NEET REVISION SERIES

STATES OF MATTER

Revise Most Important Questions to Crack NEET 2020

Q-1 - 12225731

A gas cyclinder containing cooking gas can withstand a pressure of $14.9 atm$. The pressure gauge of cyclinder indicates $12 atm$ at $27C$. Due to sudden fire in building the temperature starts rising. The temperature at which the cyclinder will explode is

(A) $42.5^\circ C$

(B) $67.8^\circ C$

(C) $99.5^\circ C$

(D) $25.7^\circ C$

CORRECT ANSWER: C

SOLUTION:

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}$$
$$\frac{12}{300} = \frac{14.9}{T_2}$$
$$T_2 = 372.5K = 99.5C$$

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Q-2 - 12225451

If $P, V,$ and T represent pressure, volume and temperature of the gas, the correct representation of Boyle's law is

(A) $V \propto \frac{1}{T}$ (at constant P)

(B) $PV = RT$

(C) $V \propto 1/P$ (at constant T)

(D) $PV = nRT$

CORRECT ANSWER: C

SOLUTION:

Boyle's law is $V \propto \frac{1}{P}$ at constant T

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Q-3 - 15880177

If V_0 is the volume of a given mass of gas at 273K at constant pressure, then accoding to Charle's law, the volume at $10C$ will be:

(A) $10V_0$

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

(C) $V_0 + \frac{10}{273}$

(D) $\frac{283}{273}V_0$

CORRECT ANSWER: D

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Q-4 - 12225434

If value of azimuthal quantum number l is 2, then total possible values of magnetic quantum number will be.

(A) 7

(B) 5

(C) 3

(D) 2

CORRECT ANSWER: B

SOLUTION:

(b) If value of 1 is 2 then
$m = -2, -1, 0,$
$+1, +2. m = -1$
$+1$
including zero.

(5 values of magnetic quantum number).

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Q-5 - 11034751

According to Charles's law

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

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

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

(D) $V \propto T$

SOLUTION:

Charles's law,

$$V \propto T \therefore \left(\frac{\partial V}{\partial T}\right)_P$$
$$= K$$

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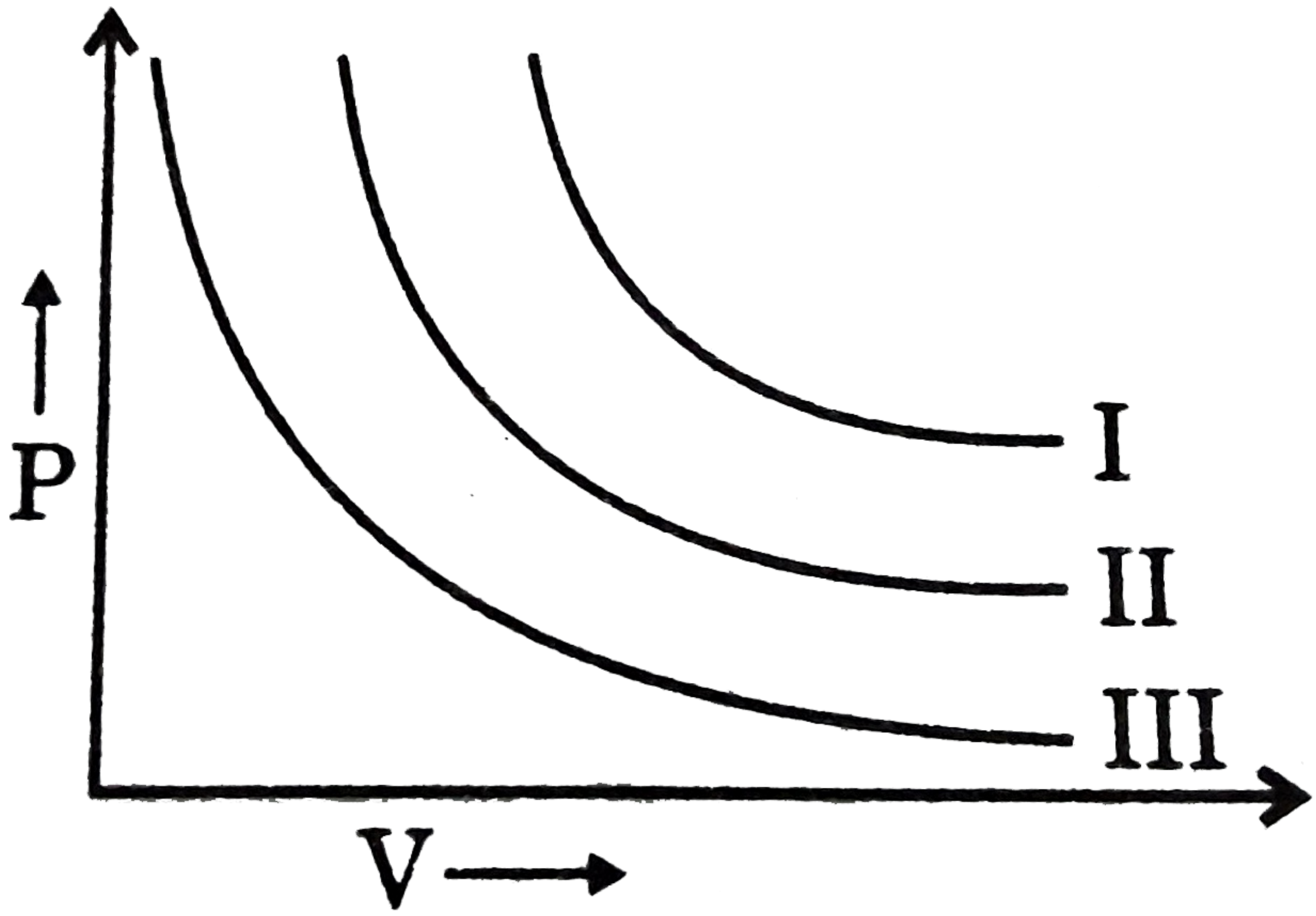
Q-6 - 17243272

