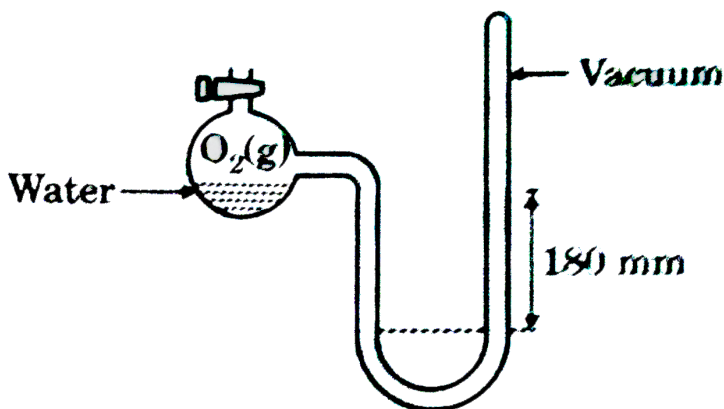
C. 28.57 m bar, 14.28 m bar

D. 28.57 m bar, 28.57 m bar

Answer: d

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75. A closed end manometer is filled with Hg as shown in the following diagram at $27^\circ C$ and volume of the bulb is 150mL. At this temperature, the vapour pressure of water is 28mm of Hg. If the bulb contains 0.001 mol of $O_2(g)$ then find the volume of liquid water. (Given that $R=0.082 \text{ L atm mol}^{-1} K^{-1}$)



A. 34 mL

B. 10 mL

C. 27 mL

D. Data insufficient

Answer: c



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76. At any top of the mountain the thermometer reads $0^{\circ}C$ and the barometer reads 710 mm Hg. At the bottom of the mountain the temperature is $40^{\circ}C$ and pressure is 760 mm Hg. Ratio of density of air at the top with that at the bottom is:

A. 1 : 1

B. 1.07 : 1

C. 1 : 1.07

D. 1 : 1.5

Answer: b



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77. A certain mountain is 14,100 feet above sea-level. The pressure at the top is 17.7 inches of Hg. If you blew up a balloon at sea level, where the pressure measured to be 29.7 inches and carried it to the top of the mountain, by what factor would its volume change w.r.t. final volume?

A. $29.7-17.7$

B. $\frac{29.7}{17.7}$

C. $\frac{17.7}{29.7}$

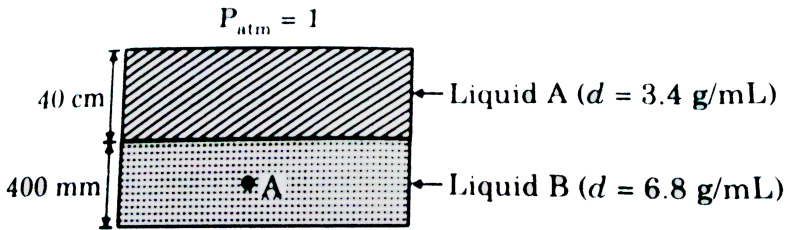
D. $\frac{12}{29.7}$

Answer: d



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78. Find pressure (in atm) at point A, 10 cm above the bottom of container:



- A. $\frac{106}{76}$
- B. $\frac{156}{76}$
- C. $\frac{101}{76}$
- D. $\frac{91}{76}$

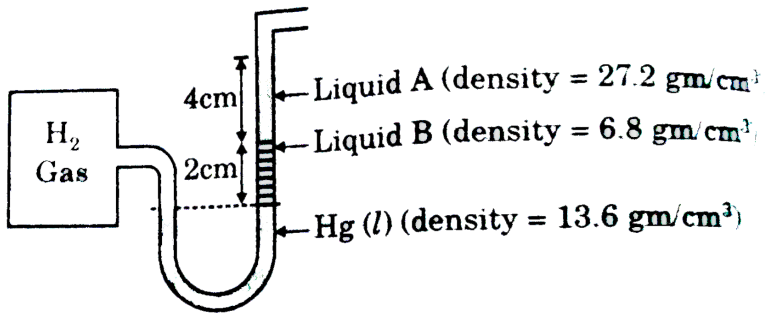
Answer: c



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79. A container of volume 2 litre contains H_2 gas at 300 K as shown

$$(P_{atm} = 76 \text{ cm of Hg})$$



The pressure (in cm Hg) of H_2 in the containr is

- A. 82cm
- B. 85cm
- C. 80cm
- D. 81cm

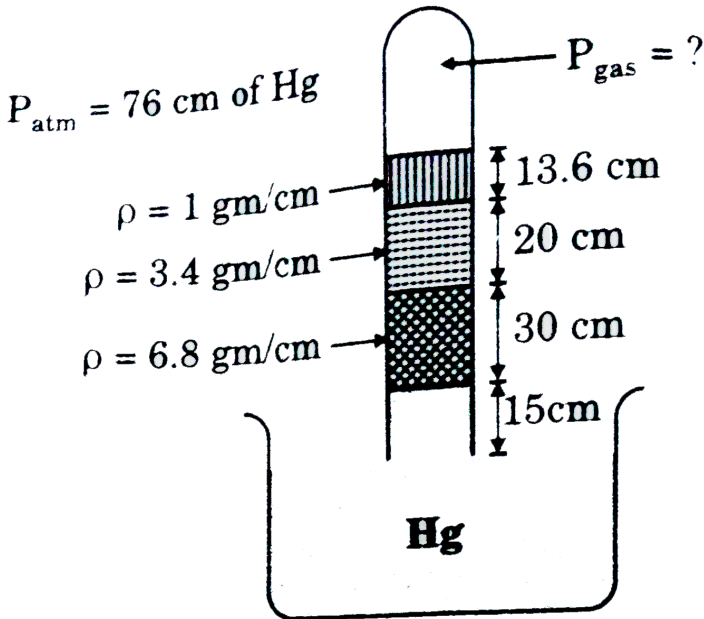
Answer: b



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80. In the figure shown the pressure of the confined gas will be:

:

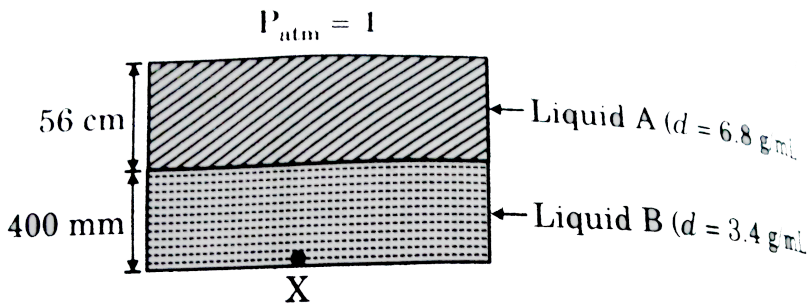


- A. 30 cm of Hg
- B. 40 cm of Hg
- C. 36 cm of Hg
- D. 46 cm of Hg

Answer: b



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81.

Total pressure at point (X) is:

- A. 0.5 atm
- B. 1 atm
- C. 1.8atm
- D. 1.5atm

Answer: d

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82. Equal weights of ethane and hydrogen are mixed in an empty container at $25^\circ C$. The fraction of the total pressure exerted by hydrogen is

A. 1:2

B. 1:1

C. 1:16

D. 15:16

Answer: d



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83. A mixture of hydrogen and oxygen at one bar pressure contains 20% by weight of hydrogen partial pressure of hydrogen will be:

A. 0.2 bar

B. 0.4 bar

C. 0.6 bar

D. 0.8bar

Answer: d

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84. A compound exists in the gaseous phase both as monomer (A) and dimer (A_2) The mol wt of A is 48 In an experiment 96g of compound was confined in a container of volume 33.6 litre and heated to $273^\circ C$ Calculate the pressure developed if the compound exists as dimer to the extent of 50 % by weight under same these conditions .

A. 1 atm

B. 2 atm

C. 1.5atm

D. 4 atm

Answer: b

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85. A mixture contains N_2O_4 and NO_2 in the ratio 2:1 by volume. The vapour density of the mixture is:

- A. 45.4
- B. 49.8
- C. 32.6
- D. 38.3

Answer: d



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86. Two glass bulbs A (of 100 mL capacity), and B (of 150mL capacity) containing same gas are connected by a small tube of negligible volume. At particular temperature the pressure to A was found to be 20 times more than that in bulb B. the stopcock is opened without changing the temperature. the pressure in A will:

A. drop by 75%

B. drop by 57%

C. drop by 25%

D. will remain same

Answer: b

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87. For 10 minutes each, at $0^\circ C$, from two identical holes nitrogen and an unknown gas are leaked into a common vessel of 4 litre capacity. The resulting pressure is 2.8 atm and the mixture contains 0.4 mole of nitrogen. What is the molar mass of unknown gas ? (Take $R = 0.821\text{L-atm mol}^{-1}\text{K}^{-1}$]

A. 448 g mol^{-1}

B. 224 g mol^{-1}

C. 226 g mol^{-1}

D. None of these

Answer: a

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88. Oxygen and cyclopropane at partial pressures of 570 torr and 170 torr respectively are mixed in a gas cylinder. What is the ratio of the number of moles of cyclopropane to the number of moles of oxygen?

A. $\frac{170}{740} = 0.23$

B. $\frac{\frac{170}{742}}{\left[\frac{170}{42} + \frac{570}{32}\right]} = 0.19$

C. $\frac{170 + 42}{570 + 32} = 0.39$

D. $\frac{170}{570} = 0.30$

Answer: d

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89. A vessel of volume 5 litre contains 1.4 g of nitrogen at a temperature 1800K. The pressure of the gas is 30% of its molecules are dissociated into atoms at this temperature is:

A. 4.05 atm

B. 2.025atm

C. 3.84atm

D. 1.92atm

Answer: d



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90. Equal masses of methane and oxygen are mixed in an empty container at $25^{\circ}C$. The fraction of the total pressure exerted by oxygen is:

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

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

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

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

Answer: a

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91. $N_2 + 3H_2 \rightarrow 2NH_3$. 1 mol N_2 and 4 mol H_2 are taken in 15L flask at $27^\circ C$. After complete conversion of N_2 into NH_3 , 5L of H_2O is added. The pressure set up in the flask is:

A. $\frac{3 \times 0.0821 \times 300}{15}$

B. $\frac{2 \times 0.0821 \times 300}{10}$ atm

C. $\frac{1 \times 0.0821 \times 300}{15}$ atm

D. $\frac{3 \times 0.0821 \times 300}{10}$ atm

Answer: d

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92. A sample of impure air contains 80% N_2 , 10% 5% CO_2 and 5% Ar by volume. The average molecular weight of the sample is : [Ar=40]

A. 29.4

B. 29.8

C. 30

D. none of these

Answer: b



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93. The density of a gas A is twice that of a gas B at the same temperature. The molecular mass of gas B is thrice that of A . The ratio of the pressure acting on A and B will be

A. 1:6

B. 7: 8

C. 6: 1

D. 1: 4

Answer: c



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94. A container consists of 1 mole of liquid water and 1 mole of $N_2(g)$, at a temperature of 300K. If aqueous tension of water at 300K is 38mm of Hg and the container is fitted with a piston operating at 0.1321 atm then calculate volume occupied by N_2 gas:

($R=0.0821\text{atm L/molK}$)

A. 300L

B. 600L

C. 20L

D. 80L

Answer: a



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95. The vapour density of a gaseous mixture of non-reactive gases 'A' and 'B' is 40. If the molar mass of gas 'A' is 20 g/mol and the mixture contains the gases in 2:3 volume ratio, then the molar mass of gas 'B' is

A. $\frac{160}{3}$

B. 40

C. 120

D. 60

Answer: c



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96. The partial pressure of hydrogen in a flask containing two grams of hydrogen and 32 g of sulphur dioxide is:

- A. $\frac{1}{16}$ th of the total pressure
- B. $\frac{1}{9}$ th of the total pressure
- C. $\frac{2}{3}$ rd of the total pressure
- D. $\frac{1}{8}$ th of the total pressure

Answer: c



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97. Equal volume of two gases which do not react together are enclosed in separate vessels. Their pressures are 10mm and 400mm respectively. If the two vessels are joined together, then what will be the pressure of the resulting mixture (temperature remaining constant)?

A. 120mm

B. 500mm

C. 1000mm

D. 205mm

Answer: d

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98. What is the total pressure exerted by the mixture of $7.0g$ of N_2 , $2g$ of hydrogen and $8.0g$ of sulphur dioxide gases in a vessel of $6L$ capacity that has been kept at $27^\circ C$.

A. 2.5bar

B. 4.5bar

C. 10 atm

D. 5.7bar

Answer: d



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99. A 40 mL of a mixture of H_2 and O_2 at $18^\circ C$ and 1 atm pressure was sparked so that the formation of water was complete. The remaining pure gas had a volume of 10mL at $18^\circ C$ and 1 atm pressure. If the remaining gas was H_2 . The mole fraction of H_2 in the 40mL mixture is:

A. 0.75

B. 0.5

C. 0.65

D. 0.85

Answer: a



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100. A gaseous mixture contains three gaseous A , B and C with a total number of moles of 10 and total pressure of $10atm$. The partial pressure

of A and B are 3atm and 1 atm respectively and if C has molecular weight of 2g/mol . Then, the weight of C present in the mixture will be :

A. 6

B. 8

C. 12

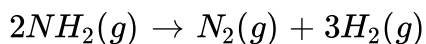
D. 3

Answer: c



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101. For the reaction



What is the % of NH_3 converted if the mixture diffuses twice as fast as that of SO_2 under similar conditions?

A. 0.03125

B. 0.3125

C. 0.0625

D. 0.625

Answer: c



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102. 1 of NO_2 and $7/8L$ of O_2 at the same temperature and pressure were mixed together. What is the relation between the masses of the two gases in the mixture?

A. $M_{N_3} = 3M_{O_2}$

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

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

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

Answer: c



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103. A container contains O_2 , He and SO_2 gases such that mass of SO_2 is double the mass of O_2 and mass of He is half the mass of O_2 gas. The mole fraction of SO_2 gas in the mixture is:

A. $\frac{1}{6}$

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

C. $\frac{5}{6}$

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

Answer: a



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104. A cylinder is filled with a gaseous mixture containing equal masses of CO and N_2 . The partial pressure ratio is :

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

$$B. P_{CO} = 0.875P_{N_3}$$

$$C. P_{CO} = 2P_{N_2}$$

$$D. P_{CO} = \frac{1}{2}P_{N_2}$$

Answer: a



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105. 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 the stop cock. The pressure fell down to 40%. The volume of the bulb B must be:

A. 75 cm^3

B. 125 cm^3

C. 150 cm^3

D. 250 cm^3

Answer: c



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106. A mixture of methane and ethane in the molar ratio of $x:y$ has a mean molar mass of 20. what would be the mean molar mass, if the gases are mixed in the molar ratio of $y:x$?

A. 22

B. 26

C. 20.8

D. 19

Answer: b



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107. 2 litres of moist hydrogen were collected over water at $26^{\circ}C$ at a total pressure of one atmosphere. On analysis, it was found that the quantity of H_2 collected was 0.0788 mole. What is the mole fraction of H_2 in the moist gas?

- A. 0.989
- B. 0.897
- C. 0.953
- D. 0.967

Answer: d

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108. In two different vessels X and Y, $H_2O(l)$ is kept at the same temperature, the vacant space left over the surface of $H_2O(l)$ is V and 3 V respectively. What is the mass ratio of vapours in two vessels?

A. 1:3

B. 3:1

C. 1:4

D. 1:1

Answer: a



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109. A sample of H_2 is collected over H_2O at $23^\circ C$ and a pressure of 732 mm Hg has a volume of 245mL what volume would the dry H_2 occupy of $0^\circ C$ and 1 atm pressure? [VP of H_2O at $23^\circ C=21$ mm Hg]

A. 211mL

B. 218mL

C. 224mL

D. 249mL

Answer: a



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110. In a mixture of N_2 and O_2 gases, the mole fraction of N_2 is found to be 0.700. the total pressure of the mixture is 1.42atm. What is the partial pressure of O_2 in the mixture?

A. 0.211atm

B. 0.426atm

C. 0.493atm

D. 0.994atm

Answer: b



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111. A .189 g sample of liquid H_2O is injected into a 5.00L flask at $25^\circ C$. What will be present in the flask when equilibrium is established? (Vapour pressure of H_2O at $25^\circ C = 23.8\text{mm Hg}$)

- A. H_2O vapour at a pressure of 186 mm Hg
- B. H_2O vapour at a pressure of 37.2 mm Hg
- C. Liquid H_2O and H_2O vapour at a pressure of 37.2 mm Hg
- D. Liquid H_2O and H_2O vapour at a pressure of 23.8mm Hg

Answer: d



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112. A mixture of 0.50 mol of H_2 gas and 1.3 mol of Ar gas is in a sealed container with a volume of 4.82L. If the temperature of the mixture is $50.0^\circ C$, what is the partial pressure of H_2 in the sample?

- A. 1.5atm

B. 2.8atm

C. 7.2atm

D. 9.9atm

Answer: b

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113. A gaseous mixture of Ne and O_2 is taken in a copper vessel of 200mL capacity at 6 bar and $27^\circ C$. The vapour density of the gaseous mixture is 11.5. Now, the vessel is heated to $127^\circ C$, at which half of the $O_2(g)$ combined with the vessel forming a solid oxide of negligible volume. Neglecting thermal expansion in the vessel, the final partial pressure of $O_2(g)$ is : (Ne=20)

A. 1bar

B. 2 bar

C. 1.75bar

D. 7bar

Answer: a

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114. Equal masses of gaseous N_2 , NH_3 and N_2O are injected into an evacuated container to produce a total pressure of 3 atm. How do the partial pressures of N_2 , NH_3 and N_2O compare?

A. $P_{N_2} = P_{NH_3} = P_{N_2O}$

B. $P_{N_2} < P_{NH_3} < P_{N_2O}$

C. $P_{NH_3} < P_{N_2O}$

D. $P_{N_2O} < P_{N_2} < P_{NH_3}$

Answer: d

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115. A flask contains a mixture of Ne(g) and Ar(g) . There are 0.250 mol of Ne(g) which exerts a pressure of 205 mm Hg. If the Ar(g) exerts a pressure of 492 mmHg, what mass of Ar(g) is in the flask? ($A_r=40$)

A. 4.16g

B. 12.1g

C. 24.0g

D. 95.9g

Answer: c



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116. A mixture of 0.100 mol of N_2 and 0.20 mol of O_2 is collected over H_2O at an atmospheric pressure of 750 mm Hg and a temperature of 22°C .

What is the partial pressure (in mmHg) of O_2 in this mixture?

Compound	Vapour pressure at 22°C
----------	---------------------------------------

H_2O	22 mmHg
----------------------	---------

A. 478

B. 485

C. 500

D. 515

Answer: b



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117. A weighed quantity of a gas is collected over water at $25^{\circ}C$ and 742 mmHg. The molar mass of the gas is to be determined at standard temperature and pressure. If the vapor pressure of water is ignored during the calculation, what is the effect on the calculated pressure and calculated molar mass of the gas?

A. Pressur low Molar mass low

B. Pressur low Molar mass high

C. Pressur high Molar mass low

D. Pressur high Molar mass high

Answer: c

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118. Dalton's law cannot be applied for which gaseous mixture at normal temperatures?

- A. O_2 and N_2
- B. NH_3 and HCl
- C. He and N_2
- D. CO_2 and O_2

Answer: b

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119. How is the vapour pressure of a liquid in a closed container affected when the quantity of liquid is doubled at constant temperature?

- A. The vapour pressure increases
- B. The vapour pressure decreases.
- C. The vapour pressure stays the same.
- D. The vapour pressure may increase or decrease depending on the liquid.

Answer: c

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120. Hydrogen is collected over water at $22^{\circ}C$ and a barometer reading of 740 mmHg. If 300 mL of hydrogen is collected, with expression will give the volume of dry hydrogen at the same temperature and pressure?

Compound	Vapour Pressure at $22^{\circ}C$
H_2O	20mmHg

A. $300mL \times \frac{740mmHg - 20mmHg}{740mmHg}$

B. $300mL \times \frac{740mmHg + 20mmHg}{740mmHg}$

C. $300mL \times \frac{740mmHg}{740mmHg - 20mmHg}$

D. $300\text{mL} \times \frac{740\text{mmHg}}{740\text{mmHg} + 20\text{mmHg}}$

Answer: a

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121. What is the total pressure in a 2.00 L container that holds 1.00 g He, 1.00 g CO and 10.0 g of NO at 27° C?

A. 21.6atm

B. 13.2atm

C. 1.24atm

D. 0.310atm

Answer: b

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122. n mol of N_2 and 0.6 mol of Ar are enclosed in a vessel of capacity 2L at 1 atm and $27^\circ C$?

- A. 0.3
- B. 0.1
- C. 0.03
- D. 0.06

Answer: c



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123. Equal weight of N_2 and O_2 are put in a flask at $27^\circ C$ Calculate the partial pressure of N_2 if partial pressure $O_2 = 0.44$ atm.

- A. 0.44atm
- B. 0.50atm
- C. 0.94atm

D. 0.38atm

Answer: b

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124. A polythene bag of 3 litre capacity is filled by helium gas (Occupying 1L at 0.3 atm and 300K) at 300K . Subsequently enough Ne gas is filled to make total pressure 0.4 atm at 300K. Calculate ratio of moles of Ne to He in container.

A. 4

B. 2

C. 1

D. 3

Answer: d

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125. A vessel contains equal masses of three gases A,B, C and recorded a pressure of 3.5 bar at $25^{\circ}C$. The molecular mass of C is twice that of B and pressure of B (in bar) in the vessel

A. 3

B. 2

C. 4

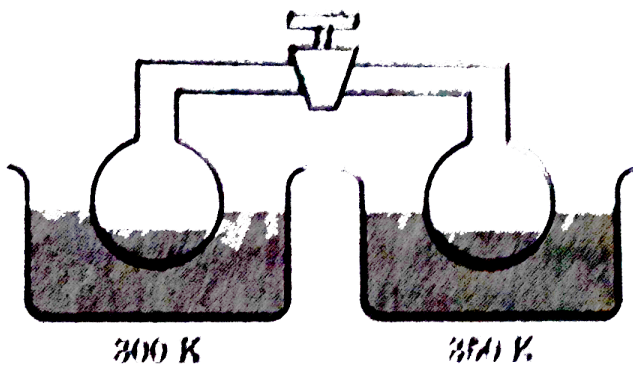
D. 1

Answer: d



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



Given that vapour pressure of $H_2O(l)$ at 300K and 350K and 22 mm of Hg and 40mm of Hg. The final pressure in each container if valve is opened while keeping the containers at the given temperatre is :

- A. 22 mm of Hg
- B. 40mm of Hg
- C. 31mm of Hg
- D. 62 mm of Hg

Answer: a



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127. A sample of air contains only N_2O_2 and H_2O . It is saturated with water vapours and total pressure is 640 torr. The vapour pressure of water is 40 torr and the molar ratio of $N_2 : O_2$ is 3:1. The partial pressure of N_2 in the sample is :

A. 540torr

B. 900torr

C. 1080torr

D. 450torr

Answer: d

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128. A vertical cylinder of height 1.52m is fitted with a movable piston of negligible mass and thickness. The lower half of the cylinder contains ideal gas and upper half is filled with Hg. The cylinder is initially at 300K.

When the temperature is raised, half of the mercury comes out of cylinder. The temperature is: (Assume no thermal expansion for Hg)

A. 337.5K

B. 364.5K

C. 546K

D. 600K

Answer: a



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129. 5 mole $H_2O_2(l)$ is placed in a container of volume 490mL at 300K, where it is completely decompositon into $H_2O(l)$ and $O_2(g)$, find exact pressure exerted by all gases.

(Given: $d_{H_2O} = 1g/mL$, Aqueous tension $H_2O(l)$ is 300K=38mm of Hg)

(Take $R=0.08\text{atm}\cdot\text{L}/\text{mol}\cdot\text{k}$)

A. 150atm

B. 150.05atm

C. 149.95atm

D. 300atm

Answer: b



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130. In a rigid container NH_3 is kept at a certain temperature where its pressure is found to be P_1 , if dissociated into N_2 and H_2 at these conditions pressure of mixture is found to be P_s . Find ratio of P_2 of P_1 .

A. 4

B. 2

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

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

Answer: a

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131. A closed vessel contains helium and ozone at a pressure of P atm. The ratio of He and oxygen atoms is 1:1. If helium is removed from the vessel the pressure of the system will reduce to:

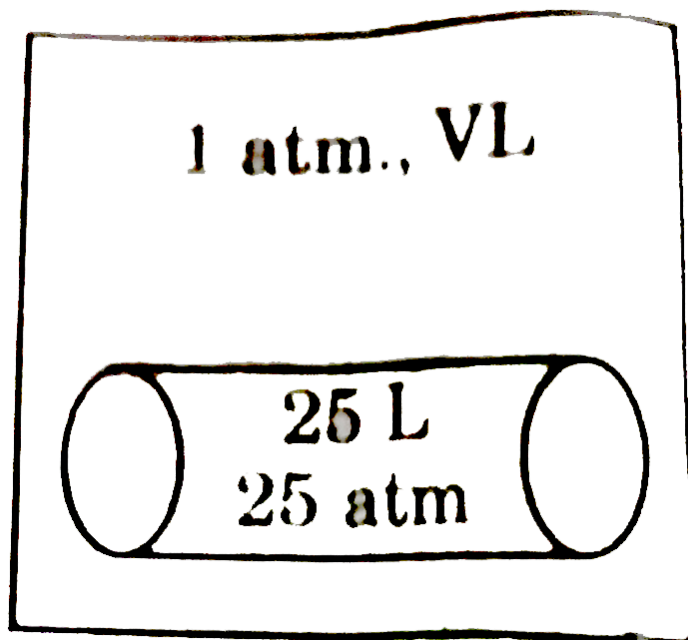
- A. $0.5P$ atm
- B. $0.75P$ atm
- C. $0.25 P$ atm
- D. $0.33 P$ atm

Answer: c

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132. Inside a drum of volume V a sealed glass tube of volume 25L containing n inert gas at 25 atm pressure is placed. The drum is now sealed. During crackling and final pressure inside drum rises to 1.5 atm. Find volume of

drum [Assume constnat temperature]



A. 1200L

B. 450L

C. 980L

D. 240L

Answer: a



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133. A 225 mL sample of H_2 is collected over water at $25^\circ C$ and 735mm Hg pressure. Which expression represents the set-up to find the volume of dry H_2 at $0^\circ C$ and 1 atmosphere? [VP of H_2O at $25^\circ C=24$ mm of Hg]

$$A. V = \frac{225 \times (735 - 24) \times 273}{760 \times 298}$$

$$B. V = \frac{225 \times 760 \times 298}{(735 - 24) \times 273}$$

$$C. V = \frac{225 \times 273 \times 760}{(735 + 24) \times 298}$$

$$D. V = \frac{225 \times (735 + 24) \times 298}{760 \times 273}$$

Answer: a



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134. There are n connected having container having volume $V, 2V, 3V, \dots, nV$ separated by stopcock. All containr have same moles of gas at same temperature. If pressure of first containr is P , then final pressure when all stopcocks are opened is:

A. $\frac{np}{(n+1)}$

B. $\frac{2p}{(n+1)}$

C. $\frac{3p}{(n+1)}$

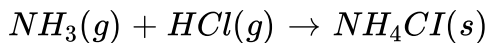
D. $\frac{p}{2(n+1)}$

Answer: b



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135. A 5.00L evacuated cylinder is charged with 25.5g of NH_3 and 36.4 g of HCl. Calculate the final pressure at $85.0^\circ C$ after the two compounds have reacted completely:



A. 2.94 atm

B. 5.88atm

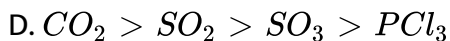
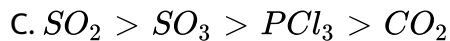
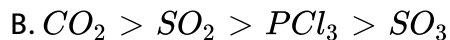
C. 8.82atm

D. 14.7atm

Answer: a

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136. The rates of diffusion of SO_3 , CO_2 , PCl_3 and SO_2 are in the following order:



Answer: d

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137. 20L of SO_2 diffuse through a porous partition in 60 seconds. Volume of O_2 diffuse under similar conditions in 30 seconds will be:

A. 12,14L

B. 14.14L

C. 18.14L

D. 28.14L

Answer: b

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138. $X\text{ mL}$ of H_2 gas effuses through a hole in a container in 5 s . The time taken for the effusion of the same volume of the gas specified below, under identical conditions, is

A. 10 sec. He

B. 20 sec. O_2

C. 25sec. CO_2

D. 55sec. CO_2

Answer: b

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139. The time taken for effusion of 32 mL of oxygen will be the same as the time taken for effusion under identical condition of :

- A. 64mL of H_2
- B. 50mL of N_2
- C. 27.3 mL of CO_2
- D. 22.62mL of SO_2

Answer: c

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140. A ballon filled with ethyne is pricked with a sharp point and quickly dropped in a tank of H_2 gas under indential conditions. After a while the

balloon will

- A. shrink
- B. enlarge
- C. completely collapse
- D. remained unchanged in size

Answer: b



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141. A bottle of dry ammonia and a bottle of dry hydrogen chloride connected through a long tube are opened simultaneously at both ends.

