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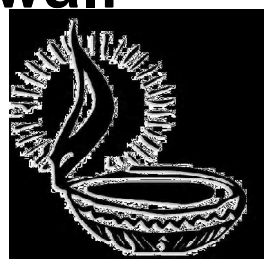

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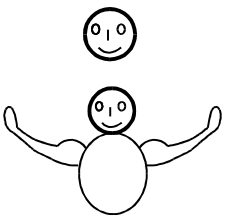

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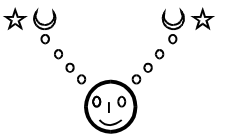


Requires slight mind scratching.

Requires recollection of various concepts.

Requires calculation skill.

SITTING I

(EASY LIFE)

Q.1 When an electronic transition occurs in an atom from higher energy state to a lower energy state with energy difference equal to ΔE electron volts, the wavelength of the radiation emitted is approximately equal to

(A) $\frac{12397\times10^{-10}}{\Delta E}$ cm (B) $\frac{12397\times10^{-10}}{\Delta E}$ Å (C) $\frac{12397\times10^{-10}}{\Delta E}$ m (D) $\frac{12397\times10^{10}}{\Delta E}$ cm

Q.2 In each of the following questions two statements are given as Assertion A and Reason R. Examine the statements carefully and answer the questions according to the instructions given below:

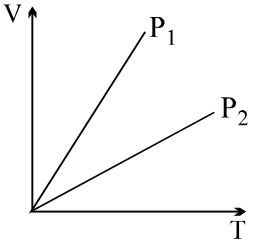
(A) if both **A** and **R** are correct and **R** is the correct reason of **A**.
(B) if both **A** and **R** are correct and **R** is not the correct reason of **A**.
(C) if **A** is correct and **R** is wrong.
(D) if **A** is wrong and **R** is correct.
(E) if both **A** and **R** are wrong.

(a) **Assertion A.** The value of van der Waal constant a is higher for NH_3 than for N_2.
Reason R. NH_3 molecules are associated with H-bonds.

(b) **Assertion A.** K.E. of all the gases approach zero as their temperature approach zero kelvin.
Reason R. Molecular motion ceases at absolute zero.

(c) **Assertion A.** Helium shows only positive deviation from ideal behaviour.
Reason R. Helium is chemically inert noble gas.

Q.3 V vs T curves at differnt pressure P_1 and P_2 for an ideal gas are shown below. Which one of the following is correct?



(A) $P_1 > P_2$ (B) $P_1 < P_2$

(C) $P_1 = P_2$ (D) $\frac{P_2}{P_1} = \frac{1}{2}$

Q.4 The units of compressibility factor are

(A) atm L^{-1} (B) atm^{-1} (C) L^{-1} (D) unitless

Q.5 Which of the following statements is most appropriate for a real gas.
(A) Force of attraction between the molecules exists at low pressure only.
(B) Force of attraction between the molecules exists at high pressure only.
(C) Force of attraction between the molecules affect gaseous property at high temperature.
(D) Force of attraction between the molecules affect gaseous property at low pressure.

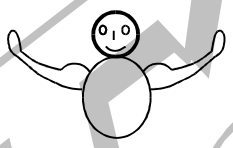
Q.6 Which among the following has rate of effusion less than the moist air?
(A) He (B) Dry air (C) NH_3 (D) Heavy hydrogen

Q.7 The behaviour of real gas is generally depicted by plotting which of the following parameter vs pressure
(A) critical volume (B) density (C) T_{ideal}/T_{real} (D) V_{real}/V_{ideal}

Q.8 The 'atom utilization' is obtained by dividing molar mass of the desired product by the sum of the molar masses of all substances produced according to the reaction equations. The "E factor" is the amount (in kg) of by product per kg of products. Calculate "atom utilization" and "E factor".Identify X, the desired product.
$(NH_4)_2S_2O_8 + MnSO_4 + 2H_2O \longrightarrow (NH_4)_2SO_4 + \underline{X} + 2H_2SO_4$

Q.9 Calculate molality of a solution containing 72 gm Buckminster Fullerene (C_{60}) in one kg water.

