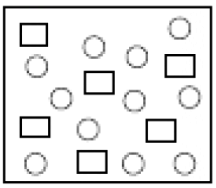
Chemical Equilibrium

1. In the figure shown below reactant A (represented by square) is in equilibrium with product B represented by circle). The equilibrium constant is :



(A) 4 (B) 8 (C) 1 (D) 2

[Jee Main, 2020]

2. At 298 K, the equilibrium constant is 2×10^{15} for the reaction:

$$Cu(s) + 2Ag^{+}(aq) \rightleftharpoons Cu^{2+}(aq) + 2Ag(s)$$

The equilibrium constant for the reaction

$\frac{1}{2}Cu^{2+}(aq) + Ag(s) \rightleftharpoons \frac{1}{2}Cu(s) + Ag^{+}(aq)$ is $x \times 10^{-8}$. The value of x is _____.

(Nearest Integer)

[JEE Main, July 2022]

3. For the reaction

$A + B \rightleftharpoons 2C$

the value of equilibrium constant is 100 at 298 K. If the initial concentration of all the three species is 1 M each, then the equilibrium concentration of C is $x \times 10^{-1}$ M. The value of x is_____. (Nearest integer)

[JEE Main, July 2021]

4. At 1990 K and 1 atm pressure, there are equal number of Cl_2 molecules and Cl atoms in the reaction mixture. The value K_P for the reaction $Cl_2 \rightleftharpoons 2Cl_{(g)}$ under the above conditions is x $\times 10^{-1}$. The value of x is (Rounded of to the nearest integer)

[JEE Main, Feb 2021]

5. PCl_5 dissociates as

$PCl_5\ (g) \rightleftharpoons PCl_3\ (g) + Cl_2\ (g)$

5 moles of PCl_5 are placed in a 200 litre vessel which contains 2 moles of N_2 and is maintained at 600 K. The equilibrium pressure is 2.46 atm. The equilibrium constant Kp for the dissociation of PCl_5 is____ $\times 10^{-3}$. (nearest integer)

(Given: R = 0.082 L atm K^{-1} mol^{-1} : Assume ideal gas behaviour) **[JEE Main, June 2022]**

6. When 5.1 g of solid NH_4HS is introduced into a two litre evacuated flask at 27°C, 20% of the solid decomposes into gaseous ammonia and hydrogen sulphide. The Kp for the reaction at 27°C is $x \times 10^{-2}$. The value of x is _____. (Integer answer)

[Given R = 0.082 L atm K^{-1} mol^{-1}] **[JEE Main, August 2021]**

7. For the reaction, $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$, $\Delta H = -57.2$ kJ mol^{-1} and $K_C = 1.7\times10^{16}$.Which of the following statement is INCORRECT ?

(A) The equilibrium constant is large suggestive of reaction going to completion and so no catalyst is required.

(B) The addition of inert gas at constant volume will not affect the equilibrium constant.

(C) The equilibrium constant decreases as the temperature increases.

(D) The equilibrium will shift in forward direction as the pressure increases.

[Jee Main, April 2019]

8. For the reaction

$$Fe_2N(s) + \frac{3}{2}H_2(g) \rightleftharpoons 2Fe(s) + NH_3(g)$$

(A) $K_c = K_p(RT)$ (B) $K_c = K_p(RT)^{3/2}$ (C) $K_c = K_p(RT)^{1/2}$ (D) $K_c = K_p(RT)^{-1/2}$

[Jee Main, 2020]

9. The value of K_p/K_C for the following reactions at 300 K are, respectively :

(At 300 K, RT = 24.62 dm^3 atm mol^{-1}) **[Chemical Equilibrium]**

$N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$

$N_2O4(g) \rightleftharpoons 2NO_2(g)$

$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$

(A) 24.62 dm^3 atm mol^{-1}
606.0 dm^6 atm^2 mol^{-2}
1.65×10^{-3} dm^{-6} atm^{-2} mol^{-2}

(B) 1, 4.1×10^{-2} dm^{-3} atm^{-1} mol,
606.0 dm^6 atm^2 mol^{-2}

(C) 1, 24.62 dm^3 atm mol^{-1},
606.0 dm^6 atm^2 mol^{-2},

(D) 1, 24.62 dm^3 atm mol^{-1},
1.65×10^{-3} dm^{-6} atm^{-2} mol^2. **[Jee Main, Jan 2019]**

10. Consider the following reaction:

$N_2O_{4(g)} \rightleftharpoons 2NO_{2(g)}$; $\Delta H° = +58K$

For each of the following cases (a, b), the direction in which the equilibrium shifts is:

(a) Temperature is decreased

(b) Pressure is increased by adding N_2 at constant T.