The white ammonium chloride ring first formed will be

- A. at the centre of the tube
- B. near the ammonia bottle
- C. near the HCl bottle

D. throughout the length of the tube.

Answer: dc

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142. The rate of effusion of helium gas at a pressure of 1000 torr is 10 torr min^{-1} . What will be the rate of effusion of hydrogen gas at a pressure of 2000 torr at the same temperature?

- A. 20 torr min^{-1}
- B. 40 torr min^{-1}
- C. $20\sqrt{2} \text{ torr min}^{-1}$
- D. 10 torr min^{-1}

Answer: c

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143. One litre of a gaseous mixture of two gases mixture of two gases effuses in 311 seconds while 2 litre of oxygen takes 20 minutes. The vapour density of gaseous mixture containing CH_4 and H_2 is:

- A. 4
- B. 4.3
- C. 3.4
- D. 5

Answer: b



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144. If the number of molecules of SO_2 (atomic weight=64) effusing through an orifice of unit area of cross-section in unit time at $0^\circ C$ and 1 atm pressure is n . the number of He molecules (atomic weight=4) effusing under similar conditions at $273^\circ C$ and 0.25 atm is:

A. $\frac{n}{\sqrt{2}}$

B. $n\sqrt{2}$

C. $2n$

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

Answer: a

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145. The ratio of rates of diffusion of SO_2 , O_2 and CH_4 is

A. $1 : \sqrt{2} : 2$

B. $1 : 2 : 4$

C. $2 : \sqrt{2} : 1$

D. $1 : 2 : \sqrt{2}$

Answer: a

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146. A certain volume of H_2 effuses from an apparatus in one minute. The same volume of ozonised oxygen ($O_3 + O_2$) mixture took 246 sec to effuse from apparatus under identical conditions. Percentage of O_2 by mole in mixture is:

A. 0.8987

B. 0.1013

C. 0.7654

D. 0.7312

Answer: a

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147. Ratio of rates of diffusion of He and CH_4 (under identical conditions):

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

B. 3

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

D. 2

Answer: d



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148. A sample of ozonised oxygen diffuses $\sqrt{2}$ times faster than pure SO_3 gas under identical conditions. The mass percent of O_3 in the sample of ozonised oxygen is:

A. 60

B. 50

C. 40

D. 30

Answer: a



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149. Pure O_2 diffuses through an aperture in 224 second, whereas mixture of O_2 and another gas containing 80% O_2 diffuses from the same in 234 second. The molecular mass of gas will be:

A. 45.6

B. 48.6

C. 50

D. 46.6

Answer: d



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150. Three footballs are respectively filled with nitrogen, hydrogen and helium. If the leaking of the gas occurs with time from the filling hole,

then the ratio of the rate of leaking of gases ($r_{N_2} : r_{H_2} : r_{He}$) from three footballs (in equal time interval) is :

A. $(1 : \sqrt{14} : \sqrt{7})$

B. $(\sqrt{14} : \sqrt{7} : 1)$

C. $(\sqrt{14} : 1 : \sqrt{7})$

D. $(1 : \sqrt{7} : \sqrt{14})$

Answer: a



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151. A straight glass tube as shown, has 2 inlets X and Y at the two ends of 200 cm long tube. HCl gas through inlet X and NH_3 gas through inlet Y are allowed to enter in the tube at the same time and pressure at a point P inside the tube. The distance of point P from X is:

A. 118.9cm

B. 81.1cm

C. 91.1 cm

D. 108.9cm

Answer: b



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152. A teacher enters a classroom from front door while a student from back door. There are 13 equidistant rows of benches in the classroom. The teacher releases N_2O , the laughing gas, from the first bench while the student releases the weeping gas ($C_6H_{11}OBr$) from the last bench. At which row will the students starts laughing and weeping simultaneously?

A. 7

B. 10

C. 9

D. 8

Answer: c



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153. Which of the following statements are correct?

- A. Helium diffuses at a rate 8.65 times as much as CO does
- B. Helium escapes at a rate 2.65 times as fast as CO does
- C. Helium escapes at a rate 4 times as fast as CO_2 does
- D. Helium escapes at a rate 4 times as fast as SO_2 does

Answer: d



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154. Calculate composition of the effusing gas (by mass) if the inside gas consist of mixture of H_2 and O_2 in a molar ratio of 2:1 respectively.

- A. $\frac{100}{8} \% H_2$
- B. $\frac{800}{9} \% H_2$

C. $\frac{100}{3} \% H_2$

D. $\frac{200}{3} \% H_2$

Answer: c



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155. A bottle of dry NH_3 and another bottle of dry HCl connected through a long tube are opened simultaneously at both ends of the tube.

The white ring (NH_4Cl) first formed will be

A. A

B. B

C. C

D. A,B and C simultaneously

Answer: c



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156. Compounds of uranium-235 and uranium -238 can be separated from one another by:

- A. distillation
- B. effusion
- C. fractional crystallization
- D. paper chromatography

Answer: b



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157. A certain volume of argon gas (Mol. Wt.=40) requires 45s to effuse through a hole at a certain pressure and temperature. The same volume of another gas of unknown molecular weight requires 60s to pass through the same hole under the same conditions of temperature and pressure. The molecular weight of the gas is:

A. 53

B. 35

C. 71

D. 120

Answer: c

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158. A gas diffuses one-third as fast as O_2 at $100^\circ C$. This gas could be:

A. He($M=4$)

B. C_2H_5 ($M = 48$)

C. C_7H_{12} ($M = 96$)

D. C_5F_{12} ($M = 288$)

Answer: d

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159. A $x:1$ molar mixture of He and CH_4 is contained in a vessel as 20 bar pressure. Due to a hole in the vessel, the gas mixture leaks out. If the composition of the mixture effusing out initially is 8:1, then calculate the value of x ?

A. 1

B. 4

C. 8

D. 9

Answer: b



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160. Which noble gas effuses approximately twice as fast as Kr?

Molar Mass (g/mol)	
Ne	20.18
Ar	39.95
Kr	83.80
Xe	131.3
Rn	222

A. Ne

B. Ar

C. Xe

D. Rn

Answer: a



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161. An unknown gas effuses through a pin-hole in a container at a rate of 7.2 mmol/s/ Under the same condition gaseous oxygen effuses at a rate of 5.1 mmol/s. what is the molar mass (in g/mol) of the unknown gas?

A. 16

B. 23

C. 45

D. 64

Answer: a



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162. Which pair of gases has the same average rate of diffusion at $25^{\circ}C$?

A. He and Ne

B. N_2 and O_2

C. N_2O and CO_2

D. NH_3 and HCl

Answer: c

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163. Helium is often found with methane, CH_4 . How do the diffusion rates of helium and methane compare at the same temperature? Helium diffuses:

- A. sixteen times as fast as methane.
- B. four times as fast as methane.
- C. twice as fast as methane.
- D. at the same rate as methane.

Answer: c

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164. An unknown gas effuses through a small hole one half as fast as methane, CH_4 , under the same conditions. What is the molar mass of the unknown gas?

A. 4g mol^{-1}

B. 8g mol^{-1}

C. 32g mol^{-1}

D. 64g. mol^{-1}

Answer: d



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165. Oxygen, which is 16 times as dense as hydrogen, diffuses:

A. $\frac{1}{16}$ times as fast

B. $\frac{1}{4}$ times as fast

C. 4 times as fast

D. 16 times as fast

Answer: b

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166. The rate of effusion of two gases 'a' and 'b' under identical conditions of temperature and pressure are in the ratio of 2:1 What is the ratio of *rms* velocity of their molecules if T_a and T_b are in the ratio of 2:1?

A. $\sqrt{2}:1$

B. 2:1

C. $1:\sqrt{2}$

D. $2\sqrt{2}:1$

Answer: d

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167. Which gas effuses fastest under identical conditions?

A. N_2

B. O_2

C. Cl_2

D. CH_4

Answer: d



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168. The rate of diffusion of two gases A and B are in the ratio 16:3. if the ratio of their masses present in the mixture is 2:3 then:

A. The ratio of their molar masses is 16:1

B. The ratio of their molar masses is 4:1

C. The ratio of their moles present inside the container is 1:24

D. The ratio of their moles inside the container is 8:3

Answer: d

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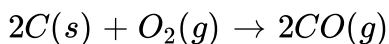
169. The rate of diffusion of a gas is

- A. directly proportional to its density
- B. directly proportional to its molecular weight
- C. directly proportional to the square of its molecular weight
- D. Inversely proportional to the square root of its molecular weight

Answer: d

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170. Certain amount of oxygen gas was passed over heated carbon, where 80% of oxygen added was converted into CO gas, as per reaction



If gaseous mixture left is allowed to effuse, then, ratio of rate of effusion of CO to O_2 will be:

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171. Hydrogen gas diffuses four times as rapidly as a mixture of C_2H_4 and CO_2 . The molar ratio of C_2H_4 to CO_2 in the mixture is

A. 1 : 1

B. 2 : 1

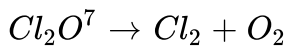
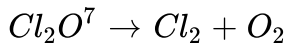
C. 3 : 1

D. 3 : 2

Answer: c

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172. Cl_2O^7 gas decomposes as:



A partially decomposed gaseous mixture is allowed to effuse through a pin-hole and the gas coming out initially was analysed . The mole fraction of the O_2 was found to be 0.60. the degree of dissociation of Cl_2O^7 will be:

A. 0.1

B. 0.2

C. 0.4

D. 0.6

Answer: b



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173. One litre of gaseous mixture of CH_4 and H_2 effuses in 200 seconds while one litre of gas 'X' takes 10 minutes to effuse in identical condition s. If molar ratio of $CH_4 : H_2$ in mixture is 1:2. find molar

A. 20

B. 30

C. 40

D. 60

Answer: d



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174. A gas cylinder contains 320 gm of O_2 at 30 atm and $27^\circ C$ what mass (in gram) of O_2 would escape if first the cylinder is heated to $127^\circ C$ and then valve is held open until the pressure the cylinder become 1 atm (the temperature being maintained at $127^\circ C$).

A. 312

B. 315

C. 340

D. 320

Answer: a



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175. Sulphur and fluorine form SF_6 and S_2F_{10} , both of which are gases at $30^\circ C$. When an equimolar mixture of them is allowed to effuse through a pinhole, what is the ratio SF_6 / S_2F_{10} in the first sample that escapes?

Molar mass $gmol^{-1}$

SF_6 146

S_2F_{10} 254

A. $\frac{1.32}{1}$

B. $\frac{1.74}{1}$

C. $\frac{3.03}{1}$

D. $\frac{3.48}{1}$

Answer: a



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176. Temperature at which *r. m. s* speed of O_2 is equal to that of neon at $300K$ is:

A. 280K

B. 480K

C. 680K

D. 180K

Answer: b



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177. The rms speed of the molecules of a gas of density 4 kg m^{-3} and pressure $1.2 \times 10^5 \text{ Nm}^{-2}$ is:

A. 120 ms^{-1}

B. 300 ms^{-1}

C. 600 ms^{-1}

D. 900 ms^{-1}

Answer: b



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178. The mass of molecule A is twice that of molecule B. The root mean square velocity of molecule A is twice that of molecule B. If two containers of equal volume have same number of molecules the ratio of pressure

$\frac{P_A}{P(B)}$ will be:

A. 8:1

B. 1:8

C. 4:1

D. 1:4

Answer: a



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179. The kinetic energy of N molecules of O_2 is x joule at $-123^\circ C$. Another sample of O_2 at $27^\circ C$ has a kinetic energy of $2x$. The latter sample contains molecules of O_2 .

A. N

B. $\frac{N}{2}$

C. $2N$

D. $3N$

Answer: a



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180. Calculate the average kinetic energy (in joule) per molecule in 8.0g of methane at $27^{\circ}C$.

A. 6.21×10^{-20} J/molecule

B. 6.21×10^{-21} J/molecule

C. 6.21×10^{-22} J/molecule

D. 3.1×10^{-22} J/molecule

Answer: b



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181. According to kinetic theory of gases, for a diatomic molecule.

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

- B. The pressure exerted by the gas is proportional to the rms velocity of the molecule.
- C. The rms velocity of the molecule is inversely proportional to the temperature.
- D. The mean translational K.E. of the molecule is proportional to the absolute temperature.

Answer: d



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182. The temperature of an ideal gas is increased from 120K to 480K. If at 120K the root-mean-square velocity of the gas molecules is v , at 480K it becomes:

A. $4v$

B. $2v$

C. $\frac{v}{2}$

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

Answer: b

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183. The ratio between the rms velocity of H_2 at 50K and that of O_2 at 800K is:

A. 4

B. 2

C. 1

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

Answer: c

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184. If two gases A and B and temperatures T_A and T_B respectively have identical Maxwellian plots, then which of the following statements is true?

A. $T_B = T_A$

B. $M_B = M_A$

C. $\frac{T_A}{M_B} = \frac{T_B}{M_A}$

D. Gases A and B may be O_2 and SO_2 at $27^\circ C$ and $327^\circ C$ respectively.

Answer: d



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185. If a gas is allowed to expand at constant temperature then:

A. the kinetic energy of the gas molecules decreases

B. the kinetic energy of the gas molecules increases

C. the kinetic energy of the gas molecules increases

D. none of the above

Answer: c



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186. A helium atom is two times heavier than a hydrogen molecule. At $298K$, the average kinetic energy of a helium atom is

- A. two times that of hydrogen molecules
- B. same as that of hydrogen molecules
- C. four times that of hydrogen molecules
- D. half that of hydrogen molecules

Answer: b



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187. The ratio of the average molecular kinetic energy of UF_6 to that of H_2 . Both at 300K is:

- A. 1:1
- B. 7:2
- C. 176:1
- D. 2:7

Answer: a



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188. At what temperature will hydrogen molecules have the same kinetic energy as nitrogen molecules have at $35^\circ C$?

- A. $\left(\frac{28 \times 35}{2}\right)^\circ C$
- B. $\left(\frac{2 \times 35}{28}\right)^\circ C$
- C. $\left(\frac{2 \times 28}{35}\right)^\circ C$

D. $35^{\circ}C$

Answer: d



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189. The translational kinetic energy of 10^{20} molecules of nitrogen at a certain temperature is 0.629J. What is the temperature in $^{\circ}C$?

A. $43.3^{\circ}C$

B. $23^{\circ}C$

C. $30.^{\circ}C$

D. $15.8^{\circ}C$

Answer: c



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190. K.E. of one mole of helium at 273 K is:

- A. 819 cal
- B. 81.9cal
- C. 8.19cal
- D. none of these

Answer: a



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191. The kinetic energy for 14 grams of nitrogen gas at $127^{\circ}C$ is nearly
(mol. Mass of nitrogen=28 and gas constant=8.31J/mol/K.)

- A. 1.0J
- B. 4.15J
- C. 2492.2J
- D. 3.3J

Answer: c



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192. At the same T and P, which of the following gases will have the highest average kinetic energy per mole? (at. Wt. H=12,O=16,S=32,F=19)

A. H_2

B. O_2

C. CH_4

D. SF_6

Answer: e



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193. Calculate the temperature at which the rms velocity of sulphur dioxide molecules is the same as that of oxygen at 300K.

A. $600^{\circ}C$

B. 600K

C. 300K

D. $300^{\circ}C$

Answer: NA



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194. Which of the following statements is not true?

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

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

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

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

Answer: b



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195. Which of the following statements is incorrect according to kinetic theory of gases?

- A. At constant temperature, velocity of an individual gas molecule changes many times in one second.
- B. All gas molecules are assumed to be spherical in shape.
- C. Between two collisions a gas molecule may travel in curved paths.
- D. There is no attraction or repulsion force between gas molecules.

Answer: c

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196. Which is not one of the postulates of the kinetic molecular theory?

- A. At a constant temp. all the particle have the same speed.
- B. There are no force of attraction between molecules.
- C. Gas particles move in a straight line between collisions.
- D. The molecules are in a state of constant random motion.

Answer: a

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197. The root mean square velocity of a gas molecule at 100K and 0.5 atm pressure is 106.4ms^{-1} . If the temperature is raised to 400K and the pressure is raised to 2 atm, the root mean square velocity becomes:

- A. 106.4ms^{-1}

B. $425.6ms^{-1}$

C. $212.8ms^{-1}$

D. $851.2ms^{-1}$

Answer: c



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198. Which relationship holds true for Boltzmann constant 'K' and gas constant 'R' (N_A is Avogadro number)?

A. $R = k \times N_A$

B. $k = R \times N_A$

C. $R \times k = N_A$

D. $R = K^2 \times N_A$

Answer: a



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199. The kinetic energy of two moles of CO_3 at a certain temperature is 1800cal. The temperature of the gas is :

- A. 300K
- B. 150K
- C. 200K
- D. 400K

Answer: a



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200. In a certain sample of gas at $25^\circ C$ the number of molecules having speeds between 4 km sec^{-1} and 4.1 km sec^{-1} is N. if the total number of gas molecules at the same temperature are doubled what will happen?

- A. Value of most probable velocity will change

B. Area under the Maxwell's curve for distribution of speeds will increase by four times.

C. No of molecules between 4 km sec^{-1} and 4.1 km sec^{-1} will become $2N$.

D. No of molecules between 4 km sec^{-1} and 4.1 km sec^{-1} will remain same.

Answer: c

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201. A 10 g sample of oxygen gas is taken in a container of volume 1 litre and is found to exert a pressure of 3 bar. Which of the following options is correct regarding speed of the molecules?

A. All the molecules are moving at a same speed which is equal to 310 m/sec.

B. $U_{\text{avg}} = 300 \text{ m/sec}$

C. $U_{\text{mps}} = 300 \times \sqrt{\frac{2}{5}} \text{ m/sec.}$

D. $U_{\text{mps}} = 310 \text{ m/sec.}$

Answer: c



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202. The slope of the curves near origin corresponding to energy distribution and speed distribution for an ideal gas is given by:

A. Both V

B. Both ' ∞ '

C. 0, ' ∞ ' respectively

D. ' ∞ ', '0' respectively

Answer: d



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203. Which of the following samples of ideal gas will have maximum translation kinetic energy??

A. $\frac{1}{2}$ mole of $CO(g)$ at 400K

B. 16g of oxygen gas at 200K

C. 28g of nitrogen gas at 300K

D. 1g of ozone at 600K

Answer: c



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204. Which of the following statements is not true about the effect of a n increase in temperature on the distribution of molecular speeds of an ideal gas?

A. The area under the curve remains same even at the higher temperature.

B. The distribution pattern becomes more uniform.

C. Fraction of molecules with speed greater than a particular high speed will increase.

D. The fraction of molecules having most probable

Answer: d

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

A. Density

B. Pressure

C. KE per mol

D. rms speed

Answer: d



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206. Kinetic theory of gases proves:

- A. only Boyle's law
- B. only Charle's law
- C. only Avogardo's law
- D. all of these

Answer: d



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207. According to kinetic theory of gases in an ideal gas between two successive collisions a gas molecule travels:

- A. in a straight line path
- B. with an accelerated velocity
- C. in a circular path
- D. in a way path

Answer: a

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208. As the temperature is raised from $20^{\circ}C$ to $40^{\circ}C$ the average kinetic energy of neon atoms changes by a factor

- A. 2
- B. $\sqrt{\frac{313}{293}}$
- C. $\frac{313}{293}$
- D. $\frac{1}{2}$

Answer: c

209. Three closed vessels A, B and C are at the same temperature T and contains gases which obey the Maxwellian distribution of velocities. Vessel A contains only O_2 . B only N_2 and C a mixture of equal quantities of O_2 and N_2 . If the average speed of the O_2 molecules in vessel A is V_1 , that of the N_2 molecule in vessel C is:

A. $\frac{(V_1 + V_2)}{2}$

B. V_1

C. $(V_1 + V_2)^{1/2}$

D. $\sqrt{3kT/M}$

Answer: b

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

A. $H_2 > N_2 > O_2 > HBr$

B. $HBr > O_2 > N_2 > H_2$

C. $HBr > H_2 > O_2 > N_2$

D. $N_2 > O_2 > H_2 > HBr$

Answer: a



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211. At what temperature root mean square speed of N_2 gas is equal to that of propane gas at STP condition?

A. $173.7^\circ C$

B. 173.7K

C. STP

D. -40°C

Answer: b



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212. Helium atom is two times heavier than a hydrogen molecule at 298 K, the average kinetic energy of helium is

- A. two times that of hydrogen molecules
- B. same as that of hydrogen molecules
- C. four times that of hydrogen molecules
- D. half that of hydrogen molecules

Answer: b



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213. If most probable velocity is represented by 'a' and fraction possessing it by 'f' , then with increase in temperature which one of the following is correct?

A. a increases/decreases

B. a decreases,fincreases

C. both a and f decrease

D. boht a and f increase

Answer: a



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214. When CO_2 under high pressure is released from a fire extinguisher. Particles of solid CO_2 are formed, despite the low sublimation temperature ($- 77^\circ C$) of CO_2 at 1.0atm it is:

- A. the gas does work pushing back the atmosphere using KE of molecules and thus lowering the temperature
- B. volume of the gas is decreased rapidly hence, temperature is lowered
- C. both a and b
- D. none of the above

Answer: a



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215. At what temperature will the total KE of 0.3 mo of He be the same as the total KE of 0.40 mol of Ar at 400K?

- A. 533K
- B. 400K
- C. 346K

D. 300K

Answer: a

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216. For two gases, A and B with molecular weights M_A and M_B . It is observed that at a certain temperature, T , the mean velocity of A is equal to the root mean square velocity of B. thus the mean velocity of A can be made equal to the mean velocity of B, if:

- A. A is at temperature, T_1 and B and $T_2 T_1 > T_2$
- B. A is lowered to a temperature $T_2 < T$ while B is at T
- C. Both A and B are raised to a higher temperature
- D. Both A and B are lowered in temperature.

Answer: b

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217. At what temperature, the average speed of gas molecules be double of that at temperature, $27^{\circ}C$?

- A. $120^{\circ}C$
- B. $108^{\circ}C$
- C. $927^{\circ}C$
- D. $300^{\circ}C$

Answer: c



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218. A sample of a gas was heated from $30^{\circ}C$ to $60^{\circ}C$ at constant pressure. Which of the following statement(s) is true?

- A. Kinetic energy of the gas is doubled
- B. Boyle's law will apply
- C. Volume of the gas will be doubled

D. None of the above

Answer: d

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219. Which of the following expression correctly represents the relationship between the average kinetic energy of CO and N_2 molecules at the same temperature?

A. $\vec{E}(CO) > \vec{E}(N_2)$

B. $\vec{E}(CO) < \vec{E}(N_2)$

C. $\vec{E}(CO) = \vec{E} N_2$

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

Answer: c

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220. If equal weights of oxygen and nitrogen are placed in separate containers of equal volume at the same temperature, which one of the following statements is true? (mol wt. $N_2 = 28$, $O_2 = 32$)

- A. Both flasks contain the same number of molecules.
- B. The pressure in the nitrogen flask is greater than the one in the oxygen flask.
- C. More molecules are present in the oxygen flask.
- D. The nitrogen has a greater average kinetic energy per mole.

Answer: b

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221. Let the most probable velocity of hydrogen molecules at a temperature $t^\circ C$ is V_0 . Suppose all the molecules dissociate into atoms when temperature is raised to $(2t + 273)^\circ C$ then the new rms velocity is

A. $\sqrt{\frac{2}{3}}V_0$

B. $\sqrt{3\left(2 + \frac{273}{t}\right)}V_0$

C. $2\sqrt{3}V_0$

D. $\sqrt{6}V_0$

Answer: d



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222. The rms velocity of hydrogen is $\sqrt{7}$ times the rms velocity 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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223. The root mean square velocity of an ideal gas at constant pressure varies with density (d) as:

A. d^2

B. d

C. \sqrt{d}

D. $\frac{1}{\sqrt{d}}$

Answer: d



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224. For one mole of gas the average kinetic energy is given as E . The U_{rms} of gas is:

A. $\sqrt{\frac{2E}{M}}$

B. $\sqrt{\frac{3E}{M}}$

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

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

Answer: a



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225. Express the average kinetic energy per mole of monostomic gas of molar mass M . at temperature T K in terms of the average speed of the molecules U_{avg} .

A. $\frac{8M}{2\pi} U_{\text{avg}}^2$

B. $\frac{3M}{16} U_{\text{avg}}^2$

C. $\left(\frac{2M}{\pi}\right) U_{\text{avg}}^2$

D. $\left(\frac{2\pi M}{16}\right) U_{\text{avg}}^2$

Answer: d

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

A. 3.5 cm/s

B. $\left(\frac{27}{2}\right) \text{ cm/s}$

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

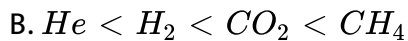
D. $\left(\frac{\sqrt{54}}{2}\right) \text{ cm/s}$

Answer: d

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227. A gas mixture at 27°C and 1 atm contains equal masses of He, H_2 , CO_2 and CH_4 . How do their molecular velocities compare?