Q.10 The density of $CaCO_{3\,(s)}$ is 2.71 g/cm^3. What is molarity of solid $CaCO_3$.

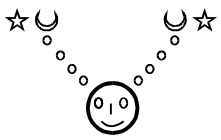


STRENGTHENING CONCEPTS

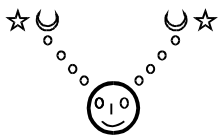
Q.11 A real gases X an ideal gas Y both undergo experiments involving their compression or expansion. Mark the option(s) in which **observation** made is correctly matched with its **interpretation** regarding dominance of 'a' & 'b' as given Vander Waal's equation.

	Observation	**Interpretation**
(A)	On expansion X underwent larger dip in pressure as compared to Y, other parameter being same.	the parameter 'a' is more influential then 'b'
(B)	On compression X underwent larger rise in presence as compared to Y, other parameter being same.	the parameter 'b' is more influential then 'a'
(C)	At some temperature the behaviour of X was similar to that of Y for low pressure region.	the temperature must be Boyle's temperature
(D)	Plot of Z vs P for the gas X at room temperature showed a dip (<1) at low pressure & then increased as pressure increased.	the value of 'a' is not small for gas X.

Q.12 The value of $(n_1 + n_2)$ and $\left(n_2^2 - n_1^2\right)$ for He^+ ion in atomic spectrum are 4 and 8 respectively. Identify the series and find $\bar{\nu}$ of corresponding line in emission sp.



BRAIN TEASERS



Q.13 For a polymerisation reaction involving gaseous reactant and product A l nB, 'A' undergoes polymerisation to an extent of 'α' as degree of polymerisation at a temp T_1. From this info calculate the following in terms of n and α.

(a) P_T/P_0 ratio where P_T is the pressure with the given extent of polymerisation and P_0 is the pressure before polymerisation when temperature was T_0 in a constant volume container

(b) V_T/V_0 ratio in a chamber where V_T is volume when polymerisation occurs and V_0 is before polymerisation. Both volume measured under similar condition of pressure & temperature.

(c) Vapour density of the mixture if the molecular weight of A is M_A.

(d) Compare rate of effusions before polymerisation and after the polymerisation.

RECALLING VARIOUS CONCEPTS AT ONE PLACE

Q.14 Calculate IE_8 of oxygen atom.

Q.15 Calculate percentage dissociation of H_2O into H^+ & OH^- at 298 K of a neutral water sample [pH = 7]

Q.16 A compound gave on analysis of 60 g sample 44.8 *l* of a gas at STP which turns lime water milky & other gas which increased the wt, of white. $CuSO_4$ crystal by 36 gm. Deduce the molecular formula of the compound.

Q.17 Elemental As, a poison that kills humans and animal pests may be obtained by reacting As_2O_3 with carbon to give As and CO. Compute masses of As and CO formed if 49.5 gm of As_2O_3 reacts completely with 7.20 gm of C.[Given at. wt. As = 75]

CALCULATION SKILL

Q.18 Under identical experimental conditions which of the following pairs of gases will be the most easy to separate by using diffusion process

(A) H_2 and D_2 (B) $U^{235}F_6$ and $U^{238}F_6$

(C) CO_2 and C_3H_8 (D) O_2 and N_2

Q.19 A solution of palmitic acid (M =256) in benzene contains 5 gm acid per litre. When this solution is dropped on surface, C_6H_6 gets evaporated and acid forms a unimolecular layer on the surface. If we wish to cover an area 5000 cm^2 with unimolecular film. What volume of solution in ml should be used? Area covered by one molecule of acid is 0.32 nm^2.

Q.20 105 ml of pure water at 4^0 C is saturated with NH_3 gas, producing a solution of density 0.9 gm/ml. If this solution contains 30% of NH_3 by wt., calculate its volume.