I,II,III are three isotherms respectively at T_1, T_2 and T_3 for a fixed mass of gas, as shown in graph. Temperature will be in order :



(A) $T_1 = T_2 = T_3$

(B) $T_1 < T_2 < T_3$

(C) $T_1 > T_2 > T_3$

(D) $T_1 > T_2 = T_3$

CORRECT ANSWER: C

Q-7 - 12225461

A certain sample of gas has a volume of 0.2 litre measured at $1atm$ pressure and $0C$. At the same pressure but at $273C$, its volume will be

(A) $0.4litres$

(B) $0.8litres$

(C) $27.8^\circ C$,

(D) 55.6 litres

CORRECT ANSWER: A

SOLUTION:

$$\frac{V_1}{V_2} = \frac{T_1}{T_2} \Rightarrow V_2 = \frac{T_2}{T_1} V_1 = \frac{546K}{273K} \times 0.2L = 0.4L$$

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Q-8 - 12225462

An open vessel containing air is heated form $300K$ to $400K$. The fraction of air originally present which goes out of it is at $400K$

(A) $3/4$

(B) $1/3$

(C) $2/3$

(D) $1/8$

CORRECT ANSWER: B

SOLUTION:

Let the volume escaped be V and the initial volume be V_1 Then form $\frac{V_1}{V_2} = \frac{T_1}{T_2}$

$$\frac{V_1}{V_1 + V} = \frac{300}{400}$$

$$\Rightarrow V = \frac{1}{3} V_1$$

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Q-9 - 12225464

$400 cm^3$ of oxygen at $27C$ were cooled to $-3C$ without change in pressure. The contraction in volume will be as per Boyle's law?

(A) $40 cm^3$

(B) $30 cm^3$

(C) $44.4 cm^3$

(D) $360 cm^3$

CORRECT ANSWER: A

SOLUTION:

$$V_2 = \frac{T_2}{T_1} \Rightarrow V_2$$
$$= \frac{270K}{300K}.\ 400cm^3$$
$$= 360cm^3$$

Contraction

$$V_1 - V_2 = 400 - 360$$
$$= 40cm^3$$

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Q-10 - 52403623

If $20cm^3$ gas at 1 atm is expanded to $50cm^3$ at constant T, then what is the final pressure

(A) $20 \times \frac{1}{50}$

(B) $50 \times \frac{1}{20}$

(C) $1 \times \frac{1}{20} \times 50$

(D) None of these

CORRECT ANSWER: A

SOLUTION:

At constant T, $P_1V_1 = P_2V_2$
$1 \times 20 = P_2 \times 50, P_2$
$= \frac{20}{50} \times 1$

Q-11 - 52403816

300 ml of a gas at $27C$ is cooled to $-3C$ at constant pressure, the final volume is

(A) 540 ml

(B) 135 ml

(C) 270 ml

(D) 350 ml

CORRECT ANSWER: C

SOLUTION:

$$V_2 = \frac{T_2}{T_2} . V_1 = \frac{270K}{300K}$$
$$\times 300ml = 270ml$$

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Q-12 - 52403826

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

(A) $310cm^3$

(B) $290cm^3$

(C) $10cm^3$

(D) $37cm^3$

CORRECT ANSWER: C

SOLUTION:

$$\frac{V_2}{V_1} = \frac{T_2}{T_1}$$
$$\because V_2 = \frac{T_2}{T_1} V_1$$
$$= \frac{310K}{300K} \times 300cm^3$$
$$= 310cm^3$$