A. $\text{He} = \text{H}_2 = \text{CO}_2 = \text{CH}_4$



Answer: d

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228. The average molecular velocity in a gas sample at 300K is 500m/s. The temperature of this gas is increased until the average velocity of its molecules is 1000m/s. what is the new temperature?

A. 420K

B. 573k

C. 600k

D. 1200k

Answer: d



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229. Two samples of gas, one of argon and one of helium, have the same pressure, temperature and volume. Which statement is true assuming both gases behave ideally?

- A. The helium sample contains more atoms than the argon sample and the helium atoms have a higher average speed.
- B. The two samples have the same number of atoms but the helium atoms have a higher average speed.
- C. The two samples have the same number of atoms and both types of atoms have the same average speed.
- D. The two samples have the same number of atoms but the argon atoms have a higher average speed.

Answer: b



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230. A sample of gas measured at 20°C and 4.0 atm is heated to 40°C at constant volume. Which statement(s) is (are) true of the gas after heating relative to its initial state?

- (P) The average molecular kinetic energy is increased.
- (Q) The average molecular speed is unchanged.
- (R) The pressure of the gas is increased to 8.0 atm.
- (S) The number of molecular collisions per second is unchanged.

- A. P only
- B. P and S only
- C. Q and R only
- D. Q and S only

Answer: a



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231. The kinetic theory of gases assumes all of the following except:

- A. Gases are composed of particles in random ceaseless motion.
- B. The sizes of gas particles are negligible compared to the size of the container.
- C. Gas particles do not attract or repel each other.
- D. When gas particles collide, kinetic energy is lost.

Answer: d



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232. With the increase in temperature of a gas, the fraction of molecules having velocities within a given range around the most probable velocity, would:

- A. increase
- B. decrease

C. remain unchanged

D. initially increase and then decrease

Answer: b



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233. Comment about the fraction of molecules moving between 400 to 500m/sec for a gas (molecular mass =20 g/mol) if its temperature increases from 300K to 400K [$\frac{25}{3}$ J/mol/K].

A. Fraction of molecules increases

B. Fraction of molecules decreases

C. Fraction of molecules remains constant

D. Fraction of molecules remains constant

Answer: b



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234. Assuming ideal gas behaviour identify the option which is incorrect as per assumption involved in KTG, speed distribution and bimolecular collisions:

- A. Lighter gases will have more uniform speed distribution pattern as compared to heavier gases at the same temperature.
- B. All the molecules of heavier gas will move at a slower speed as compared to any molecule of a lighter gas.
- C. The average distance travelled between successive collisions will remain unchanged on changing temperature of a closed rigid vessel, containing ideal gas.
- D. Average translational kinetic energy is directly proportional to absolute temperature.

Answer: b



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235. Incorrect postulate of kinetic theory of gases:

- A. Gas particles move in random motion
- B. Forces between gas molecules are negligible
- C. Gas molecules with higher molar mass have more kinetic energy
- D. Collision between gas molecules are elastic

Answer: c



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236. Equal masses of three non-reacting different ideal gases X,Y and Z are mixed in a sealed rigid container. If the temperature of the system remain constant at 400K, which of the system remain constant at 400K, which of the following statement about gas X can never be correct?

- A. Its partial pressure can be equal to $1/3^{rd}$ of total pressure

B. Average kinetic energy per mole of gas X is highest

C. It can never be liquified

D. It's partial pressure can be calculated with knowledge of volume of the container and mole of X

Answer: b

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237. In kinetic theory of gases, only translational motion of molecules is considered because:

A. there is no intermolecular forces.

B. the molecules are considered rigid spheres of negligible volume.

C. different molecules may travel at different speeds

D. in normal conditions, rotational and vibrational motion is not observed in gas molecules.

Answer: b

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

- A. Gas particles have negligible volume.
- B. A gas consists of many identical particles which are in continual motion.
- C. At high pressure, gas particles are difficult to compress.
- D. Collisions of gas particles are perfectly elastic.

Answer: c

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239. When a sample of an ideal gas is heated from 25°C to 50°C the average kinetic energy of the molecules increases. Which ratio gives the correct relationship between the average kinetic energies at the higher temperature to the lower temperature?

A. 2 : 1

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

C. 323 : 298

D. $\sqrt{323} : \sqrt{298}$

Answer: c



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240. The kinetic energy of the molecules in a sample of H_2O in its stable state at -10°C and 1 atm is doubled. What are the initial and final phases?

A. solid \rightarrow liquid

B. liquid \rightarrow gas

C. solid \rightarrow gas

D. solid \rightarrow solid

Answer: c

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241. Ar and He are both gases at room temperature. How do the average molecular velocities (v) of their atoms compare at this temperature?

A. $v_{He} = 10v_{Ar}$

B. $v_{Ar} = 10v_{He}$

C. $v_{He} = 3v_{Ar}$

D. $v_{Ar} = 3v_{He}$

Answer: c

242. Suppose that we change U_{rms} of gas in a closed container from 5×10^{-2} cm/sec to 10×10^{-2} cm/sec, which one of the following might correctly explain how this change was accomplished?

- A. By heating the gas we double the temperature.
- B. By removing 75% of the gas at constant volume we decrease the pressure to one quarter of its original value.
- C. By heating the gas we quadruple the pressure.
- D. By pumping in more gas at constant temperature we quadruple the pressure.

Answer: c

243. At what temperature, will most probable speed of the molecules of the second member of homologous series C_n, H_{2n-2} be the same as that of oxygen at $527^\circ C$?

A. $1000^\circ C$

B. $727^\circ C$

C. $1727^\circ C$

D. $1044.5^\circ C$

Answer: b



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244. Which statement is not a principle (postulate) of kinetic molecular theory?

A. The molecules of a gas are in rapid random motion.

B. The molecules of an ideal gas exhibit. No attractive forces.

C. The collisions of gaseous molecules with one another and the walls of their container are elastic.

D. Equal volumes of gases at the same temperature and pressure contain equal numbers of molecules.

Answer: d

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245. If the absolute temperature of a sample of gas is increased by a factor of 1.5, by what ratio does the average molecular speed of the molecules increase?

A. 1.2

B. 1.5

C. 2.2

D. 3.0

Answer: a

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246. Which property is the same for 1.0g samples of H_2 and CH_4 in separate 1.0L containers at $25^\circ C$?

- A. Pressure in I is the maximum.
- B. Number of molecules
- C. Average molecular velocity
- D. Average molecular kinetic energy

Answer: d

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247. Fraction of molecules (η) are related with velocity according to relation

$$\eta' = -\frac{3}{4}v^2 + 3v - \frac{9}{4} \quad (1 \leq v \leq 3)$$

Then find most probable speed?

- A. 0
- B. 1
- C. 2
- D. 3

Answer: c



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248. What is the average velocity of H_2 molecules at 100K relative to their velocity at 50K?

- A. 2.00 times the velocity at 50K
- B. 1.41 times the velocity at 50K
- C. 0.71 times the velocity at 50K

D. 0.50 times the velocity at 50K

Answer: b



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249. The quantity that does not change for a sample of a gas in a sealed rigid container when it is cooled from $120^{\circ}C$ to $90^{\circ}C$ at constant volume is:

- A. average energy of the molecule
- B. pressure of the gas
- C. density of the gas
- D. average speed of the molecules

Answer: c



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250. Three balloons are filled with the same number of atoms of He, Ar and Xe, respectively. Which statement is true under the same conditions of temperature and pressure?

- A. The balloons contain the same mass of gas.
- B. All balloons have the same volume.
- C. The densities of the three gases are the same.
- D. The average speed of the different types of atoms is the same.

Answer: b



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251. 6×10^{22} gas molecules each of mass 10^{-24} kg are taken in a vessel of 10 litre. What is the pressure exerted by gas molecules? The average velocity of the gas molecules is 92.62m/sec.

- A. $2 \times 10^5 \text{ Pa}$
- B. 20Pa

C. $2 \times 10^6 Pa$

D. $2 \times 10^4 Pa$

Answer: d



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252. Certain amount of a gas exerts some pressure on its walls at a particular temperature. It has been found that by reducing the volume of the gas to $\frac{1}{4}$ of its original value the pressure becomes 4 times that of the initial value of constant temperature. This happens because:

- A. Weight of the gas increases the pressure.
- B. Speed of the gas molecules decreases.
- C. More number of gas molecules strike the surface per second.
- D. Gas molecules attract each other.

Answer: c



253. Ratio of fraction of molecules of O_2 and SO_2 which lies between U_{rms} to $U_{\text{rms}} + du$ at same temperature is:

A. 1

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

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

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

Answer: b



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254. Pick out correct statement among the following about the equal volume of $N_2(g)$ and $O_2(g)$ at 298K and 1 atm:

- A. The average translational kinetic energy per molecule is same of $N_2(g)$ and $O_2(g)$
- B. The most probable speed of two gases is same
- C. The total translational kinetic energy of $N_2(g)$ and $O_2(g)$ is same
- D. The absolute entropy of both gases is same.

Answer: a

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255. Fraction of oxygen molecules $\left(\frac{dN}{N}\right)$ in the range U_{mps} to $U_{\text{mps}} + fU_{\text{mps}}$ where $f \ll 1$:

A. $\frac{4f}{2\sqrt{\pi}}$

B. $\frac{4}{\sqrt{\pi}} \left(\frac{M}{2RT}\right)^{1/2} e^{-1}$

C. $\frac{f}{e\pi}$

D. 1

Answer: a



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256. Identify the correct statement when a fixed amount of ideal gas is heated in a container fitted with a movable piston always operating at constant pressure.

- A. Average distance travelled between successive collisions will decrease.
- B. Collisions frequency increases since speed of the molecules increases with increase in temperature.
- C. Average relative speed of approach remains unaffected.
- D. Average angle of approach remains unaffected.

Answer: d



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257. When a gas is compressed at constant temperature

- A. the speeds of the molecules increase
- B. the collisions between the molecules increase
- C. the speeds of the molecules decrease
- D. the collisions between the molecules decrease

Answer: b



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258. At constant volume Z_{11} is directly proportional to:

- A. \sqrt{P}
- B. P
- C. T^2
- D. T

Answer: a



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259. An unknown gas is placed in a sealed container with a fixed volume. Which of the characteristics listed change(s) when the container is heated from $25^{\circ}C$ to $250^{\circ}C$?

(P) The density of the gas

(Q) The average kinetic energy of the molecules

(R) The mean free path between molecular collisions

(R) The mean free path between molecular collisions

A. P only

B. Q only

C. R only

D. P and Q only

Answer: b





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260. Choose the correct alternative (more than one may be correct)

(B.M.C=Bimolecular collision) (at constant P) (n is constant throughout).

A. λ is constant.

B. BMC made by 1 molecule per second is directly proportional to T.

C. BMC for all the molecules per unit volume is directly proportional to T^2

D. none of these

Answer: d



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261. The most probable kinetic energy of a gas molecule

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

B. kT

C. $2kT$

D. RT

Answer: a



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262. A real gas obeying van der Waals's equation will resemble ideal gas, if the:

A. constants a and b are small

B. a is large and b is small

C. a is small and b is large

D. constant a and b are large

Answer: a



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263. For the non-zero value of the force of attraction between gas molecules, gas equation will be

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

B. $PV = nRT + nbP$

C. $PV = nRT$

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

Answer: a

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264. Compressibility factor for H_2 behaving as real gas is:

A. 1

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

C. $\left(1 + \frac{Pb}{RT}\right)$

D. $\frac{RTV}{(1-a)}$

Answer: c



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265. At low pressures (for 1 mole), the van der Waal's 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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266. Calculate the radius of He atoms if its van der Waal's constant 'b' is 24 mL mol^{-1} . (Note: mL=cubic centimeter)

A. 1.334 \AA

B. 1.314 \AA

C. 1.255 \AA

D. 0.355 \AA

Answer: a



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267. In van der Waal's equation of state for a non ideal gas the term that accounts for intermolecular forces is:

A. nb

B. nRT

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

D. $(nRT)^{-1}$

Answer: c

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268. The values of van der Waal's constant 'a' for the gases O_2 , N_2 , NH_3 and CH_4 1.36,1.39,4.17,2.253 $L^3 \text{ atm mole}^{-2}$ respectively. The gas which can most easily be liquefied is:

A. O_2 and N_2

B. N_2 and O_2

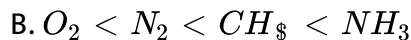
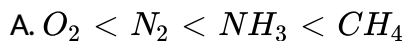
C. NH_3

D. CH_4

Answer: c

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269. The correct order of normal boiling of O_2 , N_2 , NH_3 and CH_4 for whom the values of van der Waals constant ' a ' are 1.360, 1.390, 4.170 and $2.253L^2atmmol^{-2}$ respectively, is:

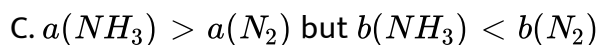
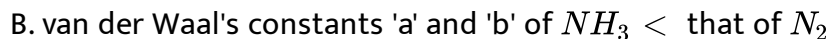
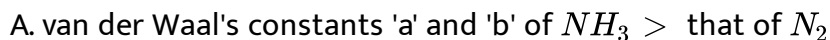


Answer: b



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270. NH_3 is liquefied more easily than N_2 . Hence



$$D. a(NH_3) < a(N_2) \text{ but } b(NH_3) > b(N_2)$$

Answer: c

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271. Four different identical vessels at same temperature contains one mole each of C_2H_6 , CO_2 , Cl_2 and H_2S at pressure P_1 , P_2 , P_3 and P_4 respectively. The value of van der Waal's constnat 'a' for C_2H_6 , CO_2 , Cl_2 and H_2S is 5.562, 3.640, 6.579 and 4.490 $\text{atm L}^2\text{mol}^{-2}$ respectively. Then:

A. $P_3 < P_1 < P_4 < P_2$

B. $P_1 < P_3 < P_2 < P_4$

C. $P_2 < P_4 < P_1 < P_3$

D. $p_1 = p_2 = p_3 = p_4$

Answer: a

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272. Under critical states of a gas for one mole of a gas, compressibility factor is :

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

B. $\frac{8}{3}$

C. 1

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

Answer: a



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273. Critical temperature of a gas is.... Boyle's temperature.

A. higher than

B. equal to

C. lower than

D. no relation

Answer: c



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274. At low pressure of 0.25 atm, 2 mole of a real gas has Boyle's temperature 100K. The approximate volume of gas at this temperature and pressure is:

A. 66 litre

B. 33 litre

C. 44.8litre

D. none of these

Answer: a



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275. One litre gas at 400K and 300atm pressure is compressed to a pressure of 600 atm and 100K. The compressibility factor is changed from 1.2 to 1.6 respectively. Calculate the final volume of the gas.

A. 2 litre

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

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

D. $\frac{4}{3}$ litre

Answer: c



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276. Consider the following statements:

(I) $(a)_{NH_3} > (a)_{H_2O}$ [(a) is van der Waal's constant]

(II) Pressure of the real gas is more than the ideal gas for same temperature and volume of the container.

(III) Compressibility factor for $H_2(g)$ is never less than unity at any temperature. The above statements 1,2,3 respectively are (T=True,F=False)

A. T F F

B. F F F

C. F T F

D. T T F

Answer: b



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277. The critical pressure P_C and critical temperature T_C for a gas obeying van der Waal's equation are 80 atm at 87°C . molar mass of the gas is 130 g/mole. The compressibility factor for the above gas will be smaller than unity under the following condition:

A. 1 atm and 800°C

B. 1 atm and 1200°

C. 1 atm and $1000^{\circ}C$

D. 1 atm and $1100^{\circ}C$

Answer: a

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278. For the four gases A,B,E and D the value of the excluded volume per mole is same. If the order of the critical temperature is $T_B > T_C > T_A > T_E$ then the order of their liquefaction pressure at a temperature $T(T < T_E)$ will be:

A. $P_A < P_B < P_E < P_D$

B. $P_B < P_D < P_A < P_E$

C. $P_E < P_A < P_D < P_B$

D. $P_D < P_E < P_A < P_B$

Answer: b

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279. Which of the following options will have compressibility factor greater than 1?

- A. H_2 gas at its critical condition.
- B. CH_4 gas at room temperature and low pressure.
- C. N_2 gas at Boyle's temperature and low pressure.
- D. He gas at normal temperature and normal pressure.

Answer: d

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280. The density of CO_2 at 10 atm and 400K is 22g/L. the dominant force between CO_2 gas molecules is:

- A. attractive

B. repulsive

C. neither attractive nor repulsive

D. can't be predicted

Answer: a

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281. At moderate pressures, the compressibility factor of a gas is given by:

$$Z = 1 + 0.4P - \frac{200P}{T} \quad (\text{P in bars and T in Kelvin})$$

The Boyle's temperature is given by:

A. 200K

B. 500K

C. $\frac{2400}{27}K$

D. 400K

Answer: b

282. Which of the following options regarding true/false statement for a van der Waal's gas is correct? Statement-1 : At critical condition, the gas will follow the equation $8 PV=3nRT$

Statement-2: At Boyle's temperature, $Z=1$ at all pressures.

Statement-3: Greater the size of molecules, greater will be the van der Waal's constant 'b'.

Statement-4: For H_2 gas, if $P=200$ atm and $T=300K, Z > 1$.

- A. All the statements are correct
- B. Only statement-2 is incorrect.
- C. Statement-1 and Statement-2 are incorrect statements.
- D. Statements-1 and Statement-4 are incorrect statements.

Answer: b

283. Which of the following statements is not correct regarding compressibility factor of real gas?

- A. At Boyle's temperature compressibility factor can be 1.04 at some pressures.
- B. For a gas in which only repulsive forces are existing and are significant, 'z' will always be greater than 1.
- C. As pressure tends to zero compressibility factor of all real gases approaches towards unity.
- D. At Boyle's temperature compressibility factor be 0.96 at some pressure.

Answer: d



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284. What will be the nature of forces at critical conditions for a real gas?

A. Attractive

B. Repulsive

C. No net dominant forces

D. Depends on the types of the gas, attractive for most of them and repulsive for H_2 and He.

Answer: a



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285. van der Waal's constants for gases A,B and C are as follows:

Gas	a (kPa $dm^6 mol^{-2}$)	B (L/mol)
-----	----------------------------	-------------

A	410	0.027
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B	1215	0.03
---	------	------

C	608	0.032
---	-----	-------

Which of the following options contain correct arrangement of "gas with highest critical temperature" ad "gas with most ideal behaviour around $1850K$ " respectively?

A. B,A

B. A,B

C. C,B

D. B,C

Answer: a



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286. For a hypothetical gas containing molecules as point masses and having non-zero intermolecular attractions, which of the following is correct?

A. The gas shows positive deviations from ideal gas behaviour.

B. Graph of Z v/s $\frac{1}{V}$ at a particular temperature will have negative slope

C. The gas will be difficult to compress as compared to ideal gas.

D. 2 moles of the gas at a temperature of 273K can be stored in a 45 litre of container at 1 atm pressures.

Answer: b

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287. A real gas most closely approaches the behaviour of an ideal gas at:

- A. 15 atm and 200K
- B. 1 atm and 273 K
- C. 0.5 atm and 500K
- D. 15 atm and 500K

Answer: c

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288. Calculate the compressibility factor for CO_2 , if one mole of it occupies 0.4 litre at 300K and 40 atm. Comment on the result.

A. 0.40, CO_2 is more compressible than ideal gas

B. 0.65, CO_2 is more compressible than ideal gas

C. 0.55, CO_2 is more compressible than ideal gas

D. 0.62, CO_2 is more compressible than ideal gas

Answer: b

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289. Which of following statement(s) point is maximum.

(P) Slope of isotherm at critical point is maximum.

(Q) Larger is the value of T_c easier is the liquification of gas.

(R) van der Waal's equation of state is applicable below critical temperature at all pressure.

A. Only P

B. P and Q

C. Q and R

D. Only Q

Answer: b

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290. Consider the following statements: The coefficient B in the virial equation of state

(P) is independent of temperature

(Q) is equal to zero at boyle temperature

$$PV_m = RT \left(1 + \frac{B}{V_m} + \frac{C}{V_m^2} + \dots \right)$$

(R) has the dimension of molar volume which of the above statement are correct?

A. P and Q

B. P and R

C. Q and R

D. P, Q and R

Answer: c



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291. Consider the following statements : if the van der Waal's parameters of two gases are given as:

$$a \left(\text{atmL}^2 \text{mol}^{-2} \right) b \left(\text{Lmol}^{-1} \right)$$

Gas X: 6.5 0.056

Gas Y: 8.0 0.011

(P): $V_C(X) < V_C(Y)$ (Q): $P_C(X) < P_C(Y)$

(R) : $T_C(X) < T_C(Y)$

Select the correct alternate.

- A. Only P
- B. P and Q
- C. P,Q andR
- D. Q are R

Answer: d



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292. Select correct statement(s).

- A. we can condense vapours 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. All the statements are correct.

Answer: d



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293. At Boyle's temperature the value of compressibility factor $Z = (PV_m/RT = V_{\text{real}}/V_{\text{ideal}})$ has a value of 1, over wide range of pressure. This is due to the fact that in the van der Waal's equation:

- A. the constant 'a' is negligible and not 'b'
- B. the constant 'b' is negligible and not 'a'
- C. both the constant 'a' and 'b' are negligible
- D. the effect produced due to the molecular attractions compensates the effect produced due to the molecular volume.

Answer: d

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294. The critically density of the gas CO_2 is 0.44 g cm^{-3} at a certain temperature, if r is the radius of the molecule, r^3 in cm^3 is approximately:

(N is Avogadro number)

- A. $\frac{25}{\pi N}$
- B. $\frac{100}{nN}$
- C. $\frac{6}{\pi N}$
- D. $\frac{25}{\pi N}$

Answer: d

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295. The compressibility of a gas is less than unity at S.T.P

A. $V_m > 22.7$ litres

B. $V_m > 22.7$ litres

C. $V_m = 22.7$ litres

D. $V_m = 45.4$ litres

Answer: c

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296. The term that corrects for the attractive forces present in a real gas in the van der Waal's equation is:

A. nb

B. $\frac{an^2}{V^2}$

C. $-\frac{an^2}{V^2}$

D. $-nb$

Answer: b

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297. On heating vapours of $S_8(g)$ decomposes to $S_2(g)$, Due to this, the van der Waal's constant 'b' for the resulting gas:

A. increases

B. decreases

C. remains same

D. changes unpredictably

Answer: b

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298. Three gases A,B and C have values of van der Waal's constnat, a (in units of $\text{litre}^3\text{mol}^{-2}\text{ atm}$) of 1.38,6.70 and 4.00 respectively. The ease of liquefaction of gases decreases in the order:

A. $B > A > C$

B. $B > C > A$

C. $A > B > C$

D. $C > A > B$

Answer: b

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299. van der Waal's constants for neon and hydrogen are (a_1, b_1) and (a_2, b_2) respectively. The maximum number of moles of neon which will

form a homogeneous mixture with n_2 moles of hydrogen at 25°C and constant pressure P is:

A. $4n_2 \frac{Pb_2^2}{a_2}$

B. $27n_2 \frac{Pb_2^2}{a_2}$

C. $27n_2 \frac{Pb_1^2}{a_1}$

D. ∞

Answer: b



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300. The compressibility factor of $H_2(g)$ at its critical condition if it follows van der Waals' equation is given by:

A. $Z > 1$

B. $Z = 1$

C. $Z = \frac{3}{8}$

D. $Z = \frac{1}{8}$

Answer: c

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301. In van der Waals' equation of state of the gas law, the constant 'b' is a measure of :

- A. intermolecular collisions per unit volume
- B. intermolecular attractions
- C. volume occupied by the molecules
- D. intermolecular repulsions

Answer: c

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302. The critical temperature of water is the

- A. temperature at which solid, liquid and gaseous water coexist.
- B. temperature at which water vapour condenses.
- C. maximum temperature at which liquid water can exist.
- D. minimum temperature at which water vapor can exist.

Answer: c



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303. 10 litre container contains He at 210 atm and 300K. Given value of 'b'

for 'He' is $0.8 \text{ dm}^3 \text{ mol}^{-1}$ Compressibility factor is

$$\left(R = 0.08 \text{ atm L mol}^{-1} / \text{K}^{-1} \right)$$

- A. 1.4
- B. 1.7
- C. 0.7

D. 0.4

Answer: b



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304. The phase transition from gas to solid is called:

- A. deposition
- B. desublimation
- C. both a and b
- D. sublimation

Answer: a



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305. The critical temperature of carbon dioxide is 304.3K. Which statement is true about the behaviour of carbon dioxide above this temperature?

- A. Solid, liquid and gaseous carbon dioxide are in equilibrium above this temperature.
- B. Liquid carbon dioxide does not exist above this temperature.
- C. Carbon dioxide molecules do not exist above this temperature.
- D. none of these

Answer: c

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306. Which statement is correct about the critical point of a phase diagram?

- A. Solid, liquid and gas are present in equilibrium.

B. Liquid and vapour are indistinguishable from one another.

C. Liquid can be produced by a change in pressure.

D. Vapour can be produced by a change in temperature.

Answer: b

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307. CH_4 gas is behaving non-ideally. Compressibility factor for gas is 1.5 at 2 atm, 400K. Calculate molar volume for gas: [Given:

$$R = 0.08 \frac{\text{Litre-atm}}{K - \text{mole}}]$$

A. 24 litre

B. 16 litre

C. 48 litre

D. 8 litre

Answer: a



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308. Under what conditions does the behavior of real gases deviate most from that predicted by the ideal gas law?

- A. low P, low T
- B. high P, low T
- C. low P, high T
- D. high P, high T

Answer: b



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309. At the critical condition ($T = T_C, P = P_C, V = V_C$), the only incorrect information is:

- A. The surface differentiating liquid and gaseous phases disappears.

B. The density of matter in liquid and gaseous state becomes equal.

C. The compressibility factor of real gases becomes $\frac{8}{3}$.

D. The intermolecular attraction between gas molecules still dominates.

Answer: c

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310. Select the correct statement with reference to van der Waal's gas.

A. The compressibility factor for gas at critical state is $\frac{8}{3}$

B. At critical temperature, real gas behave like an ideal gas

C. At Boyle's temperature, real gas behaves like an ideal gas at all pressure

D. At Boyle's temperature, gas cannot be liquefied

Answer: d



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311. Boyle's temperature of a van der Waal's gas is 810K then at $-30^{\circ}C$, select the correct observation.

- A. Gas can be liquified at any pressure
- B. Gas behaves ideally at all pressures
- C. Gas can't be liquified at any pressure
- D. Gas behaves ideally at high pressure

Answer: c



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312. Correct option regarding a container containing 1 mole of a gas in 22.4 litre container at 273 K is:

- A. If compressibility factor (z) > 1 then P will be less than 1 atm.