(A) (a) towards product, (b) no change

(B) (a) towards reactant, (b) no change

(C) (a) towards product, (b) towards reactant

(D) (a) towards reactant, (b) towards product

[Jee Main, 2020]

11. Two solids dissociate as follows

$A(s) \rightleftharpoons B(g) + C(g)$; $K_{p_1} = x\ atm^2$

$D(s) \rightleftharpoons C(g) + E(g)$; $K_{p_2} = y\ atm^2$

The total pressure when both the solids dissociate simultaneously is :-

(A) $x^2 + y^2$ (B) $2\left(\sqrt{x+y}\right)atm$ (C) $(x + y)$ atm (D) $\sqrt{x+y}\ atm$

[Jee Main, Jan 2019]

Ionic Equilibrium

1. K_a for butyric acid (C_3H_7COOH) is 2×10^{-5}. The pH of 0.2 M solution of butyric acid is _____ $\times 10^{-1}$. (Nearest integer) [Given log 2 = 0.30]

[JEE Main, July 2022]

2. 200 mL of 0.01 M HCl is mixed with 400 mL of 0.01M H_2SO_4. The pH of the mixture is _____.

(A) 1.14 (B) 1.78 (C) 2.34 (D) 3.02

[JEE Main, July 2022]

3. Arrange the following solutions in the decreasing order of pOH:

(a) 0.01 M HCl (b) 0.01 M NaOH

(c) 0.01 M CH_3COONa (d) 0.01 M NaCl

(A) (b) > (c) > (d) > (s) (B) (a) > (c) > (d) > (b)

(C) (b) > (d) > (c) > (a) (D) (a) > (d) > (c) > (b)

[Jee Main, 2020]

4. 20 mL of 0.1 M H_2SO_4 solution is added to 30 mL of 0.2 M NH_4OH solution. The pH of the resultant mixture is : [pk_b of NH_4OH = 4.7]. **[Ionic Equilibrium]**

(A) 9.4 (B) 5.0 (C) 9.0 (D) 5.2

[Jee Main, Jan 2019]

5. Class XII students were asked to prepare one litre of buffer solution of pH 8.26 by their chemistry teacher. The amount of ammonium chloride to be dissolved by the student 1n 0.2 M ammonia solution to make one litre of the buffer is

(Given pK_b (NH_3)=4.74; Molar mass of NH_3=17g mol^{-1}; Molar mass of NH_4Cl= 53.5g mol^{-1})

(A) 53.5 g (B) 72.3 g (C) 107.0 g (D) 126.0 g

[JEE Main, July 2022]

6. Consider the following statements

(a) The pH of a mixture containing 400 mL of 0.1 M H_2S0_4 and 400 mL of 0.1 M NaOH will be approximately 1.3.

(b) Ionic product of water is temperature dependent.

(c) A monobasic acid with $K_a = 10^{-5}$ has a pH = 5. The degree of dissociation of this acid is 50%.

(d) The Le Chatelier's principle is not applicable to common-ion effect.

The correct statements are :

(A) (a), (b)and(c) (B) (a) and (b) (C) (b) and (c) (D) (a), (b) and (d)

[Jee Main, April 2019]

7. An acidic buffer is obtained on mixing :

(A) 100 mL of 0.1 M HCl and 200 mL of 0.1 M NaCl

(B) 100 mL of 0.1 M HCl and 200 mL of 0.1 M CH_3COONa

(C) 100 mL of 0.1 M CH_3COOH and 100 mL of 0.1 M NaOH

(D) 100 mL of 0.1 M CH_3COOH and 200 mL of 0.1 M NaOH

[Jee Main, 2020]

8. Given below are two statements.

Statement I: In the titration between strong acid and weak base methyl orange is suitable as an indicator.

Statement II: For titration of acetic acid with NaOH phenolphthalein is not a suitable indicator.

In the light of the above statements, choose the most appropriate answer from the options given below:

(A) Statement I is false but Statement II is true

(B) Statement I is true but Statement II is false

(C) Both Statement I and Statement II are true

(D) Both Statement I and Statement II are false **[JEE Main, August 2021]**

9. In base vs. Acid titration, at the end point methyl orange is present as

(A) quinonoid form (B) heterocyclic form (C) phenolic from (D) benzenoid form

[JEE Main, July 2022]

10. If K_{sp} of Ag_2CO_3 is 8×10^{-12}, the molar solubility of Ag_2CO_3 in 0.1M $AgNO_3$ is :

[Ionic Equilibrium]

(A) 8×10^{-10} M (B) 8×10^{-13} M (C) 8×10^{-12} M (D) 8×10^{-11} M

[Jee Main, Jan 2019]

11. The solubility of $Ca(OH)_2$ in water is:

[Given : The solubility product of $Ca(OH)_2$ in water = 5.5×10^{-6}]

(A) 1.77×10^{-6}

(B) 1.11×10^{-6}

(C) 1.11×10^{-2}

(D) 1.77×10^{-2} **[JEE Main, Feb 2021]**

12. The solubility of AgCl will be maximum in which of the following?

(A) 0.01 M KCl (B) 0.01 M HC1

(C) 0.01 M $AgNO_3$ (D) De-ionised water

[JEE Main, June 2022]