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Q-13 - 12225480

At definite temperature the volume of a definite mass of gas is $10L$ at $5atm$ pressure, at the same temperature if the pressure of the gas is decreased to $1atm$, the volume of same gas becomes

(A) $50L$

(B) $2L$

(C) $5L$

(D) $0.5L$

CORRECT ANSWER: A

SOLUTION:

$p_1 = 5atm$

$v_1 = 10L$

$p_2 = 1atm \quad V_2 = ?$

$P_1V_1 = p_2V_2$

or $\dfrac{P_1}{P_2} = \dfrac{V_1}{V_2}$

$\dfrac{5}{1} = \dfrac{V_2}{10}$

$V_2 = 50L$

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Q-14 - 52403810

Pressure of a mixture of 4 g of O_2 and 2g of H_2 confind in a bulb of 1 litre at $0C$ is

(A) 25.215 atm

(B) 31.205 atm

(C) 45.215 atm

(D) 15.210 atm

CORRECT ANSWER: A

SOLUTION:

$$\text{No. of moles of } O_2 = \frac{4}{32} = 0.125$$

$$\text{No. of moles of } H_2 = \frac{2}{2} = 1$$

$$\text{Total no. of moles } = 1 + 0.125 = 1.125$$

$$P = \frac{nRT}{V}$$
$$= \frac{1.125 \times 0.0821 \times 273}{1}$$
$$= 25.21 atm$$

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Q-15 - 12225487

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

(A) $1:1$

(B) $1:2$

(C) $2:1$

(D) $4:1$

CORRECT ANSWER: A

SOLUTION:

$$\frac{d_1}{d_2} = \frac{1}{2}, \frac{T_1}{T_2} = \frac{2}{1}$$

$$\therefore \frac{P_1}{P_2} = \frac{V_2}{V_1} \times \frac{T_1}{T_2}$$

$$= \frac{T_1 d_1}{T_2 . d_2}$$

$$\frac{P_1}{P_2} = \frac{2}{1} . \frac{1}{2} = \frac{1}{1}$$

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Q-16 - 12225488

Which of the following is/are incorrect regarding the universal gas constant (R)?

(A) R is independent of pressure

(B) R is independent of temperature

(C) R is independent of volume of gas

(D) R is dependent on nature of gas

CORRECT ANSWER: D

SOLUTION:

R is dependent only on units of measurement of pressure and volume

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Q-17 - 52403615

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

(A) 2

(B) $1/2$

(C) 4

(D) $1/4$

CORRECT ANSWER: C

SOLUTION:

$$d_a = 2d_b, 2M_a = M_b$$
$$PV = nRT$$
$$= \frac{m}{M} RT, P = \frac{m}{V}$$
$$. \frac{RT}{M} = \frac{dRT}{M}$$

$$\frac{P_a}{P_b} = \frac{d_a}{d_b} \frac{M_b}{M_a} = \frac{2d_b}{d_b}$$
$$\times \frac{2M_a}{M_a} = 4$$

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Q-18 - 14624160

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) $\frac{1}{2} \times 3$

CORRECT ANSWER: 3

SOLUTION:

$$PV = nRT$$
$$\frac{P}{3} \times 2V = nRT$$
$$T' = \frac{2}{3}T$$

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Q-19 - 11034740

If $10g$ of a gas at atmospheric pressue is cooled from $273C$ to $0C$,

keeping the volume constant, its pressure would become

(A) $1/273atm$

(B) $2atm$

(C) $\frac{1}{2}atm$

(D) $5.05 \times 10^4 Nm^{-2}$

SOLUTION:

Hint: Given,

$T_1 = 273C$ or $546.15K$

$P_1 = 1atm$

$T_2 = 0C$ or $273.15K$

$P_2 = ?$

$$\therefore \frac{P_1}{T_1} = \frac{P_2}{T_2}$$

$$\therefore P_2 = \frac{P_1 \times T_2}{T_1}$$

$$= \frac{1 \times 273.15}{546.15}$$

$$= \frac{1}{273.1} atm \text{ or } 5.05 \times 10^4 Nm^{-2}$$

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Q-20 - 12225497

What is the molecular weight of a gas whose density

$40C$ and $785mm$ of Hg pressure is $1.3gL^{-1}$?