- B. If compressibility factor (z) > 1 then P will be greater than 1 atm.
- C. If b dominates, pressure will be less than 1 atm.
- D. If a dominates, pressure will be greater than 1 atm.

Answer: b

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313. In the van der Waal's equation for real gases, corrections are introduced for both the pressure and the volume terms of the Ideal Gas Equation. Identify the origin of both correction factors and specify whether each is added to or subtracted from the corresponding ter.

- | | | |
|----|----------------------------------|------------------------------|
| | Pressure | Volume |
| A. | (a) attractive forces/subtracted | molecular size/added |
| | Pressure | Volume |
| B. | (b) attractive forces/added | molecular size/subtracted |
| | Pressure | Volume |
| C. | (c) molecular size/subtracted | attractive forces/added |
| | Pressure | Volume |
| D. | (d) molecular size/added | attractive forces/subtracted |

Answer: b



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314. What is the most effective way to condense a gas?

- A. Decrease the temperature and increase the pressure.
- B. Decrease the temperature and decrease the pressure.
- C. Increase the temperature and decrease the pressure
- D. Increase the temperature and increase the pressure.

Answer: a



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315. The volume of real gases often exceed those calculated by the ideal gas equation. These deviations are best attributed to the:

A. attractive forces between the molecules in real gases.

B. dissociation of the molecules in real gases.

C. kinetic energy of the molecules in real gases.

D. volumes of the molecules in real gases.

Answer: d

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316. When the temperature of a sample of H_2S gas is lowered, the pressure decreases more than predicted by the ideal gas equation. To what is this deviation from expected behaviour due?

(P) attractive forces between molecules

(Q) mass of the molecules

(R) Volume of the molecules

A. P only

B. Q only

C. P and R only

D. Q and R only

Answer: a

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317. The third virial coefficient of a real gas $2 \times 10^{-2} (L/mol)^2$. The value of van der Waals' constant 'b' is:

A. 0.1414 L/mol

B. 0.707 L/mol

C. 0.2828 L/mol

D. none of these

Answer: a

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318. Select the incorrect statement(s).

A. At critical conditions, volume occupied by the gas 12 times the volume of 1 mole gaseous molecules

B. A gas can be liquefied above its T_b (Boyle's temperature) by application of pressure.

C. At very high pressure and moderate temperature, the volume of a moles of real gas is equal to $\frac{nRT}{P} + nb$

D. For a real gas, following equation $\left(P + \frac{a}{TV^2}\right)(V - \beta) = RT$, where α and β are constant: Boyle's temperature is $\sqrt{\frac{\alpha}{R\beta}}$

Answer: b



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319. For a real gas, behaving ideally, the pressure may be:

A. $ab V_{\text{molar}}$

B. $\frac{V_{\text{molar}}}{ab}$

C. $\frac{a}{V_{\text{molar}} b}$

D. $\frac{b}{aV_{\text{molar}}}$

Answer: c

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320. The value of 'a' for NH_3 is greater than that of N_2 . This means:

- A. NH_3 has greater size
- B. NH_3 has greater attractions
- C. NH_3 has smaller size
- D. NH_3 has smaller attractions

Answer: b

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321. Attractive forces between non-polar, real gas molecules are:

- A. short-range interactions
- B. inversely proportional to the sixth power of the distance between two interacting particles
- C. Important only at short distance (-500pm)
- D. all of the above

Answer: a



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322. n moles of helium gas are placed in a vessel of volume V Litre, at T K.

If V_1 is free volume of helium then diameter of He atom is:

A. $\left[\frac{3}{2} \frac{V_1}{\pi N_A n} \right]^{1/3}$

B. $\left[\frac{3(V - V_1)}{2\pi N_A n} \right]$

C. $\left[\frac{6(V - V_1)}{\pi N_A n} \right]^{1/3}$

$$D. \left[\frac{6V_1}{nN_A n} \right]^{1/3}$$

Answer: b

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323. Select the incorrect option for van der Waal's gas.

A. He has smaller 'a' (van der Waals' constant) than Ne,Kr,Ar, CO_2 , CH_4

and NH_3

B. He has smaller 'b' (van der Waals' constant) than Ne,Kr,Ar, CO_2 , CH_4

and NH_3

C. At 273K and 1 atm, He molecules have attractions with respect to

ideal behaviour

D. At 273 K and 1 atm He molecules have repulsions with respect to

ideal behaviour

Answer: c

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324. Which relationship does hold good for van der Waals' gas under all conditions where all terms have their usual meaning?

A. $PV = nRT$

B. $\left(P + \frac{a}{n^2V^2}\right)(V - nb) = nRT$

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

D. $\left(P + \frac{a^2n}{V^2}\right)(V - nb) = nRT$

Answer: c

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325. At critical temperature:

A. liquid passes into gaseous state imperceptibly and continuously

B. gas passes into liquid state imperceptibly and continuously

C. surface separating two phases disappears

D. all of the above

Answer: d



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326. Select the incorrect option.

A. At extremely low pressure and high temperature, gases behave ideally.

B. At Boyle's temperature, gases behave ideally in low pressure region.

C. If a gas is kept at $T > T_C$. It can never be liquefied.

D. Gas is more compressible if repulsive forces dominate over attractive forces between molecules.

Answer: d



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327.	Gas	H_2	He	O_2	N_2
	Critical temp. in K	33.2	5.3	154.3	126

From the above data, what would be the order of liquefaction of these gases? Start writing the order for the gas which liquefies first:

- A. H_2, He, O_2, N_2
- B. H_2, O_2, He, N_2
- C. N_2, O_2, He, H_2
- D. O_2, N_2, H_2, He

Answer: d



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328. Critical constants for a real gas are given as

$$T_C = 180K,$$

$$V_C = 0.123 \frac{L}{\text{mole}}$$

$$P_C = 45 \text{ atm,}$$

the correct statement for the real gas is:

A. The actual volume of single gas molecule is $\left(\frac{0.123 \times 10^{-3}}{6023 \times 10^{23}} \right)$

B. $b = 3 \times 0.123 \text{ L mol}^{-1}$

C. The Boyle's temperature is less than 180K

D. Gas cannot be liquefied at 200K

Answer: d



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329. The third virial coefficient of He gas is $4 \times 10^{-2} (\text{L/mol})^2$, then what will be volume of 2 mole He gas at 1 atm and 273 K?

A. 22.0L

B. 44.0L

C. 44.8L

D. 45.2L

Answer: d

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330. If two gases have same value of a but different values of b (a and b are van der Waal's constant) which of the following statement is wrong?

- A. The gas having smaller value of B has larger compressibility
- B. the gas having smaller value of b will occupy lesser volume
- C. The gas having smaller value of b has lesser compressibility
- D. Both a and b

Answer: c

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331. Number of N_2 molecules present in 1 litre of vessel at 1 atm, 273K when compressibility factor is 1.2.

A. 2.23×10^{24}

B. 2.23×10^{22}

C. 2.7×10^{22}

D. 2.7×10^{24}

Answer: b



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332. Statement-1: Distribution pattern of speed will be more uniform for H_2 as compared to O_2 .

Statement-2: Fraction of molecules having speed equal to U_{mps} will be more in case H_2 than O_2 at same T.

- A. Statement-I is True, Statement-II is True : Statement-II is a correct explanation for Statement-I
- B. Statement-I is True, Statement-II is True : Statement-II is *NOT* a correct explanation for Statement-I
- C. Statement-I is True, Statement-II is False.
- D. Statement-I is False, Statement-II is True.

Answer: c

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333. Assertion: Absolute zero temperature is a theoretically possible temperature at which the volume of the gas becomes zero.

Reason: The total kinetic energy of molecules is zero at this temperature.

- A. Statement-I is True, Statement-II is True : Statement-II is a correct explanation for Statement-I

- B. Statement-I is True, Statement-II is True : Statement-II is *NOT* a correct explanation for Statement-I
- C. Statement-I is True, Statement-II is False.
- D. Statement-I is False, Statement-II is True.

Answer: b

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334. Statement-1: 10g of $CaCO_3$ on heating gave 2.27L CO_2 at STP and 0.1 mol non-volatile residue.

Statement-2: Total moles of reactant and products always remain conserved in a chemical reaction.

- A. Statement-I is True, Statement-II is True : Statement-II is a correct explanation for Statement-I
- B. Statement-I is True, Statement-II is True : Statement-II is *NOT* a correct explanation for Statement-I

C. Statement-I is True, Statement-II is False.

D. Statement-I is False, Statement-II is True.

Answer: c

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335. Statement-1: Gas with lower molar mass will effuse or diffuse faster.

Statement-2: Total kinetic Energy of any gas depends upon its molar mass.

A. Statement-I is True, Statement-II is True : Statement-II is a correct explanation for Statement-I

B. Statement-I is True, Statement-II is True : Statement-II is *NOT* a correct explanation for Statement-I

C. Statement-I is True, Statement-II is False.

D. Statement-I is False, Statement-II is True.

Answer: b

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336. Assertion: Pressure exerted by a mixture of gases is equal to the sum of their partial pressure.

Reason: Reacting gases react to form a new gas having pressure equal to the sum of both.

- A. Statement-I is True, Statement-II is True : Statement-II is a correct explanation for Statement-I
- B. Statement-I is True, Statement-II is True : Statement-II is *NOT* a correct explanation for Statement-I
- C. Statement-I is True, Statement-II is False.
- D. Statement-I is False, Statement-II is True.

Answer: c

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337. Statement-1: CH_4 , CO_2 has value of Z (compressibility factor) less than one, generally. Statement-2: $Z < 1$ is due to repulsive forces among the molecules.

- A. Statement-I is True, Statement-II is True : Statement-II is a correct explanation for Statement-I
- B. Statement-I is True, Statement-II is True : Statement-II is *NOT* a correct explanation for Statement-I
- C. Statement-I is True, Statement-II is False.
- D. Statement-I is False, Statement-II is True.

Answer: c



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338. Statement-1: Critical temperature of the gas is the temperature at which it occupies 22.7L of volume.

Statement-2: Molar volume of every gas at STP is 22.7L.

- A. Statement-I is True, Statement-II is True : Statement-II is a correct explanation for Statement-I
- B. Statement-I is True, Statement-II is True : Statement-II is *NOT* a correct explanation for Statement-I
- C. Statement-I is True, Statement-II is False.
- D. Statement-I is False, Statement-II is True.

Answer: c



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339. Statement-1: Excluded volume or co-volume equals to $(V-nb)$ for n moles gas.

Statement-2: co-volume depends on the effective size of gas molecules.

- A. Statement-I is True, Statement-II is True : Statement-II is a correct explanation for Statement-I
- B. Statement-I is True, Statement-II is True : Statement-II is *NOT* a correct explanation for Statement-I
- C. Statement-I is True, Statement-II is False.
- D. Statement-I is False, Statement-II is True.

Answer: d



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340. Statement-1: Gases like N_2, O_2 behave as ideal gases at high temperature and low pressure.

Statement-2: Molecular probable velocity is the velocity possessed by maximum fraction of molecules at the same temperature.

Statement-2: Molecular interactions diminish at high temperature and low pressure.

- A. Statement-I is True, Statement-II is True : Statement-II is a correct explanation for Statement-I
- B. Statement-I is True, Statement-II is True : Statement-II is *NOT* a correct explanation for Statement-I
- C. Statement-I is True, Statement-II is False.
- D. Statement-I is False, Statement-II is True.

Answer: a



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341. Assertion: Most probable velocity is the velocity possessed by maximum fraction of molecules at the same temperature.

Reason: On collision, more and more molecules acquire higher speed at the same temperature.

- A. Statement-I is True, Statement-II is True : Statement-II is a correct explanation for Statement-I
- B. Statement-I is True, Statement-II is True : Statement-II is *NOT* a correct explanation for Statement-I
- C. Statement-I is True, Statement-II is False.
- D. Statement-I is False, Statement-II is True.

Answer: c

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342. Statement-1: Noble gases can be liquefied.

Statement-2: Molecular mass of nitrogen is smaller than that of oxygen.

- A. Statement-I is True, Statement-II is True : Statement-II is a correct explanation for Statement-I

- B. Statement-I is True, Statement-II is True : Statement-II is *NOT* a correct explanation for Statement-I
- C. Statement-I is True, Statement-II is False.
- D. Statement-I is False, Statement-II is True.

Answer: a

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343. Statement-1: The diffusion rate of oxygen is smaller than that of nitrogen under same conditions of T and P.

Statement-2: Molecular mass of nitrogen is smaller than that of oxygen.

- A. Statement-I is True, Statement-II is True : Statement-II is a correct explanation for Statement-I
- B. Statement-I is True, Statement-II is True : Statement-II is *NOT* a correct explanation for Statement-I
- C. Statement-I is True, Statement-II is False.

D. Statement-I is False, Statement-II is True.

Answer: a

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344. Statement-1: The density of an ideal gas doubles when the pressure of the gas is doubled in a closed and rigid system.

Statement-2: Density of an ideal gas is directly proportional to pressure at constant temperature.

A. Statement-I is True, Statement-II is True : Statement-II is a correct explanation for Statement-I

B. Statement-I is True, Statement-II is True : Statement-II is *NOT* a correct explanation for Statement-I

C. Statement-I is True, Statement-II is False.

D. Statement-I is False, Statement-II is True.

Answer: d



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345. Statement-1: The total kinetic energy of vapours formed over liquid $H_2O(l)$ in two closed container A and B having free space 1 litre and 2 litre respectively over $H_2O(l)$ at the same temperature is in the ratio 1:2. (Assuming ideal gas behaviour of vapours).

Statement-2: Vapour pressure of a substance depends only on temperature.

- A. Statement-I is True, Statement-II is True : Statement-II is a correct explanation for Statement-I
- B. Statement-I is True, Statement-II is True : Statement-II is *NOT* a correct explanation for Statement-I
- C. Statement-I is True, Statement-II is False.
- D. Statement-I is False, Statement-II is True.

Answer: a



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346. Statement-1: A gas from a flask is allowed to effuse through a pinhole, rate of effusion decreases linearly with time.

Statement-2: With time, gas pressure in flask decreases.

- A. Statement-I is True, Statement-II is True : Statement-II is a correct explanation for Statement-I
- B. Statement-I is True, Statement-II is True : Statement-II is *NOT* a correct explanation for Statement-I
- C. Statement-I is True, Statement-II is False.
- D. Statement-I is False, Statement-II is True.

Answer: d



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347. At the same temperature and pressure, which of the following will have same kinetic energy per mole as N_2O ?

A. He

B. H_2S

C. CO_2

D. NO_3

Answer: a,b,c,d



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348. At the same T and P, which of the following gases will have the highest average kinetic energy per mole? (at.wt. : H=1,C=12,O=16,S=32,F=19)

A. H_2

B. O_2

C. CH_4

D. SF_6

Answer: a,b,c,d



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349. The van der Waal's gas constant 'a' is given by:

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

B. $3P_C V_C^2$

C. $\frac{1}{8} \frac{RT_C}{P_C}$

D. $\frac{27}{64} \frac{R^2 T_C^2}{P_C}$

Answer: b,d



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350. Critical temperature for a particular gas is -177°C then for which of the following case value of compressibility factor of the gas may be more than unity?

A. At 0°C and 0.01atm

B. AT 0°C and 2000atm

C. At 60°C and 0.01atm

D. At 60°C and 10atm

Answer: b,c,d



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351. A small capillary tube of length 100cm closed at one end is kept horizontally and a mercury column of length 10cm is exactly in the middle. If the atmospheric pressure is 1atm then identify the correct option(s).

- A. The pressure of "air trapped" in the orgina: horizontal position is 750mm of Hg.
- B. The length of the air trapped when the tube is held vertically with open end upwards is $\frac{45 \times 76}{86} \text{ cm}$.
- C. The length of the air trapped when the tube is held vertically with open end downwards is $\frac{45 \times 76}{66} \text{ cm}$.
- D. No air will be trapped when it is held vertically with open end downward.

Answer: b,c



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352. Chlorofluorocarbons such as CCl_3F (molecular mass=137.5) and CCl_2F_2 (molecular mass=121) have been linked to ozone depletion in Antarctica. A research reported that the concentration of these gases are 240 and 800 parts per trillion (10^{12}), by volume respectively. what are the

concentrations of these gases (in moles per litre). under conditions typical of Antarctic stratosphere (200K and 0.05 atm)? ($R=0.08\text{L-atm/K-mol}$)

A. $[CCl_3F] = 7.5 \times 10^{-13} \text{ mol/L}$

B. $[CCl_3F] = 1.75 \times 10^{-12} \text{ mol/L}$

C. $[CCl_2F_2] = 2.5 \times 10^{-12} \text{ mol/L}$

D. $[CCl_2F_2] = 6.6 \times 10^{-12} \text{ mol/L}$

Answer: a,c



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353. A glass tube, of uniform cross section area, is 88cm long. When the tube is horizontal, it contains two air columns AB (10cm) and CD (40cm), separated by mercury column BC (38cm), when the tube is kept vertical with end "A" up, the mercury column moves downward by 5 cm. The correct statement(s) regarding the tube is/are:

- A. End A of tube is open but end D is closed
- B. End A of tube is closed but end D is open.
- C. Both the ends of tube is closed.
- D. When the tube is kept vertical with end D up, the mercury column will move downward by less than 5 cm.

Answer: c,d

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354. A student collected two values of P, V_m for a gas at two different temperature (V_m is the molar volume of gas)

$P \cdot V_m (L - atm)$	20	20
Temperature ($^{\circ}C$)	30	300

He considered the gas ideal. Which of the following correct values, he will get on applying ideal gas equation?

A. $0K = -273^{\circ}C$

B. $0K = -240^{\circ}C$

$$C. R = 0.0821L - \text{atm}/K - \text{mol}$$

$$D. R = 0.0741L - \text{atm}/K - \text{mol}$$

Answer: b,d

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355. The temperature of a certain mass of a gas increased from $37^{\circ}C$ to $38^{\circ}C$. The volume of the gas will.....by $1/273$ of its volume atAssume constant pressure.

A. decrease, $37^{\circ}C$

B. increase, 273K

C. increase, 310K

D. decrease, 273K

Answer: b

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356. For gaseous state which of the following is incorrect?

- A. Thermal energy =Molecular attraction
- B. Thermal energy $>$ $>$ Molecular attraction
- C. thermal energy $<$ $<$ Molecular attraction
- D. Molecular force $>$ $>$ Attraction in liquid.

Answer: a,c,d



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357. The rate of diffusion of 2 gases 'A' and 'B' are in the ratio 16:3. If the ratio of their masses present in the mixture is 2:3, then:

- A. The ratio of their molar masses is 16:1
- B. The ratio of their molar masses is 1:4
- C. The ratio of their moles present inside the container 1:24

D. The ratio of their moles present inside the container 8:3

Answer: b,d

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358. If a gas is allowed to expand at constant temperature then which of the following does not hold true?

- A. the kinetic energy of the gas molecules decreases
- B. the kinetic energy of the gas molecules increases
- C. the kinetic energy of the gas molecules increases
- D. Cannot be predicted unless volumes of the gases are given

Answer: a,b,c,d

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359. Which of the following are correct statements?

- A. van der Waals, constant 'a' is a measure of attractive force
- B. van der Waals' constant 'b' is also called co-volume or excluded volume
- C. b' is expressed in $L\text{mol}^{-2}$
- D. a' is expressed in $\text{atm } L^2\text{mol}^{-2}$

Answer: a,b,c,d



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360. A gas described by van der Waal's equation:

- A. behaves similar to an ideal gas in the limit of large molar volumes
- B. behaves similar to an ideal gas in the limit of large pressures

- C. is characterised by van der Waals' coefficients that are dependent on the identify of the gas but are independent of the temperature
- D. has the pressure that is lower than the pressure exerted by the saem gas behaving ideally.

Answer: a,c,d

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361. 0.28 g of a gas occupies 227 mL at STP. The gas could be:

- A. N_2
- B. CO
- C. C_2H_4
- D. N_2O_4

Answer: a,b,c,d

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362. At constant pressure which of the following does not represent Charles's law?

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

B. $V = T$

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

D. $V \propto d$

Answer: acd



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363. At of the following does not show explicitly the relationship between Boyle's law and Charles' law?

A. $\frac{P_1}{P_2} = \frac{T_1}{T_2}$

B. $PV=K$

$$C. \frac{P_2}{P_1} = \frac{V_1}{V_2}$$

$$D. \frac{V_2}{V_1} = \frac{P_1}{P_2} \times \frac{T_2}{T_1}$$

Answer: abc



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364. Select the correct observation for a 8.21 litre container, filled with 2 moles of He at 300K/

A. It has pressure 6 atm.

B. If it is an open rigid container, its pressure increases to 8 atm on heating to 400K

C. IF it is closed non-rigid (like thin skin balloon), its volume increases to 16.42 lit on heating to 600K.

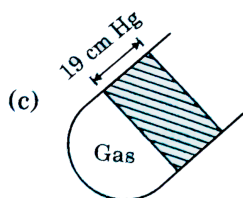
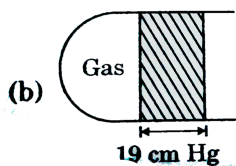
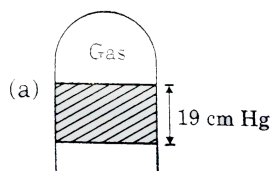
D. When connected with another similar empty container maintained at 150K while maintaining original container at 300 K, pressure

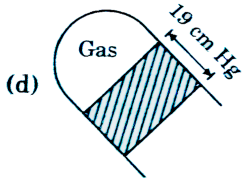
reduced to $\frac{2}{3}$ atm.

Answer: ac

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365. In which of the following case(s) pressure of gas is less or equal to atmospheric pressure?





Answer: abd

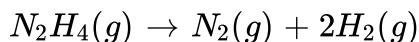
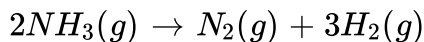
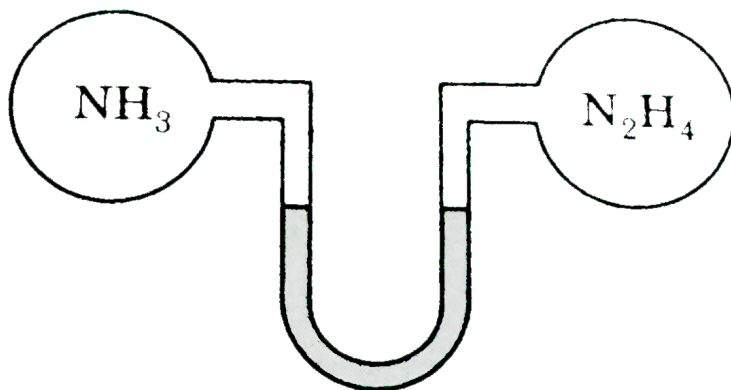
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366. If the difference in the level of Hg in an open arm manometer (One end open to atmosphere and other end is connected to gas chamber) is 6 mm. then what can be the pressure of gas? (Given: $1 \text{ atm} = 1.01325 \times 10^5 \text{ N/m}^2$)

- A. 765mm of Hg
- B. 755 mm of Hg
- C. 765 torr
- D. 700torr

Answer: abc

367. Figure shows a manometer, one arm is connected with a bulb containing NH_3 and other arm containing N_2H_4 both at initial pressure of 1 atm. Initially both arms of manometer contains liquid at same level, what will be difference in level of arms, when 50% $NH_3(g)$ and 75% $N_2H_4(g)$ dissociates according to the given reaction. Assume temperature remains constant?



A. 76 cm if liquid having density 13.6 g/mL is used

- B. 38 cm if liquid having density 27.2 g/mL is used
- C. 152 cm if liquid having density 6.8g/mL is used
- D. 304 cm if liquid having density 3.4g/mL is used

Answer: abcd

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368. Select the incorrect statement(s).

A. The compressibility factor (Z) for H_2 and He is given by equation

$$: Z = 1 + \frac{Pb}{RT}$$

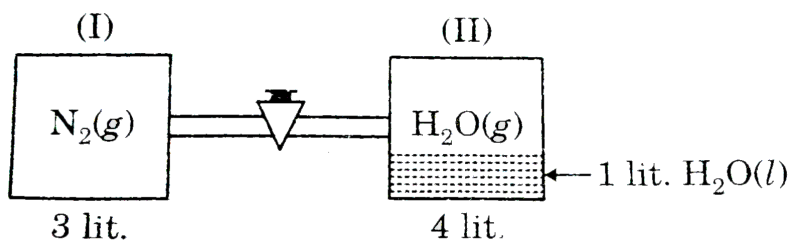
B. At critical temperature all real gases behave like and ideal gas.

C. The compressibility factor for gas at critical state is $\frac{8}{3}$

D. The rms velocity of ideal gas molecule will be doubled if pressure is made four times by decreasing the volume of container.

Answer: bcd

369. Two containers are connected by a tube of negligible volume container (I) has $N_2(g)$ gas at a pressure 4 atm and temperature T (K) and container (II) has 1 litre $H_2O(l)$ at temp (T) initially. Find correct option(s) after stopcock is removed. (Aq. tension=190torr)



- A. Pressure of $N_2 = 2.0$ atm
- B. Total pressure=2.25atm
- C. Total pressure=1.05 atm
- D. Pressure of $H_2O(g)$ is 0.25 atm

Answer: abd

370. According to the van der Waals theory of non-ideal gases, which of the following statements is/are correct?

- A. H_2 and He are impossible to liquefy at room temperature
- B. For NH_3 , Z decreases more rapidly on increasing pressure than methane in the lower pressure region.
- C. In the low pressure region Z decreases on increasing pressure. H_2 and He are exceptions to that.
- D. In the high pressure region Z increases with increasing pressure, H_2 and He are exceptions to that.

Answer: abc

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371. When an equimolar mixture of two gases A and B [$M_A > M_B$] is allowed to effuse through a pin hole :

A. B comes out at a faster rate

B. relative rate of effusion of A increases with time

C. rate of effusion of B will always be greater

D. Initially, with equal molar ratio, rate of effusion of B is greater than rate of effusion of A.

Answer: abd

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372. Which of the following statement(s) is/are correct?

A. In the van der Waal's equation of state

$\left(P + \frac{a}{V_m^2}\right)(V_m - b) = RT$ for NH_3 and N_2 . The value of 'a' for

NH_3 is larger than that of N_2

B. Pressure exerted by real gas is lesser than that exerted by ideal gas under all conditions.

C. At high pressure, repulsive forces predominate in real gases.

D. If a real gas follows the equation $P(V_m - b) = RT$, it can easily be liquefied.

Answer: ac

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373. For one mole of any van der Waal's gas $a = 0.27 \text{ atm-litre}^2 / \text{mol}^2$ and $b = 1.218 \text{ cm}^3 / \text{mol}$. Select the correct statement(s).