13. When 35 mL of 0.15 M lead nitrate solution is mixed with 20 mL of 0.12 M chromic sulphate solution, _____ $\times 10^{-5}$ moles of lead sulphate precipitate out. (Round off to the Nearest Integer) **[JEE Main, March 2021]**

14. The solubility of AgCN in a buffer solution of pH=3 is x. The value of x is: (Assume : No cyano complex is formed; K_{sp} (AgCN) $=2.2\times10^{-16}$ and $K_a(HCN) = 6.2\times10^{-10}$]

(A) 0.625×10^{-6}

(B) 1.9×10^{-5}

(C) 2.2×10^{-16}

(D) 1.6×10^{-6} **[JEE Main, Feb 2021]**

15. The number of moles of NH_3, that must be added to 2 L of 0.80 M $AgNO_3$ in order to reduce the concentration of Ag^+ ions to 5.0×10^{-8} M ($K_{formation}$ for $[Ag(NH_3)_2]^+ = 1.0\times 10^8$) is _____ .

(Nearest integer)

[Assume no volume change on adding NH_3]

[JEE Main, August 2021]

Redox Reaction

1. Which of the following oxoacids of sulphur contains "S" in two different oxidation states?

(A) $H_2S_2O_3$ (B) $H_2S_2O_6$ (C) $H_2S_2O_7$ (D) $H_2S_2O_8$

[JEE Main, June 2022]

2. Which one of the following is an example of disproportionation reaction?

(A) $3MnO_4^{2-} + 4H^+ \longrightarrow 2MnO_4^- + MnO_2 + 2H_2O$

(B) $MnO_4^{2-} + 4H^+ + 4e^- \longrightarrow MnO_2 + 2H_2O$

(C) $10I^- + 2MnO_4^- + 16H^+ \longrightarrow 2Mn^{+2} + 8H_2O + 5I_2$

(D) $8MnO_4^- + 3S_2O_3^{2-} + H_2O \longrightarrow 8MnO_2 + 6SO_4^{2-} + 2OH^-$

[JEE Main, June 2022]

3. $2MnO_4^- + bC_2O_4^{2-} + cH^+ \longrightarrow xMn^{2+} + yCO_2 + zH_2O$

If the above equation is balanced with integer coefficients, the value of c is _____.

(Round off to the Nearest Integer).

[JEE Main, March 2021]

4. The neutralization occurs when 10 mL of 0.1 M acid 'A' is allowed to react with 30 mL of 0.05 M base $M(OH)_2$. The basicity of the acid 'A' is_____. [M is a metal]

[JEE Main, June 2022]

5. In the reaction of oxalate with permanganate in acidic medium, the number of electrons involved in producing one molecule of CO_2 is : **[Equivalent Concept]**

(A) 10 (B) 6 (C) 1 (D) 2

[Jee Main, Jan 2019]

6. A 20.0 mL solution containing 0.2 g impure H_2O_2 reacts completely with 0.316 g of $KMnO_4$ in acid solution. the purity of H_2O_2 (in%) is _____

(mol. wt. of H_2O_2 = 34; mol. wt. of $KMnO_4$ = 158)

[Jee Main, 2020]

7. 15 mL of aqueous solution of Fe^{2+} in acidic medium completely reacted with 20 mL of 0.03 M aqueous $Cr_2O_7^{2-}$. The molarity of the Fe^{2+} solution is _____ $\times 10^{-2}$ M.

(Round off to the Nearest Integer) **[JEE Main, March 2021]**

8. In order to oxidise a mixture of one mole of each of FeC_2O_4, $Fe_2(C_2O_4)_3$ and $Fe_2(SO_4)_3$ in acidic medium, the number of moles of $KMnO_4$ required is : **(Equivalent Concept)**

(A) 1 (B) 3 (C) 2 (D) 1.5

[Jee Main, April 2019]

9. A 2.0 g sample containing MnO_2 is treated with HCl liberating Cl_2. The Cl_2 gas is passed into a solution of KI and 60.0 mL of 0.1 M $Na_2S_2O_3$ is required to titrate the liberated iodine. The percentage of MnO_2 in the sample is _____. (Nearest integer)

[Atomic masses (in u) Mn = 55; Cl = 35.5; O = 16, I = 127, Na = 23, K = 39, S = 32]

[JEE Main, June 2022]

10. 20 mL of 0.02 M hypo solution is used for the titration of 10 mL of copper sulphate solution, in the presence of excess of KI using starch as an indicator. The molarity of Cu^{2+} is found to be _____ $\times 10^{-2}$ M [nearest integer]

Given: $2Cu^{2+} + 4I^- \rightarrow Cu_2I_2 + I_2$

$$I_2 + 2S_2O_3^{2-} \rightarrow 2I^- + S_4O_6^{2-}$$

[JEE Main, July 2022]

Atomic Structure

1. If the Thompson model of the atom was correct, then the result of Rutherford's gold foil experiment would have been :

(A) All of the α-particles pass through the gold foil without decrease in speed.