(A) 32

(B) 40

(C) 15

(D) 98

CORRECT ANSWER: A

SOLUTION:

We know that $PV = nRT$

$PV = \frac{\omega}{M}RT \text{ or } P$

$= \frac{\omega}{V} \times \frac{1}{M}RT$

Or $P = \frac{d}{M}RT$

Now,

$\frac{785}{760} = \frac{1.3}{M} \times 0.0821$

$\times 313$

or $M = 32.4 \text{ or } 32$

Q-21 - 12225498

$120g$ of an ideal gas of molecular weight 40 is confirmed to a volume of $20 litre at 400K$, then the pressure of is:

(A) $490 atm$

(B) $4.92 atm$

(C) $2236 atm$

(D) $22.4 atm$

CORRECT ANSWER: B

SOLUTION:

$$P = \frac{3 \times 0.082 \times 400}{20}$$
$$\Rightarrow P = 4.92 atm$$

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Q-22 - 12225502

A cylinder contains accetylene gas at $27C$ and $4.05 Mpa$. The pressure in the cylinder after half the mass of gas is used up and temperature has fallen to $12C$ will be:

(A) $4.05 MPa$

(B) $2.025 MPa$

(C) $3.84 MPa$

(D) $1.92 MPa$

CORRECT ANSWER: D

SOLUTION:

$$PV = \frac{w}{M_w} RT \quad \frac{P}{WT}$$
$$= \text{constant}$$

$$\frac{P_1}{w_1 T_1} = \frac{P_2}{w_2 T_2}$$
$$\frac{4.05}{w \times 300}$$
$$= \frac{P_2}{\frac{w}{2} \times 285}$$

$$P_2 = 1.92 MPa$$

Q-23 - 12225503

For a definite amount of gas, pressure and volume are increased to triple of the initial amount, Therefore

(A) Temperature increased to nine times of its initial value

(B) Temperature increased to thrice of its initial value

(C) Temperature remains unaltered

(D) Temperature reduced to thrice of its initial value

CORRECT ANSWER: A

SOLUTION:

$$\frac{PV}{T} = \text{constant}$$

$$\Rightarrow \frac{PV}{T_1} = \frac{3P3V}{T_2}$$

$$T_2 = 9T_1$$

Temperature increased to nine times of its initial value.

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Q-24 - 12225504

$3.2g$ of S is heated to occupy a volume of $780ml$ at $450C$ and $723mm$ pressure. Formula of sulphure is

(A) S_2

(B) S

(C) S_4

(D) S_8

CORRECT ANSWER: D

SOLUTION:

$$PV = \frac{w}{M}RT$$

$$\frac{723}{760} \times \frac{780}{1000} = \frac{3.2}{M} \times 0.0821 \times 683$$

$$M = 256$$

$$\therefore \text{ Atomicity } = \frac{256}{32} = 8$$

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Q-25 - 12225505

The pressure and temperature of $4dm^3$ of carbon dioxide gas are doubled. Then the volume of carbon dioxide gas would be

(A) $2dm^3$

(B) $3dm^3$

(C) $4dm^3$

(D) $8dm^3$

CORRECT ANSWER: C

SOLUTION:

$$\frac{P_1V_1}{T_1}=\frac{P_2V_2}{T_2},$$
$$\frac{P_1\times 4}{T_1}=\frac{2P_1\times V_2}{2T_1}$$

$8=2\times V_2$ so $V_2=4dm^2$

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Q-26 - 12225507

The volume of 10moles of an ideal gas at $10atm$ and $500K$ is

(A) $82L$

(B) $41L$

(C) $20.5L$

(D) $\frac{82}{3}L$

CORRECT ANSWER: B

SOLUTION:

$n = 10mole$

$P = 10atm$

$T = 500K$

$R = 0.0821L - atmK^{-1}mol^{-1}$

$PV = nRT$

$10 \times V = 10 \times 0.082 \times 500$

$V = 41L$

Q-27 - 12225508

The molecules of a gas A travel four times faster than the molecules of gas B at same temperature. The ratio of molecular weights (M_A / M_B) is

(A) $1/16$

(B) 4

(C) $1/4$

(D) 16

CORRECT ANSWER: A

SOLUTION:

$$\frac{r_1}{r_2} = \frac{x_1}{x_2} = \sqrt{\frac{M_2}{M_1}}$$

$$= 4$$

$$\frac{M_2}{M_1} = 16\frac{M_1}{M_2} = \frac{1}{16}$$

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Q-28 - 11034916

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

(A) $\frac{1}{2}$
(B) $\frac{8}{9}$
(C) $\frac{1}{9}$
(D) $\frac{16}{17}$

SOLUTION:

Let $16g$ of both be mixed.

Mole of $H_2 = \frac{16}{2} = 8$

Mole of $CH_4 = \frac{16}{16} = 1$

Mole fraction of $H_2 = \frac{8}{1+8} = \frac{8}{9}$

Which is also the fraction of total pressure executed by H_2.