A. At 600°C and 680 atm, it will exist in gaseous form.

B. At 400°C and 6800 atm, it will exist in liquid form.

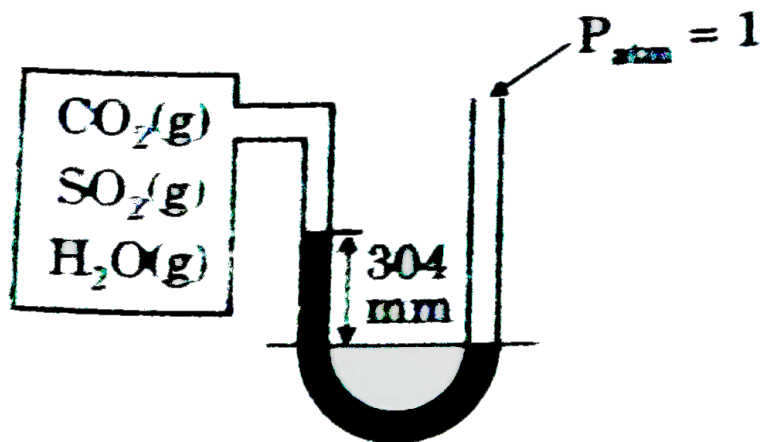
C. At 2700K and low pressure, compression factor ' Z ' < 1 .

D. At 2700 K and low pressure, compression factor ' Z ' > 1 .

Answer: ab

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374. A 82.1 L container connected with manometer contains mixture of CS_2 and H_2S gases and added with required amount of oxygen to form to CO_2 , SO_2 and $H_2O(g)$ at $227^\circ C$. Final conditions of manometer is shown.



- A. Moles of CS_2 originally present is 0.3
- B. Moles of CS_2 originally present is 0.2
- C. Moles of H_2S originally present is 0.3
- D. Total pressure after combustion is 0.6 atm

Answer: bcd



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375. For a real gas, following equation $\left(P + \frac{a}{TV_m^2}\right)(V_m - \beta) = RT$,

where α and β are positive constants. Select the correct option(s):

A. $T_C = \frac{8\alpha}{27R\beta}$

B. $V_{cm} = 3\beta$

C. Second virial coefficient $= \beta - \frac{\alpha}{RT}$

D. Third virial coefficient $= \beta^2$

Answer: bd



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376. Two bulbs of volumes 200 cm^3 and 100 cm^3 are connected by a short tube containing an insulating porous plug that permits equalization of pressure but not of temperature between the bulbs. The system is sealed at 77°C when it contains oxygen under a pressure of 1 bar. The small

bulb is immersed at 27°C and the large bulb is placed at 127°C .

Neglecting thermal expansion of the bulbs, select the correct options.

- A. Final pressure inside the system would be greater than 1 bar
- B. Final pressure inside the system would be less than 1 bar
- C. Number of moles of O_2 would increase in small container compared to initial
- D. Number of moles of O_2 would increase in big container compared to initial

Answer: ac

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377. van der Waal's equation of state for real gases may be written as:

$$PV_m = RT \left(1 + \frac{B}{V_m} + \frac{C}{V_m^2} + \dots \right)$$

Select the correct statement(s).

A. B' and C are temperature dependent.

B. B' is temperature dependent while 'C' is temperature independent.

C. B' may be positive negative or zero.

D. B' may be positive and 300 K is performing 4×10^9 collisions per sec per O_2 molecule. Select the correct statement(s): Given:

$$[N_A = 6 \times 10^{23}]$$

Answer: bc

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378. For $O_2(g)$ at 1 atm and 300K is performing 4×10^9 collisions per sec per O_2 molecule. Select the correct statement

A. $[O_2] = 0.042M$

B. Number density = 2.3×10^{22} molecuels/ m^3

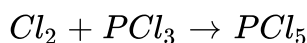
C. $u_{avg} = \sqrt{\frac{8 \times 0.0821 \times 300}{32}} cm / s$

$$D. \text{ Mean free path } (\lambda) = \frac{\sqrt{\frac{8 \times 8.314 \times 300}{3.14 \times 0.032}}}{4 \times 10^9} m$$

Answer: ad

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379. If Cl_2 and PCl_3 can react to form PCl_5 according to following reaction



In tube A, 355 gm Cl_2 is taken and in tube B, 1375 gm PCl_3 is taken. When half the mass of gas in tube A is transferred to B, reaction took place in B.

After the reaction is complete, half of the mass of mixture in B is again transferred to A to cause same reaction in container A. (no reversibility)

Select the correct option(s).

- A. Tube A contains 3.75 moles of PCl_5 and 1.25 moles of PCl_3 finally.
- B. Tube A contains 2.5 moles of Cl_2 and 1.25 moles of PCl_5 finally
- C. Tube B contains 3.75 moles of PCl_3 and 1.25 moles of PCl_5 finally

D. None of the above

Answer: ac



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380. Choose the correct statement(s) among the following.

- A. Average molecular speed of gases omcreases wotj decrease in fraction of molecules moving slowly.
- B. Rate of effusion of gases increases with increase in collision frequency at constant volume.
- C. Rate of effusion is inversely proportional to molecular weight of gas.
- D. Mean free path does change with change in temperature at constant pressure.

Answer: ab



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381. Choose the correct alternative (more than one may be correct)

(B.M.C.=Bimolecular collision)(at constantV) (n-is constant throughout).

A. λ is constant.

B. BMC made by 1 molecule per second is directly proportional to $\sqrt{\bar{P}}$.

C. BMC for all the molecules per unit volume is directly proportional

to $T^{3/2}$

D. None of the above

Answer: ab



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382. Select the correct option.

- A. Gas is more compressible, if repulsive forces dominate over attractive forces between molecules.
- B. At extremely low pressure and high temperature gases behave ideally.
- C. At Boyle's temperature gases behave ideally in low pressure region.
- D. If a gas is kept at $T > T_C$. It can never be liquefied.

Answer: bcd

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383. A closed vessel at temperature T contains a mixture of two diatomic gases A and B. Atomic mass of A is 16 times that of B and mass of gas A contained in the vessel is 2 times that of B. which of the following statements are correct?

- A. Average kinetic energy per molecule of A is equal to that of B.
- B. Root mean square velocity of B four times that of A.

C. Pressure exerted by B is eight times of that of A.

D. Number of molecules of B, in cylinder, is eight times that A,.

Answer: abcd

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384. Select the correct option(s) for an ideal gas.

A. Most probable speed increases with increase in temperature

B. Fraction of particles moving with most probable speed increases with increase in temperature

C. Fraction of particles moving with most probable speed are more for Cl_2 than H_2 under similar conditions of T,P andV

D. Most probable speed is more for Cl_2 than H_2 at same temperature.

Answer: ac

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385. According to kinetic theory of gases, for a diatomic molecule which is (are) not correct?

- A. The pressure exerted by the gas is directly proportional to the mean speed of the molecule
- B. The pressure exerted by the gas is directly proportional to the root mean square speed of the molecule.
- C. The root mean square speed of the molecule is inversely proportional to the temperature.
- D. The mean translational kinetic energy of the molecule is proportional to the absolute temperature.

Answer: abc



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386. Choose the incorrect statement.

- A. Rate of effusion of gas is inversely proportional to the molecular weight of gas.
- B. Mean free path of gases decreases with increase in temperature at constant volume.
- C. Partial pressure of gas does not change on addition of another gas in the same container at constant volume and temperature.
- D. Compressibility of real gases are always more than ideal gases.

Answer: abd



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387. Which of the following are correct for real gases?

- A. Value of 'a' is measure of magnitude of intermolecular attractive forces within the gas and is independent of temperature and pressure.
- B. Repulsive interactions between molecules are short range interaction and are significant when molecules are almost in contact.
- C. Boyle point of a real gas depends upon nature of gas.
- D. Real gases show ideal behavior when conditions of temperature and pressure are such that the intermolecular forces are practically negligible.

Answer: abcd



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388. 5 moles gas are introduced in 1 litre container at $47^{\circ}C$. Select the correct option(s).

[R=0.08litre-atm/mol-K]

- A. Pressure would be 128 atm if it behaves ideally
- B. pressure would be 28 atm if it follows van der Waals' equation, $a=4$ atm-litre² / mol² and $b=0$
- C. Pressure would be 33.33 atm if it follows van der Waals' equation , $a=4$ atm-litre² / mol² and $b=0.04$ L/mole
- D. Pressure would be 160 atm if it follows van der Waal's equation, $a=0$ atm– litre² / mol² and $b=0.04$ L/mole

Answer: abd

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389. 1 mol N_2 and 3 mol H_2 are introduced in 8.21 litre container initially at $27^\circ C$ where no chemical reaction takes place. Select the correct statement(s).

A. Partial pressure of N_2 is 12 atm

B. Partial pressure of N_2 is 3 atm

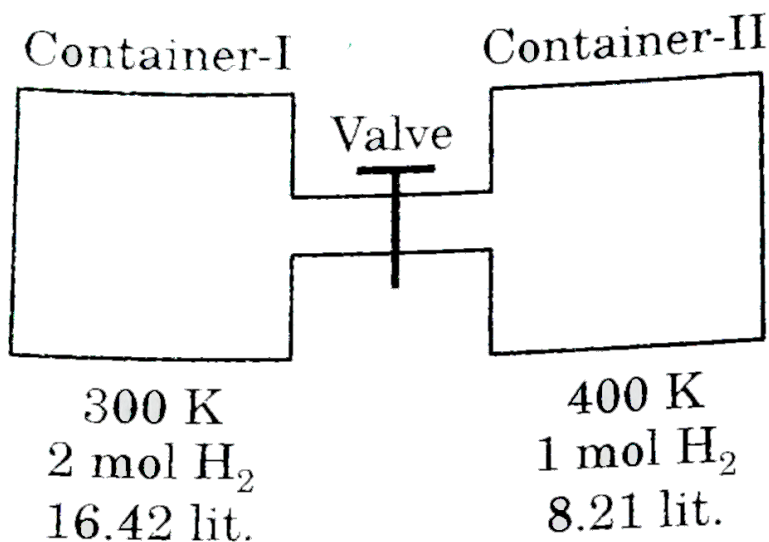
C. Total pressure is 9 atm.

D. If temperature is increased to 600K and NH_3 formation takes place with 100% yield then total pressure developed is 12 atm.

Answer: bd

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390. Select the correct option(s)

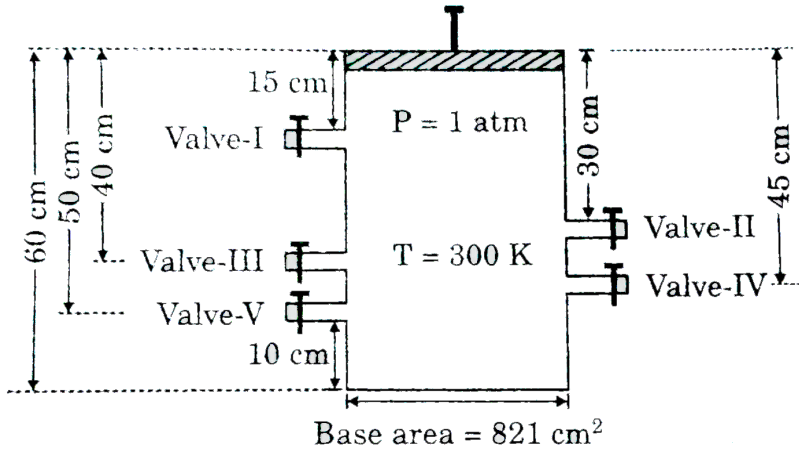


- A. Pressure in container-I is 3 atm before opening the valve.
- B. Pressure after opening the valve is 3.57 atm.
- C. Moles in each compartment are same after opening the valve.
- D. Pressure in each compartment are same after opening the valve.

Answer: ad

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391. A container fitted with frictionless massless piston consists of five valves -I,II,III,IVandV. These valves open automatically if pressure exceed over 1.5,2.2,2.5,4.4 and 4.8 atm respectively Under diagram) system is in sate of equilibrium. Piston is now presisted in downward direction very slowly. [Note: Consider the diameter of valve tube negligible and temperature remains constant.]



Select the correct option(s)

A. Valve-II will be opened first.

B. As the piston crosses the valve which will be opened first, the remaining number of moles in container are $\frac{5}{3}$.

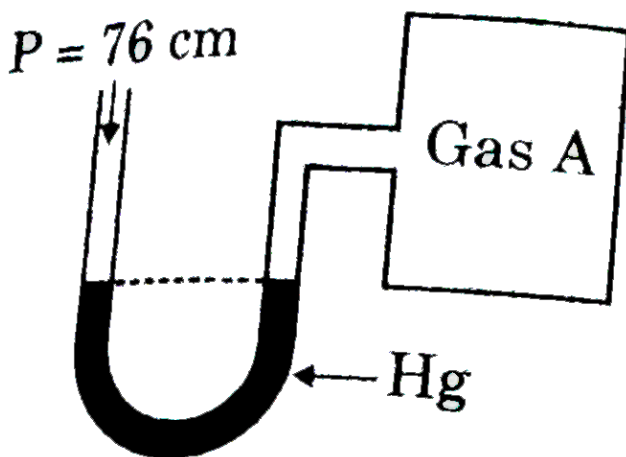
C. Valve-V will be second valve which open.

D. Number of moles will zero as piston crosses Valve-V.

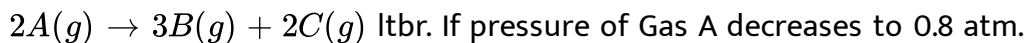
Answer: bc

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392. An 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:



Then:

(Assume temperature to be constant at 300K)

- A. total pressure increased by 1.3 atm
- B. total pressure increased by 0.3 atm
- C. total pressure increased by 22.3 cm of Hg

D. difference in mercury level is 228mm

Answer: bd

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393. According to kinetic theory of gases:

A. collisions are always elastic

B. heavier molecules transfer more momentum to the wall of the container.

C. only a small number of molecules have very high velocity

D. between collisions, the molecules move to straight lines with constant velocities

Answer: acd

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394. Choose the correct statement(s) for real gases.

- A. Real gases do not follow ideal gas equation perfectly under all conditions.
- B. At very high pressure, the measured volume is more than calculated volume.
- C. At low pressure measured and calculated volumes approach each other.
- D. Real gas can never be liquified.

Answer: abc



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395. Which of the assumptions/postulates of kinetics theory does not hold good for a real gas?

- A. There is no force of attraction between the molecules of a gas.

- B. Volume of the molecules of a gas is negligibly small in comparison to the space occupied by the gas.
- C. Particles of a gas are always in constant and random motion/
- D. Collisions of gas molecules are perfectly elastic.

Answer: ab

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396. If distance between 2 molecules is r then $\lim_{r \rightarrow \infty} \frac{1}{r^x}$ will result in which of the following equations to be true/applicable?

- A. $Z=1$
- B. $Z < 1$
- C. $Z > 1$
- D. $PV_m = RT$

Answer: ad

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397. Choose the correct statement(s) regarding Boyle's point.

A. It depends on nature of gas.

B. Above this point, real gas show positive deviations from ideality and

$$Z < 1.$$

C. Below Boyle's point, real gas first show decrease in Z value with increasing pressure to reach a minimum value.

D. On further increase in pressure, the value of Z increases continuously.

Answer: acd

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398. According to ideal gas equation $\frac{PV}{nT}$ for gas will always be constant and the constant is same for all gases. The constant represented as R is termed as universal gas constant has a value equal to 0.0821 atm-lit/mol-K. Another constant Boltzmann constant is defined as $\frac{R}{N_A} = k$ where N_A represents Avogadro's number. The value of $\frac{PV}{kT}$ will give:

- A. number of moles of gas
- B. density of gas
- C. number of molecules of gas
- D. mass of gas

Answer: c



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399. According to ideal gas equation $\frac{PV}{nT}$ for gas will always be constant and the constant is same for all gases. The constant represented as R is termed as universal gas constant has a value equal to 0.0821 atm-lit/mol-

K. Another constant Boltzmann constant is defined as $\frac{R}{N_A} = k$ where N_A represents Avogadro's number.

The value of R in terms of bar · mL/mole-Kelvin will be:

A. 0.0821

B. 82.1

C. 83.18

D. $\frac{82.1}{1.01325}$

Answer: c



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400. According to ideal gas equation $\frac{PV}{nT}$ for gas will always be constant and the constant is same for all gases. The constant represented as R is termed as universal gas constant has a value equal to 0.0821 atm·lit/mol·K. Another constant Boltzmann constant is defined as $\frac{R}{N_A} = k$ where N_A represents Avogadro's number.

A container of volume 40 litres consists of some gas at a pressure of 2

atm and temperature of 300 K it is heated to 400 K such that half of the gas escapes and volume changes to 60 litres The new pressure of the gas at final condition will be:

A. 2 atm

B. 1 atm

C. $\frac{8}{9}$ atm

D. $\frac{9}{8}$ atm

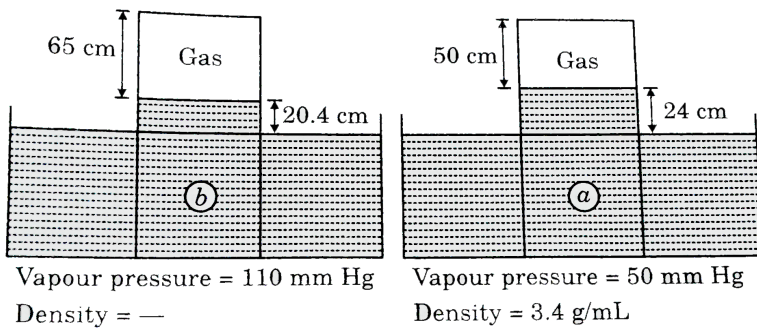
Answer: c



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401. If same amount of gas is trapped over liquid (a) and liquid (b) in following container4s. Assuming temperature and cross-sectional area of container are same.

$$P_{\text{atm}} = 760\text{mmHg}, d_{\text{Hg}} = 13.6\text{g/mL}$$



If same amount of gas is trapped over liquid (a) and liquid (b) in following containers. Assuming temperature and cross-sectional area of container are same. $P_{atm} = 760\text{mmHg}$, $d_{Hg} = 13.6\text{g/mL}$

Find the pressure (in cm Hg) of gas over liquid (a)

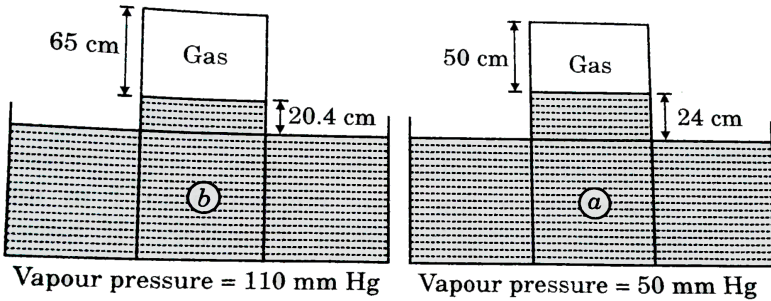
- A. 76 cm
- B. 11 cm
- C. 50 cm
- D. 65 cm

Answer: d

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402. If same amount of gas is trapped over liquid (a) and liquid (b) in following containers. Assuming temperature and cross-sectional area of container are same. $P_{atm} = 760\text{mmHg}$, $d_{Hg} = 13.6\text{g/mL}$

Find the pressure (in cm Hg) of gas over the liquid (b).



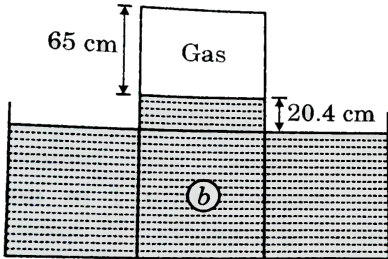
- A. 76 cm
- B. 11 cm
- C. 50 cm
- D. 65 cm

Answer: c

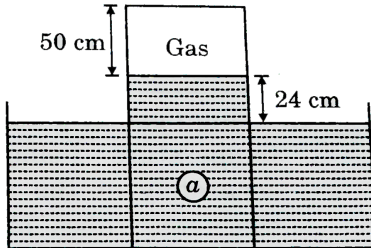
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403. If same amount of gas is trapped over liquid (a) and liquid (b) in following containers. Assuming temperature and cross-sectional area of container are same. $P_{atm} = 760\text{mmHg}$, $d_{Hg} = 13.6\text{g/mL}$

The density of liquid (b) will be:



Vapour pressure = 110 mm Hg
Density = —



Vapour pressure = 50 mm Hg
Density = 3.4 g/mL

- A. 5g /
- B. 10g /
- C. 15g /
- D. 20g /

Answer: b



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404. Equal masses (W gram each) of three non-reacting gases X, Y and Z were mixed in sealed rigid container and total pressure at a given temperature T was found to be ' P ' atmosphere. Now ' $2W$ ' gram of X is further added to same container and temperature was raised to ' $2T$ '. At ' $2T$ ' temperature new pressure was found to be ' $4P$ ' atmosphere. Now ' $3W$ ' gram of Y was added further and temperature was raised to ' $4T$ '. New pressure was found to be ' $12P$ '.

Based on above information lightest and heaviest gases are respectively:

- A. Y, Z
- B. X, Z
- C. X, Y
- D. Z, X

Answer: b



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405. Equal masses (W gram each) of three non-reacting gases X, Y and Z were mixed in sealed rigid container and total pressure at a given temperature T was found to be ' P ' atmosphere. Now ' $2W$ ' gram of X is further added to same container and temperature was raised to ' $2T$ '. At ' $2T$ ' temperature new pressure was found to be ' $4P$ ' atmosphere. Now ' $3W$ ' gram of Y was added further and temperature was raised to ' $4T$ '. New pressure was found to be ' $12P$ '.

Partial pressure of X and Y after adding ' $2W$ ' gram of X in container are respectively

A. $P, \frac{P}{3}$

B. $2P, \frac{P}{6}$

C. $2P, \frac{P}{3}$

D. $3P, \frac{2P}{3}$

Answer: d



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406. Equal masses (W gram each) of three non-reacting gases X, Y and Z were mixed in sealed rigid container and total pressure at a given temperature T was found to be ' P ' atmosphere. Now ' $2W$ ' gram of X is further added to same container and temperature was raised to ' $2T$ '. At ' $2T$ ' temperature new pressure was found to be ' $4P$ ' atmosphere. Now ' $3W$ ' gram of Y was added further and temperature was raised to ' $4T$ '. New pressure was found to be ' $12P$ '.

In final conditions partial pressure of 'Z' is:

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

B. $\frac{3P}{4}$

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

D. $\frac{P}{6}$

Answer: c



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407. The constant motion and high velocities of gas particles lead to some important practical consequences. One such consequence is that gases mix rapidly when they come in contact. The mixing of different gases by random molecular motion and with frequent collisions is called diffusion. A similar process in which gas molecules escape through a tiny hole into vacuum is called effusion.

Helium gas at 1 atm and SO_2 at 2 atm pressure, temperature being the same, are released separately at the same moment into 1 m long evacuated tubes of equal diameters. If helium reaches the other end of the tube in t sec, what distance SO_2 would traverse in the same time interval in the other tube?

- A. 25 cm
- B. 50 cm
- C. 60 cm
- D. 75 cm

Answer: b



408. The constant motion and high velocities of gas particles lead to some important practical consequences. One such consequence is that gases mix rapidly when they come in contact. The mixing of different gases by random molecular motion and with frequent collisions is called diffusion. A similar process in which gas molecules escape through a tiny hole into vacuum is called effusion.

4 g of H_2 effused through a pinhole in 10 sec at constant temperature and pressure. The amount of oxygen effused in the same time interval and at the same conditions of temperature and pressure would be

- A. 4 g
- B. 8 g
- C. 16 g
- D. 32 g

Answer: c



409. The constant motion and high velocities of gas particles lead to some important practical consequences. One such consequence is that gases mix rapidly when they come in contact. The mixing of different gases by random molecular motion and with frequent collisions is called diffusion. A similar process in which gas molecules escape through a tiny hole into vacuum is called effusion.

For 10 min each at 27°C from two identical bulbs, helium and an unknown gas X at equal pressure are leaked into a common vessel of 3L capacity. The resulting pressure is 4.1 atm and the mixture contains 0.4 mol of helium. The molar mass of gas X is

- A. 16
- B. 32
- C. 64
- D. none of these

Answer: c



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410. For a non-ideal gas, the compressibility factor (Z) is defined as

$$Z = \frac{PV_m}{RT}, V_m = \text{molar volume}$$

Compressibility of an unknown gas at 600 K and 1.0 atm was found to be

1.2 Also, this gas was found to effuse 1.58 times slower than the pure

methane gas under identical conditions Take $R = 0.0821 \text{ L-atm-}$

$\text{mol}^{-1}\text{k}^{-1}$

Density of the gas in the above mentioned experimental condition is:

A. 0.98gL^{-1}

B. 0.68gL^{-1}

C. 1.02gL^{-1}

D. 1.47gL^{-1}

Answer: b



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411. For a non-ideal gas, the compressibility factor (Z) is defined as

$$Z = \frac{PV_m}{RT}, V_m = \text{molar volume}$$

Compressibility of an unknown gas at 600 K and 1.0 atm was found to be

1.2 Also, this gas was found to effuse 1.58 times slower than the pure

methane gas under identical conditions Take $R = 0.0821 \text{ L-atm-}$

$\text{mol}^{-1}\text{k}^{-1}$

Molar volume of the gas in the given experimental condition is:

A. 41.0 L

B. 39.4 L

C. 59.1 L

D. 27.3 L

Answer: c



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412. Ideal gas is defined as a gas whose molecules move independent of each other without any net force between them. Also molecules//atoms of ideal gas are assumed to be like point masses with negligible size. But real gas molecules have net force between them and have a finite size which may or may not be negligible.

Two samples of O_2 (g) having equal moles at 1 atm and 0° C are heated at constant volume to 27° C Assuming both samples are ideal at 0° C but at 27° C one is ideal and another is real which of the following is correct?

- A. Final pressure is more for real gas
- B. Final pressure is more for ideal gas
- C. Final pressure is equal in both cases
- D. Cannot predict

Answer: b



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413. Ideal gas is defined as a gas whose molecules move independent of each other without any net force between them. Also molecules//atoms of ideal gas are assumed to be like point masses with negligible size. But real gas molecules have net force between them and have a finite size which may or may not be negligible.

In the above given experiment if helium gas was used in both samples which sample would have greater final pressure?

- A. Ideal gas
- B. Real gas
- C. Equal in both samples
- D. Cannot predict

Answer: b



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414. Two bulbs 'X' and 'Y' of equal volumes are connected through a stop cock. Each bulb contained 9.6 g of dioxygen gas at 0.4 atm pressure and 300 K. The first bulb 'X' is then heated to 500K keeping bulb 'Y' at 300 K.

