

# PHYSICAL CHEMISTRY

NEET

CRASH COURSE

STATE OF MATTER

**SMART ACHIEVERS**  
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Q.1 The correct gas equation is :

(1)  $\frac{P_1 V_1}{P_2 V_2} = \frac{T_1}{T_2}$       (2)  $\frac{V_2 T_2}{P_1} = \frac{V_1 T_1}{P_2}$       (3)  $\frac{P_1 T_1}{V_1} = \frac{P_2 T_2}{V_2}$       (4)  $\frac{V_1 V_2}{T_1 T_2} = P_1 P_2$

Q.2 8.2L of an ideal gas weighs 9.0g at 300K and 1 atm pressure. The molecular mass of gas is

(1) 9      (2) 27      (3) 54      (4) 81

Q.3 The density of a gas is equal to (P=pressure, V=volume, T= temperature, R = gas constant, n=number of moles and M= molecular weight) :

(1)  $nP$       (2)  $\frac{PM_w}{RT}$       (3)  $\frac{P}{RT}$       (4)  $\frac{M_w}{V}$

Q.4 When gases are heated from 20°C to 40°C at constant pressure, the volumes :

- (1) Decrease by the same magnitude  
 (2) Become double  
 (3) Increase in the ratio of their molecular masses  
 (4) Increase

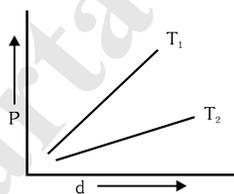
Q.5 When pressure of  $\text{NH}_3(\text{g})$  is 1 atm in 44.8 lit flask at 0°C then number of molecules of ammonia gas is :

(1)  $4N_A$       (2)  $N_A$       (3)  $\frac{N_A}{2}$       (4)  $2N_A$

Q.6 V versus T curves at constant pressure  $P_1$  and  $P_2$  for an ideal gas are shown in Fig. Which is correct

(1)  $P_1 > P_2$       (2)  $P_1 < P_2$       (3)  $P_1 = P_2$       (4) All

Q.7 Figure shows graphs of pressure versus density for an ideal gas at two temperatures  $T_1$  and  $T_2$ . Which is correct :



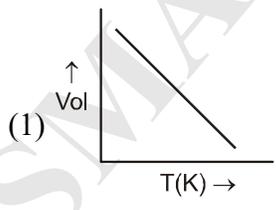
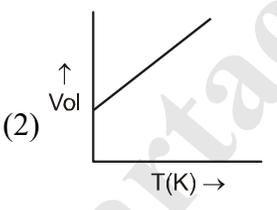
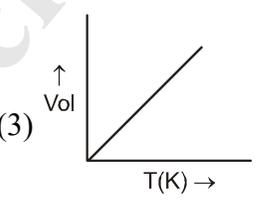
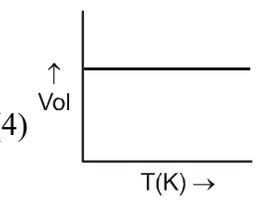
(1)  $T_1 > T_2$       (2)  $T_1 = T_2$       (3)  $T_1 < T_2$       (4) None of the above

Q.8 Most probable speed, average speed and RMS speed are related as :

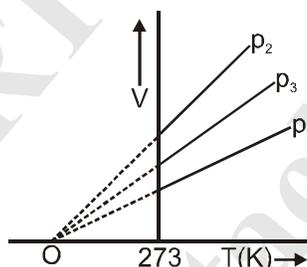
(1) 1 : 1.128 : 1.224      (2) 1 : 1.128 : 1.424  
 (3) 1 : 2.128 : 1.224      (4) 1 : 1.428 : 1.442

Q.9 Four particles have speed 2, 3, 4 and 5 cm/s respectively. Their rms speed is :

(1) 3.5 cm/s      (2)  $\left(\frac{27}{2}\right)$  cm/s      (3)  $\sqrt{54}$  cm/s      (4)  $\left(\frac{\sqrt{54}}{2}\right)$  cm/s