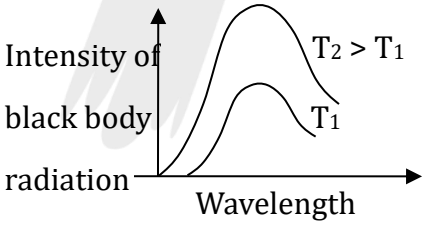
(B) α-Particles are deflected over a wide range of angles.

(C) All α-particles get bounced back by 180°

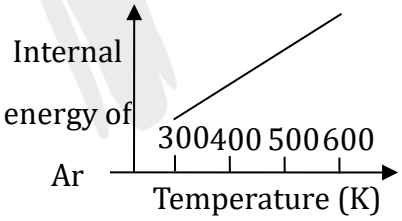
(D) α-Particles pass through the gold foil deflected by small angles and with reduced speed.

[JEE Main, July 2021]

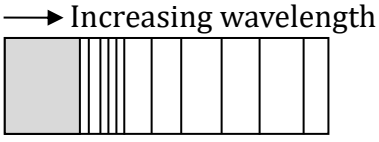
2. The figure that is not a direct manifestation of the quantum nature of atoms is :



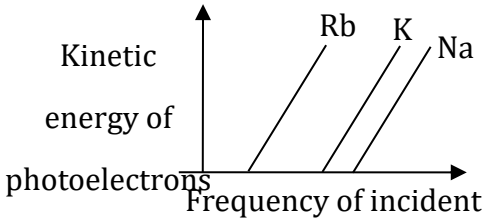
(A)



(B)



(C)



(D)

[Jee Main, 2020]

3. A 50 watt bulb emits monochromatic red light of wavelength of 795 nm. The number of photons emitted per second by the bulb is $x \times 10^{20}$. The value of x is _____.

[Given : $h = 6.63 \times 10^{-34}$ Js and $c = 3.0 \times 10^{8}$ ms^{-1}]

[JEE Main, August 2021]

4. According to Bohr's atomic theory :-

(a) Kinetic energy of electron is $\propto \frac{Z^2}{n^2}$

(b) The product of velocity (v) of electron and principal quantum number (n), 'vn' $\propto Z^2$

(c) Frequency of revolution of electron in an orbit is $\propto \frac{Z^3}{n^3}$

(d) Coulombic force of attraction on the electron is $\propto \frac{Z^3}{n^4}$

Choose the most appropriate answer from the options given below :

(A) (c) Only

(B) (a) Only

(C) (a), (c) and (d) only

(D) (a) and (d) only

[JEE Main, Feb 2021]

5. The radius of the second Bohr orbit, in terms of the Bohr radius, a_0, in Li^{2+} is :

(A) $\frac{2a_0}{3}$ (B) $\frac{4a_0}{3}$ (C) $\frac{2a_0}{9}$ (D) $\frac{4a_0}{9}$

[Jee Main, 2020]

6. For the Balmer series in the spectrum of H atom, $\bar{\nu} = R_H \left\{ \frac{1}{n_1^2} - \frac{1}{n_2^2} \right\}$, the correct statements among (I) to (IV) are :

(I) As wavelength decreases, the lines in the series converge

(II) The integer n_1 is equal to 2

(III) The lines of longest wavelength corresponds to $n_2 = 3$

(IV) The ionization energy of hydrogen can be calculated from wave number of these lines

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

[Jee Main, 2020]

7. The ratio of the shortest wavelength of two special series of hydrogen spectrum is found to be about 9. The spectral series are : **(Atomic Structure)**

(A) Paschen and Pfund (B) Balmer and Brackett

(C) Lyman and Paschen (D) Brackett and Pfund

[Jee Main, April 2019]

8. The work function of sodium metal is 4.41×10^{-19} J. If photons of wavelength 300 nm are incident on the metal, the kinetic energy of the ejected electrons will be ($h = 6.63 \times 10^{-34}$ J s; $c = 3 \times 10^{8}$ m/s) _____ $\times 10^{-21}$ J. **[Jee Main, 2020]**

9. The wavelength of an electron and a neutron will become equal when the velocity of the electron is x times the velocity of neutron. The value of x is ___. (Nearest Integer)

(Mass of electron is 9.1×10^{-31} kg and mass of neutron is 1.6×10^{-27} kg)

[JEE Main, July 2022]

10. The minimum uncertainty in the speed of an electron in an one dimensional region of length $2a_0$ (Where a_0 = Bohr radius 52.9 pm) is_____ km s^{-1}.

(Given: Mass of electron = 9.1×10^{-31} kg, Planck's constant h = 6.63×10^{-34} Js)

[JEE Main, July 2022]

11. Identify the incorrect statement from the following.

(A) A circular path around the nucleus in which an electron moves is proposed as Bohr's orbit.

(B) An orbital is the one electron wave function (Ψ) in an atom.

(C) The existence of Bohr's orbits is supported by hydrogen spectrum.