Final pressure in bulb 'X' is:

- A. 0.2 atm
- B. 0.3 atm
- C. 0.5 atm
- D. 0.75 atm

Answer: c



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415. Two bulbs 'X' and 'Y' of equal volumes are connected through a stop cock. Each bulb contained 9.6 g of dioxygen gas at 0.4 atm pressure and 300 K. The first bulb 'X' is then heated to 500K keeping bulb 'Y' at 300 K.

Final number of moles of dioxygen in vessel 'Y' would be:

A. 0.225

B. 0.275

C. 0.375

D. 0.425

Answer: c



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416. The process by which a gas passes through a small hole into vacuum is called effusion. The rate of change of pressure(p) of a gas at constant temperature due to effusion of gas from a vessel of constant volume can be related to rate of change of number of molecules by the expression:

$$\frac{dp}{dt} = \frac{kT}{V} \left(\frac{dN}{dt} \right)$$

where rate of change of number of molecules

$$\Rightarrow - \left(\frac{dN}{dt} \right) = \frac{pA_0}{(2\pi mkT)^{1/2}}$$

where k =Boltzmann constant

N_A = Avogadro's number

T= Temperature (in K)

V= volume of vessel

N=Number of molecules

A_0 = Area of aperture

m=Mass of single molecule

$$\gamma = \frac{V}{A_0} \sqrt{\frac{2\pi m}{kT}}$$

If 2 g of SO_2 effuses from given container in 10 sec then, mass of He effusing out in 30 seconds under identical conditions will be:

A. 6 g

B. 3 g

C. 1.5 g

D. 0.75 g

Answer: c



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417. The process by which a gas passes through a small hole into vacuum is called effusion. The rate of change of pressure(p) of a gas at constant temperature due to effusion of gas from a vessel of constant volume can be related to rate of change of number of molecules by the expression:

$$\frac{dp}{dt} = \frac{kT}{V} \left(\frac{dN}{dt} \right)$$

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where k =Boltzmann constant

N_A = Avogadro's number

T = Temperature (in K)

V = volume of vessel

N =Number of molecules

A_0 = Area of aperture

m =Mass of single molecule

$$\gamma = \frac{V}{A_0} \sqrt{\frac{2\pi m}{kT}}$$

In 1 m long tube at one end He is introduced while from other end SO_2 is introduced under identical conditions Gas will first meet from He and at a distance:

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

B. $\frac{1}{5}$ m

C. $\frac{3}{5}$ m

D. $\frac{4}{5}$ m

Answer: d



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418. A container is divided into two compartments. One compartment contains 2 moles of N_2 gas at 1 atm and 300 K and other compartment contains H_2 gas at the same temperature and pressure. Volume of H_2 compartment is four times the volume of N_2 compartment [Assuming no reaction under these conditions]

Calculate the final total pressure if partition between two compartments is removed.

A. 2 atm

B. 3 atm

C. 1 atm

D. 1.5 atm

Answer: c



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419. A container is divided into two compartments. One compartment contains 2 moles of N_2 gas at 1 atm and 300 K and other compartment contains H_2 gas at the same temperature and pressure. Volume of H_2 compartment is four times the volume of N_2 compartment [Assuming no reaction under these conditions]

If the container containing N_2 and H_2 are further heated to 1000 K, forming NH_3 with 100% yeild calculate the final total pressure.

A. 2.22 atm

B. 3 atm

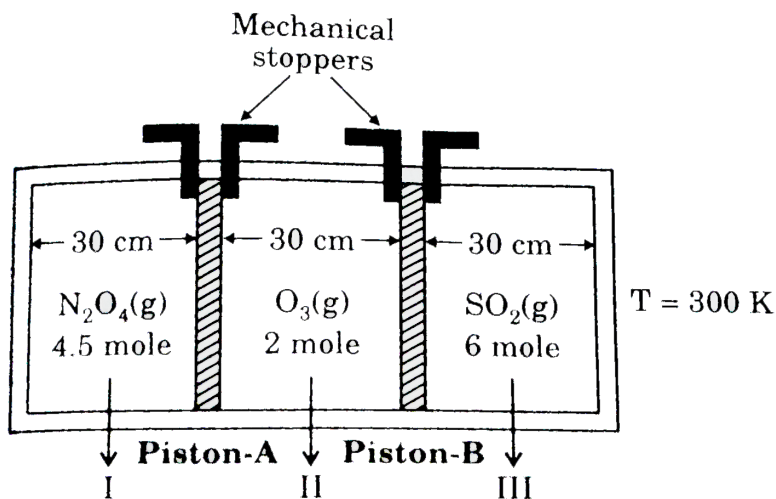
C. 2 atm

D. 3.33 atm

Answer: c

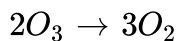
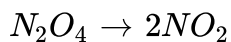
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420. The figure shows initial conditions of a uniform cylinder with frictionless pistons A and B held in shown position by mechanical stoppers.



If the mechanical stoppers holding piston A and B as shown in figure are removed and in the mean time N_2O_4 and O_3 gases separately undergo

following reaction completely [Assume that temperature remains constant]



Which statement is incorrect after attaining final equilibrium state?

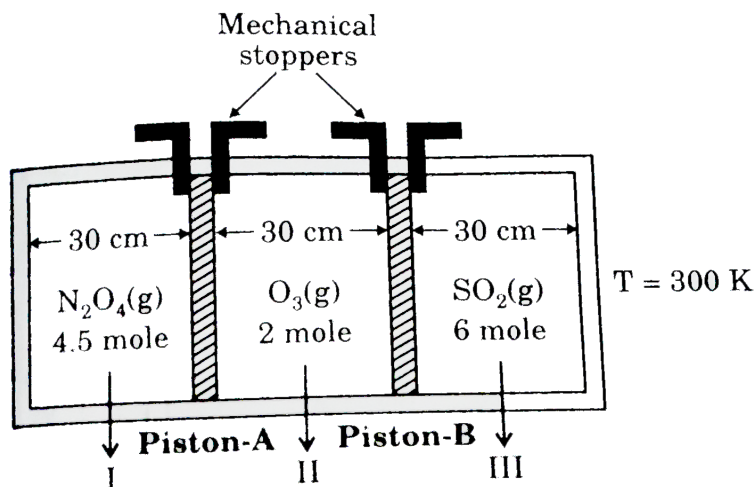
- A. Position of piston A is 45 cm from left end
- B. Position of piston B is 60 cm from left end
- C. Total moles of gases in all compartments is 18.
- D. Position 'B' final and initial position are different

Answer: d

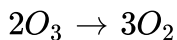
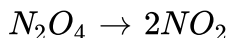


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421. The figure shows initial conditions of a uniform cylinder with frictionless pistons A and B held in shown position by mechanical stoppers.



If the mechanical stoppers holding piston A and B as shown in figure are removed and in the mean time N_2O_4 and O_3 gases separately undergo following reaction completely [Assume that temperature remains constant]



Which statement is correct after all the pistons have attained their final positions (assume σ to be same for all gases)?

A. Z_{11} will be highest for molecules of gas in compartment 1

B. Mean free path will be longest for molecules of gas in compartments 2

C. Z_{11} will be same for all gases

D. Mean free path will be same for molecules of gas in all compartments

Answer: d

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422. A gaseous mixture comprising of equal moles of $H_2/O_2/M$ (M mass=128) was subjected to series of effusion steps. What will be the number effusion steps required so as to change the composition to:

One in which lightest: Heaviest gas is 4096:1 What will be the composition of this mixture (w.r.t all the gases)?

A. 4,4096:16:1

B. 6, 4096×64 :64:1

C. 4,2048:8:1

D. 5, 4096:16:1

Answer: a



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423. A gaseous mixture comprising of equal moles of $H_2/O_2/M$ (M mass=128) was subjected to series of effusion steps. What will be the number effusion steps required so as to change the composition to: One in which $H_2:O_2$ is 4096:1. What will be the composition of this mixture (w.r.t. all the gases)?

A. 4,4096:16:1

B. 6, $4096 \times 64:64:1$

C. 4,2048:8:1

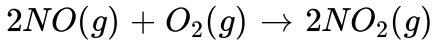
D. 5,4096:16:1

Answer: b

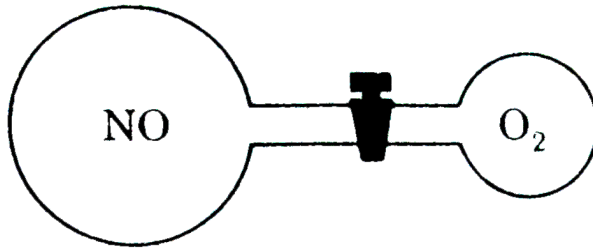


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424. Nitric oxide (NO) reacts with molecular oxygen as follows:



Initially NO and O_2 are separated as shown below. When the valve is opened the reaction quickly goes to completion. Assume that the temperature remains constant at 27°C [$R = 0.08\text{atmlit}/\text{mol}/\text{K}$]



4L at 0.5 atm
and 300 K

2L at 1 atm
and 300 K

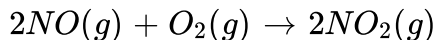
Number of moles of NO_2 after reaction in 4 L container is:

- A. $\frac{1}{24}$
- B. $\frac{1}{18}$
- C. $\frac{1}{22}$
- D. $\frac{1}{12}$

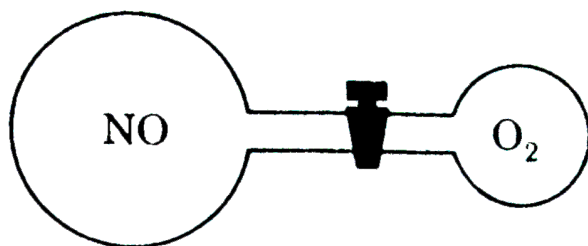
Answer: b



425. Nitric oxide (NO) reacts with molecular oxygen as follows:



Initially NO and O_2 are separated as shown below. When the valve is opened the reaction quickly goes to completion. Assume that the temperature remains constant at 27°C [$R = 0.08\text{atmlit}/\text{mol}/\text{K}$]



4L at 0.5 atm
and 300 K

2L at 1 atm
and 300 K

The pressure of O_2 in 2L container after reaction is:

A. $\frac{1}{6}$

B. 0

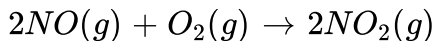
C. $\frac{1}{3}$

D. none of these

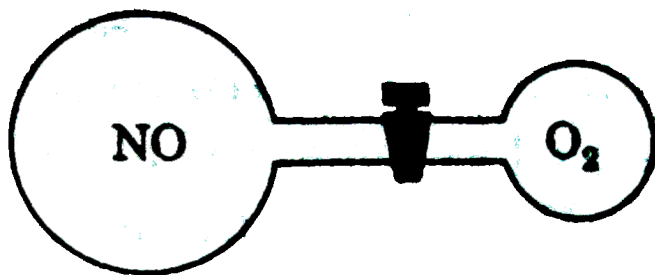
Answer: a

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426. Nitric oxide (NO) reacts with molecular oxygen as follows:



Initially NO and O_2 are separated as shown below. When the valve is opened the reaction quickly goes to completion. Assume that the temperature remains constant at 27°C [$R = 0.08\text{atmlit}/\text{mol}/\text{K}$]



**4L at 0.5 atm
and 300 K**

**2L at 1 atm
and 300 K**

The ratio of partial pressure of NO_2 in 4L container to 2L container is:

A. 1

B. 2

C. 3

D. 0.5

Answer: a



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427. Under a given condition, it is found that two separate gases effuse out of two separate containers in such a way that they follow the equation

$$\frac{dN}{dt} = -K_1N \text{ and } \frac{dN}{dt} = -K_2NK_1 = 6.93 \times 10^{-2} \text{ sec}^{-1}. K_2 = 6.93 \times 10^{-2} \text{ sec}^{-1}$$

where N is no of molecule remaining in the container.

Which one of the following may represent fraction of number of molecules present after the given interval for gas-I?

A. $t = 0$ $t = 100 \text{ sec}$ $t = 200 \text{ sec}$

$$1 \frac{1}{2} \frac{1}{8}$$

$$B. t = 0t = 100 \text{ sec } t = 200 \text{ sec}$$

$$1 \frac{1}{8} \frac{1}{16}$$

$$C. t = 0t = 100 \text{ sec } t = 200 \text{ sec}$$

$$1 \frac{1}{2} \frac{1}{4}$$

$$D. t = 0t = 100 \text{ sec } t = 200 \text{ sec}$$

$$1 \frac{1}{4} \frac{1}{16}$$

Answer: c



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428. Under a given condition, it is found that two separate gases effuse out of two separate containers in such a way that they follow the equation

$$\frac{dN}{dt} = -K_1N \text{ and } \frac{dN}{dt} = -K_2NK_1 = 6.93 \times 10^{-2} \text{ sec}^{-1}. K_2 = 6.93 >$$

where N is no of molecule remaining in the container.

Identify the correct option regarding sequence of (True) and (False) statements

(i) The time required for moles of gas I to get reduced to half of original and that of gas II to be reduced to half of original is independent of initial moles of gas I and gas II.

(ii) The rate at which initially molecules will come out in gas I as compared to gas II will be greater in gas II if initial number of molecules are same.

(iii) The time required for moles to get reduced from 1 to 0.8 in gas I and 2 to 1.6 in gas II will be same.

(iv) for the two gases, moles remaining in the container after some interval should be in Geometrical Progression.

A. TFFT

B. FTFT

C. FTFT

D. TTFF

Answer: a



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429. For the data

Gaseous Substance	T_C/K	P_C/bar	V_C/dm³ mol
<i>A</i>	33.2	13	0.065
<i>B</i>	5.3	2.3	0.058
<i>C</i>	126	34	0.090
<i>D</i>	154	50	0.074
<i>E</i>	304	74	0.096
<i>F</i>	647	221	0.045
<i>G</i>	406	113	0.072

IF temperature is decreased from a very high value which will start liquefying at 3rd position?

- A. G
- B. F
- C. A
- D. E

Answer: d



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430. For the data

For which gas is Z expected to be > 1 always?

Gasous Substance	T_C/K	P_C/bar	$V_C/\text{dm}^3\text{mol}^{-1}$
A	33.2	13	0.065
B	5.3	2.3	0.058
C	126	34	0.090
D	154	50	0.074
E	304	74	0.096
F	647	221	0.045
G	406	113	0.072

A. A

B. B

C. F

D. G

Answer: ab



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431. For the data

If adsorption of gases is done on a charcoal surface which gas will start adsorbing after gas D?

Gaseous Substance	T_C/K	P_C/bar	V_C/dm³ mol⁻¹
<i>A</i>	33.2	13	0.065
<i>B</i>	5.3	2.3	0.058
<i>C</i>	126	34	0.090
<i>D</i>	154	50	0.074
<i>E</i>	304	74	0.096
<i>F</i>	647	221	0.045
<i>G</i>	406	113	0.072

A. C

B. E

C. F

D. G

Answer: a



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432. A barometer is an instrument that is used for the measurement of pressure. The construction of the barometer is as follows:

A thin narrow calibrated capillary tube is filled to the brim with a liquid such as mercury and is inverted into a trough filled with the same fluid. Now depending on the external atmospheric pressure the level of the inside capillary comes to rest, then the net forces on the column should be balanced. Applying force balance we get $P_{atm} \times A = m \times g$

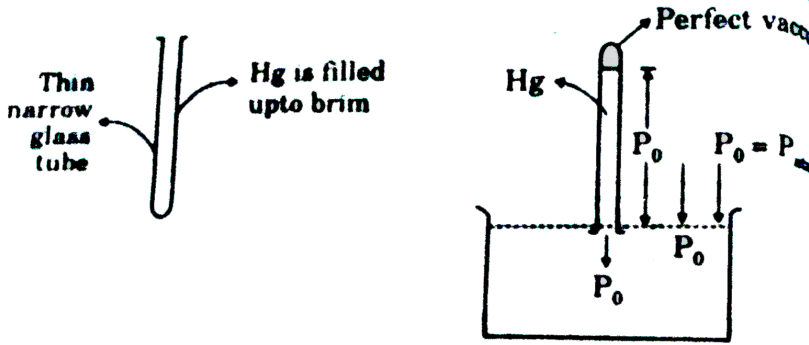
(A is the cross-sectional area of the capillary tube) if ρ is the density of the fluid, then $m = \rho \times g \times h$

(h is the height to which mercury has risen in the capillary)

Hence $P_{atm} \times A = (\rho \times g \times h) \times A$ or $P_{atm} = \rho gh$

Faulty Barometer:

An ideal barometer will show a correct reading only if the space above the mercury column is vacuum but in case if some gas column is trapped in the space above the mercury column then the barometer is classified as a faulty barometer. The reading of such a barometer will be less than the true pressure.



For such a faulty barometer

$$P_0 A = mg + P_{gas} A$$

$$P_0 = \rho h g + P_{gas}$$

$$\text{or } \rho g h = P_0 - P_{gas}$$

A tube closed at one end is dipped in mercury as shown in figure such that the closed surface coincides with the mercury level in the container

By how much length of the tube should be extended such that the level of Hg in the tube is 5 cm below the mercury level inside the container?

(Assume temperature remains constant)

$P_0 A$

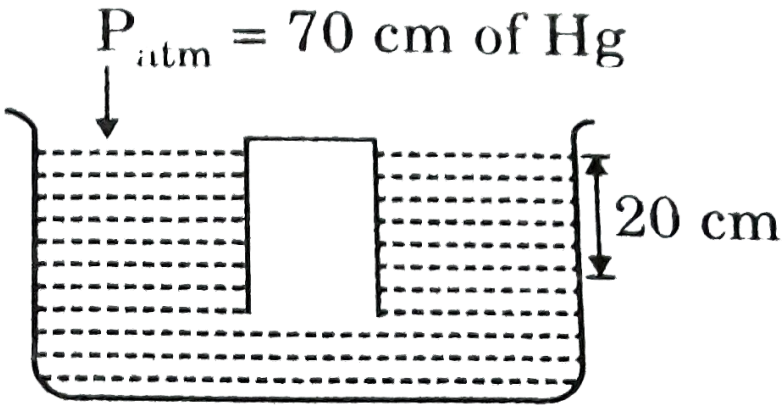
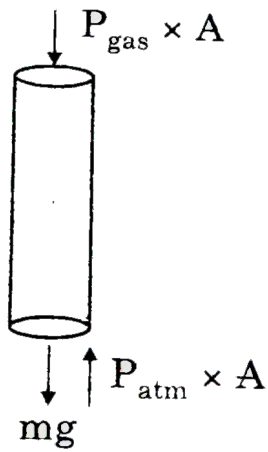
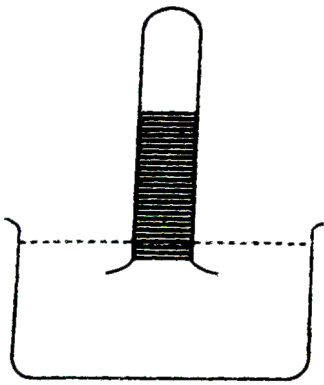


at equilibrium

$$P_0 A = mg$$

$$= \pi \rho (Ah)g$$

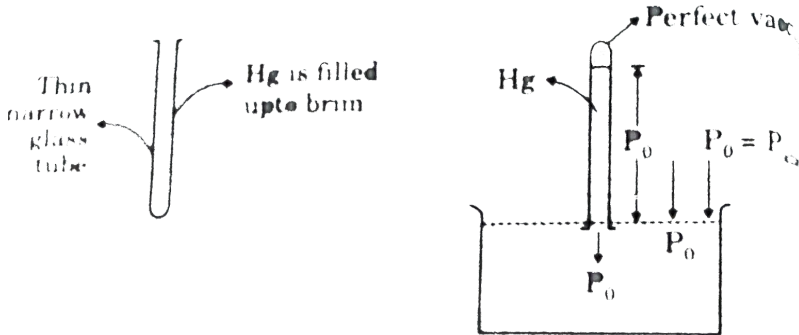
Mg



- A. 18 cm
- B. 19 cm
- C. 24 cm
- D. 30 cm

Answer: b

433. A barometer is an instrument that is used for the measurement of pressure. The construction of the barometer is as follows:



A thin narrow calibrated capillary tube is filled to the brim with a liquid such as mercury and is inverted into a trough filled with the same fluid. Now depending on the external atmospheric pressure the level of the liquid inside capillary comes to rest, then the net forces on the column should be balanced. Applying force balance we get $P_{atm} \times A = m \times g$

(A is the cross-sectional area of the capillary tube) if ρ is the density of the fluid, then $m = \rho \times g \times h$

(h is the height to which mercury has risen in the capillary)

Hence $P_{atm} \times A = (\rho \times g \times h) \times A$ or $P_{atm} = \rho gh$

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An ideal barometer will show a correct reading only if the space above the mercury column is vacuum but in case if some gas column is trapped in the space above the mercury column then the barometer is classified as a faulty barometer. The reading of such a barometer will be less than the true pressure

For such a faulty barometer

$$P_0 A = mg + P_{gas} A$$

$$P_0 = \rho h g + P_{gas}$$

$$\text{or } \rho g h = P_0 - P_{gas}$$

If the tube shown below is placed vertically with the open end upward then the length of the air column will be (Assume temperature remains constant)

$P_0 A$

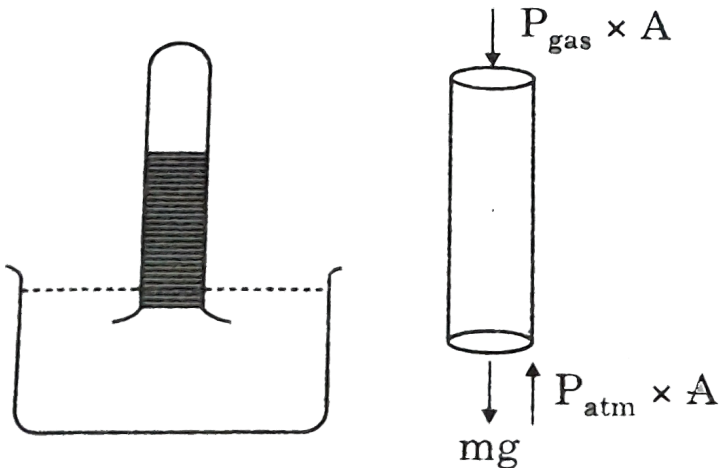


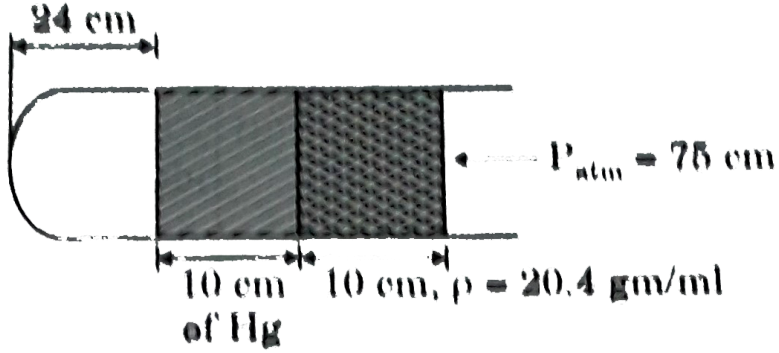
at equilibrium

$$P_0 A = mg$$

$$= \pi \rho (Ah) g$$

Mg



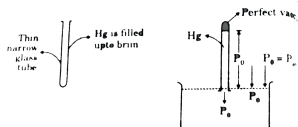


- A. 20 cm
- B. 36 cm
- C. 18 cm
- D. 15 cm

Answer: c

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434. A barometer is an instrument that is used for the measurement of pressure. The construction of the barometer is as follows:



A thin narrow calibrated capillary tube is filled to the brim with a liquid such as mercury and is inverted into a trough filled with the same fluid. Now depending on the external atmospheric pressure the level of the inside capillary comes to rest, then the net forces on the column should be balanced. Applying force balance we get $P_{atm} \times A = m \times g$

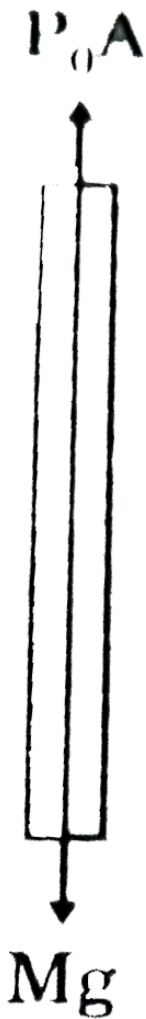
(A is the cross-sectional area of the capillary tube) if ρ is the density of the fluid, then $m = \rho \times g \times h$

(h is the height to which mercury has risen in the capillary)

Hence $P_{atm} \times A = (\rho \times g \times h) \times A$ or $P_{atm} = \rho gh$

Faulty Barometer:

An ideal barometer will show a correct reading only if the space above the mercury column is vacuum but in case if some gas column is trapped in the space above the mercury column then the barometer is classified as a faulty barometer. The reading of such a barometer will be less than the true pressure



at equilibrium
 $P_0 A = mg$
 $= \pi \rho (\Delta h) g$

For such a faulty barometer

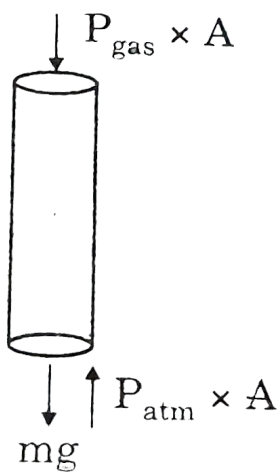
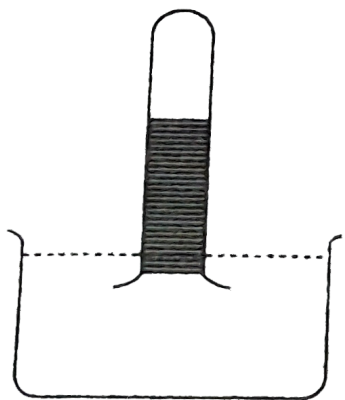
$$P_0 A = mg + P_{gas} A$$

$$P_0 = \rho h g + P_{gas}$$

$$\text{or } \rho g h = P_0 - P_{gas}$$

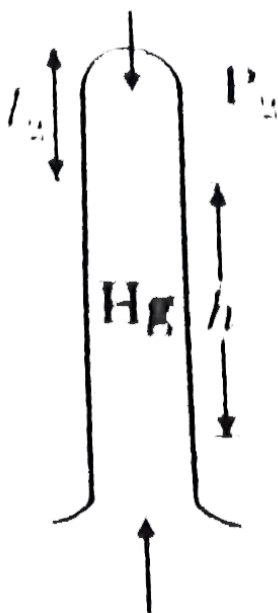
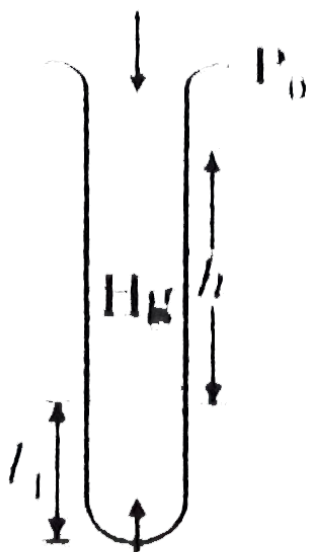
A gas column is trapped between closed end of a tube and a mercury

column of length (h) when this tube is placed with its open end upwards
the length (h) when this tube is placed with its open end upwards the
length of gas column is (l_1) the length of gas column becomes (l_2) when
open end of tube is held downwards (as shown in figure) find
atmospheric in terms of height of Hg column. (Assume temperature
remains constant)



Case I

Case II



A. $\frac{h(l_1 + l_2)}{l_2 - l_1}$

B. $\frac{h(l_2 + l_1)}{l_1 - l_2}$

C. $\frac{l_1 + l_2}{h(l_2 - l_1)}$

D. $(h_1 l_1 + h_2 l_2)$

Answer: a



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435.