- Q.10 Average K.E. of  $\text{CO}_2$  at  $27^\circ\text{C}$  is  $E$ . The average kinetic energy of  $\text{NO}_2$  at the same temperature will be  
 (1)  $E$  (2)  $22E$  (3)  $E/22$  (4)  $E/\sqrt{2}$
- Q.11 The correct expression for the vander waal's equation of states is :  
 (1)  $\left(p + \frac{a}{n^2V^2}\right)(V - nb) = nRT$  (2)  $\left(p + \frac{an^2}{V^2}\right)(V - nb) = \Delta nRT$   
 (3)  $\left(p + \frac{an^2}{V^2}\right)(V - b) = nRT$  (4)  $\left(p + \frac{an^2}{V^2}\right)(V - nb) = nRT$
- Q.12 At relatively high pressure, van der waals' equation reduces to :  
 (1)  $PV = RT$  (2)  $PV = RT + \frac{a}{V}$  (3)  $PV = RT + Pb$  (4)  $PV = RT - \frac{a}{V^2}$
- Q.13 If the pressure and absolute temperature of 2 litres of  $\text{CO}_2$  are doubled, the volume of  $\text{CO}_2$  would become  
 (1) 2 litres (2) 4 litres (3) 5 litres (4) 7 litres
- Q.14 A volume of  $1 \text{ m}^3$  is equal to :  
 (1)  $1000 \text{ cm}^3$  (2)  $100 \text{ cm}^3$  (3)  $10 \text{ dm}^3$  (4)  $10^6 \text{ cm}^3$
- Q.15 A gas at  $298 \text{ K}$  is shifted from a vessel of  $250 \text{ cm}^3$  capacity to that of  $1 \text{ L}$  capacity. The pressure of the gas will:  
 (1) become double (2) becomes four times  
 (3) decrease to half of the original value (4) decrease to one-fourth of the original value
- Q.16 The correct representation of Charles' law is given by :  
 (1)  (2)  (3)  (4) 
- Q.17 If  $P$ ,  $V$ ,  $M$ ,  $T$  and  $R$  are pressure, volume, molar mass, temperature and gas constant respectively, then for an ideal gas, the density is given by  
 (1)  $\frac{RT}{PM}$  (2)  $\frac{P}{RT}$  (3)  $\frac{M}{V}$  (4)  $\frac{PM}{RT}$
- Q.18 The temperature at which RMS velocity of  $\text{SO}_2$  molecules is half that of  $\text{He}$  molecules at  $300 \text{ K}$  is :  
 (1)  $150 \text{ K}$  (2)  $600 \text{ K}$  (3)  $900 \text{ K}$  (4)  $1200 \text{ K}$
- Q.19 At  $27^\circ\text{C}$ , the ratio of rms velocities of ozone to oxygen is :  
 (1)  $\sqrt{3/5}$  (2)  $\sqrt{4/3}$  (3)  $\sqrt{2/3}$  (4)  $0.25$

- Q.20 The term that corrects for the attractive forces present in a real gas in the vander Waals equation is :
- (1)  $nb$                       (2)  $\frac{an^2}{\sqrt{2}}$                       (3)  $-\frac{an^2}{\sqrt{2}}$                       (4)  $-nb$
- Q.21 Equal masses of methane and oxygen are mixed in an empty container at  $25^\circ\text{C}$ . The fraction of total pressure exerted by oxygen is :
- (1)  $1/3$                       (2)  $1/2$                       (3)  $2/3$                       (4)  $\frac{1}{3} \times \frac{273}{298}$
- Q.22 Equal masses of methane and hydrogen are mixed in an empty container at  $25^\circ\text{C}$ . The fraction of the total pressure exerted by hydrogen is :
- (1)  $\frac{1}{2}$                       (2)  $\frac{8}{9}$                       (3)  $\frac{1}{9}$                       (4)  $\frac{16}{17}$
- Q.23 Maximum deviation from ideal gas is expected from :
- (1)  $\text{N}_2(\text{g})$                       (2)  $\text{CH}_4(\text{g})$                       (3)  $\text{NH}_3(\text{g})$                       (4)  $\text{H}_2(\text{g})$
- Q.24 A gas can be liquified :
- (1) above its critical temperature                      (2) at its critical temperature  
(3) below its critical temperature                      (4) at any temperature
- Q.25 The volume-temperature graphs of a given mass of an ideal gas at constant pressure are shown below :



What is the correct order of pressures ?

