States of Matter

Question1

Identify the wrong relation for real gases :

KCET 2024

Options:

A. $Z = \frac{V_{\text{ideal}}}{V_{\text{real}}}$

B. $p_{\text{ideal}} = p_{\text{real}} + \frac{an^2}{V^2}$

C. $V_{\text{real}} = V_{\text{ideal}} - nb$

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

Answer: A

Solution:

Wrong relation about real gases is given in option a. Its correct form is

$Z = \frac{V_{\text{real}}}{V_{\text{idea}}}$

(Z = Compressibility factor)

Question2

Which property of CO_2 makes it biologically and geo-chemically important?

KCET 2022

Options:

A. Its colourless and odourless nature

B. Its low solubility in water

C. Its high compressibility

D. Its acidic nature

Answer: B

Solution:

The property of low solubility of carbon dioxide in water makes it biologically and geo-chemically important. Carbon dioxide on reaction with water form carbonic acid, which dissociates to give HCO_3^- ions. H_2CO_3/HCO_3^- buffer system helps to maintain pH of blood between $7.26 - 7.42$.

Question3

The volume of 2.8 g of CO at $27^\circ C$ and 0.821 atm pressure is($R = 0.08210$ L. atm K mol^{-1})

KCET 2022

Options:

A. 1.5 litres

B. 3 litres

C. 30 litres

D. 0.3 litres

Answer: B

Solution:

Given, amount of CO $= 2.8$ g

Temperature $= 27^{\circ}\text{C}$

Pressure $= 0.821$ atm

$R = 0.08210$ L atm K mol^{-1}

We know that, $pV = RT$

$\therefore \quad V = \frac{RT}{p} = \frac{0.0821 \times 300}{0.821} = 30$ L

$\therefore$ 28 g of CO occupy volume 30 L

$\therefore$ 2.8 g of CO occupy volume $= \frac{30 \times 2.8}{28} = 3$ L

Question4

When the absolute temperature of ideal gas is doubled and pressure is halved, the volume of gas

KCET 2021

Options:

A. will be half of original volume

B. will be 4 times the original volume

C. will be 2 times the original volume

D. will be 1/4th times the original volume

Answer: B

Solution:

Given, final temperature (T_2)

$= 2 \times (T_1)$ initial temperature

Final pressure $(p_2) = 2 \times \frac{(p_1)}{2}$ initial pressure

According to gas law,

$$\frac{p_1V_1}{T_1} = \frac{p_2V_2}{T_2}$$

$$\therefore \quad \frac{p_1V_1}{T_1} = \frac{p_1 \times V_2}{2 \times 2T_1}$$

$$V_2 = 4V_1$$

$\therefore$ Volume increase by 4 times.

Question5

Which of the following equations does not represent Charles's law for a given mass of gas at constant pressure?

KCET 2019

Options:

A. $\frac{V}{T} = K$

B. $\log V = \log K + \log T$

C. $\log K = \log V + \log T$

D. $\frac{d(\ln V)}{dT} = \frac{1}{T}$

Answer: C

Solution:

Charle's law states that "pressure remaining constant, the volume of a fixed mass of a gas is directly proportional to its absolute temperature. The general equation is as follows :

$\frac{V}{T} =$ Constant (K); $\quad V = KT \quad$ .... (i)

Taking the logarithm of equation (i)

$\log V = \log K + \log T \quad$ .... (ii)
$\log K = \log V - \log T \quad$ .... (iii)

Equation (ii) can also be represented as

$\ln V = \ln K + \ln T \quad$ .... (iv)

Taking differentiation of equation (iv) w.r.t T.

$\frac{d(\ln V)}{dT} = 0 + \frac{1}{T}; \frac{d(\ln V)}{dT} = \frac{1}{T}$

Question6

For an ideal gas, compressibility factor is

KCET 2018

Options:

A. 0

B. 1

C. -1

D. +2

Answer: B

Solution:

The compressibility factor, denoted by Z, is defined as:

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

For an ideal gas, the ideal gas law states that:

$PV = nRT$

Substituting this into the expression for Z gives:

$Z = \frac{nRT}{nRT} = 1$

So, the compressibility factor for an ideal gas is 1.

Answer: Option B.

Question7

Dry ice is

KCET 2018

Options:

A. solid CO

B. solid SO_2

C. solidCO_2

D. solid O_2

Answer: C

Solution:

Dry ice is the solid form of carbon dioxide. Here's a quick explanation:

Dry ice is made of carbon dioxide (CO_2).

At atmospheric pressure, carbon dioxide does not melt into a liquid but instead transitions directly from a solid to a gas; this process is called sublimation.

Among the options provided, the correct answer is the one that indicates dry ice is a solid form of carbon dioxide.

Thus, the correct answer is:

Option C: solid CO_2

Question8

The pressure of real gases is less than that of ideal gas because of

KCET 2017

Options:

A. increases in the kinetic energy of the molecules

B. increases in the number of collisions

C. intermolecular attraction

D. finite size of particles

Answer: C

Solution:

The presence is much greater in ideal gas compared to the pressure of a real gas since the particles do not have the attractive forces that enable the molecules to hold back when they will collide at an impact. Hence, particles collide with less energy.