Column-I

- (a) For a gas repulsive tendency dominates
- (b) At $T_B = -3^\circ C$ for a gas in high pressure region
- (c) At T_C
- (d) For He gas at $0^\circ C$ in all pressure region

Column-II

- (p) Effects in'
- (q) There is n
- (r) $Z > 1$
- (s) $T_C = 80K$



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436. Match the following Column-I to Column-II

Column-I		Column-II	
(a)	$P_1V_1 = P_2V_2 = P_3V_3 = \dots\dots$	(p)	Dalton's law of partial pressures at constant temperature
(b)	$\frac{V_1}{T_1} = \frac{V_2}{T_2} = \frac{V_3}{T_3} = \dots\dots$ at constant pressure	(q)	Kinetic equation of an ideal gas
(c)	$r \propto \frac{1}{d}$	(r)	22.7 litre for an ideal gas
(d)	$P = P_1 + P_2 + P_3 + \dots\dots$	(s)	Isotherm
(e)	$(V - b)\left(P + \frac{a}{V^2}\right) = RT$	(t)	Isobar
(f)	R/N_A	(u)	Charles' law
(g)	Molar volume at STP	(v)	Graham's law
(h)	$PV = \frac{1}{3} mNc^2$	(w)	Boyle's law
(i)	Graph between P and V at constant T	(x)	Equation for real gases
(j)	Graph between V and T at constant P	(y)	Boltzmann's constant



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437.

Column-I

Column-II

(a) At low pressure

$$(p) Z = 1 + \frac{pb}{RT}$$

(b) At high pressure

$$(q) Z = 1 - \frac{a}{V_m RT}$$

(c) At low density of gas

(r) Gas is more compressible than ideal gas

(d) f or H_2 and $Heat 0^\circ C$

(s) Gas is less compressible than ideal gas



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438. Match gases under specified conditions listed in Column-I with their properties//laws in Column-II.

Column-I

Column-II

(a) Hydrogen gas ($P=200 \text{ atm}$, $T=273\text{K}$)

(p) Compressibility factor

(b) Hydrogen gas ($p \sim 0$, $T=273\text{K}$)

(q) Attractive forces are

(c) CO_2 ($P = 1 \text{ atm}$, $T = 273\text{K}$)

(r) $PV=nRT$

(d) Real gases with very large molar volume

(s) $P(V-nb)=nRT$



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439. Match of following (where U_{rms} = root mean square speed U_{av} = average speed U_{mp} = most probable speed)

List-I

List-II

(a) U_{rms} / U_{av} (p) 1.22

(b) U_{av} / U_{mp} (q) 1.13

(c) U_{rms} / U_{mp} (r) 1.08



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440.

List-I (Van der Waals equation)

List-II (given by)

(a) high pressure and low temperature

(p) $PV = RT + Pb$

(b) low pressure

(q) $PV = RT - a/V$

(c) Force of attraction is negligible

(r) $PV = RT + aV$

(d) volume of molecule is negligible

(s) $\left[P + \frac{a}{V^2} \right] (V - b) = RT$



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441. One mole of N_2 (g) is taken in 1 litre empty container fitted with a movable piston at 300 K at constant pressure then match the change (List-II) in parameters (List-I) of gas as compared to initial state and select

the correct code.

List-I(Parameter)

List-II(

- | | |
|---|-------------------|
| (a) Z_1 (number of collisions made by a molecule per unit time) | (1) $\frac{1}{8}$ |
| (q) Z_{11} (collision frequency) | (2) 2 |
| (r) λ (mean free path) | (3) $\frac{1}{2}$ |
| (s) U_{rms} (root mean square speed) | (4) 4 |

A.

P	Q	R	S
2	4	1	3

B.

P	Q	R	S
1	2	4	3

C.

P	Q	R	S
3	4	1	2

D.

P	Q	R	S
2	1	4	2

Answer: (p-3);(q-1);(r-4);(s-2)



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442. Column-II gives the values of van der Waal's constant 'a' of a few gases which are shown in column-I Identify the gas with the

corresponding 'a' value:

	Column-I	Column-II
(P)	H_2	(1) $137.8kPa\text{dm}^6\text{mol}^{-2}$
(Q)	He	(2) $21.8kPa\text{dm}^6\text{mol}^{-2}$
(R)	O_2	(3) $364.0kPa\text{dm}^6\text{mol}^{-2}$
(S)	CO_2	(4) $3.5kPa\text{dm}^6\text{mol}^{-2}$

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443.

Column-I	Column-II
(a) Gas at critical temperature	(p) Gas can be liquified
(b) Gas at Boyle's temperature and low pressure	(q) Deviate from ideal gas behaviour
(c) Compressibility factor $Z < 1$	(r) Gas follows the ideal gas law
(d) High temperature and low pressure	(s) Assumption of no intermolecular forces

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444. Sample of different gases are given at different conditions in column-I and column-II consisting of translational kinetic energy of these

gases at given conditions.

Column-I

Column-II

(P) $2\text{mo} \leq \text{SO}_2(\text{g})$ at 700K

(1) Maximum K.E. per gram

(Q) $1\text{mo} \leq \text{SO}_3(\text{g})$ at 400K

(2) Maximum total K.E.

(R) $4\text{mo} \leq \text{CH}_4(\text{g})$ at 300K

(3) Maximum K.E. per gram

(S) $2.5\text{mo} \leq \text{He}(\text{g})$ at 450K

(4) Minimum K.E. per molecule

A.

P	Q	R	S
4	3	1	2

B.

P	Q	R	S
2	3	1	4

C.

P	Q	R	S
1	2	3	4

D.

P	Q	R	S
2	3	4	1

Answer: (d)



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445.

Column-I

Column-II

(P) If volume of gas molecules be negligible

(1) $\left(P + \frac{a}{V_2}\right)(V - b) = RT$

(Q) At very high pressure

(2) $PV = RT + Pb$

(R) At low pressure and high temperature

(3) $PV = RT - \frac{a}{V}$

(S) van der Waal's gas

(4) $PV = RT$

- A.

P	Q	R	S
3	2	4	1
- B.

P	Q	R	S
2	4	1	3
- C.

P	Q	R	S
3	4	1	2
- D.

P	Q	R	S
2	3	1	4

Answer: (a)

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446. 6 litres of H_2O is placed in a closed room of volume 827 litre and temperature at 300K if vapour pressure of liquid water is 22.8 mm of Hg at 300K and its density is $1gm/cm^3$ Then: [Given $R=0.0821$

$L - atm/mo \leq - K$ assuming volume of liquid water to be constant]

Column-I

- (P) Mass of H_2O in gaseous state (gm)
- (Q) Moles of H_2O in gaseous state (in moles)
- (R) Total number of moles of oxygen gas that can be obtained from vapour
- (S) Total number of moles of all atoms from water in vapour form

- A.

P	Q	R	S
1	2	4	3

	P	Q	R	S
B.	4	3	2	1
	P	Q	R	S
C.	2	4	1	3
	P	Q	R	S
D.	1	2	3	4

Answer: (c)

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447. If two moles of an ideal gas at 546 K occupies a volume of 44.8 litres.

Find out pressure (in atm)

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448. A glass tube with a sealed end is completely submerged in a vessel with mercury. The air column is 15 cm long. The what height (in cm) must the upper end be raised above the level of Hg so that the level of Hg inside the tube is at the level of Hg in the vessel ?

[Atmospheric pressure = 75 cm of Hg column]

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449. An ideal gas is trapped between a mercury column and the closed lower end of a narrow vertical tube of uniform bore. The upper end of the tube is open to atmosphere (atmospheric pressure = 76 cm of Hg). The length of mercury and the trapped gas columns are 20 cm and 43 cm respectively. What will be the length of the gas column when the tube is tilted slowly at constant temperature in a vertical plane through an angle of 60° ?

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450. Two gases A and B having molecular weight 60 and 45 respectively are enclosed in a vessel. The weight of A is 0.5 g and that of B is 0.2 g. The total pressure of the mixture is 750 mm. Calculate the partial pressure (in mm) of gas A.

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451. Pressure in a bulb dropped from 2000 to 1500 mm in 50 minutes when the contained oxygen leaked through a small hole. The bulb was then completely evacuated. A mixture of oxygen and another gas of molecular weight 72 in molar ratio 1:1 at a total pressure of 6000 mm was introduced. Find the molar ratio of two gases remaining in the bulb after a period of 70 minutes. If your answer is x then fill your OMR with $46x$ (Exclude decimal places)

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452. Calculate the volume (in litre) occupied by 4 mole of a van der Waal's gas present at a temperature of $400K$ and exerting a pressure of 2 atm if van der Waal's constant a and b are respectively $33.256Pa - m^6/mol^2$ and $10^{-2}m^3/mole$. [Given: $R = 0.0821atm-lit/mole$]

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453. Find the number of diffusion steps required to separate the isotopic mixture initially containing some amount of H_2 gas and 1 mol of D_2 gas in a container of 3 litre capacity maintained at 24.6 atm and $27^\circ C$ to the final mass ratio $\left(\frac{W_{D_2}}{W_{H_2}}\right)$ equal to $\frac{1}{4}$

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454. Calculate pressure exerted by 1 mole of a van der Waal's gas at a temperature of $\frac{8}{0.0821} K$ in a $\frac{1}{2} L$ container if volume of the molecule is assumed to be negligible and van der Waal's constant $a = 2 \text{ atm-lit}^2 \text{ mole}^{-2}$

Express answer in atm.

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455. A vessel of 10 L capacity contains 4 g He gas. The vessel is heated such that its absolute temperature becomes double. In order to make the pressure of gas half of its initial pressure, the mass of gas (in g) which

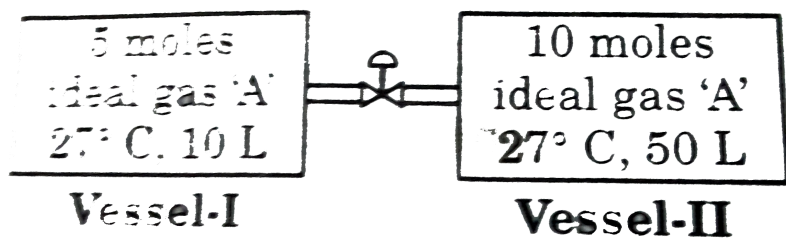
should be removed from the vessel is :

(Assume no change in the capacity of vessel) :

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456. Cycle tubes, each of capacity 4 L are to be filled by N_2 gas at 5 atm and $300K$. The gas is present in a many tubes can be completely inflated by connecting the cylinder with tubes.

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457.

The volume of connecting tube is negligible. Now, the stopcock is opened.

The temperature of both vessels are maintained at $27^\circ C$

$$\left[\text{Take: } R = \frac{1}{2} \text{ L atm/mol K} \right]$$

Codes Description for final condition

01 2.5 moles of gas will transfer from vessel-I to vessel-II

02 2.5 moles of gas will transfer from vessel-II to vessel-I

03 Final moles of gases in both vessels will be same

04 Final pressures of gases in both vessels will be same

Fill OMR as sum of correct codes.

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458. $22.4\text{L C}_2\text{H}_6$ gas at 0°C 1 atm is burnt in excess of O_2 gas. The products are passed through 5 L of 2 M KOH solution. The maximum moles of K_2CO_3 which may form in the solution is :

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459. A container with a volume of 20.0L holds $\text{N}_2(\text{g})$ and $\text{H}_2\text{O}(\text{l})$ at 300K and 1.0 atm. The liquid water is then decomposed completely into $\text{H}_2(\text{g})$ and $\text{O}_2(\text{g})$ by any means, at constant temperature. If the final pressure becomes 1.86 atm, what was the mass of water (in gm) present initially. Neglect the initial volume of water. [Given : Vapour pressure of water at 300 K = 0.04 atm, $R = 0.08\text{ L-atm/K-mol}$]



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460. A column of mercury of 10cm length is contained in the middle of a narrow horizontal 1m long tube which is closed at both the ends. Both the halves of the tube contain air at a pressure of 76 cm of mercury. By what distance will the column of mercury be displaced if the tube is held vertically?



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461. Assuming the same pressure in each case, calculate the mass of hydrogen (in g) required to inflate a balloon to a certain volume V at $127^\circ C$ if 8g helium is required to inflate the balloon to half the volume, $0.50V$ at $27^\circ C$.



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

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463. The pressure in vessel that contained pure oxygen dropped from 2000 torr to 1500 torr in 40 min as the oxygen leaked through a small hole into a vacuum. When the same vessel was filled with another gas, the pressure dropped from 2000 torr to 1500 torr in 80 min. What is the molecular weight of the second gas ?

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464. For 10 minutes each, at $0^{\circ}C$, from two identical holes nitrogen and an unknown gas are leaked into a common vessel of 4 litre capacity. The resulting pressure is 2.8 atm and the mixture contains 0.4 mole of

nitrogen. What is the molar mass of unknown gas ? (Take

$$R = 0.821 \text{ L-atm mol}^{-1} \text{ K}^{-1}]$$

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465. At what temperature in $^{\circ} \text{C}$ would the most probable speed of CO_2 molecules be twice that at 127°C ?

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466. The density of water vapour at 240 atm and 527°C is 90 g/dm^3 . Determine the molar volume, V_m of water and the compression factor. [Use : $R = 0.8 \text{ L-atm/mol K}$]. Hence, write the value of $4Z$.

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467. A spherical balloon of 21 cm diameter is to be filled up with hydrogen at 1 atm, 273 K from a cylinder containing the gas at 20 atm and 27°C . If

the cylinder can hold 2.82 litre of water, calculate the number of balloons that can be filled up completely.

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468. At 27°C , hydrogen is leaked through a tiny hole into a vessel for 20 min . Another unknown gas at the same T and P as that of H_2 , is leaked through the same hole for 20 min. After the effusion of the gases the mixture exerts a pressure of 6 atm. The hydrogen content of the mixture is 0.7 mole. If the volume of the container is 3 litre, what is molecular weight of unknown gas ?

(Use: $R = 0.821\text{L atm K}^{-1}\text{mole}^{-1}$)

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469. The average velocity of gas molecules is 400 m/sec calculate its rms velocity at the same temperature.

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470. At $400K$, the root mean square (rms) speed of a gas X (molecular weight = 40) is equal to the most probable speed of gas Y at 60 K. The molecular weight of the gas Y is.

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471. A valve between a 5 litre tank in which the gas pressure is 9 atm and a 10 litre tank containing gas at 6 atm is opened and pressure equilibration ensures at a constant temperature. What is the final pressure (in atm) in the two tanks ?

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472. In a basal metabolism measurements timed at 6.0 minute a patient exhaled 52.5 litre of air measured over water at $20^{\circ}C$ The vapour pressure of water at $20^{\circ}C$ is 17.5 torr The barometric pressure was 750 torr. The exhaled air analysed 16.75 volume per cent of oxygen and

inhaled air 20.32 percent oxygen, both on a dry basis Neglecting any solubility of the gases in water and any difference in the total volume of inhaled and exhaled air, calculate rate of oxygen consumption by the patient in mL (*STP*) per minute

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473. Two vessels whose volumes are in the ratio 2:1 contains nitrogen and oxygen at 800 mm and 680 mm pressure respectively, when they are connected together, what will be the pressure (in cm of Hg) of the resulting mixture ?

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474. A gas mixture contains equal number of molecules of N_2 and SF_6 . Some of it is passed through gaseous effusion apparatus. Calculate how many molecules of N_2 are present in the product gas for every 100 molecules of SF_6 . [At. Wt. of $F = 20$]

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475. Find the critical constant (P_C , V_C and T_C) in terms of A and B , also find compressibility factor (z) for the following equation of state

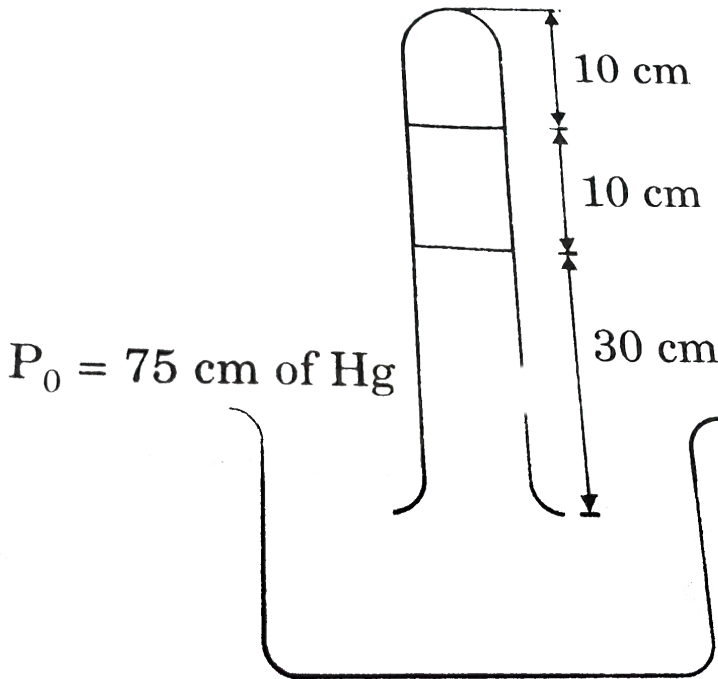
$$PV = RR - \frac{A}{V} + \frac{2B}{V^2}$$

where A and B are constants, P = pressure and V = molar volume. Hence, write the value of $\frac{1}{Z_C}$.

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476. A tube of length 50 cm is containing a gas in two sections separated by a mercury column of length 10cm as shown in figure. The tube's open end is just inside the Hg surface in container, find pressure of gas in

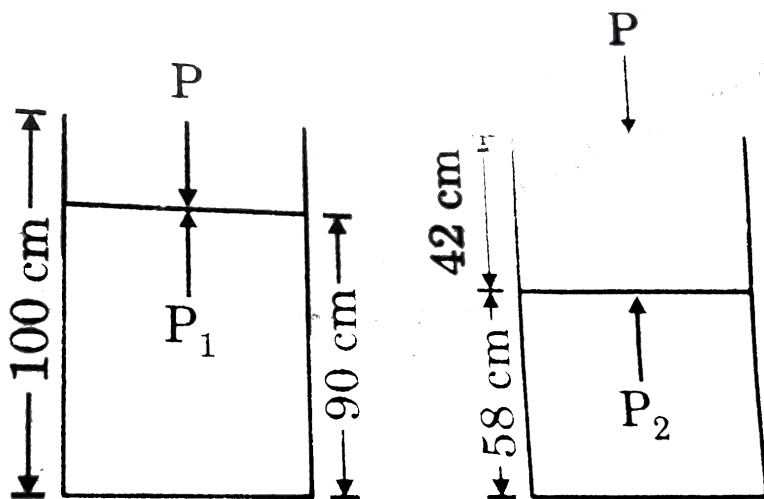
upper section. [Assume atmospheric pressure = 75 cm of Hg column]



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477. A vertical cylinder of total length 100 cm is closed at the lower end and is fitted with a movable frictionless gas tight disc at the other end. An ideal gas is trapped under the disc. Initially the height of the gas column is 90 cm when the disc is in equilibrium between the gas and the atmosphere. Mercury is then slowly poured on the top of the disc and it just starts overflowing when the disc has descended through 32 cm. Find

the atmospheric pressure (in cm of Hg). Assume that the temperature of the gas to remain constant and neglect the thickness and weight of the disc. Give your answer excluding the decimal places.

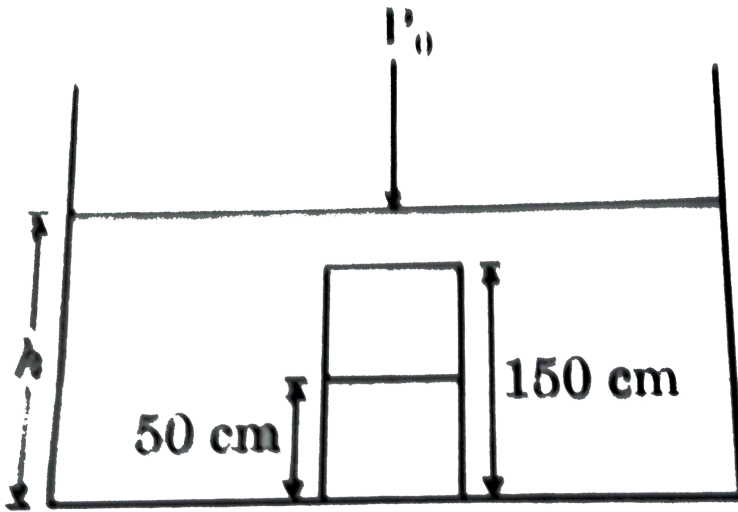


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478. To an evacuated vessel with movable piston under external pressure of 1 atm 0.1 mole of He and 1.0 mole of an unknown compound vapour pressure 0.68 atm at $0^\circ C$ are introduced Considering the ideal gas behaviour the total volume (in litre) of the gases at $0^\circ C$ is close to .

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479. A cylindrical diving bell (initially in open air), whose length is 150 cm is lowered to the bottom of a tank. The water is found to rise 50 cm in the bell. Find the depth of the tank. Assume the atmospheric pressure at the surface as equivalent to 1000 cm of water and the temperature as constant



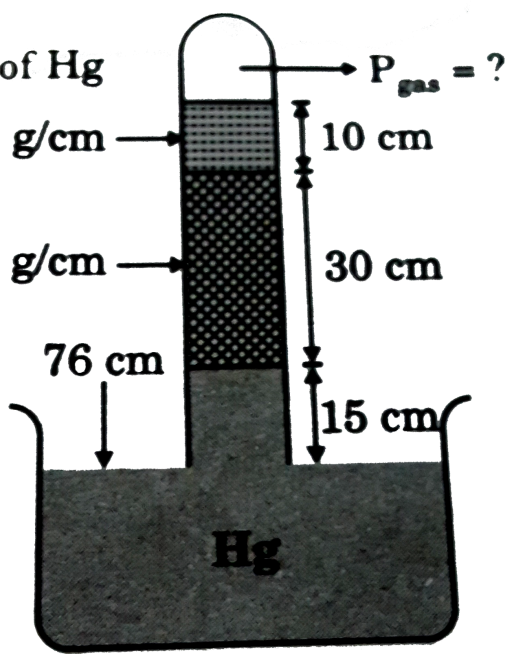
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480. In the following arrangement find the pressure of the confined gas in cm of Hg

$$P_{\text{atm}} = 76 \text{ cm of Hg}$$

$$\rho = 27.2 \text{ g/cm}$$

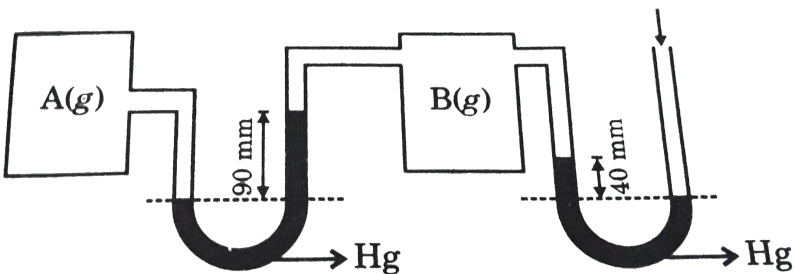
$$\rho = 6.8 \text{ g/cm}$$



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481. At 300K , two gases are filled in two equal sized containers as given

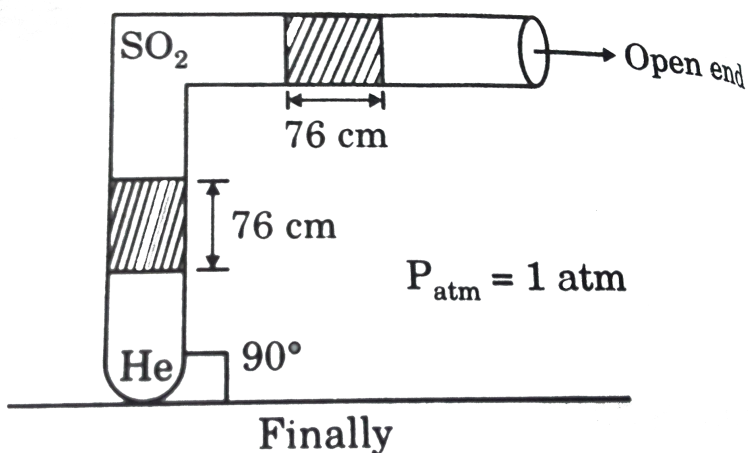
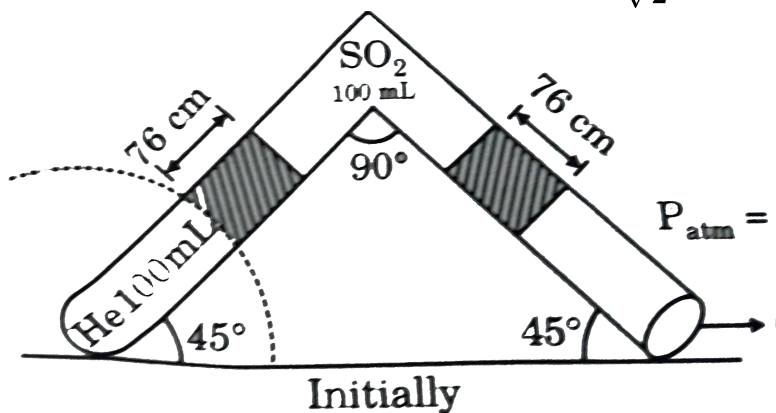
$$1 \text{ atm} = 760 \text{ mm of Hg}$$

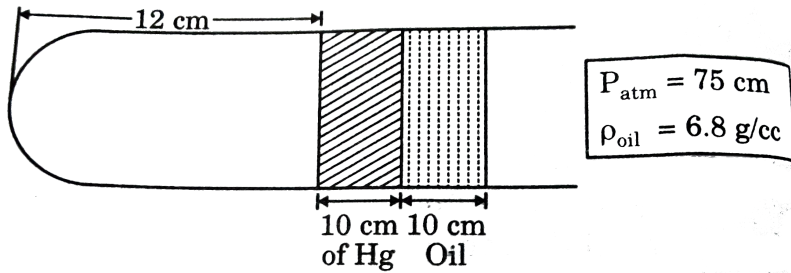


What will be the pressure of A(g) (in mm of Hg) ?



