Gaseous State

1. Ideal Gas, Boyle's Law, Barometer & Manometer

Q 1. **Assertion (A):** Three states of matter are the result of balance between intermolecular forces and thermal energy of the molecules
Reason (R): Intermolecular forces tend to keep the molecules together but thermal energy of molecules tends to keep them apart.
[NCERT Exemplar]
(A) Both A and R are true and R is the correct explanation of A
(B) Both A and R are true but R is not the correct explanation of A
(C) A is true but R is false
(D) A is false but R is true

Q 2. The behavior of a real gas approaches to ideal behavior at
(A) low T & low P (B) High T & High P
(C) low T & High P (D) High T & low P

Q 3. At which pressure & temperature conditions is the behavior of a real gas closest to that of an ideal gas?
(A) 15 atm and 200 K (B) 1 atm and 273 K
(C) 0.5 atm and 500K (D)15 atm and 500 K

Q 4. The mixture of three gases X(density 0.90), Y(density 0.178) & and Z (density 0.42) is enclosed in a closed vessel at constant temperature. When equilibrium is established, the
(A) gas X will be at the top of the
(B) gas Y will be at the top of the vessel
(C) gases X,Y, Z will constitutes homogenous mixture throughout the vessel
(D) gas Y will be at the bottom of the vessel

Q 5. Pressure is defined as
(A) Force per unit area
(B) Normal force per unit area
(C) Force per unit normal area
(D) Both (B) & (C)

Q 6. Which of the following is not a unit of pressure?
(A) Pascal (B) Torr
(C) Dynes (D) atm

Q 7. Which of the following pressure is of the highest magnitude?
(A) 300 cm of Hg (B) 28 lb/in^2 (psi)
(C) 380 torr (D) 0.9 atm
(E) 104 N/m^2

Q 8. Atmospheric pressure is measured by
(A) Manometer (B) Barometer
(C) Lactometer (D) Thermometer

Q 9. If H_2O is used in barometer in place of Hg, then height of H_2O column correspond to 1 atm pressure is
(A) 760 cm (B) 10.336 m
(C) 103.36 cm (D) 5.58 m

Q 10. 0.5 atm = ….. cm of diesel (density of diesel = 0.832 g/ml)
(A) 516.8 (B) 445
(C) 621.15 (D) None of these

Q 11. If the barometer vessel has X-sectional area 50 cm^2 and inverted U-tube has X-sectional area 0.5 cm^2 then calculate the height of Hg in final situation when initially height of Hg in vessel is 10 cm. [P_{atm} = 1 atm]
(A) 9.24 cm (B) 9.04 cm
(C) 8.15 cm (D) 9.50 cm

Q 12. Manometer measure
(A) atmospheric pressure
(B) pressure due to liquid column
(C) pressure of a gaseous system
(D) none of these

Q 13. A vessel containing gas at a pressure of 60 cm of Hg was connected to arm A of open end manometer. The atmospheric pressure was recorded as 74cm of Hg. If the mercury in arm A stands at 84.5 cm height, the mercury in arm B will stand at
(A) 70.5 cm (B) 74 cm
(C) 24.5 cm (D) 88 cm

Q 14. A vessel containing gas at a pressure of 60 cm of Hg was connected to arm A to close end manometer. The pressure of gas in attached to another arm was recorded as 74cm of Hg. If mercury in arm A stands at 30 cm height, at which height the mercury in arm B will stand?
(A) 46 cm (B) 16 cm
(C) 14 cm (D) None of these

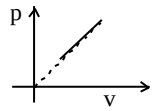
2. Charle's Law, Avogadro's Law

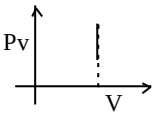
Q 1. A balloon is filled with hydrogen at room temperature. It will burst if pressure exceeds 2 bar. If at 1 bar pressure the gas occupies 2.27 L volume, upto what volume can the balloon be expanded? **[NCERT Solved]**

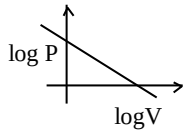
Q 2. The volume of gaseous system is reduced to 1/3rd of its volume then pressure increase by
(A) 2% (B) 3%
(C) 200% (D) 300%

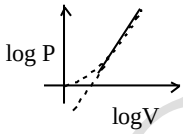
Q 3. At a constant temperature, what should be the percentage increase in pressure for a 5% decrease in the volume of gas
(A) 5% (B) 10%
(C) 5.26% (D) 4.26%

Q 4. Which of the following curve is correct case at constant mole & temperature?

(A) 

(B) 

(C) 

(D) 

Q 5. An air bubble reaches to surface from bottom of a river & in this phenomena radius of bubble increases 2 times. If pressure at surface is 1 atm ten Find the depth of the river. (1 atm = 10.36 m of H_2O)
(A) 10.36 m (B) 82.88 m
(C) 20.72 m (D) 72.52 m

Answer Q.N. 20 to Q.N. 22 from following data:

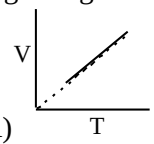
A 10.0 cm column of air is trapped by a column of Hg 8.00 cm long in a capillary tube of uniform bore when the tube is held horizontally in a room at 0.9400 atm pressure. What will be the length of the air column when the tube is held?

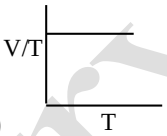
Q 6. Vertically with the open end
(A) 8.99 cm (B) 9.99 cm
(C) 9.5 cm (D) 11.01 cm

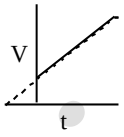
Q 7. Vertically with the open end down
(A) 9.7 cm (B) 10.3 cm
(C) 11.3 cm (D) 8.7 cm

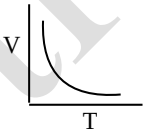
Q 8. at 45^0 angle from the vertical with the open end up?
(A) 9.72 cm (B) 9.27 cm
(C) 8.95 cm (D) None of these

Q 9. Regarding Charles law, which is wrong?

(A) 

(B) 

(C) 

(D) 

Q 10. On a ship sailing in pacific Ocean where temperature is 23.4°C, a balloon is filled with 2 L air. What will be the volume of the balloon when the ship reaches Indian ocean, Where temperature is 26.1°C ? **[NCERT Solved]**

Q 11. The temperature of a certain mass of gas was increased from 40°C to 41°C at constant pressure. The volume of the gas.
(A) Will remain constant
(B) Will increase by $\frac{1}{273}$ of its volume at 273 K
(C) Will increase by $\frac{1}{273}$ of its volume at 40°C
(D) Will increase, but the increase in volume cannot be predicted

Q 12. Pressure remaining the same, the volume of a given mass of an ideal gas increases for every degree centigrade rise in temperature by definite fraction of its volume at **[CBSE PMT 1989]**
(A) 0°C (B) Absolute Zero
(C) its critical temperature
(D) its Boyle's temperature

Q 13. What is the increase in volume when the temperature of 600 ml of air increases from 27°C to 47°C under constant pressure ?
(A) 640 ml (B) 40 ml
(C) 20 ml (D) None of these

Q 14. If temperature of a system is changed from 27°C to 127°C then percentage increment in volume is
(A) 66.67% (B) 133.33%
(C) 33.33% (D) 166.67%

Q 15. If methane gas and oxygen gas are placed in two identical containers under same conditions of temperature and pressure the mass of O_2 gas is
(A) negligible in comparison with that of CH_4
(B) double that of methane
(C) same as that of methane
(D) half that of methane

Q 16. The temperature of a given mass of a gas is increased from 19ºC to 20°C at constant volume. The Pressure P of the gas is increase
(A) to P (20/19)
(B) by 1/273.15 of its pressure at 0°C
(C) by 1/273.15 of its pressure at 10 K
(D) by a factor of 1/273/15

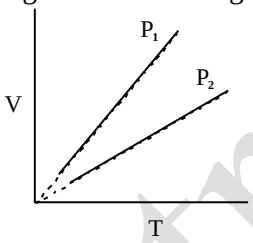
Q 17. An LPG cylinder, containing 15 Kg butane at 300 K and 10 atm pressure, is leaking. After one day, its pressure becomes 8 atm. The quantity of gas leaked is **[AIIMS 2012]**
(A) 1 Kg (B) 2 Kg (C) 3 Kg (D) 4 Kg