SITTING II

EASY LIFE

Q.1 In each of the following questions two statements are given as Assertion A and Reason R. Examine the statements carefully and answer the questions according to the instructions given below:
(A) if both **A** and **R** are correct and **R** is the correct reason of **A**.
(B) if both **A** and **R** are correct and **R** is not the correct reason of **A**.
(C) if **A** is correct and **R** is wrong.
(D) if **A** is wrong and **R** is correct.
(E) if both **A** and **R** are wrong.

(a) **Assertion A.** α-particles have quite less penetrating power.
Reason R. α-particles are di-positive ions having appreciable mass.

(b) **Assertion A.** Isotopes of an element can be identified with the help of a mass spectrograph.
Reason R. A mass spectrograph can differentiate between ions having different charge to mass (e/m) ratio.

Q.2 If the mean free path is l at one bar pressure then its value at 5 bar pressure, if temperature is kept constant.

(A) $5\,l$ (B) $\frac{2}{5}l$ (C) $\frac{l}{5}$ (D) l

Q.3 Open end manometer was connected to gas chanber. The Hg level stood 15 mm higher in the open end as compared to the end connected to gas chamber. If the atmospheric pressure is 101.3 kPa. The gas pressure in k Pa is
(A) 103.3 (B) 101.3 (C) 94.3 (D) 115.3

Q.4 Which of the following gas has highest value of 'a'?
(A) Ne (B) O_2 (C) Cl_2 (D) N_2

Q.5 Three gases of densities A (0.82), B (0.26), C (0.51) are enclosed in a vessel of 4L capacity. Pick up the correct statement assuming ideal gas behaviour:
I. Gas A will tend to lie at the bottom
II. The number of atoms of various gases A, B, C are same
III. The gases will diffuse to form homogeneous mixture
IV. The average kinetic energy of each gas is same
(A) I, IV (B) only III (C) III, IV (D) I, III

Q.6 Ratio of C_p and C_υ of a gas 'X' is 1.4. The number of atoms of the gas 'X' present in 11.2 litres of it at STP will be
(A) 6.02×10^{23} (B) 1.2×10^{23} (C) 3.01×10^{23} (D) 2.01×10^{23}

Q.7 The moles of O_2 required for reacting with 8960 mL g of ammonia at STP is
$xNH_3 + yO_2 \rightarrow aNO + bH_2O$ is
(A) 5 (B) 2.5 (C) 1 (D) 0.5

Q.8 Find the number of spectral lines in Paschen series emitted by atomic H, when electron is excited from ground state to n^{th} energy level returns back.

BRAIN TEASERS

Q.9 For calculating lattice energy of an ionic crystal, the variation of potential energy was studied following the relation, $U(r) = -\frac{\alpha^2 e^2 nA}{r} + \frac{B}{r^x}$

where 'α', 'e', n, A and x are constants depending upon type of crystal and 'r' is the distance between the ions. Calculate expression of B in terms of given constant for a stable crystal lattice given that ions are at a distance of r_0. Calculate potential energy of the crystal in terms of r_0 and other given constants. Plot an appropriate graph of U (r) v/s r indicating r_0 in the graph.

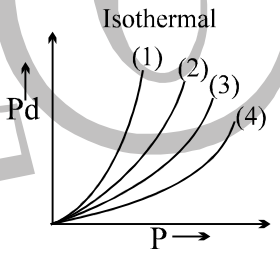
Q.10 Electromagnetic radiations of wavelengths 242 nm is just sufficient to ionise Na atom. Calculate ionisation energy of Na in kJ/mol.

RECALLING VARIOUS CONCEPTS AT ONE PLACE

Q.11 A beam of some kind of particle of velocity 2.1×10^7 m/s is scattered by a gold (z = 79) foil. Find specific charge of this particle (charge/mass) if the distance of closest approach is 2.5×10^{-14} m.