- (1)  $p_1 > p_3 > p_2$                       (2)  $p_1 > p_2 > p_3$                       (3)  $p_2 > p_3 > p_1$                       (4)  $p_2 > p_1 > p_3$
- Q.26 The root mean square velocity of one mole of a monatomic gas having molar mass  $M$  is  $U_{\text{rms}}$ . The relation between the average kinetic energy ( $E$ ) of the gas and  $U_{\text{rms}}$  is :
- (1)  $U_{\text{rms}} = \sqrt{\frac{3E}{2M}}$                       (2)  $U_{\text{rms}} = \sqrt{\frac{2E}{3M}}$                       (3)  $U_{\text{rms}} = \sqrt{\frac{2E}{M}}$                       (4)  $U_{\text{rms}} = \sqrt{\frac{E}{3M}}$
- Q.27 In vanderwaals equation of state of the gas law, the constant 'b' is a measure of :
- (1) intermolecular repulsions  
(2) intermolecular attraction  
(3) volume occupied by the molecules  
(4) intermolecular collisions per unit volume

Q.28 If  $Z$  is a compressibility factor, vander Waals equation at low pressure can be written as :

(1)  $Z = 1 + \frac{RT}{Pb}$       (2)  $Z = 1 - \frac{a}{VRT}$       (3)  $Z = 1 - \frac{Pb}{RT}$       (4)  $Z = 1 + \frac{Pb}{RT}$

Q.29 At what temperature the RMS velocity of  $\text{SO}_2$  be same as that of  $\text{O}_2$  at 303 K ?

(1) 273 K      (2) 606 K      (3) 303 K      (4) 403 K

Q.30 What will be the partial pressure of  $\text{H}_2$  in a flask containing 2g of  $\text{H}_2$ , 14 g of  $\text{N}_2$  and 16 g of  $\text{O}_2$  :

(1) 1/2 the total pressure      (2) 1/3 the total pressure  
(3) 1/4 the total pressure      (4) 1/16 the total pressure

### ASSERTION & REASON

**Directions :** Each of these questions contains an Assertion followed by reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

- (1) If both assertion and reason are true and reason is the correct explanation of assertion.
- (2) If both assertion and reason are true but reason is not the correct explanation of assertion.
- (3) If Assertion is true but reason is false.
- (4) If both assertion and reason are false.

Q.31 **Assertion :** Compressibility factor of non-ideal gases is always less than 1.

**Reason :** Non-ideal gases exert less pressure than expected for ideal gas.

Q.32 **Assertion :** The value of van der Waals constant 'a' is higher for ammonia than for nitrogen.

**Reason :** Intermolecular hydrogen bonding is present in ammonia.

Q.33 **Assertion :** Effusion rate of oxygen is larger than nitrogen.

**Reason :** Molecular size of nitrogen is smaller than oxygen.

Q.34 **Assertion :** Compressibility factor for hydrogen varies with pressure with positive slope at all pressures.

[AIIMS 2005]

**Reason :** Even at low pressure, repulsive forces dominate hydrogen gas.

Q.35 **Assertion :** At high pressure, the compressibility factor  $Z$  is  $\left(1 + \frac{Pb}{RT}\right)$       [AIIMS 2007]

**Reason :** At high pressure van der Waal's equation is modified as  $P(V - b) = RT$ .

**ANSWER KEY**  
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Q.1	1	Q.2	2	Q.3	2	Q.4	4	Q.5	4	Q.6	2	Q.7	1
Q.8	1	Q.9	4	Q.10	1	Q.11	4	Q.12	3	Q.13	1	Q.14	4
Q.15	4	Q.16	3	Q.17	4	Q.18	4	Q.19	3	Q.20	2	Q.21	1
Q.22	2	Q.23	3	Q.24	3	Q.25	1	Q.26	3	Q.27	3	Q.28	2
Q.29	2	Q.30	1	Q.31	4	Q.32	1	Q.33	3	Q.34	1	Q.35	1