Q 18. A gas cylinder containing cooling gas can withstand a pressure of 14.9 atm. The pressure gauge of cylinder indicates 12 atm at 27 ºC. Due to sudden fire in the building the temperature starts rising. The temperature at which cylinder explode is **[AIIMS 1998]**
(A) 87.5 ºC (B) 99.5 ºC
(C) 115.5 ºC (D) 135.5 ºC

Q 19. Two identical vessels separately contain equal masses of Hydrogen and Helium at the same temperature. Then
(A) The number of molecules in the two vessels are equal
(B) the pressures are equal
(C) the pressure of H_2 is double that of He
(D) the pressure of H_2 is half of that of He

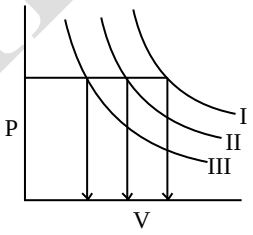
3. Ideal Gas Law

Q 1. V versus T curves at constant pressure P_1 and P_2 for an ideal gas are show in fig. which is correct



(A) $P_1 > P_2$ (B) $P_1 < P_2$
(C) $P_1 = P_2$ (D) All

Q 2. I, II and III are three isotherms respectively at T_1, T_2 and T_3 temperatures. The order of temperature will be



(A) $T_1 = T_2 = T_3$ (B) $T_1 < T_2 < T_3$
(C) $T_1 > T_2 > T_3$ (D) $T_1 > T_2 = T_3$

Q 3. An open vessel containing air is heated from 300 K to 400 K. The fraction of air, which goes out with respect to originally present is
(A) ¾ (B) ¼
(C) 2/3 (D) 1/8

Q 4. The value of the universal gas constant R depends upon the
(A) Nature of the gas
(B) Mass of the gas
(C) Temperature of the gas
(D) The units of measurement

Q 5. Which of the following indicates the value of gas constant
(A) 1.987 cal/K/mole
(B) 8.3 cal/deg/mole
(C) 0.0821 lit/deg/mole
(D) 1.987 joules/deg/mole

Q 6. Which of the following represents a combination of Boyle's Law and Charles Law?

(A) $P_1V_1T_1 = P_2V_2T_2$ (B) $\frac{P_1T_2}{V_2} = \frac{P_2T_1}{V_1}$

(C) $\frac{P_1T_1}{V_1} = \frac{P_2T_1}{V_2}$ (D) $\frac{T_2V_1}{P_1} = \frac{T_1V_2}{P_2}$

Q 7. The quantity $pV/(k_BT)$ represents the

(A) number of molecules in the gas
(B) mass of the gas
(C) number of moles of the gas
(D) translation energy of the gas

Q 8. At 25°C and 760 mm of Hg pressure a gas occupies 600 mL volume. What will be its pressure at a height where temperature is 10°C and volume of the gas is 640 mL.

[NCERT Solved]

Q 9. A volume V of a gas at a temperature T_1 and a pressure p is enclosed in sphere. It is connected to another sphere of volume $V/2$ by a tube and stopcock. The second sphere is initially evacuated and the stopcock is closed. If the stopcock is opened the temperature of the gas in the second sphere becomes T_2. The first sphere is maintained at a temperature T_1. What is the final pressure p_1 within the apparatus ?

(A) $\frac{2pT_2}{2T_2 + T_1}$ (B) $\frac{2pT_2}{T_2 + 2T_1}$

(C) $\frac{pT_2}{2T_2 + T_1}$ (D) $\frac{2pT_2}{T_1 + T_2}$

Q 10. Two flasks of equal volume have been joined by a narrow tube of negligible volume. Initially both flasks are at 300 K containing 0.60 mol of O_2 gas each at 0.5 atm pressure. One of the flasks is then placed in a thermostat at 600K. Calculate final pressure and the number of mol of O_2 gas in each flask.

(A) 0.5 atm (B) 0.667 atm
(C) 0.33 atm (D) None of these

Q 11. The pressure exerted by 12g of an ideal gas at temperature t°C in a vessel of volume V litre is one atm. When the temperature is increased by 10°C at the same volume, the pressure increases by 10%. Calculate the temperature 't' and volume V/ (molecular weight of the gas = 120)

(A) 0.41 lit (B) 0.205 lit
(C) 0.82 lit (D) None of these

Q 12. A bicycle tire is filled with air to a pressure of 610 pKa, at a temperature of 19°C riding the bike on asphalt on a hot day increases the temperature of the tire to 58°C the volume of the tire increases by 4.0% what is the new pressure in the bicycle tire?

(A) 660 KPa (B) 690 KPa
(C) 440 KPa (D) 715 KPa

Q 13. A quantity of H_2 gas occupies a volume of 30 ml at a certain temperature & pressure. What volume would half this mass of H_2 occupy at triple the absolute temperature if the pressure were one ninth to that of the original gas? **[AIIMS 2016]**

(A) 270 ml (B) 90 ml
(C) 405 ml (D) 137 ml

Q 14. Which of the following is a correct representation

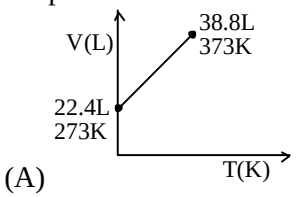
(A) $P_1d_1T_1 = P_2d_2T_2$ (B) $\frac{d_1P_1}{T_1} = \frac{d_2P_2}{T_2}$

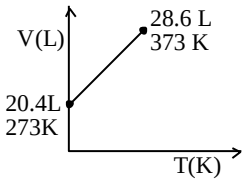
(C) $\frac{P_1}{d_1T_1} = \frac{P_2}{d_2T_2}$ (D) $\frac{P_1T_1}{d_1} = \frac{P_2T_2}{d_2}$

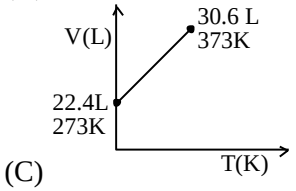
Q 15. The density of a dry air is

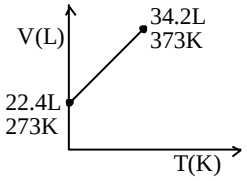
(A) Less than that of wet air
(B) greater than that of wet air
(C) equal to that of wet air
(D) double then wet air

Q 16. Which one of the following V, T plots represents the behavior of one mole of an ideal gas at one atmp? **[AIIMS 2013]**

(A)


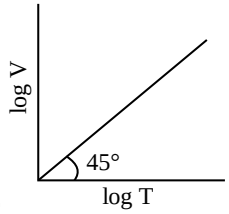
(B)


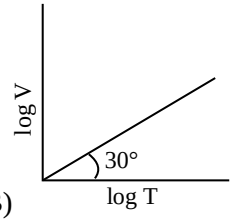
(C)


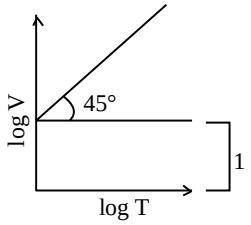
(D)


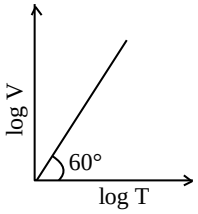
Q 17. For a closed (not rigid) container containing n = 10 moles of an ideal gas fitted with movable,

frictionless, weightless piston operating such that pressure of gas remains constant at 0.821 atm, which graph represents correct variation of log V vs log T where V is in litre and T in Kelvin

(A) 

(B) 

(C) 

(D) 

Q 18. 4.0 g of Argon has pressure P at temperature TK in a vessel. On keeping the sample at 50° higher temperature, 0.8g gas was given out to maintain the pressure P. The original temperature was

(A) 73 K (B) 100 K
(C) 200 K (D) 510 K

Q 19. What would be the SI unit for the quantity pV^2T^2/n ? **[NCERT]**

4. Dalton's law of Partial Pressure, Vapour Pressure

Q 1. Dalton's law of partial pressure is applicable to the following mixture of gases

(A) $H_2 + F_2$ (B) $NH_3 + HCl$
(C) $SO_2 + Cl_2$ (D) $N_2 + O_2$

Q 2. Dalton's law of partial pressures is not applicable to one of the following

(A) $H_2 + Cl_2$ (B) $SO_2 + Cl_2$
(C) $NH_3 + HCl$ (D) All the above

Q 3. Three gases X,Y,Z are placed in a container and have partial pressure as p_1, p_2, p_3 respectively at T Kelvin. The total pressure at T Kelvin will be

(A) Will be always equal to $(p_1 + p_2 + p_3)$
(B) $< (p_1 + p_2 + p_3)$
(C) $> (p_1 + p_2 + p_3)$
(D) $= (p_1 + p_2 + p_3)$ only if the gases do not react chemically at T & behave ideally

Q 4. The pressure of a moist gas at 100°C is 750 mm and aqueous tension at that temperature is 10 mm. Then vapour pressure of the dry gas is

(A) 750mm (B) 760 mm
(C) 740 mm (D) 720 mm

Q 5. Which gas cannot be Collected over water ?