Question No. 12 and 13 are based on the adjoining graph.

Q.12 At 273 K, Pd v/s P is plotted for various gases & numbered 1,2,3,4. Assuming ideal behaviour and four gases to be N_2, He, CO_2 & H_2 respectively. The correct sequence is (where P denotes Pressure in atmosphere & d denotes density in gm/L)



(A) 2,1,3,4 (B) 4,1,2,3
(C) 4,3,2,1 (D) 2,3,1,4

Q.13 If Pd v/s P is plotted for He gas (ideal gas) at a different temperature and if $\left[\frac{d}{dP}(Pd)\right]_{P=0.821atm} = 1$, for that isothermal curve, then the temperature will be

(A) 40 K (B) 800 K (C) 400 K (D) 80 K

Q.14 Find molality of mercurous ion, if the concentration of aqueous solution containing it is 160 ppm.

CALCULATION SKILL

Q.15 Which of the following gaves have mean free path longer than oxygen under similar conditions?

I. H_2 II. CO_2 III. Cl_2 IV. N_2

(A) I, III (B) II, IV (C) I, IV (D) II, III

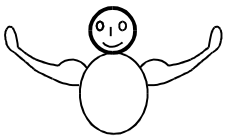
Q.16 By what factor does water expand when converted into vapour at 100°C and 1 atm pressure. The density of liquid water at 100°C and 1 atm is 0.96 g cm^{-3}.

(A) 815 (B) 2000 (C) 1630 (D) 500

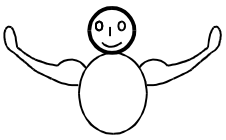
Q.17 The empirical formula of an organic compound containing carbon and hydrogen is CH_2. The mass of one litre of this organic gas is exactly equal to that of one litre of N_2. Therefore the molecular formula of the organic gas is

(A) C_2H_4 (B) C_3H_6 (C) C_6H_{12} (D) C_4H_8

Q.18 In a photoelectric experiment, it was found that the stopping potential decreases from 1.85 V to 0.82V as the λ of incident light is varied from 300 nm to 400 nm. Calculate planks constant in eVs.



STRENGTHENING CONCEPTS



Q.19 Near Mount Kailash is the sacred lake, Mansorvar. In the crystal clear water of the lake, things at the bottom of the lake are also clearly visible. On a hot sunny day, when the temperature at the surface is 27°C an algae at the bottom of the lake produces a 25 ml bubble of pure oxygen. As the bubble rises to the top, it gets saturated with the water vapours and has a volume of 100 ml of the surface. The pressure at the surface is 720 mm Hg. If the depth of the lake is 27.2 m, find the temperature at the bottom of the lake. Vapour pressure of water at 27°C is 20 mm Hg. $d_{H_2O} = 1$ gm/ml, $d_{Hg} = 13.6$ g/ml.

Q.20 A beam of light has three λ, 4144 Å, 4972 Å and 6216 Å with a total intensity of 3.6×10^{-3} Wm^{-2} equally distributed amongst the three λ. The beam falls normally on an area 1.0 cm^2 of a clean metallic surface of work function 2.3 eV. Assume that there is no loss of light by reflection etc. Calculate the no. of photoelectrons emitted in 2 sec.

SITTING III

EASY LIFE

Q.1 At low pressure, the graph of PV vs 1/V for a given amount at a constant temperature for a real gas is

(A) straight line parallel to the x-axis

(B) straight line passing through origin & having the slope

(C) straight line having the intercept & negative slope.

(D) none of these.

Q.2 If X is the total number of collision which a gas molecule registers with others per unit time under partcular conditions, then the collison frequency of the gas containing N molecules/ unit volume is

(A) X / N (B) NX (C) 2NX (D) NX / 2

Q.3 Total number of molecules in 22.4 L each of H_2O, Cl_2 & NH_3 at STP would be in the order.