(D) Atomic orbital is characterized by the quantum numbers n and l only

[JEE Main, July 2022]

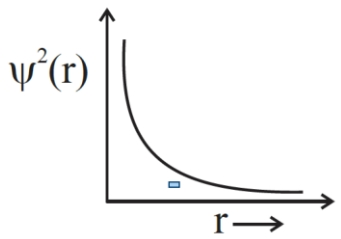
12. The correct statement about probability density (except at infinite distance from nucleus) is :

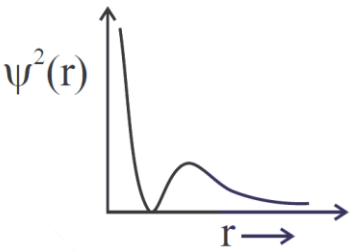
(A) It can negative for 2p orbital (B) It can be zero for 1s orbital

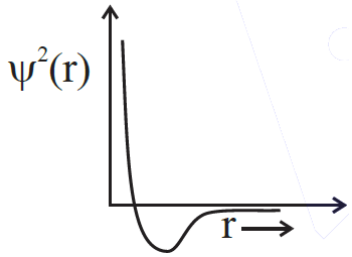
(C) It can never be zero for 2s orbital (D) It can be zero for 3p orbital

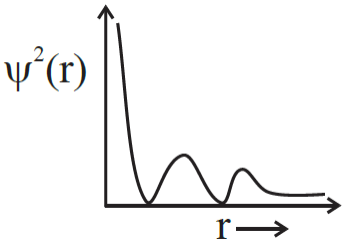
[Jee Main, 2020]

13. Which of the following is the correct plot for the probability density $\psi^2(r)$ as a function of distance 'r' of the electron form the nucleus for 2s orbital?

(A) 

(B) 

(C) 

(D) 

[JEE Main, June 2022]

14. Consider the following statements:

(a) The principal quantum number 'n' is a positive integer with values of 'n' = 1, 2, 3,....

(b) The azimuthal quantum number '*l*' for a given 'n' (principal quantum number) can have values as '*l*' = 0, 1, 2, ... n

(c) Magnetic orbital quantum number 'm*l*' for a particular '*l*' (azimuthal quantum number) has (2*l* + 1) values.

(d) ±1/2 are the two possible orientations of electron spin.

(e) For *l* = 5, there will be a total of 9 orbital.

Which of the above statements are correct?

(A) (a), (b) and (c)

(B) (a), (c), (d) and (e)

(C) (a), (c) and (d)

(D) (a), (b), (c) and (d) **[JEE Main, June 2022]**

15. The Azimuthal quantum number for the valence electrons of Ga^+ ion is_____. (Atomic number of Ga = 31) **[JEE Main, July 2021]**

16. Consider the following pairs of electrons

(A) (a) n = 3, 1 = 1, m1 = 1, ms = $+\frac{1}{2}$

(b) n = 3, 1 = 2, m1 = 1, ms = $+\frac{1}{2}$

(B) (a) n = 3, 1 = 2, m1 = – 2, ms = $-\frac{1}{2}$

(b) n = 3, 1 = 2, m1 = –1, ms = $-\frac{1}{2}$

(C) (a) n = 4, 1 = 2, m1 = 2, ms = $+\frac{1}{2}$

(b) n = 3, 1 = 2, m1 = 2, ms = $+\frac{1}{2}$

The pairs of electron present in degenerate orbitals is/are:

(A) Only A (B) Only B (C) Only C (D) (B) and (C)

[JEE Main, June 2022]

17. What is the spin-only magnetic moment value (BM) of a divalent metal ion with atomic number 25, in it's aqueous solution?

(A) 5.92 (B) 5.0 (C) zero (D) 5.26

[JEE Main, March 2021]

Gaseous

1. 0.5 moles of gas A and x moles of gas B exert a pressure of 200 Pa in a container of volume 10 m^3 at 1000 K. given R is the gas constant in $JK^{-1}\ mol^{-1}$, x is :

(A) $\frac{2R}{4+12}$ (B) $\frac{2R}{4-12}$ (C) $\frac{4-R}{2R}$ (D) $\frac{4+R}{2R}$

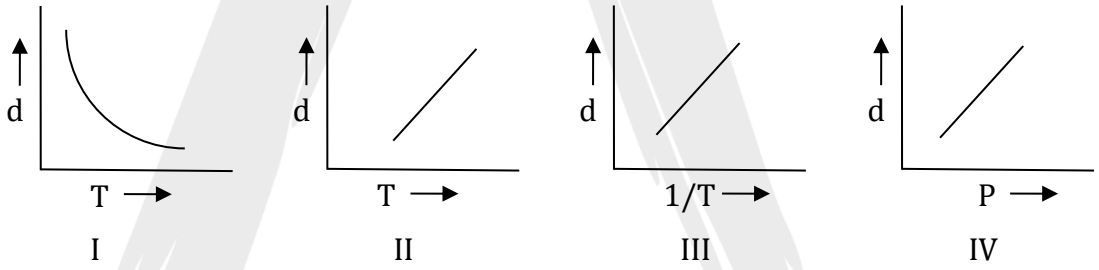
[JEE Main, Jan 2019]