(A) NH_3 (B) CO
(C) N_2 (D) H_2

Q 6. Equal weights of methane & oxygen are mixed in an empty container at 25°C. The fraction of total pressure exerted by oxygen is

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

Q 7. A neon – dioxygen mixture contains 70.6g dioxygen and 167.5g neon. If pressure of the mixture of gases in the cylinder is 25 bar. What is the partial pressure of dioxygen and neon in the mixture ? **[NCERT Solved]**

Q 8. At 25°C and 730 mm pressure, 380 ml of dry oxygen was collected. If the temperature is constant what volume will oxygen occupy at 760 mm pressure.

(A) 365 ml (B) 449 ml
(C) 569 ml (D) 621 ml

Q 9. A cylinder containing $H_2O(l)$ at 25°C recorded a pressure of 500 torr. The volume of cylinder is reduced to half by forcing the piston downward at the same temperature; the pressure reading would be (Aq. Tension = 23 torr)

(A) 977 torr (B) 1000 torr
(C) 1100 torr (D) 1023 torr

Q 10. A close container of volume of 20 lit contains a mixture of Ne and Ar gases, at a temperature of 300 K and pressure of 10^5 N/m^2. The total mass of the mixture is 28 g. Find the masses of Ne & Ar in the container [Ne = 20, Ar = 40]

(A) 4 g, 24 g (B) 10 g, 18 g
(C) 8 g, 20 g (D) 12 g, 16 g

Q 11. Pressure of 1 g of an ideal gas A at 27°C is found to be 2 bar. When 2 g of another ideal gas B is introduced in the same flask at same temperature the pressure becomes 3 bar. Find a relationship between their molecular masses. **[NCERT]**

Q 12. When 2 g of a gaseous substance A is introduced into an initially evacuated flask at 298 K, the pressure is 1 atm. 3 g of another gas B is then added to the flask at same T and the final pressure is found to be 1.5 atm. Calculate the ratio of Molecular mass of A & B.
(A) 4 :3 (B) 2:3
(C) 1:3 (D) 1:2

Q 13. A container holds 22.4 lit of a gas at 1 atm pressure and 273 k. the gas contains mixture of Ar, O_2 & SO_2 in which,
(1). $P_{SO_2} = P_{O_2} + P_{Ar}$ (2). $P_{O_2} = 2P_{Ar}$
Calculate the density of the gas mixture.
(A) 1.1005 g/lit (B) 2.201 g/lit
(C) 4.40 g/lit (D) None of these

Q 14. At STP, a container has 1 mole of He, 2 mole Ne, 3 mole O_2 and 4 mole N_2. Without changing total pressure if 2 mole of O_2 is removed, the partial pressure of O_2 will be decreased by
(A) 26% (B) 40%
(C) 58.33% (D) 66.66%

Q 15. Pay load is defined as the difference between the mass of displaced air and the mass of the balloon. Calculate the pay load when a balloon of radius 10m, mass 100 kg is filled with helium at 1.66 bar at 27°C. (Density of air = 1.2 kg m^{-3} and R = 0.083 bar dm^3K^{-1} mol^{-1}) **[NCERT]**
(A) 3797.8 kg (B) 4797.8 kg
(C) 5012.8 kg (D) None

5. Ideal Gas Problems, K.T.G.

Q 1. An evacuated glass vessel weighs 50.0 g when empty 148.0 g when filled with a liquid of density 0.98 g/ml and 50.5g when filled with an ideal gas at 760 mm Hg at 300 K. Determine the molar mass of the gas
(A) 62.5 g/mol (B) 123 g/mol
(C) 91 g/mol (D) None of these

Q 2. A preweighed vessel was filled with O_2 at STP and weighed. It was then evacuated, filled with SO_2 at the same temperature and pressure and again weighed. The weight of the O_2 will be :
(A) the same as that of the SO_2
(B) twice that of the SO_2
(C) half that of the SO_2
(D) one-fourth that of the SO_2

Q 3. 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 mole/lit. (R = 0.082 litre atm/mol.K)
(A) at STP (B) when V = 22.4 litre
(C) when T = 12.18 K
(D) impossible under any condition

Q 4. The circulation of blood in human body supplies O_2 and releases CO_2. The concentration of O_2 and CO_2 is variable but on the average 100 mL blood contains 0.02g of O_2 and 0.08g of CO_2. The volume of O_2 and CO_2 at 1 atm and at a body temperature of 37°C, assuming 10 litre blood in human body, would be
(A) 2 lit, 4 lit (B) 1.5 lit, 4.5 lit
(C) 1.59 lit, 4,62 lit. (D) 3.82 lit, 4.62 lit

Q 5. At given temperature if $\rho(X) = 3\rho(Y)$ & $M(Y) = 2M(X)$, where ρ and M are density and molar mass of the gases X and Y respectively, then the ratio of their pressure would be
(A) $p(X)/p(Y) = 1/4$ (B) $p(X)/p(Y) = 4$
(C) $p(X)/p(Y) = 6$ (D) $p(X)/p(Y) = 1/6$

Q 6. The density of gas A is twice to that of B at the same temperature the molecular weight of gas B is twice to that of A. The ratio of pressure of gas A and B will be :
(A) $1:6$ (B) $1:1$ (C) $4:1$ (D) $1:4$

Q 7. Pressure of 1 g ideal gas X at 300 K is 2 atm. When 2g of another gas Y is introduced in the same vessel at same temperature, the pressure become 3 atm then correct relationship between molar mass of X and Y is

(A) $M_Y = 2M_X$ (B) $M_Y = 4M_X$

(C) $M_X = 4M_Y$ (D) None of these

Q 8. A rigid container containing 5 mole H_2 gas at some pressure and temperature. The gas has been allowed to escape by simple process from the container due to which pressure of the gas becomes half of its initial pressure and temperature become $(2/3)^{rd}$ of its initial. The mass of gas remaining is

(A) 7.5g (B) 1.5g

(C) 2.5g (D) 3.5g

Q 9. Two glass bulbs A and B at same temperature are connected by a very small tube having a stopcock. Bulb A has a volume of $100cm^3$ and contained the gas while bulb B was empty. On opening the stopcock, the pressure fell down to 20%. The volume of the bulb B is

(A) $100cm^3$ (B) $200cm^3$

(C) $250cm^3$ (D) $400cm^3$

Q 10. Two closed vessel A and B of equal volume of 8.21 L are connected by a narrow tube of negligible volume with open valve. The left hand side container is found to contain 3 mole CO_2 and 2 mole of He at 400 K, what is the partial pressure of He in vessel B at 500 K.

(A) 2.4 atm (B) 8 atm

(C) 12 atm (D) None of these

Q 11. Which occurs when a substance X is converted from liquid to vapour phase at the standard boiling point ?