482. A thin glass tube (uniform cross-section) is filled with He and SO_2 between Hg column as shown in diagram. When it is rotated by angle 45° anticlockwise as shown in diagram, calculate the sum of final volume of both gases (Assume T remains constant) [Use : $\frac{1}{\sqrt{2}} = 0.7$]





483.

If above tube is held vertical with open end upward then find the length of air column (in cm).

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484. An unknown gas behaves ideally at 540 K in low pressure region, then calculate the temperature (in K) below which it can be liquefied by applying pressure.

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

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486. Two flask of equal volume are connected by a narrow tube (of negligible volume) are at 27°C and contain 0.7 moles of H_2 each at 0.5 atm. One of the flask is then immersed into a bath kept at 127°C , while other remains at 27°C . If number of moles of H_2 in flask 1 and flask 2 finally, are a and b respectively, then calculate value of $10 \times |a - b|$.

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487. The van der Waal's constants for a gas are $a = 1.92 \text{ atm } L^2\text{mol}^{-2}$, $b = 0.06\text{Lmol}^{-1}$. If $R = 0.08\text{L atm } K^{-1}\text{mol}^{-1}$, what is the Boyle's temperature (in K) of this gas ?

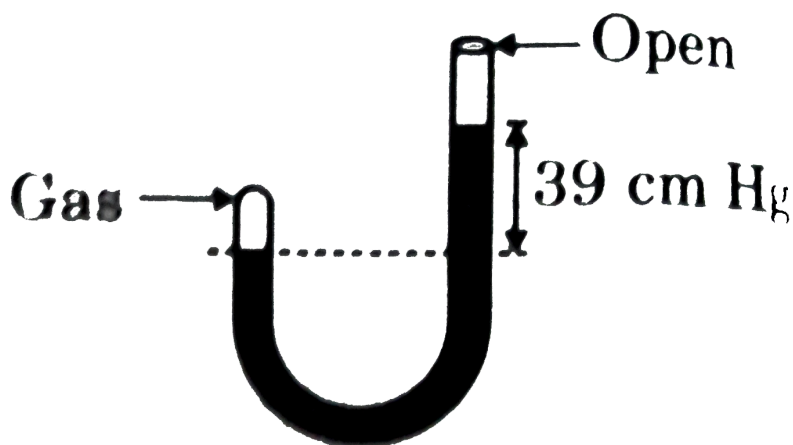
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488. Calculate the mole present of N_2 gas in a mixture of N_2 and O_2 if the partial pressure of O_2 is 6.3 cm of Hg in a container of volume 22.4 litre and total pressure is 90 cm of Hg at $300K$

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489. Some gas is present in J-shaped tube and in this case level of mercury in both limbs of tube differ by 39 cm of Hg. If mercury is replaced by another liquid of density $\frac{3}{4}$ of density of mercury then find the height difference in limbs. Assume temperature to be constant and smaller limb

is closed, (density of mercury 13.6 g/mL)



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490. The density of a mixture of O_2 and N_2 gases at 1 atm and 273 K is 0.0013 gm/mL. If partial pressure of O_2 in the mixture is A, then calculate value of 25 A.

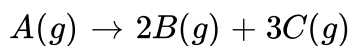
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491. One litre gaseous mixture is effused in 4.5 minutes and 30 seconds while 1 litre of oxygen takes 10 minutes for effusion. The gaseous mixture

contains in it ethane and hydrogen. Calculate vapour density of gaseous mixture.

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492. Gas A taken in a closed rigid container is allowed to decompose partially according to the reaction



The gaseous mixture formed effuses 1.5 times faster than a gas having molecular weight 105 under similar conditions. Find the mole fraction of C in the gaseous mixture formed

Given : Mol. wt. of A = 140

Mol. wt. of B = 64

Mol. wt. of C = 4

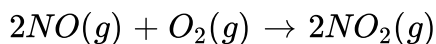
Write your answer by multiplying with 10.

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493. For a real gas critical pressure is 75 atm and van der Waal's constant 'b' is 40 millilitres per mole. If critical temperature of gas is TK. Calculate value of $\left(\frac{T}{100}\right)$. [Use $R = 0.08\text{L atm mol}^{-1}\text{K}^{-1}$].

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494. 2 moles of $\text{NO}(g)$ and 16 gm of $\text{O}_2(g)$ were mixed in a 6.25 litre vessel at 27°C temperature to produce maximum amount of $\text{NO}_2(g)$



$$\left(\text{Use: } R = \frac{1}{12}\text{L-atm mol}^{-1}\text{K}^{-1}\right)$$

Calculate change in pressure (in atm) due to this reaction.

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495. If the mean free path is 10 cm at one bar pressure, then, its value in cm at 5 bar pressure, if temperature is kept constant will be :

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496. Average translational kinetic energy of an ideal gas molecule at $27^\circ C$ is $3.88 \times 10^{-x} eV$. Hence x is :

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497. H_2 and O_2 are kept in mass ratio 1 : 8 respectively at 6 atm. If small orifice is made then relative rate of effusion of H_2 with respect to O_2 initially is :

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498. Calculate the mole fraction of N_2 gas in a mixture of N_2 and O_2 . If the partial pressure of O_2 is 63 of Hg and the total pressure of the mixture is 90 cm of Hg. First multiply your answer with 10, then fill OMR.

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499. If at 200 K and 500 atm, density of CH_4 is $0.246g/mL$ then its compressibility factor (Z) is approximately 2.0×10^x then x is :

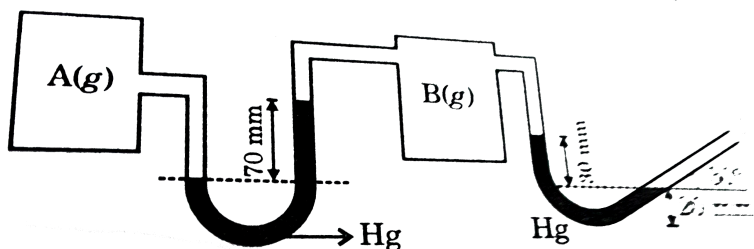
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500. Density of ideal gas at 2.46 atm and 300 K is $0.8g/L$ Hence g-molar mass of gas is :

$[R = 0.082L\text{-atm/mol-K}]$

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501. At 300 K two gases are filled in two equal sized containers as given



What will be the pressure of A(g) (in mm of Hg) ?

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502. A container contains air above liquid water. Total pressure was 800 torr. What will be the final pressure if volume is doubled ? (Aqueous tension = 40 torr).

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503. If 10 moles of a real gas is present in 2 litre container having a free volume of 1600 mL at pressure P and temperature T, then at what pressure in atmosphere and at 273 K its compressibility factor is 1.5 ? (neglect α)

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504. Absolute temperature of diatomic has increased eight fold, where it dissociates completely into atom. How many times will be the new rms velocity-compared to initial ?

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505. Two flasks A and B have equal volume at $100K$ and $200K$ and have $4atm$ and $1atm$ pressures, respectively. The flask A contains H_2 gas and B contains CH_4 gas. The collision diameter of CH_4 is twice that of H_2 .

(i) Which of the following is true about the mean free path (λ) of the molecules?

(a) λ of H_2 is twice that of CH_4 .

(b) λ of CH_4 is twice that of H_2 .

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

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

(ii) Which of the following is true about the viscosity of the gases?

(a) Viscosity of $H_2 = 2 \times$ viscosity of CH_4

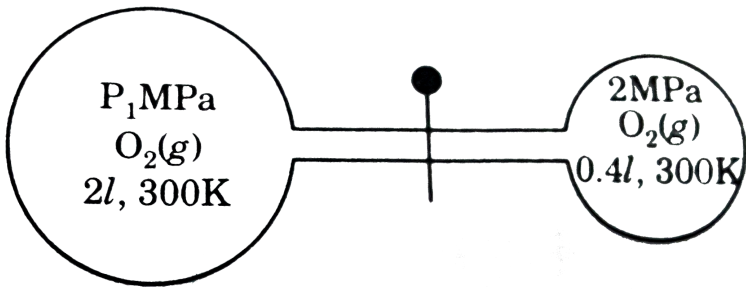
(b) Viscosity of $H_2 = 3 \times$ viscosity of CH_4

(c) Viscosity of $H_2 =$ viscosity of CH_4

(d) Viscosity of $H_2 = \frac{1}{2} \times$ viscosity of CH_4



506. If in below diagram after opening valve, final pressure is $\frac{7}{6}$ Mpa, then calculate P_1 (in MPa)



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507. An ideal gas occupies 2 litres volume at 300 K and 1 atm. Calculate the volume occupied by equal moles of real gas at same temperature and pressure

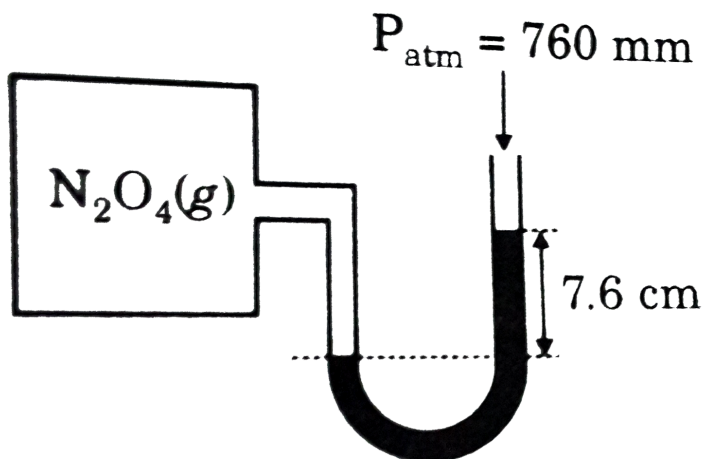
Given : $b = 0.05$ litre/mol

$R = 0.08$ atm

$Z = 1.5$ at given condition.

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508. In a container initially only N_2O_4 is present and no difference in height of Hg-column of two limbs :



If due to dissociation of N_2O_4 at constant temperature the difference in the column of mercury becomes 7.6 cm then calculate % dissociation of N_2O_4 . [$N_2O_4 \rightarrow 2NO_2$]

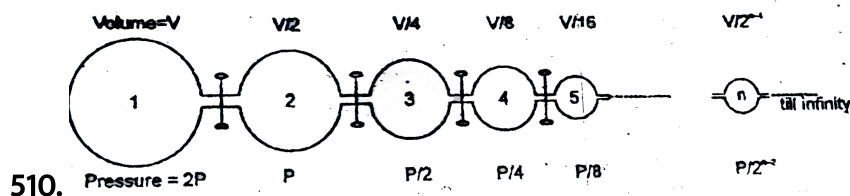
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509. At $30^\circ C$ dry air [75 % N_2 + 25 % O_2] is placed over $H_2O(l)$ at 800 torr (combined pressure of all 3 gases). If pressure is gradually increased isothermally to 1560 torr, then calculate partial pressure of O_2 at this

pressure in torr.

$$[VP_{H_2O} = 50\text{torr at } 30^\circ C]$$

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Infinite number of flasks are connected to one another as shown above.

The volume and pressure in each flask vary as shown. The stopcocks are initially closed. The common pressure, when all the stopcocks are opened,

is : (Assume constant temperature)

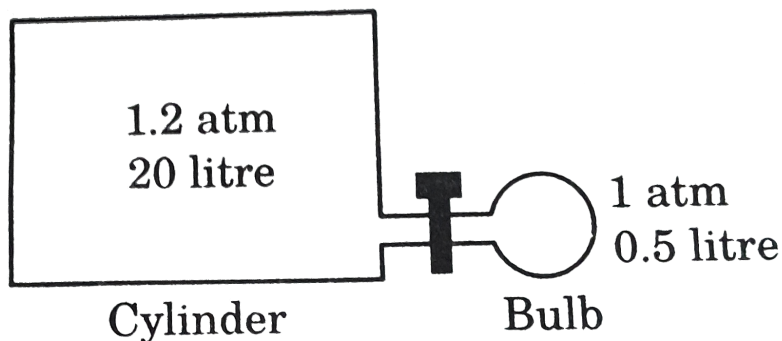
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511. In 1 litre rigid vessel at 1 atm and 300 K, N collision/sec-cm² of gas is observed with container's wall. If temperature is increased to 1200K, xN collision/sec-cm² is observed for gas. Hence x is

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512. 0.5 L of evacuated container is filled by gas upto 1 atm exactly, by connecting it to 20 litre cylinder initially at 1.2 atm. How many evacuated containers can be filled ?



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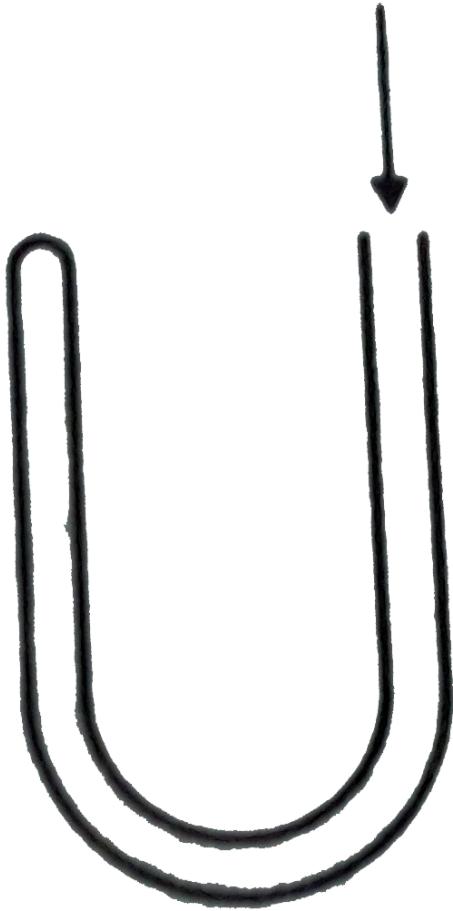
513. At constant pressure mean free path of ideal gas $\lambda \propto T^x$. Hence, 'x' is :

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514. 100 mL of a gas is stored over mercury in mercury manometer at 27°C radius of inside column is r and that of outside is R and initially mercury level is equal in both column

(a) If $R = r$. Find the new temperature (in K) if due to change in temperature outside level of mercury is raised by 20 mm

$$P_{\text{atm}} = 1 \text{ atm}$$



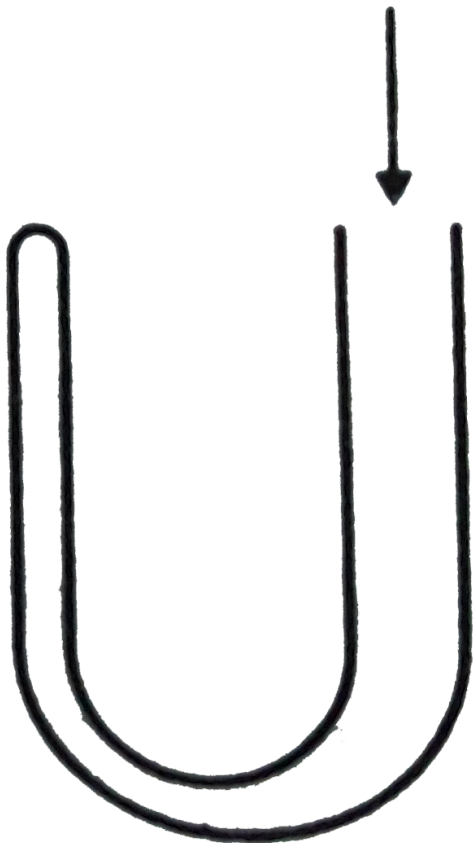
(i) Assume volume of gas remain constant by some experimental means

$$\Rightarrow T_1$$

(ii) Volume does not remain constant ($\pi r^2 = 10\text{cm}^2$) $\Rightarrow T_2$

(b) If $R = 2r$ and inside level falls by $80\text{mm} \Rightarrow T_3$

$$P_{\text{atm}} = 1 \text{ atm}$$



Give the answers by adding T_1, T_2, T_3 to the nearest integer.

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515. A good vacuum produced in common lab apparatus corresponds to 10^{-6} torr at 25°C . Calculate number of molecules per cubic centimeter

at this T and P. In scientific notation, $x \times 10^y$. Find the value of y .

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516. An ideal gas at 650 Torr occupies a bulb of unknown volume. A certain amount of gas is withdrawn and found to occupy 1.52cm^3 at one atm. The pressure of the gas remaining in the bulb is 600 Torr. Calculate volume of the bulb (in mL) taking temperature constant. Give answer excluding decimal places.

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517. One litre flask contains air, water vapour and a small amount of liquid water at a pressure of 200 mm Hg. If this is connected to another one litre evacuated flask, what will be the final pressure of the gas mixture at equilibrium? Assume $T = 50^\circ\text{C}$, aqueous tension at 50°C is 93 mm Hg. Give answer excluding the decimal places.

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518. A diver at a depth of 10 m exhales a bubble of air of volume 24.63 mL. The bubble catches an organism which survives on the exhaled air trapped in the bubble. Find out what will be the volume [x in mL] of the bubble when it reaches the surface after 10 min. The organism just inhales the air at the rate of 0.05 millimoles per minute and exhales nothing, Also find out the average rate [y in m mol/min] at which organism should inhale so that volume of bubble remains constant at the depth and the surface. Hence, find the value of $\frac{x}{y}$ excluding decimal places

[Given : P atm = 1 atm ,

$d(H_2O) = g/cm^3, g = 1000cm/s^2, T_{H_2O} = 200K$ (throughout)].



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519. The gas 'A' decomposes as $A \rightarrow B + 5C$

A partially decomposed gaseous mixture is allowed to effuse through a pin hole and the gas coming out initially was analysed. The mole fraction

of C in effused gas was found to be 0.6. Determine :

(a) ratio of ratio of effusion of 'C' and 'B'

(b) the percentage of dissociation of 'A'. (Give answer excluding the decimal places)

[Given : Molecular mass of A = 360,

Molecular mass of C = 40]

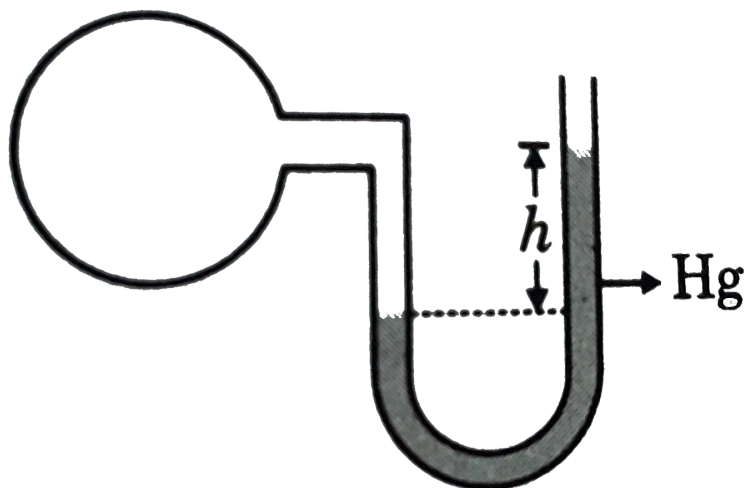
Hence, fill OMR answer of (a) and (b) with the value of $\frac{(b)}{(a)}$



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520. A bulb of constant volume is attached to a very thin manometer tube as shown in figure. Gas starts leaking through a small hole in the bulb causing change in pressure as :

$$\frac{dp}{dt} = -kP^2$$



When k is constant and P is pressure at any instant

Initial height difference 'h' was 76 cm and after 10 mm 'h' was 38 cm.

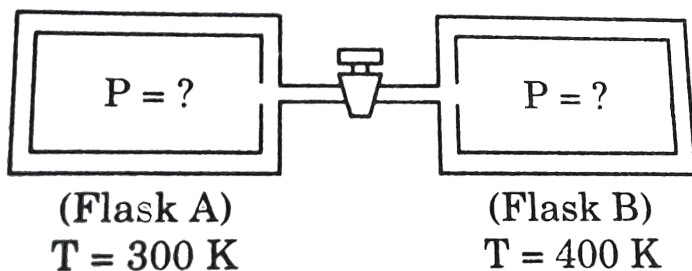
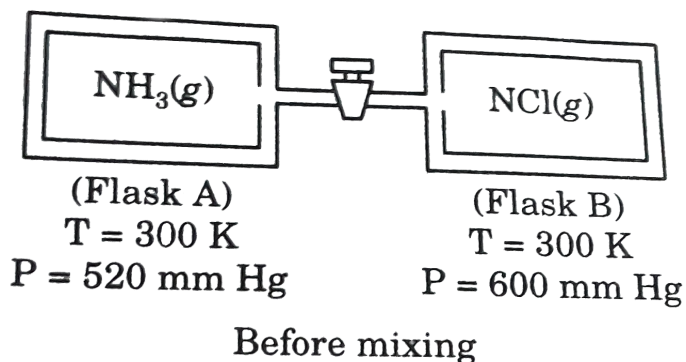
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521. For oxygen at $25^\circ C$, the collision diameter is 0.361 nm. What is the mean free path (in m) for oxygen molecules at (a) 1 atm pressure and (b) 0.1 Pa pressure ?

In scientific notation, if your answer is $x \times 10^y$ then fill y in OMR.

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522. Two flasks A and B of equal volume containing NH_3 and HCl gases, are connected by a narrow tube of negligible volume. The two gases were prevented from mixing by stopper fitted in connecting tube. For further details of the experiment, refer to the given figure. What will be final pressure (in mm of Hf) in each flask when passage connecting two tubes are opened, assuming ideal gas behaviour of NH_3 and HCl gas and the reaction



523. 22.4LCH_4 at 1 atm and 273 K was thought to have mass 16 g but when weighed experimentally it was found to have 17.5 g due to the presence of carbon-14. Calculate % of carbon atom having atomic mass '14'.

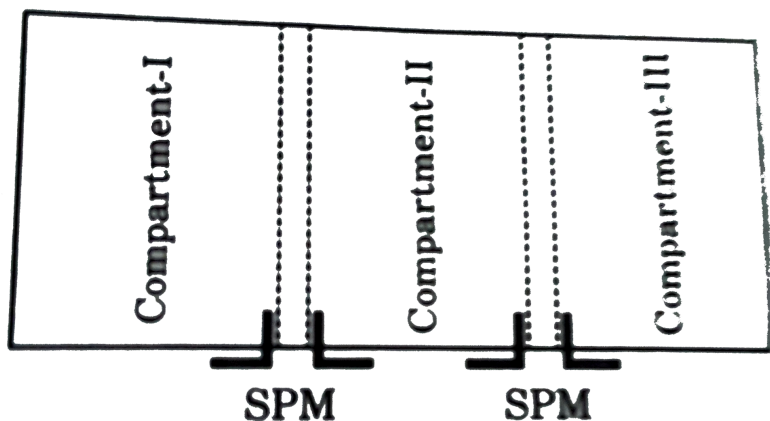
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524. Two glass bulbs A and B are connected by a very small tube having a stop cock. Bulb A has a volume of 100 cm^3 and contained the gas, while bulb B was empty. On opening the stop cock, the pressure fell down to 40%. The volume of the bulb B must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

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525. A mixture of H_2 , He and O_2 with mass ratio equal to the ratio of their atomic weight is present in compartment-II of a cylinder as shown in figure. The SPM is fixed by stoppers such that it divides the cylinder into

three equal parts. Find the ratio of pressure in the three parts at equilibrium.



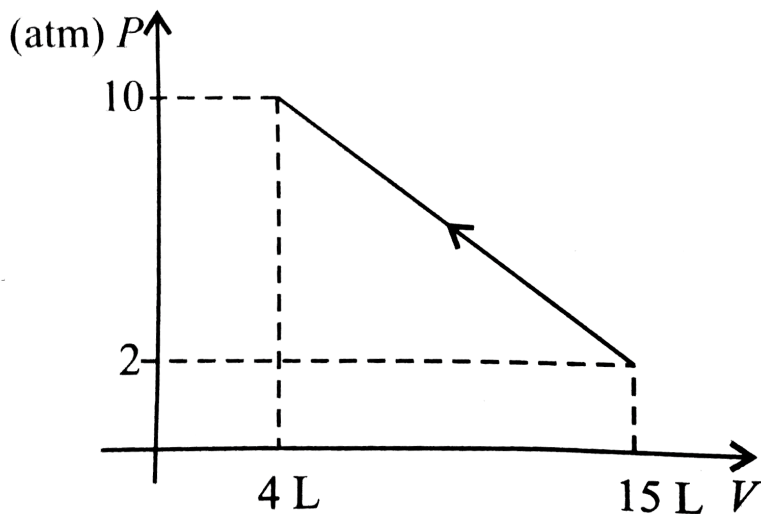
[If the answer is $a : b : c$ then fill in OMR sheet as $a + b + c$. For example if $2 : 6 : 8$ then $1 + 3 + 4 = 8$]



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526. 1mol of a gas is changed from its initial state ($15L, 2\text{atm}$) to final state ($4L, 10\text{atm}$). If this change can be represented by a straight line in

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



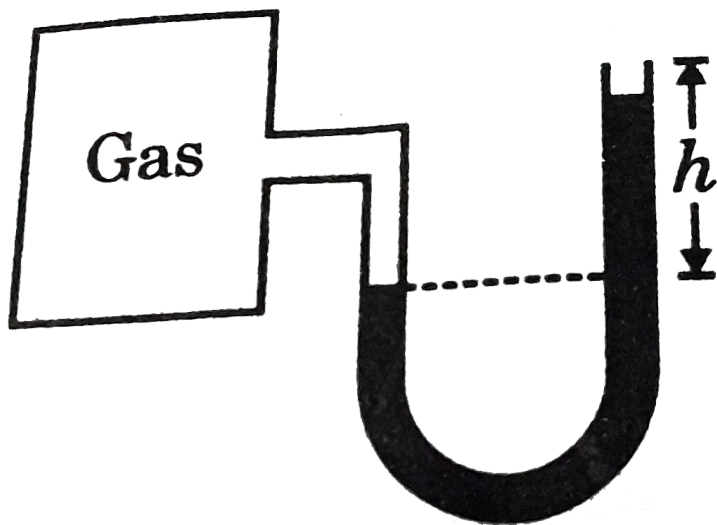
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527. $PCl_5(g)$ density (in g/L) of mixture at 24 atm and $300K$, when $PCl_5(g)$ undergo 50% decomposition. $[R = 0.08 \text{ atm L mol}^{-1} K^{-1}]$

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528. If the gas in container gas pressure 77 cm of Hg, then calculate the height difference in manometer (in mm) which contain glycerine

$(d = 3.4\text{g/mL})$.



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529. One litre of N_2 and 2 litre of O_2 under identical conditions of T and P are mixed. Find the volume of mixture if the pressure of the mixture is reduced to half of initial value.

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530. For a real gas, if at critical conditions molar volume of gas is $8.21L$ at 3 atm , then critical temperature (in K) will be :



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