(A) $Cl_2 = NH_3 = H_2O$ (B) $Cl_2 < H_2O < NH_3$

(C) $H_2O = NH_3 < Cl_2$ (D) $Cl_2 = NH_3 < H_2O$

Q.4 Which of the following statement is(are) true in the context of photoelectric effect?

(A) The kinetic energy of ejected electrons is independent of the photon intensity of radiation.

(B) The threshold frequency is same for all metals.

(C) The number of photoelectrons ejected depends on the frequency of the incident radiation

(D) The kinetic energy of the emitted electrons depends on the frequency of the incident radiation

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Q.5 A certain gas diffuses from two different vessels A and B. The vessel A has a circular orifice while vessel B has square orifice of length equal to the radius of the orifice of vessel A. The ratio of the rates of diffusion of the gas form vessel A to vessel B, assuming same temperature and pressure is
(Assume rate of effusion directly proportional to area of orifice)
(A) π (B) $1/\pi$ (C) 1 : 1 (D) 2 : 1

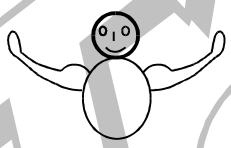
Q.6 When a hydrogen atom emits a photon of energy 12.1 eV. Its orbita angular momentum changes by
(A) $\frac{h}{2\pi}$ (B) $\frac{2h}{\pi}$ (C) $\frac{h}{\pi}$ (D) $\frac{h}{3\pi}$

Q.7 According to the Bohr theory for the hydrogen atom, the number of revolutions of the electron per second in the orbit of quantum number, n is proportional to
(A) n^{-2} (B) $\sqrt{n}$ (C) n^{-3} (D) n^{-1}

Q.8 A protein molecule containing 4472 atoms has _____ calories of vibrational degree of freedom contribution to the total molar heat capacity at constant volume.

Q.9 A gas obeys the equation of state P (V – b) = RT. The slope for an isochore will be _____.

Q.10 If 20% by weight of nitrogen is present in a compound, the molecular weight of the compound may be
(A) 144 (B) 28 (C) 100 (D) 140



STRENGTHENING CONCEPTS

Q.11 Two containers A and B have the same volume. Container A contains 5 moles of O_2 gas. Container B contains 3 moles of He & 2 moles of N_2. Both the containers are separately kept in vacuum at the same temperature & have the same small orifice. The ratio of rate of effusion of O_2 with that of He gas mixture. (The "effusing" mixture in container B can not be assume of the same composition as composition of the mixture present in container B)
(A) $\sqrt{\frac{7}{8}}$ (B) $\sqrt{\frac{1.7}{4}}$ (C) $\sqrt{\frac{1}{6}}$ (D) $\sqrt{\frac{1.1}{4}}$

Q.12 A point source of light is used in a photoelectric effect. If the source is removed farther from the emitting metal, the stopping potential
(A) will increase (B) will decrease
(C) wll remain constant (D) will either increase or decrease

Q.13 The photocurrent in an experiment on photoelectric effect increases if
(A) the intensity of the source is increased (B) the exposure time is increased
(C) the intensity of the source is decreased (D) the exposure time is decreased

Q.14 0.5 g of a metallic oxide is converted to 1.165 g of the corresponding sulphate. If the atomic mass of the element is 88 g mol^{-1}, the metallic oxide is
(A) MO_2 (B) M_2O_3 (C) MO (D) M_2O

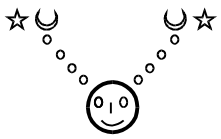
Q.15 A steel vessel of volume, one litre is filled with a mixture of methane and oxygen of a total pressure of one atm at 27^0C. The gas mixture is exploded. What would be the final pressure of the products at 127^0C?
(A) 3.13 atm (B) 1.33 atm (C) 1.13 atm (D) 2.08 atm

Q.16 A light beam of wavelength 400 nm is incident on a metal of work function 2.2 eV. A particular e^- absorbs a photon and makes 2 collisions before coming out of the metal.