I. Potential energy of the system decreases

II. The distance between molecules increases

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

(A) I only (B) II only

(C) III only (D) II and III only

Q 12. The root mean square speed of 8 g of He is $300ms^{-1}$. Total kinetic energy of He gas is

(A) 120 J (B) 240 J

(C) 360 J (D) None of these

Q 13. For a monoatomic gas, kinetic energy = E. The relation with rms velocity is **[AIEEE 2004]**

(A) $u = \left(\frac{2E}{m}\right)^{1/2}$ (B) $u = \left(\frac{2E}{3m}\right)^{1/2}$

(C) $u = \left(\frac{E}{2m}\right)^{1/2}$ (D) $u = \left(\frac{E}{3m}\right)^{1/2}$

Q 14. Internal Energy and pressure of a gas per unit volume are related to **[CBSE PMT 1993]**

(A) $P = \frac{2}{3}E$ (B) $P = \frac{3}{2}E$

(C) $P = \frac{1}{2}E$ (D) $P = 2E$

Q 15. According to kinetic theory of gases

(A) the pressure exerted by a gas is proportional to mean square velocity of the molecules at constant volume

(B) the pressure exerted by the gas is proportional to the root mean square velocity of the molecules

(C) the root mean square velocity is inversely proportional to the temperature

(D) the mean translation K.E. of the molecule is directly proportional to the absolute temperature

Q 16. At constant volume, for a fixed number of moles of a gas the pressure of the gas increases with rise to temperature due to

(A) increase in average molecular speed

(B) increased rate of collisions amongst molecules

(C) Increase in molecular attraction

(D) Decrease in mean free path

Q 17. A He atom at 300 K is released from the surface of the earth to travel upwards, assuming that it undergoes no collision with other molecules, how high will it be before coming to the rest?

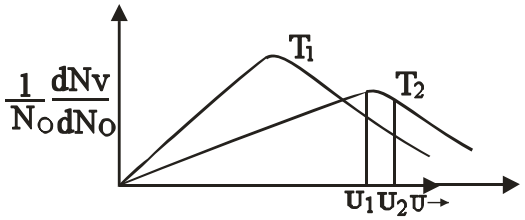
(A) 9.53 m (B) 95.3 m

(C) 953 m (D) $9.51\times10^4 m$

6. Maxwell Boltzmann Velocity Distribution Curve

Answer Q.N. 85 to Q.N. 88 from the given data:

Maxwell distribution of speeds is given as :The area under the curve is equal to the total number of molecules in the collection. On increasing temperature fraction of molecules having speed equal to u_{mp} (most probable speed) decrease. The speed distribution also depends on the mass of the molecules along with temperature. In general, the distribution depends upon the value of M/T, (M = molar mass, T in Kelvin). On the basis of the given curve, answer the following.



Q 1. On increasing the temperature, number of molecules having speed between u_1 and u_2
(A) Increases (B) decreases
(C) remain same (D) can't deteremined

Q 2. On increasing temperature, which of the following statement is incorrect?
(A) Area under the curve remains constant.
(B) Fraction of the molecules having speed equal to u_{mp} decreases.
(C) More molecules posses speeds near to the most proable speed.
(D) The distribution of speeds depends only on the values of M (M = molar mass, T in Kelvin).

Q 3. Which of the following statement is incorrect ?
(A) The distribution of speeds of O_2 molecules at temperature T will be same as those of SO_2 molecules at same temperature.
(B) At same temperature, distribution of speeds of SO_2 and O_2 molecules will be different.
(C) The distribution of speeds of O_2 molecules at temp. T K will be the same as those of SO_2 molecule at temperature 2T K.
(D) None of these.

Q 4. If u_{mp} at T_1 K is U_1, then the value of u_{rms} at T_2 is
(A) $3\sqrt{\frac{T_2}{T_1}}.U_1$ (B) $\sqrt{\frac{3T_2}{2T_1}}.U_1$
(C) $\sqrt{\frac{T_2}{T_1}}.U_1$ (D) $2\sqrt{\frac{T_2}{T_1}}u_1$

Q 5. Three molecules of different gases have speeds of 2 m/s, 4 m/s, 6 m/s respectively. The root mean square velocity at this temperature
(A) (2+4+6)/3 (B) $(4)^{1/2}$
(C) $(56/3)^{1/2}$ (D) none of these

Q 6. By how many folds should the temperature of the gas be increased in order to increase the r.m.s. speed of gas molecules in a closed container from 500 m/s to 1000 m/s.
(A) 0.5 times (B) 0.4 times
(C) 4 times (D) 40 times

Q 7. If the average speed of N_2 molecules at 300 K is 515 m/s, the average speed of Co at 600 K would be approximately,
(A) 515 m/s (B) 1030 m/s
(C) 258 m/s (D) 1030 m/s

Q 8. Which one of the following is the ratio of the average molecular kinetic energies of helium (atomic weight 4) and sulphur dioxide (molecular weight 64) at 300 K ?
(A) 1:6 (B) 1 : 4
(C) 1 : 1 (D) 1 : 2

Q 9. The r.m.s velocity of hydrogen is $(7)^{1/2}$ times the r.m.s. velocity of nitrogen. If T is temperature of the gas
(A) $T_{H2} = T_{N2}$ (B) $T_{H2} > T_{N2}$
(C) $T_{H2} < T_{N2}$ (D) $T_{H2} = (7)^{1/2} T_{N2}$

Q 10. The RMS velocity of gas molecules at NTP cannot be calculated from one of the following formula
(A) $\sqrt{\frac{3P}{d}}$ (B) $\sqrt{\frac{3PV}{M}}$
(C) $\sqrt{\frac{3RT}{M}}$ (D) $\sqrt{\frac{3RT}{d}}$

Q 11. Molecular velocities of two gases at the same temperature are U_1 and U_2 and their molecular

masses are m_1 and m_2 respectively. Which of the following expression is correct

(A) $\frac{m_1}{U_1^2}=\frac{m_2}{U_2^2}$ (B) $m_1U_1=m_2U_2$

(C) $\frac{m_1}{U_1}=\frac{m_2}{U_2}$ (D) $m_1U_1^2=m_2U_2^2$

Q 12. The average speed of O_2 at 273 K is equal to that of H_2 at

(A) same temperature (B) Higher temperature
(C) Lower temperature (D) critical temperature

Q 13. If for two gases of molecular masses M_x and M_y at temperature T_x and T_y, $T_xM_y=T_yM_x$, then which property has the same magnitude for both the gases:

(A) number of molecules (B) volume
(C) KE per molecule (D) RMS speed

Q 14. The relative ratio of $u_{rms}:u_{av}:u_{rms}$ at a given temperature is

(A) $\sqrt{3}:\sqrt{56/22}:\sqrt{2}$ (B) $\sqrt{56/22:\sqrt{2}:\sqrt{3}}$

(C) $\sqrt{3}:\sqrt{2}:\sqrt{56/22}$ (D) $\sqrt{2}:\sqrt{56/22}:\sqrt{3}$

Q 15. At what temperature will most probable speed of the molecules of the second member of homologous series C_nH_{2n-2} be the same as that of SO_2 at 527°C

(A) 500°C (B) 727°C
(C) 227°C (D) None of these

Q 16. For the following set of speeds, calculate (a) the average speed (b) the mean square speed (c) the root mean square speed (d) the most probable speed.
10 m/s, 15 m/s, 20 m/s, 25m/s, 25 m/s, 30 m/s

7. Diffusion & Effusion

Q 1. Among N_2, O_2 and SO_2 the gas with highest rate of diffusion is

(A) O_2 (B) SO_2
(C) N_2 (D) All are same

Q 2. The gas which diffuses twice as quickly as SO_2 is

(A) CH_4 (B) H_2
(C) O_2 (D) He

Q 3. The correct mathematical equations for grahams law are at constant temperature and pressure

(A) $\frac{r_1}{r_2}=\sqrt{\frac{M_1}{M_2}}$ (B) $r\propto\frac{1}{\sqrt{VD}}$

(C) $\frac{r_1}{r_2}=\sqrt{\frac{M_2}{M_1}}$ (D) $\frac{r_1}{r_2}=\sqrt{\frac{d_2}{d_1}}$

Q 4. 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

Q 5. In a closed room of 1000 m^3, a perfume bottle is opened up. The whole room after some times develop smell of perfume. This is due to which property of gases

(A) Viscosity (B) density
(C) diffusion (D) none of these

Q 6. 50 m of each gas A and B takes 200 and 150 sec respectively for effusing out from a pinhole under similar conditions. If the Molecular mass of B is 36, then molecular mass of gas A is **[CBSE PMT 2012]**

(A) 96 (B) 128 (C) 32 (D) 64

Q 7. X ml of H_2 gas effuses through a hole in a container in 5 seconds. The time taken for the effusion of the same volume of the gas specified below under identical condition. **[IIT – 1996]**

(A) 10 seconds : He (B) 20 seconds : O_2
(C) 25 seconds : CO (D) 55 seconds : CO_2