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Q-29 - 11034931

XmL of H_2 gas effuses through a hole in a container in $5s$. The time taken for the effusion of the same volume of the gas specified below, under identical conditions, is

(A) $10s$, He

(B) $20s$, O_2

(C) $25s$, CO

(D) $55s$, CO_2

SOLUTION:

For the same volume diffused,

$t \propto M$ (Graham' s law)

$$\frac{t_1}{t_2} = \sqrt{\frac{M_1}{M_2}}$$

$$(a)\ \frac{5}{10} \ne \sqrt{\frac{2}{4}}$$

$$(b)\ \frac{5}{20} = \sqrt{\frac{2}{32}}$$

$$(c)\ \frac{5}{25} \ne \sqrt{\frac{2}{28}}$$

$$(d)\ \frac{5}{55} \ne \sqrt{\frac{2}{44}}$$

Q-30 - 12225513

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) $2:1$

(B) $\sqrt{2}:1$

(C) $2\sqrt{2}:1$

(D) $1:\sqrt{2}$

CORRECT ANSWER: C

SOLUTION:

$$\frac{r_a}{r_b}=\frac{2}{1}=\sqrt{\frac{M_b}{M_a}}$$

$$V_{rms} \propto \sqrt{\frac{T}{M}}\left(AsV_{rms}\right.$$

$$\left.=\sqrt{\frac{3RT}{M}}\right)$$

$$\frac{V_{rma}(a)}{V_{rms(B)}}$$

$$= \sqrt{\frac{T_a}{T_b} \times \frac{M_b}{M_a}} = \frac{2}{1}$$

$$\times \frac{\sqrt{2}}{1} = \frac{2\sqrt{2}}{1}$$

$$\therefore 2\sqrt{2} : 1$$

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Q-31 - 12225516

N_2 is found in a litre flask under $100kPa$ pressure and O_2 is found in another $3litre$ flask under $20KPa$ pressure. If the two flask are connected, the resultant pressure is

(A) $310kPa$

(B) $210kPa$

(C) $420kPa$

(D) $265 kPa$

CORRECT ANSWER: D

SOLUTION:

Total volume of two flasks $= 1 + 3 = 4$

If P_1 the pressure of gas N_2 in the mixture of N_2 and

O_2 , then

$P = 100 kPa, P_1 = ?,$
$V = 1 \text{litre}, V_1 = 4 \text{litre}$

Applying Boyle's law $PV = P_1 V_1$
$100 \times 1 = P_1 \times 4, P_1$
$= 25$

If P_2 is the pressure of O_2 gas in the mixture of O_2 and

N_2

then,

$320 \times 3 = P_2 \times 4, P_2$
$= 240$

Hence, total pressure

$$P = P_1 + P_2 = 25 + 240 = 265 kP_a$$

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Q-32 - 12225521

A and B are two idential vessels. A contains $15g$ ethane at $1atm$ and $298K$. The vessel B contains $75g$ 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

CORRECT ANSWER: A

SOLUTION:

$$\frac{15}{30} = \frac{75}{M_B}$$
$$M_B = 150, (VD)_B$$
$$= \frac{150}{2} = 75$$

Q-33 - 15880307

20L of SO_2 diffuse through a porous partition in 60 seconds.

Volume of O_2 diffuse under similar conditions in 30 secodns will

be:

(A) 12,14L

(B) 14.14L

(C) 18.14L

(D) 28.14L

CORRECT ANSWER: B

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Q-34 - 11034847

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

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

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

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

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

SOLUTION:

$$PV = nRT$$

$$PV = \frac{w}{m}RT$$

$$P_{O_2}V = \frac{w}{32}RT \ .(i)$$

$$P_{O_2}V = \frac{w}{28}RT \; .(ii)$$

$$\frac{P_{O_2}}{P_{N_2}} = \frac{28}{32}$$

$$P_{O_2} = 0.875P_{N_2}$$

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Q-35 - 12225527

A sample of gas is at $0C$. The temperature at which its rms speed of the molecule will be doubled is

(A) $103^\circ C$

(B) $273^\circ C$

(C) $723^\circ C$

(D) $819^\circ C$

CORRECT ANSWER: D

SOLUTION:

$$\frac{r_1}{r_2} = \sqrt{\frac{T_2}{T_1}}$$
$$2 = \sqrt{\frac{T_2}{273}}$$
$$T_2 = 273 \times 4$$
$$= 1092K = 1092$$
$$- 273 = 819C$$

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Q-36 - 12225528

A vessel contains $0.1 mole of He$, 0.1 mole of O_2 and 0.3 mole of N_2. The total pressure is 1 atomosphere. The pressure exerted by O_2 is

(A) 380mm of Hg

(B) 456mm of Hg

(C) 304mm of Hg

(D) 152mm of Hg

CORRECT ANSWER: D

SOLUTION:

Total moles

$$= 0.1(He) + 0.1(O_2)$$
$$+ 0.3(N_2) = 0.5\text{moles}$$

Pressure exerted by $O_2 =$ mole fraction of

$O_2 \times \text{total pressure}$

$$\frac{0.1}{0.5} \times 1 = \frac{1}{5} \times 760$$
$$= 152 mmHg$$

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Q-37 - 15880305

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

(A) $PCl_3 > SO_3 > CO_2$

(B)

$CO_2 > SO_2 > PCl_3$
$> SO_3$

(C)

$SO_2 > SO_3 > PCl_3$
$> CO_2$

(D)

$CO_2 > SO_2 > SO_3$
$> PCl_3$

CORRECT ANSWER: D

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Q-38 - 12225533

Under identical conditions of temperature, the density of a gas X is three times that of gas Y while molecular mass of gas Y is twice that of X. The ratio of pressure of X and Y will be

(A) 6

(B) $1/6$

(C) $2/3$

(D) $3/2$

CORRECT ANSWER: A

SOLUTION:

$$\rho = \frac{PM}{RT} \Rightarrow P$$

$$= \frac{\rho RT}{M}$$

$$P_x = \frac{\rho \times RT}{M_x} \quad P_y$$

$$= \frac{\frac{\rho_x RT}{3}}{2Mx}$$

$$6P_y = \frac{\rho_x RT}{M_X}$$

$$\therefore 6P_Y = P_X \quad \frac{P_X}{P_Y}$$

$$= 6$$

Q-39 - 12225534

NH_3 and SO_2 gases are being prepared at two corners of a laboratory. The gas that will be detected first in the middle of the laboratory is:

(A) NH_3

(B) SO_2

(C) both at the same time

(D) can't determine

CORRECT ANSWER: A

SOLUTION:

Rate of diffusion $\propto \dfrac{1}{\sqrt{\text{molecular mass}}}$

Q-40 - 12225536

$1000ml$ of a gas A at 600torr and $500ml$ of a gas B at 800torr are placed in a $2L$ flask. The final pressure will be

(A) 2000torr

(B) 1000torr

(C) 500torr

(D) 1400torr

CORRECT ANSWER: C

SOLUTION:

From Dalton's partial pressure law

$$P_1 = \frac{1000}{1500} \times 600$$

$$+ \frac{500}{1500} \times 800$$

$$= 400 + \frac{800}{3}$$

$$= \frac{2000}{3}\text{torr}$$

.

$$V_1 = 1500mL$$

$$P_2 = ?V_2 = 2L$$

$$= 2000mL$$

From $P \propto \frac{1}{V}$

$$\frac{P_1}{P_2} = \frac{V_2}{V_1} =$$

$$\Rightarrow \frac{2000/3}{P_2} = \frac{2000}{1500}$$

$$\Rightarrow P_2 = \frac{1500}{3}$$

$$= 500\text{torr}$$

Q-41 - 52403662

Equal masses of methane and oxygen are mixed in an empty container at $25C$. The fraction of the total pressure exerted by oxygen is

(A) $\frac{2}{3}$
(B) $\frac{1}{3} \times \frac{273}{298}$
(C) $\frac{1}{3}$
(D) $\frac{1}{2}$

CORRECT ANSWER: C

SOLUTION:

Let the mass of methane and oxygen is w

mole fraction of oxygen $= \dfrac{\frac{w}{32}}{\frac{w}{32} + \frac{w}{16}}$

$$= \frac{\frac{1}{32}}{\frac{1}{32} + \frac{1}{16}} = \frac{\frac{1}{32}}{\frac{3}{32}}$$

$$= \frac{1}{3}$$

Let the toal pressure be P

The pressure exerted by oxygen (partial pressure)

$$= X_{O_2} \times P_{\text{total}} \Rightarrow P$$

$$\times \frac{1}{3}$$

, Hence, (c) is correct .

Q-42 - 11034926

The rate of diffusion of methane at a given temperature is twice that of a gas X. The molecular weight of X is

(A) 64.0

(B) 32.0

(C) 4.0

(D) 8.0

SOLUTION:

$$\frac{r_{\text{methane}}}{r_{gas}}$$

$$= \sqrt{\frac{M_{gas}}{M_{\text{methane}}}}$$

(Graham's law)

or $2 = \sqrt{\frac{M_{gas}}{16}}$

or $M_{gas} = 64$

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Q-43 - 12225546

The $r.m.s.$ velocity of hydrogen at

$27C, R = 8.314 Jmol^{-1} K^{-1}$ is:

(A) $1.934m/s$

(B) $19.34m/s$

(C) $193.4m/s$

(D) $1934m/s$

CORRECT ANSWER: D

SOLUTION:

$$U_{rms} = \sqrt{\frac{3RT}{M_w}}$$

$$\Rightarrow \sqrt{\frac{3 \times 8.314 \times 300}{2 \times 10^{-3}}}$$

$$U_{rms} = 1934m/\text{sec}$$

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Q-44 - 12225551

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) $180K$

CORRECT ANSWER: B

SOLUTION:

$$U_{rms} = \sqrt{\frac{T}{M_w}T}$$

$$\propto M_w$$

$$\frac{T_{N_e}}{T_{O_2}} = \frac{20}{32} \quad T_{O_2}$$

$$= 480K$$

Q-45 - 11034838

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

(A)
$H_2 > N_2 > O_2 > HBr$

(B)
$HBr > O_2 > M_2 > H_2$

(C)
$HBr > H_2 > O_2 > N_2$

(D)
$N_2 > O_2 > H_2 > HBr$

SOLUTION:

$$\mu_{rms} = \sqrt{\frac{3RT}{M}}$$ or $$\mu_{rms} \propto \sqrt{\frac{1}{M}}$$

Hence,

$$He > N_2 > O_2$$
$$> HBr$$

Q-46 - 18255327

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

(A) 4

(B) 2

(C) 1

(D) 43469

SOLUTION:

(c) $U_{rms} = \sqrt{\frac{3RT}{M}}$

$\therefore \frac{U_1}{U_2}$

$$= \sqrt{\frac{3RT_1}{M_1} \times \frac{M_2}{3RT_2}}$$

$$= \sqrt{\frac{T_1 M_2}{T_2 M_1}}$$

$$= \sqrt{\frac{50 \times 32}{800 \times 2}} = 1$$

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Q-47 - 12225560

The ratio, $\frac{\text{rms velocity of} SO_2}{\text{rms velocity of He}}$, of sulpur dioxide and helium gases at $30C$ is equal to:

(A) 4

(B) 0.25

(C) 0.10

(D) 8

CORRECT ANSWER: B

SOLUTION:

$$\frac{(U_{rms})SO_2}{(U_{rms})_{He}}$$

$$= \sqrt{\frac{M_{He}}{M_{SO_2}}}$$

$$\sqrt{\frac{4}{64}} = \frac{1}{4} = 0.25$$

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Q-48 - 12225565

The $R.\ M.\ S.$ Speed of the molecules of a gas of density kgm^{-3} and pressure $1.2 \times 10^5\, Nm^{-2}$ is:

(A) $120ms^{-1}$

(B) $300ms^{-1}$

(C) $600ms^{-1}$

(D) $900ms^{-1}$

CORRECT ANSWER: B

SOLUTION:

$$U_{rms}=\sqrt{\frac{3PV}{M}}$$

$$=\sqrt{\frac{3P}{d}}$$

$$=\sqrt{\frac{3\times1.2\times10^5}{4}}$$

$$=300m/\sec$$

Q-49 - 12225568

The average speed of an ideal gas molecule at $27C$ is $0.3m$, $\sec^{-1}$.

The average speed at $927C$

(A) $0.15m\sec^{-1}$

(B) $0.6m\sec^{-1}$

(C) $1.2m\sec^{-1}$

(D) $0.6cm\sec^{-1}$

CORRECT ANSWER: B

SOLUTION:

$$U_{AVg} = \sqrt{\frac{8RT}{\pi M}}$$

$$\Rightarrow \frac{U_{AVg.}}{0.3} = \sqrt{\frac{1200}{300}}$$

$$U_{AVg.} = 0.6m/\sec$$

Q-50 - 52403771

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

(A) $u/2$

(B) 2u

(C) 4u

(D) 14u

CORRECT ANSWER: B

SOLUTION:

$$\frac{U_1}{U_2} = \sqrt{\frac{n_1 T_1}{n_2 T_2}}$$
$$= \sqrt{\frac{n \times T}{2n \times 2T}} = \sqrt{\frac{1}{4}}$$
$$= \frac{1}{2}$$

$$U_1 = 2U_1 = 2U$$

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Q-51 - 12225583

The KE of N molecule of O_2 is x joules at $-123C$. Another sample of O_2 at $27C$ has a KE of $2x$ joules. The latter sample contains

(A) N molecules of O_2

(B) $2N$ molecules of O_2

(C) $N/2$ molecules of O_2

(D) $N/4$ molecules of O_2

CORRECT ANSWER: A

SOLUTION:

$$KE = \frac{3}{2}RT, T =$$
$$-123 + 273 =$$
$$+150K$$

$$\frac{3}{2} \times R \times 150 = 3$$
$$\times 8.314 \times 75 = xJ$$

$$= 225 \times 8.314 = x$$

At

$$27C = 27 + 223$$
$$= 300K$$

KE for

$$= 2xJ = \frac{3}{2} \times 8.314$$
$$\times 300$$

N molecules

$\therefore x\text{Joule} = 3 \times 8.314 \times 75$

In both the cases xJ corresponds to N molecules.