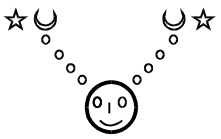
(a) Assuming that 10% of extra energy is lost to the metal in each collision, find the final kinetic energy of this e^- as it comes out of the metal.

(b) Under the same assumptions, find the maximum no. of collisions, the e^- should suffer before it becomes unable to come out of the metal.

Assume:(extra energy=incident energy of photon – energy lost by electron in previous collisions)



BRAIN TEASERS



Q.17 The advantage of using KO_2 as gas masks in spaceships is that it absorbs Co_2, at the same time releasing oxygen. If 0.001 mole of KO_2 is present in an atmosphere containing 22.4 cm^3 of CO_2 at STP free for moisture, what will be the volume of O_2 released at STP?

$$2KO_2 + CO_2 \rightarrow K_2CO_3 + (3/2)O_2$$

(A) 22.4 cm^3 (B) 11.2 cm^3 (C) 16.8 cm^3 (D) 44.8 cm^3

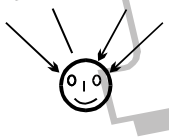
Q.18 15 ml of pure O_2 is subject to silent electric discharge, when only 10% of it is converted to ozone. The volume of the resulting mixture and the volume that remains after absorption in turpentine are respectively

(A) 14.5 ml, 13.5 ml (B) 12 ml, 10 ml (C) 15 ml, 13.5 ml (D) 20 ml, 15 ml

Q.19 Cl_2O_7 gas decomposes as

$$Cl_2O_7 \longrightarrow Cl_2+O_2$$

A partially decomposed gaseous mixture is allowed to effuse through a pin hole and the gas coming out initially was analysed. The mole fraction of O_2 in diffused gas was found to be 0.60, determine the degree of dissociation of Cl_2O_7.



RECALLING VARIOUS CONCEPTS AT ONE PLACE

Q.20 a moles of X reacts with b moles of Y according to the reaction in which the stoichiometric ratio of X : Y equals to c : b where (a > c), then quantity left behind after complete reaction is

(A) X(a – c) Y(0) (B) X (0) Y (c – a) (C) X (0) Y (a – c) (D) X (c – a) Y (0)

Q.21 $Al_2(SO_4)_3$ solution of 1 molal concentration is present in 1 litre solution of 2.684 gm/cc. How many moles of $BaSO_4$ would be precipitated on adding $BaCl_2$ in excess.

(A) 2 moles (B) 3 moles (C) 2.684 × 3 moles (D) 6 moles

Q.22 In an auto engine with no pollution controls, about 5% of the fuel (C_8H_{18}) is unburned. Molar ratio of CO and C_8H_{18} emitted in the exhaust gas is:

(A) 100 (B) 152 (C) 50 (D) 5

Q.23 A 40 ml of mixture of H_2 & O_2 was placed in a gas burette at 18°C and 1 atm P. A spark was applied so that the formation of water was complete. The remaining pure gas had a volume of 10 ml at 18°C & 1 atm P. If the remaining gas was H_2, what was the initial mole % of H_2 in mixture.

(A) 75 (B) 50 (C) 25 (D) 12.5

Q.24 A mixture of two gases A and B in the mole ratio 2 : 3 is kept in a 2 litre vessel. A second 3 litre vessel has the same two gases in the mole ratio 3 : 5. Both gas mixtures have the same temperature and same pressure. They are allowed to intermix and the final temperature and pressure are the same as the initial values, the final volume being 5 litres. Given that the molar masses are M_A and M_B, what is the mean molar mass of the final mixture?