Q 8. According to Graham's law, at a given temperature the ratio of rates of diffusion r_A/r_B of gases A and B is given by

(A).$(P_A/P_B)\,(M_A/M_B)^{1/2}$

(B). $(P_A/P_B)^{1/2}(M_A/M_B)$
(C).$(P_A/P_B)(M_B/M_A)^{1/2}$
(D). $(P_B/P_A)^{1/2}(M_A/M_B)$

Q 9. Rate of diffusion of a gas is 720 ml/ minute. If the gas diffused for 20 seconds only. The volume of the gas diffused in ml is
(A) 240 (B) 120
(C) 60 (D) 30

Q 10. Assuming that at S.T.P. gas A has a density of 0.09 gram per litre and gas B has a density of 1.44 gram per litre. The ratio between the rates of diffusion of A and B is
(A) 1:16 (B) 16:1
(C) 2:1 (D) 4:1

Q 11. A bottle of dry NH_3 and another bottle of dry HCl connected through a long tube are opened simultaneously at both the ends. The white ring (NH_4Cl) first formed will be
(A) at the centre of the tube
(B) near the HCl bottle
(C) near the ammonia bottle
(D) throughout the length of the tube

Q 12. When two cotton plugs, one moistened with ammonia and the other with hydrochloric acid, are simulataneously inserted into opposite ends of a glass tube 87.0 cm long, a white ring NH_4Cl forms where gaseous NH_3 and gaseous HCl first come into contact

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

At what distance from the ammonia – moistened plug does this occur ?
(A) 51.7 cm from NH_3 end
(B) 51.7 cm from HCl end
(C) 43.5 cm at mid point
(D) none of these

Q 13. Two identical balloons are filled with equal moles of hydrogen and helium. Which balloon will contract first, if the same size holes are made in both of them ?
(A) Balloon filled with hydrogen gas
(B) Balloon filled with helium gas
(C) Both will contract at the same time
(D) Hydrogen filled balloon will contract but helium filled balloon will contract

Q 14. A balloon containing methane is picked with a sharp needle and quickly plunged into a tank of hydrogen at same pressure. After sometime, the balloon will
(A) get enlarged
(B) get collapsed
(C) remain as before
(D) reduce to half of its original size

Q 15. A 4:1 molar mixture of He and CH_4 is contained in a vessel at 20 bar pressure. Due to a hole in the vessel, the gas mixture leaks out. What is the composition of the mixture effusing out initially? **[IIT–1994]**
(A) 2:1 (B) 4:1
(C) 8:1 (D) 16:1

Q 16. At room temperature, ammonia gas at 1 atm pressure and hydrogen chloride gas at P atm pressure are allowed to effuse through identical pin holes from opposite ends of a glass tube of one metre length and of uniform cross- section. Ammonium chloride is first formed at a distance of 60cm from the end through which HCl gas is sent in. What is the value of p ?

Q 17. A vessel contains equal number of moles of Helium and Methane. Through a small orifice the half of gas effused out. The ratio of the number of mole of Helium and methane remaining in the vessel is
(A) 2:1 (B) 1:2
(C) 1:4 (D) 4:1

8. Collision Terms

Q 1. If volume of 1 H_2 molecule is 10^{-27}cc then collision diameter will be

(A) 2×10^{-27}cm (B) 2×10^{-9}cm

(C) 1.24×10^{-9}cm (D) 1.24×10^{-10}cm

Q 2. If collision diameter of Cl_2 gas 2×10^{-8} cm then find the molar volume of N_2 gaseous molecules at NTP.

(A) 2.52cc (B) 4.18 cc

(C) 22.4 lit (D) None of these

Q 3. Relative avg speed of gaseous molecules in a gaseous system is

(A) $2V_{arg}$ (B) $\sqrt{2}V_{arg}$

(C) $\sqrt{3}V_{arg}$

(D) depends on orientation of molecular velocity

Q 4. Volume swapped by gas molecules of radius r in which it collides with other molecules in 1 sec is

(A) $\sqrt{2}V_{arg}\pi r^2$ (B) $2\pi r^2 v_{arg}$

(C) $4\pi r^2 V_{arg}$ (D) $\pi r^2 V_{arg}$

Q 5. If pressure of gaseous system is increased by 4 times & temperature by 2 times then collision no increases by

(A) 4 times (B) $\sqrt{2}$ times

(C) $2\sqrt{2}$ times (D) 2 times

Q 6. If pressure of a gaseous system is increased by 2 times & temperature by 4 times then collision frequency is changed by

(A) 0.5 times (B) 2 times

(D) 4 times (D) 0.25 times

Q 7. Mean free path is defined as

(A) $\frac{Distance\ Travelled}{No\ of\ collisions}$ (B) $\frac{Collision\ No}{Avg\ speed}$

(C) $\frac{Avg\ speed}{Collision\ No}$ (D) Both A & C

Q 8. Which of the following gas molecules has the largest mean free path?

(A) H_2 (B) N_2

(C) O_2 (D) Cl_2

Q 9. Calculate mean free path of N_2 molecules with radius 156 pm at 25°C & 10^{-3} mm Hg pressure

(A) 3.57 cm (B) 7.14 cm

(C) 14.28 cm (D) None of these

Q 10. If a molecules collides at distance 10A°, 12A°, 15A° & 18A° then mean free path is

(A) 10A° (B) 18A°

(C) 13.75A° (D) 15A°

Q 11. If diffusion coefficient of a gas is directly proportion to mean free path & avg speed then find the factor by which diffusion coefficient increase if temperature is increased by 4 times & pressure is increased by 2 times **[JEE Adv. 2017]**

(A) 4 (B) $2\sqrt{2}$

(C) 2 (D) $\sqrt{2}$

Q 12. The mean free path of the molecule of a certain gas at 300 K is 2.6×10^{-5}m. The collision diameter of the molecule is 0.26 nm. Calculate pressure of the gas

(A) 1.281×10^{2}Pa (B) 5.306×10^{2}Pa

(C) 5.306×10^{1}Pa (D) 1.28×10^{1}Pa

Q 13. The mean free path of the molecule of a certain gas at 300 K is 2.6×10^{-5}m. The collision diameter of the molecule is 0.26 nm. Calculate number of molecules per unit volume of the gas

(A) $1.281\times10^{23}/m^3$ (B) $5.306\times10^{23}/m^3$

(C) $5.306\times10^{21}/m^3$ (D) None of these

Q 14. A certain Coefficient of a monoatomic gas is directly proportional to its density, avg speed and mean free path. Which of the following is/are correct for this coefficient.

(A) depends on pressure at constant temperature

(B) directly proportional to Pressure at const volume

(C) directly proportional to square root of Molar mass of gas

(D) inversely proportional to atomic diameter

9. Real gas Equations

Q 1. At 100 ^{0}C and 1 atm pressure, if the density of liquid water is 1.0 gm/cm^3 and that of water vapour is 0.0006 gm/cm^3. The volume occupied by water molecules in 1 L of steam at that temperature is
(A) 6 cm^3 (B) 60 cm^3
(C) 0.6 cm^3 (D) 0.06 cm^3

Q 2. A real gas expected to exhibit maximum deviations from ideal gas laws at
(A) low T and high P (B) low T and low P
(C) high T and high P (D) high T and low P

Q 3. $\frac{a}{V^2}$ given in Vander Waals equation is for
(A) internal press. (B) intermolecular attraction
(C) both (A) & (B) (D) temperature correction

Q 4. In van der Waals equation of state for a real gas, the term that accounts for the intermolecular forces is **[IIT 2009]**
(A) $V_m - b$ (B) $\frac{a}{V_m^2}$
(C) RT (D) 1/RT

Q 5. The values of Vander Walls constant 'a' for the gases O_2, N_2, NH_3 and CH_4 are 1.360, 1.390, 4.170 and 2.253 L^{2}atm mol^{-2} respectively. The gas which can be most easily be liquefied is
(A) O_2 (B) N_2
(C) NH_3 (D) CH_4

Q 6. Calculate the collision diameter of a gas molecule having van der waal constant b = 39.1 cm^{3}mol^{-1}
(A) 156 Pm (B) 312 Pm
(C) 78 Pm (D) None of these