2. A spherical balloon of radius 3 cm containing helium gas has a pressure of 48×10^{-3} bar. At the same temperature, the pressure, of a spherical balloon of radius 12 cm containing the same amount of gas will be ..... $\times 10^{-6}$ bar. **[JEE Main, 2020]**

3. Geraniol, a volatile organic compound, is a component of rose oil. The density of the vapour is 0.46 gL^{-1} at 257°C and 100 mm Hg. The molar mass of geraniol is _____ (Nearest Integer)
[Given R = 0.082 L atm $K^{-1}\ mol^{-1}$]

[JEE Main, June 2022]

4. Which one of the following graphs is not correct for ideal gas ?

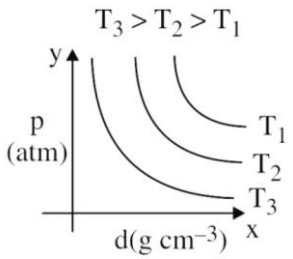


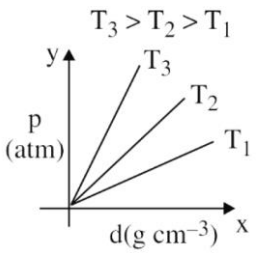
d = Density, P = Pressure, T = Temperature

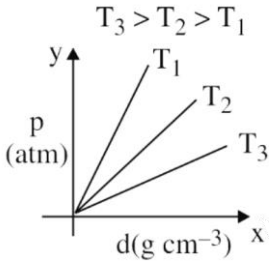
(A) IV (B) II (C) III (D) I

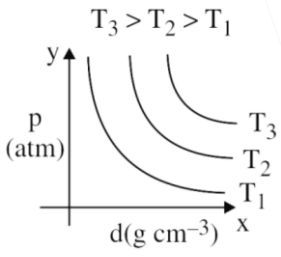
[JEE Main, 2020]

5. Which amongst the given plots is the correct plot for pressure (p) vs density (d) for an ideal gas?

(A) 

(B) 

(C) 

(D) 

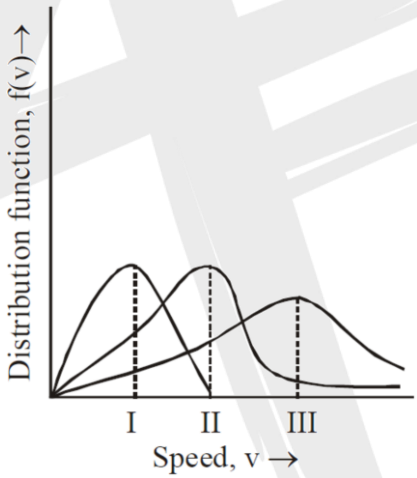
[JEE Main, June 2022]

6. 'x' g of molecular oxygen (O_2) is mixed with 200 g of neon (Ne). The total pressure of the nonreactive mixture of O_2 and Ne in the cylinder is 25 bar. The partial pressure of Ne is 20 bar at the same temperature and volume. The value of 'x' is
[Given: Molar mass of O_2 = 32 g mol^{-1}. Molar mass of Ne = 20 g mol^{-1}]

[JEE Main, July 2022]

7. Points I,II and III in the following plot respectively correspond to (V_{mp} :most probable velocity)

(Ideal Gas)



(A) V_{mp} of O_2 (400 K) ; V_{mp} of N_2 (300 K); V_{mp} of H_2 (300 K)
(B) V_{mp} of N_2 (300 K) ; V_{mp} of H_2 (300 K); V_{mp} of O_2 (400 K)
(C) V_{mp} of H_2 (300 K) ; V_{mp} of N_2 (400 K); V_{mp} of O_2 (300 K)
(D) V_{mp} of N_2 (300 K) ; V_{mp} of O_2 (400 K); V_{mp} of H_2 (300 K) **[JEE Main, April 2019]**

8. For a real gas at 25°C temperature and high pressure (99 bar) the value of compressibility factor is 2, so the value of Vander Waal' s constant 'b' should be × 10^{-2} L mol^{-1} (Nearest integer)
(Given R = 0.083 L bar K^{-1} mol^{-1})

[JEE Main, July 2022]

9. At a given temperature T, gases Ne, Ar, Xe and Kr are found to deviate from ideal gas behaviour. Their equation of state is given as

$P = \frac{RT}{V - b}$ at T.