(A) $\frac{77M_A+123M_B}{200}$ (B) $\frac{123M_A+77M_B}{200}$ (C) $\frac{77M_A+123M_B}{250}$ (D) $\frac{123M_A+77M_B}{250}$

Q.25 The NH_3 evolved from 1.40 gm sample of protein was absorbed in 45 ml of 0.4 M HNO_3. The excess acid required 20 ml of 0.1 M NaOH. The % N in the sample is

(A) 8 (B) 16 (C) 19.42 (D) 24

CALCULATION SKILL

Q.26 A mixture of carbon monoxide and carbon dioxide is found to have a density of 1.7 g/lit. at S.T.P. The mole fraction of carbon monoxide is

(A) 0.37 (B) 44.1 (C) 0.30 (D) 0.50

Q.27 $K_2Cr_2O_7$ is obtained in the following steps:

$2FeCrO_4 + 2Na_2CO_3 + O \longrightarrow Fe_2O_3 + 2Na_2CrO_4 + 2CO_2$

$2Na_2CrO_4 + H_2SO_4 \longrightarrow Na_2Cr_2O_7 + H_2O + Na_2SO_4$

$Na_2Cr_2O_7 + 2KCl \longrightarrow K_2Cr_2O_7 + 2NaCl$

To get 0.25 mol of $K_2Cr_2O_7$, mol of 50% pure $FeCrO_4$ required:

(A) 1 mol (B) 0.50 mol (C) 0.25 mol (D) 0.125 mol

Q.28 8 gm O_2 gas is taken at 320 K in 3.01 L vessel. The mean free path is $\sqrt{\frac{8.314}{3.14}}$ pm, then calculate

(i) No. of collisions made by any one molecule in unit time assuming all molecule are moving

(ii) Total no. of bimolecular collision in unit time per unit volume (Collision frequency) in the sample of O_2 gas.

(iii) No. of collision made by any one molecule assuming all other are stationary.

ANSWER KEY

SITTING I

Q.1 C Q.2 (a) A (b) A (c) B Q.3 B

Q.4 D Q.5 D Q.6 B Q.7 D

Q.8 0.13, 0.85 Q.9 0.1 m Q.10 27.1 M Q.11 A,B,C,D

Q.12 $n_1 = 1, n_2 = 3$, $\bar{\nu} = 389969.7\ cm^{-1}$ Q.13 (a) $\frac{P_T}{P} = [1 + (n-1)\alpha] \times \frac{T_1}{T_0}$

(b) $\frac{V_T}{V} = [1 + (n-1)\alpha]$ (c) $\left[\frac{M_A}{2}\left[\frac{1}{1+(n-1)\alpha}\right] = d\right]$ (d) $\frac{r_b}{r_a} = \frac{P}{P_T}\sqrt{\frac{1}{1+(n-1)\alpha}}$

Q.14 870 eV Q.15 1.8×10^{-7} % Q.16 CH_2O Q.17 37.5, 19.2 grams

Q.18 A Q.19 0.133 ml Q.20 500/3

SITTING II

Q.1 (a) A (b) A Q.2 C Q.3 A Q.4 C

Q.5 C Q.6 A Q.7 D Q.8 (n–3)

Q.9 $B = \frac{\alpha^2 e^2 n A r_0^{x-1}}{x}$ Q.10 494.5 kJ/mol Q.11 4.8×10^7 C/g

Q.12 D Q.13 D Q.14 4×10^{-4} m Q.15 A

Q.16 A Q.17 A Q.18 4.12×10^{-15} eVs

Q.19 298.6 K Q.20 11×10^{11}

SITTING III

Q.1 A Q.2 D Q.3 D Q.4 A, D

Q.5 A Q.6 C Q.7 C Q.8 26820

Q.9 R/(V – b) Q.10 B Q.11 D Q.12 C

Q.13 A Q.14 A Q.15 B

Q.16 (a) 0.311 eV (b) 4 collisions Q.17 C Q.18 A

Q.19 $\alpha = 0.2$ Q.20 A Q.21 D Q.22 B

Q.23 A Q.24 B Q.25 B Q.26 A

Q.27 A Q.28 (i) $\sqrt{8} \times 10^{14}$ (ii) $5\sqrt{2} \times 10^{36}$ (iii) 2×10^{14}