Q 7. The vander Waals equation of state is given by $(P + an^2 / V^2)(V - nb) = nRT$
The ratio a / b has the dimensions of
(A) atm. lit^{-1} (B) lit, atm, mol^{-1}
(C) lit, atm, mol^{-2} (D) lit, mol^{-1}

Q 8. Using Vander Waal's equation calculate the constant, 'a' (in atm.lit^2.mol $^{-2}$) when two moles of a gas confined in a four litre flask exerts a pressure of 11.0 atm at a temperature of 300K. The value of 'b' is 0.05Lmol^{-1} **[IIT–1998]**
(A) 6.46 (B) 3.23
(C) 12.92 (D) None of these

Q 9. What volume would 3.00 mol oxygen occupy at 50.0 atm pressure and 100 ^{0}C according to the van der waals equation?
(Given : value of a = 1.46 L^2.atm/mol^2 ; value of b = 0.0318 L/mol)
(A) 1.84 Lit (B) 1.81 Lit
(C) 3.68 Lit (D) None of these

Q 10. Calculate from the vander waal's equation, the temperature at which 192 gm of SO_2 would occupy a vol. of 10 lit. at 15 atm pressure.
[a = 6.7atm lit^2 mol^{2,} b = 0.0564 lit mol^{-1}]
(A) 323°C (B) 350.5°C
(C) 250°C (D) 77.5°C

Q 11. Maximum deviation from ideal gas is expected from **[NEET 2013]**
(A) H_2(g) (B) N_2 (g)
(C) CH_4 (g) (D) NH_3 (g)

Q 12. At low pressure, the Vander Waals equation become
(A) $PV_m = RT$ (B) $P(V_m - b) = RT$
(C) $\left(P + \frac{a}{V_m^2}\right)V_m = RT$ (D) $P = \frac{RT}{V_m} + \frac{a}{V_m^2}$

Q 13. At high temperature & low pressure, the Vander Waals equation become
(A) $P = \frac{RT}{V_m} + \frac{a}{V_m^2}$ (B) $PV_m = RT$
(C) $P(V_m - b) = RT$ (D) $\left(P + \frac{a}{V_m^2}\right)V_m = RT$

Q 14. A gas obeys the equation of state
P(V–b) = RT; (Parameter b is a constant)
The slope for an isochore will be
(A) negative (B) zero
(C) R/(V – b) (D) R / P

Q 15. For the real gas equation $\left(P + \frac{a}{V^2}\right)V = RT$,
The slope of isobar will be
(A) $\frac{R}{P + a\ln V}$ (B) $\frac{RV^2}{PV^2 - a}$

(C) $\frac{RV^2}{a-PV^2}$ (D) $\frac{PV^2-a}{RV^2}$

Q 16. In the virial equation

$$PV = RT\left[1+\frac{B}{V_m}+\frac{C}{V_{m^2}}+....\right]$$ 'B' is equal to

[using Unit & Dimension Method]

(A) $b-aRT$ (B) $b+aRT$

(C) $b-\frac{a}{RT}$ (D) $a-\frac{b}{RT}$

Q 17. The value of 3rd virial coefficient is

[using Unit & Dimension Method]

(A) $b-\frac{a}{RT}$ (B) b^2

(C) a^2 (D) B^2

Q 18. At Boyle's temperature,

(A) $B=0$ (B) $C=0$

(C) $A=0$ (D) $PV=0$

Q 19. At Boyle's temperature

(A) Attractive force dominant

(B) Repulsive force dominant

(C) No force exist between molecules

(D) Attractive force between molecules is counter balanced by repulsive force

10. Compressibility Factor

Q 1. The compressibility factor for ideal gas is

(A) 1.5 (B) 1.0 (C) 2.0 (D) infinity

Q 2. The compressibility of gas < 1 at NTP. Therefore

(A) Vm > 22.4 ml (B) Vm < 22.4 ml

(C) Vm = 22.4 ml (D) Vm = 44.8 ml

Q 3. **Assertion (A):** At constant temperature, pV vs V plot for real gases is not a straight line

Reason (R): At high pressure all gases have $Z>1$ but at intermediate pressure most gases have $Z<1$ **[NCERT Exemplar]**

(A) Both A and R are true and R is the correct explanation of A

(B) Both A and R are true but R is not the correct explanation of A

(C) A is true but R is false

(D) A is false but R is true

Q 4. The compressibility factor of real gas is usually greater than one (Z>1) at high T and high Pressure. This is because

(A) the constant a is negligible while b is not

(B) the constant b is negligible while a is not

(C) both a and b are negligible

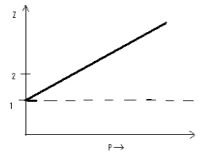
(D) both a and b are not negligible

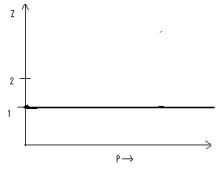
Q 5. The compressibility factor for hydrogen at room temperature and at any range of pressure is

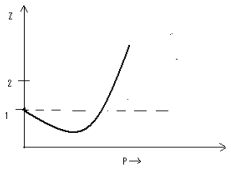
(A) less than 1 (B) equal

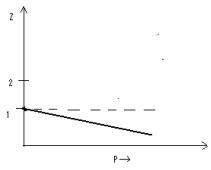
(C) greater than 1 (D) zero

Q 6. Which of the following gives a plot of compressibility factor (Z) vs P at particular temperature for helium?

(A) 

(B) 

(C) 

(D) 

Q 7. At high temperature, the compressibility factor of a real gas equal to

(A) $1+\frac{bP}{RT}$ (B) $1+\frac{RT}{bP}$

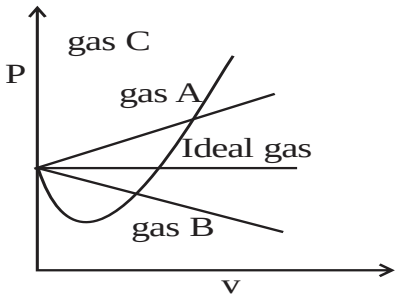
(C) $1+\frac{RT}{b}.P$ (D) None of these

Q 8. At low pressures, the Van –der walls equations is written as $\left(P+a/V^2\right)V=RT$. The compressibility factor is then equal to

(A) $1-a/RTV$ (B) $1-RTV/a$

(C) $1+a/RTV$ (D) $1+RTV/a$

Q 9. Refer to the figure given:



Which of the following statement is wrong?

(A) for gas A, a=0 and Z will linearly depend on pressure

(B) for gas B, b=0 and Z will linearly depend on pressure

(C) Gas C is a real gas and we can find 'a' and 'b' if intersection data is given

(D) All Vander Waal gases will behave like gas C and give positive slope at high pressure.

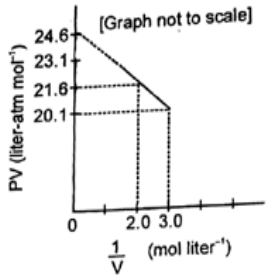
Q 10. The compression factor for one mole of a Vander waal's gas at 0°C and 100atm pressure is found to be 0.5. Assuming that the volume of a gas molecule is negligible, calculate the Vander Waal's constant 'a'. (in atm.lit² .mol⁻²)

[IIT–2001]

(A) 0.63 (B) 1.253

(C) 2.506 (D) 0.315

Q 11. For one mole of a van der waals gas when b = 0 and T = 300K, the PV vs. 1/V plot is shown below. The value of the van der waals constant a (atm. $\text{litre}^2\text{mol}^{-2}$) is **[JEE Adv. 2012]**

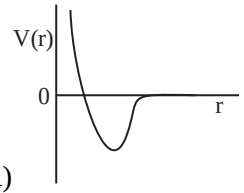


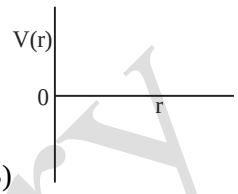
(A) 1.0 (B) 4.5

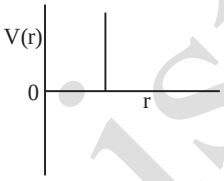
(C) 1.5 (D) 3.0

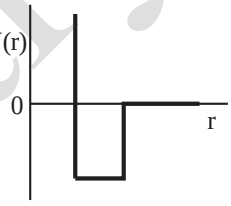
Q 12. One mole of a monoatomic real gas satisfies the equation $p(V-b)=RT$ where b is a constant. The relationship of interatomic potential V(r) and interatomic distance r for the gas is given by

[JEE Adv. 2015]

(A) 

(B) 

(C) 

(D) 

Q 13.