Here, b is the Vander Waals constant. Which gas will exhibit steepest increase in the plot of Z (compression factor) v_s p? **(Real Gas)**

(A) Kr (B) Ar (C) Xe (D) Ne

[JEE Main, April 2019]

10. Consider the following table : **(Real Gas)**

Gas	a/(k Pa dm^6 mol$_{-1}$)	b/(dm^3 mol^{-1})
A	642.32	0.05196
B	155.21	0.04136
C	431.91	0.05196
D	155.21	0.4382

a and b are van der Waals constants. The correct statement about the gases is :

(A) Gas C will occupy lesser volume than gas A; gas B will be more compressible than gas D

(B) Gas C will occupy more volume than gas A; gas B will be more compressible than gas D

(C) Gas C will occupy lesser volume than gas A; gas B will be lesser compressible than gas D

(D) Gas C will occupy more volume than gas A; gas B will be lesser compressible than gas D

[JEE Main, April 2019]

Mole Concept

1. A protein 'A' contains 0.30% of glycine (molecular weight 75). The minimum molar mass of the protein 'A' is_____ × 10^3 g mol^{-1} [nearest integer]

[JEE Main, June 2022]

2. 5 moles of AB_2 weigh 125 × 10^{-3} kg and 10 moles of A_2B_2 weigh 300 × 10^{-3} kg. The molar mass of A (M_A) and molar mass of B (M_B) in kg mol^{-1} are:

(A) $M_A = 5 \times 10^{-3}$ and $M_B = 10 \times 10^{-3}$ (B) $M_A = 50 \times 10^{-3}$ and $M_B = 25 \times 10^{-3}$

(C) $M_A = 25 \times 10^{-3}$ and $M_B = 50 \times 10^{-3}$ (D) $M_A = 10 \times 10^{-3}$ and $M_B = 5 \times 10^{-3}$

[Jee Main, April 2019]

3. 1 mol of an octahedral metal complex with formula $MCl_3 \cdot 2L$ on reaction with excess of $AgNO_3$ gives 1 mol of AgCl. The denticity of Ligand L is _____ . (Integer answer)

[JEE Main, August 2021]

4. $NaClO_3$ is used, even in space crafts, to produce O_2. The daily consumption of pure O_2 by a person is 492 L at 1 atm, 300 K. How much amount of $NaClO_3$, in grams is required to produce O_2 for the daily consumption of a person at 1 atm, 300 K ? _____.

$NaClO_3(s) + Fe(s) \rightarrow O_2(g) + NaCl(s) + FeO(s)$

$R = 0.082\ L\ atm\ mol^{-1}\ K^{-1}$

[Jee Main, 2020]

5. For a reaction,

$N_2(g) + 3H_2(g) \longrightarrow 2NH_3(g)$; identify dihydrogen ($H_2$) as a limiting reagent in the following reaction mixtures. **(Mole Concept)**

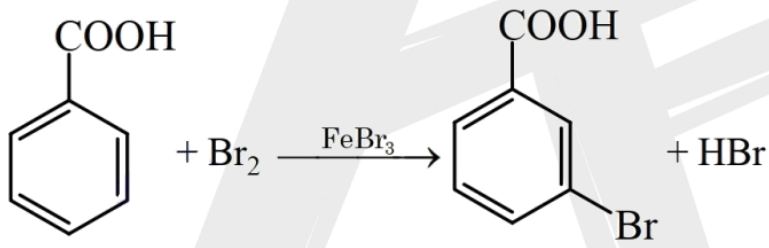
(A) 28 g of N_2 + 6 g of H_2 (B) 56 g of N_2 + 10 g of H_2

(C) 14 g of N_2 + 4 g of H_2 (D) 35 g of N_2 + 8 g of H_2

[Jee Main, April 2019]

6. CNG is an important transportation fuel. When 100 g CNG is mixed with 208 oxygen in vehicles, it leads to the formation of CO_2 and H_2O and produces large quantity of heat during this combustion, then the amount of carbon dioxide, produced in grams is_____. [nearest integer]
[Assume CNG to be methane] **[JEE Main, June 2022]**

7.



Consider the above reaction where 6.1 g of benzoic acid is used to get 7.8 g of m-bromo benzoic acid. The percentage yield of the product is_____.
(Round off to the Nearest integer)
[Given : Atomic masses : C = 12.0u, H : 1.0u, O : 16.0u, Br = 80.0 u]

[JEE Main, March 2021]

8. 116 g of a substance upon dissociation reaction, yields 7.5 g of hydrogen, 60g of oxygen and 48.5 g of carbon. Given that the atomic masses of H, O and C are 1, 16 and 12 respectively. The data agrees with how many formulae of the following?

(A) CH_3COOH (B) HCHO (C) CH_3OOCH_3 (D) CH_3CHO

[JEE Main, June 2022]

9. On complete combustion 0.30 g of an organic compound gave 0.20 g of carbon dioxide and 0.10 g of water. The percentage of carbon in the given organic compound is _____ (Nearest integer).