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Q-52 - 52403814

What is the relationship between the average velocity (v) , root mean square velocity (u) and most probable velocity (a)

(A)
$\alpha : v : u : : 1 : 1.128 : 1.224$

(B)
$\alpha : v : u : : 1.128 : 1 : 1.224$

(C)

$\alpha : v : u : : 1.128 : 1.224 : 1$

(D)

$\alpha : v : u : : 1.124 : 1.228 : 1$

CORRECT ANSWER: A

SOLUTION:

$V_{av} : V_{rms} : V_{\text{most probable}} = V : U : \alpha$

$$\sqrt{\frac{8RT}{\pi M}} : \sqrt{\frac{3R}{M}} : \sqrt{\frac{2RT}{M}}$$

$$\alpha : V : U = \sqrt{2} : \sqrt{\frac{8}{\pi}} : \sqrt{3} = 1 : 1.128 : 1.224$$

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Q-53 - 12225591

NH_3 is liquefied more easily than N_2. Hence

(A) a and b of $NH_3 >$ that of N_2

(B) $a(NH_3) > a(N_2)$ but $b(NH_3) < b(N_2)$

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

(D) None

CORRECT ANSWER: B

SOLUTION:

More is the value of a mass greater is the liquefaction and bigger is the size of molecule bigger is the $'b'$ value.

Q-54 - 12225596

Calculate the compressibility factor for CO_2 if one mole of it occupies 0.4 litre at $300K$ and $40atm$. 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

CORRECT ANSWER: B

SOLUTION:

$$Z = \frac{PV}{RT}$$

$$\Rightarrow \frac{40 \times 0.4}{300 \times 0.082}$$

$$Z = 0.65$$

Q-55 - 12225603

Which of the following is the correct set of volume calculated by ideal gas equation and van der Waals equation respectively for 1 mole CO_2 gas at $300K$ and $10atm$ pressure.

$(R = 0.0821 LatmK^{-1}mol^{-1})$

(A) $2.463L$, $2.56L$

(B) $2.463L$, $2.38L$

(C) $2.463L$, $2.463L$,

(D) $2.463L$, $2.5L$

CORRECT ANSWER: B

SOLUTION:

$$V_I = \frac{nRT}{p}$$
$$= \frac{1 \times 0.0821 \times 300}{10}$$
$$= 2.463L$$

For CO_2, at $10atmZ < 1$
$$\Rightarrow \frac{V_R}{V_I} < 1 \Rightarrow V_R$$
$$< V_I$$

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Q-56 - 12225606

Which of the following satisfies the greater compressibility of real gas?

(A) $Z < 1$

(B) At the higher pressure

(C) Above the Boyle's temperature

(D) Lesser the value of $''a''$ but higher value of $''b''$

CORRECT ANSWER: A

SOLUTION:

$Z < 1$ shows that the gas has greater compressibility at intermidiate pressure and all reactive forces are dominant, higher value of $'a'$ and lower value of $'b'$ above Boyle's temperature is not possible because $Z > 1$.

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Q-57 - 12225607

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 $2.253 L^2 atm mol^{-2}$ respectively, is:

(A)

$O_2 < N_2 < NH_3$
$< CH_4$

(B)

$O_2 < N_2 < CH_4$
$< NH$

(C)

$NH_3 < CH_4 < N_2$
$< O_2$

(D)

$NH_3 < CH_4 < O_2$
$< N_2$

CORRECT ANSWER: B

Q-58 - 15880475

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) $\frac{1}{4}$

CORRECT ANSWER: A

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Q-59 - 12225615

For which of the following gas/gases, $\frac{P_C V_C}{RT_C}$ close to 0.22?

(A) Cl_2

(B) CH_3OH

(C) C_2H_4

(D) CH_4

CORRECT ANSWER: B

SOLUTION:

Molecule having hydrogen bonding values of $\frac{P_C V_C}{T}$ close to 0.22

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Q-60 - 11034817

It is eaiser to liquefy oxygen than hydrogen because.

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

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

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

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

SOLUTION:

$$\mu_{rms}(H_2) = \sqrt{\frac{T}{M}}$$

$$= \sqrt{\frac{50}{2}} = 5$$

μ_{rms} of

$$O_2 \propto \sqrt{\frac{T}{M}} = \sqrt{\frac{800}{32}}$$

$$= 5$$

Therefore, the ratio is 1.