Column-I

(A) Compressibility factor , Z = 1

(B) Compressibility factor, Z > 1

(C) Compressibility factor, Z < 1

(D) Boyle temperature

Column – II

(p) Attractive forces dominate

(q) PV = nRT

(r) Repulsive forces dominate

(s) Attractive force and repulsive forces cancel

Q 14. Match gases under specified conditions listed in Column I with their properties/laws in Column II

[JEE Adv. 2007]

Column-I

(A) hydrogen gas $(P=200\text{atm}, T=283\text{K})$

(B) hydrogen gas $(P-0, T=273\text{K})$

(C) $CO_2(P=1\text{atm}, T=273\text{K})$

(D) real gas with very large molar volume

Column –II

(p) compressibility facto $\neq 1$

(q) attractive forces are dominant

(r) $PV=nRT$

(s) $p(V-nb)=nRT$

Answer Q.N. 165 & 166 from following passage

A gas undergo dissociation as $A_4(g) \rightarrow 4A(g)$

In a closed container having volume of 22.4 lit at 273 K. if the initial moles of A_4 taken before dissociation is 1 atm for ideal behavior, then

Q 15. If the gases are not ideal & at the beginning total pressure observed is less than 1 atm then
(A) For A_4 ; Z > 1 (B) For A_4 ; Z < 1
(C) For A_4 ; Z = 1 (D)For A ; Z > 1

Q 16. If the gases are not ideal & after 100 % dissociation total pressure observed is greater than 4 atm then
(A) the compression of A(g) is easier than that of ideal gas
(B) the compression of A(g) is difficult than that of ideal gas
(C) the compression of A(g) is same as that of ideal gas
(D) A can not be compressed

11. Liquefaction of Gas, Inversion Temperature

Q 1. a and b are van der Waals' constants for gases. Chlorine is more easily liquefied than ethane because
(A) a nad b for $Cl_2 > a$ and b for C_2H_6
(B) a and b for $Cl_2 < a$ and b for C_2H_6
(C) a for $Cl_2 > a$ for C_2H_6 but b for $Cl_2 > b$ for C_2H_6
(D) a for $Cl_2 > a$ for C_2H_6 but b for $Cl_2 < b$ for C_2H_6

Q 2. Which set of conditions represents easiest way to liquefy a gas ?
(A) low temperature and high pressure
(B) high temperature and low pressure
(C) low temperature and low pressure
(D) high temperature and high pressure

Q 3. The critical temperature is the temperature
(A) below which the gas undergoes cooling when expanded into vacuum
(B) at which a gas liquefies at 1 atm
(C) at which the average kinetic energy of the molecules is minimum
(D) above which the gas cannot be liquefied how so ever high pressure may be applied

Q 4. **Assertion (A):** Gases do not liquefy above their critical temperature, even on applying high pressure
Reason (R): Above critical temperature, the molecular speed is high and intermolecular attractions cannot hold the molecules together because thye escape because of high speed.
[NCERT Exemplar]
(A) Both A and R are true and R is the correct explanation of A
(B) Both A and R are true but R is not the correct explanation of A
(C) A is true but R is false
(D) A is false but R is true

Q 5. A gas can be liquefied at a temperature T K and pressure P provided that
(A) $T = T_c$ and $P < P_c$ (B) $T < T_c$ and $P < P_c$
(C) $T > T_c$ and $P < P_c$ (D) $T < T_c$ and $P < P_c$

Q 6. The van der wall's constants (a and b) of two gases A and B are

	$a/dm^6 atm\,mol^{-2}$	$b/dm^3 mol^{-1}$
A:	1.360	0.0318
B:	3.592	0.0426

The critical parameters $P_c : V_v : T_c$ is Incorrectly related as
(A) $P_c(A) < P_c(B)$ (B) $V_c(A) < V_c(B)$
(C) $T_c(A) < T_c(B)$ (D) $T_c(A) > T_c(B)$

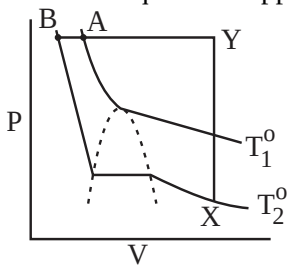
Q 7. At critical condition
(A) $\frac{dp}{dv} = 0$ (B) $\frac{d^2p}{dv^2} > 0$
(C) $\frac{dp}{dv} = 0$ (D) $\frac{d^2p}{dv^2} = 0$

Q 8. In vander waal gas in gaseous state condition the vander waal equation has
(A) three different real roots for Vm
(B) only one real roots for Vm
(C) 2 different real roots for Vm
(D) Three identical real root for Vm

Q 9. In vander wall gas in gaseous & liquid mixture condition, the vander waal equation has

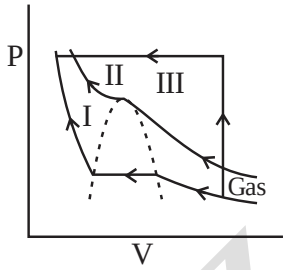
(A) three different real roots for Vm
(B) only one real roots for Vm
(C) 2 different real roots for Vm
(D) Three identical real root for Vm

Q 10. A gas at T_2^o is condensed to liquid following the path XYAB. The liquid first appears at the point



(A) Y at T_2^o (B) A at T_2^o
(C) B at T_1^o (D) A at T_1^o

Q 11. A gas can be condesned to liquid through the paths I, II & III as shown in the figure. The path(s) through which the gas changes into liquid abruptly is/are



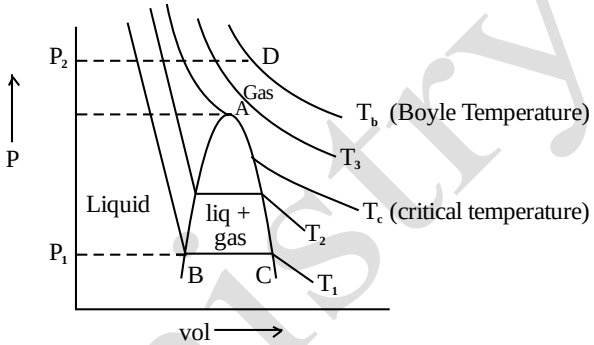
(A) I & II (B) II & III
(C) I & III (D) II

Q 12. At critical condition, Z_c is equal to
(A) 8/3 (B) 3/8
(C) 1/4 (D) None of these

Q 13. **Assertion (A)**: Meniscus of a liquid disappears at critical temperature.
Reason (R): Density of liquid & gas become equal at critical temperature. **[AIIMS 2007]**
(A) Both assertion and reason are true and the reason is the correct explanation of assertion
(B) Both assertion and reason are true and reason is not the correct explanation of assertion
(C) Assertion is true but the reason is false
(D) Both assertion and reason are false

Passage -1

Andrews isotherm for CO_2 may be plotted as shown



Q 14. Pressure P_1 along the line BC is called
(A) pressure of gas at T_1
(B) critical pressure
(C) vapour pressure of liquid at T_1
(D) pressure of gas below T_c

Q 15. Which of the following is a correct statement ?
P: within the area BAC, state of matter is called "vapour".
Q: At T_b, PV remains a constant,
R: At point "A", liquid state of matter loses its meniscus
(A) only P,Q (B) only Q,R
(C) P,Q and R (D) only P,R

Q 16. At point 'A', which of the following is true ?
P: compressibility factor becomes 0.375
Q: gas is called vander Waals' gas
R: below 'A' only one variable is required for liquefaction
(A) only P,Q (B) only Q,R
(C) P, Q and R (D) Only P,R

Q 17. For real gases
(A) the critical temp. is that above which no amount of applied pressure will cause the gas to liquefy
(B) the critical temp. give a rough measure of the inherent volume occupied by the gas molecules
(C) isothermal changes are those in which no heat flows in or out of the system
(D) None of these

12. Gas Stoichiometry

Q 1. Calculate the volume of CO_2 produced by combustion of 40 mL of acetone in presence of excess of oxygen
(A) 100 ml (B) 120 ml
(C) 40 ml (D) 160 ml

Q 2. What volume of air will be required to oxidise 210 ml. of sulphur dioxide to sulphur trioxide, if the air contains 21% of oxygen ?
(A) 500 ml (B) 1000 ml
(C) 600 ml (D) none of these

Q 3. What volume of CO_2 is obtained in the combustion of 2 litres of butane ?
(A) 6 ltr (B) 2 ltr
(C) 8 ltr (D) 10 lt

Q 4. 500 mL of a hydrocarbon gas, burnt in excess of oxygen, yields 2500 mL CO_2 and 3 liters of water vapour, all volumes being measured at the same temperature and pressure. What is the formula of the hydrocarbon ?
(A) C_4H_8 (B) C_5H_{12}
(C) C_5H_{10} (D) None of these

Q 5. 20 ml of mixture of C_2H_2 and CO was exploded with 30 ml. of oxygen gas. After the reaction gases have volume 34 ml. on treatment with KOH 8 ml of oxygen remain. The volume of C_2H_2 in the mixture is
(A) 6 ml (B) 14 ml
(C) 10 ml (D) 12 ml

Q 6. 25 ml of a hydrocarbon gas was required complete combustion of 357 ml. of air having 21% oxygen by volume. The gaseous product have volume 327 ml. (All volumes are measured at NTP) What is the formula of hydrocarbon
(A) C_2H_6 (B) C_3H_8
(C) C_3H_6 (D) None of these

Q 7. A mixture of CO and H_2 was exploded with 31 ml. of O_2. The volume after explosion was 29 ml. which reduced to 12 ml. when shaken with KOH. Find the percentage of H_2 in the mixture .
(A) 44.7% (B) 60.1%
(C) 50% (D) 55.3%

Q 8. On passing 25 mL of a gaseous mixture of N_2 and NO over heated over copper 20 ml. of gas remained. The percentage of N_2 in the mixture is
(A) 40% (B) 80%
(C) 20% (D) 60%

Q 9. The explosion of a mixture consisting of one volume of a gas being studied and one volume of H_2 yielded one volume of water vapour and one volume of N_2. The volumes being measured under identical conditions. Find the formula of the gas
(A) NO (B) NO_2
(C) N_2O (D) N_2O_3

Q 10. 60 mL of a mixture of nitrous oxide and nitric oxide was exploded with excess of hydrogen. If 38 mL of N_2 was formed, calculate the volume of each gas in the mixture.
(A) 16 ml (B) 8 ml
(C) 12 ml (D) 20 ml

Q 11. 5 ml of a gas containing C & H was mixed with an excess of oxygen (30 ml) and the mixture exploded by means of an electric spark. After the explosion the volume of mixed gases remaining was 25 ml. on adding a conc. solution of KOH, the volume further diminished to 15 ml, the residual gas being pure oxygen. All volume have been reduced to NTP. Calculate the Molecular formula of the hydrocarbon gas.
(A) C_3H_4 (B) C_2H_4
(C) C_3H_8 (D) C_3H_6

Q 12. The ratio of mass percent of C and H in an organic compound (CxHyOz) is 6:1. If one molecule of the above compound contains half as much oxygen as required to burn 1 molecule of Compound CxHy completely to CO_2 & H_2O, then find empirical formula of the compound.
(A) $C_3H_6O_3$ (B) C_2H_4O
(C) $C_3H_4O_2$ (D) $C_2H_4O_3$

Q 13. 40 ml of a gas taken in an eudiometer tube was subjecte to sparks till the volume did not change any further. The volume was found to increase by 40 ml. 40 ml of oxygen is added and mixture was further exploded. The gases remained were 30 ml. deduce the formula of the gas.

(A) NH_3 (B) N_2H_4
(C) HN_3 (D) N_2O

Q 14. When a certain quantity of oxygen was convereted to 'O_x' in a suitable apparatus the volume decresed by 4 ml. On addition of a substance absorbing 'Ox' the volume further decreases by 8 ml. all volumes are measured at same temperature & pressure. From this data calculate the value of x.

(A) 3 (B) 4 (C) 5 (D) 6

Q 15. When 100 ml of an $O_2 - O_3$ mixture was passed through turpentine, there was reduction in volume by 20 ml. If 100 ml of the above mixture is heated, what will be the increase in volume?

(A) 20 ml (B) 10 ml
(C) 30 ml (D) 50 ml

Q 16. A mixture of C_2H_2 and C_3H_8 occupied a certain volume at 80 mm Hg. The mixture was completely burnt to CO_2 and $H_2O(l)$. When the pressure of CO_2 was found to be 230 mm Hg at the same temperature and volume, the mole fraction of C_3H_8 in the mixture is

(A) 0.125 (B) 0.875
(C) 0.6 (D) 0.8

Q 17. The total pressure of a mixture of oxygen and hydrogen is 1.0 atm. The mixture is ignited and the water is removed. The remaining gas in pure hydrogen and exerts a pressure of 0.40 atm when measured at the same value of T and V as the original mixture. What was the composition of the original mixture in mole percent?

(A) $x_{02} = 0.2; x_{H_2} = 0.8$
(B) $x_{02} = 0.4 lx_{H_2} = 0.6$
(C) $x_{o2} = 0.6; x_{H2} = 0.4$
(D) $x_{02} = 0.8; x_{H2} = 0.2$

Answer Key

1. Boyle's Law, Barometer & Manometer

(1). A (2). D (3). C
(4). C (5). D (6). C
(7). A (8). B (9). B
(10). C (11). A (12). C
(13). A (14). B

2. Charle's Law, Avogadro's Law

(1). 11.35 lit (2). C (3). C
(4). C (5). D (6). A
(7). C (8). B (9). D
(10). 2.018 lit. (11). B (12). A
(13). B (14). C (15). B
(16). B (17). C (18). B
(19). C

3. Ideal Gas Law

(1). B (2). C (3). B
(4). D (5). A (6). B
(7). A (8). 676.6 mm (9). A
(10). B (11). C (12). A
(13). C (14). C (15). B
(16). C (17). A (18). C
(19). Nm^4K^2/mol

4. Dalton's law of Partial Pressure, Vapour Pressure

(1). D (2). D (3). D
(4). C (5). A (6). A
(7). PO_2 = 5.25 bar, P_{Ne} =19.75 bar
(8). A (9). A (10). A
(11). $M_B = 4M_A$ (12). C
(13). B (14). C (15). A

5. Ideal Gas Problems, K.T.G.

(1). B (2). C (3). C
(4). C (5). C (6). C
(7). B (8). A (9). D
(10). B (11). D (12). C
(13). A (14). A (15). D
(16). A (17). D

6. Maxwell Boltzmann Velocity Distribution

(1). A (2). D (3). A
(4). B (5). C (6). C
(7). D (8). C (9). C
(10). D (11). D (12). C
(13). D (14). A (15). C
(16). 20.83 m/s, 479.16 m/s, 21.88 m/s, 25 m/s

7. Diffusion & Effusion

(1). C (2). A (3). C
(4). A (5). C (6). D
(7). B (8). B (9). A
(10). D (11). B (12). A
(13). A (14). A (15). C
(16).B (17). B

8. Collision Terms

(1). C (2). A (3). B
(4). C (5). C (6). A
(7). D (8). D (9). B
(10). C (11). A (12). B
(13). A (14). C

9. Real gas Equations

(1). C (2). A (3). B
(4). C (5). C (6). B
(7). B (8). A (9). B
(10). B (11). D (12). B
(13).C (14). C (15). B
(16). C (17). B (18). A
(19). D

10. Compressibility Factor

(1). B (2). B (3). B
(4). A (5). C (6). A
(7). A (8). A (9). B
(10). B (11). C (12). C
(13). A – q.s ; B – r ; C – p ; D – q, s
(14). A – p.s ; B – r ; C – p, q ; D – r
(15). B (16). B

11. Liquefaction of Gas, Inversion Temp.

(1). D (2). A (3). D
(4). A (5). B (6). D
(7). C (8). B (9). A
(10). B (11). B (12). B
(13). A (14). C (15). B
(16). C (17). A

12. Gas Stoichiometry

(1). B (2). A (3). C
(4). B (5). A (6). C
(7). D (8). D (9). B
(10). A (11). B (12). D
(13). A (14). B (15). B
(16). B (17). A