[JEE Main, June 2022]

10. At 300 K and 1 atmospheric pressure, 10 mL of a hydrocarbon required 55 mL of O_2 for complete combustion, and 40 mL of CO_2 is formed. The formula of the hydrocarbon is:

(A) C_4H_7Cl (B) C_4H_{10} (C) C_4H_8 (D) C_4H_6

[Jee Main, April 2019]

11. 100 mL of Na3PO4 solution contains 3.45 g of sodium. The molarity of the solution is ____$\times 10^{-2}$ mol L^{-1}. (Nearest integer)

[Atomic Masses - Na : 23.0 u, O : 16.0 u, P : 31.0 u]

[JEE Main, August 2021]

12. 8g of NaOH is dissolved in 18g of H_2O. Mole fraction of NaOH in solution and molality (in mol kg^{-1}) of the solutions respectively are : **[Concentration Terms]**

(A) 0.2, 22.20 (B) 0.167,22.20 (C) 0.167, 11.11 (D) 0.2, 11.11

[Jee Main, Jan 2019]

13. Chlorophyll extracted from the crushed green leaves was dissolved in water to make 2 L solution of Mg of concentration 48 ppm. The number of atoms of Mg in this solution is x × 10^{20} atoms. The value of x is ___ . (Nearest Integer)

(Given: Atomic mass of Mg is 24 g mol^{-1}, N_A= 6.02 × 1023 mol^{-1})

[JEE Main, July 2022]

14. The mole fraction of a solute in a 100 molal aqueous solution _____ $\times 10^{-2}$.

(Round off to the Nearest Integer).

[Given : Atomic masses : H : 1.0 u, O : 16.0 u]

[JEE Main, March 2021]

15. A solution of two components containing n_1 moles of the 1st component and n_2 moles of the 2nd component is prepared. M_1 and M_2 are the molecular weights of component 1 and 2 respectively. If d is the density of the solution in g mL^{-1}, C_2 is the molarity and x_2 is the mole fraction of the 2nd component, then C_2 can be expressed as :

(A) $C_2 = \frac{dx_1}{M_2 + x_2(M_2 - M_1)}$ (B) $C_2 = \frac{1000x_2}{M_1 + x_2(M_2 - M_1)}$

(C) $C_2 = \frac{1000dx_2}{M_1 + x_2(M_2 - M_1)}$ (D) $C_2 = \frac{dx_2}{M_2 + x_2(M_2 - M_1)}$

[Jee Main, 2020]

16. The molarity of HNO_3 in a sample which has density 1.4g/mL and mass percentage of 63% is _____. (Molecular weight of HNO_3 = 63)

[Jee Main, 2020]

17. The volume strength of 1M H_2O_2 is: **[Concentration Terms]**

(Molar mass of H_2O_2 = 34 g mol^{-1})

(A) 16.8 (B) 11.35 (C) 22.4 (D) 5.6

[Jee Main, Jan 2019]

18. The number of moles of CuO, that will be utilized in Dumas method for estimation nitrogen in a sample of 57.5g of N, N-dimethylaminopentane is _____ × 10^{-2}. (Nearest integer)

[JEE Main, August 2021]

19. In Duma's method of estimation of nitrogen, 0.1840 g of an organic compound gave 30 mL of nitrogen collected at 287 K and 758 mm of Hg pressure. The percentage composition of nitrogen in the compound is _____. (Round off to the Nearest Integer).

[Given : Aqueous tension at 287 K = 14 mm of Hg]

[JEE Main, March 2021]

20. In an estimation of bromine by Carius method, 1.6 g of an organic compound gave 1.88 g of AgBr. The mass percentage of bromine in the compound is .....

(Atomic mass, Ag= 108, Br = 80 g mol^{-1}) **[Jee Main, 2020]**

21. In Carius method, halogen containing organic compound is heated with fuming nitric acid in the presence of: **[JEE Main, July 2021]**

(A) HNO_3 (B) $AgNO_3$ (C) $CuSO_4$ (D) $BaSO_4$

22. In the sulphur estimation, 0.471 g of an organic compound gave 1.44 g of barium sulphate. The percentage of sulphur in the compound is ____%. (Nearest integer)

(Atomic Mass of Ba = 137 u) **[JEE Main, August 2021]**

23. 0.8 g of an organic compound was analysed by Kjeldahl's method for the estimation of nitrogen. If the percentage of nitrogen in the compound was found to be 42%, then_____ mL of 1 M H_2SO_4 would have been neutralized by the ammonia evolved during the analysis.

[JEE Main, July 2021]

24. A 0.166 g sample of an organic compound was digested with cone. H_2SO_4 and then distilled with NaOH. The ammonia gas evolved was passed through 50.0 mL of 0.5 N H_2SO_4. The used acid required 30.0 mL of 0.25 N NaOH for complete neutralization. The mass percentage of nitrogen in the organic compound is____.

[JEE Main, June 2022]

ANSWER KEY

Chemical Equilibrium

1. (D) **2.** (2) **3.** (25) **4.** (5) **5.** (1107) **6.** (6) **7.** (A)
8. (C) **9.** (D) **10.** (B) **11.** (B)

Ionic Equilibrium

1. (27) **2.** (B) **3.** (D) **4.** (C) **5.** (C) **6.** (A) **7** (B)
8. (B) **9.** (A) **10.** (A) **11.** (C) **12.** (D) **13.** (525) **14.** (B)
15. (4)

Redox Reaction

1. (A) **2.** (A) **3.** (16) **4.** (3) **5.** (C) **6.** (85) **7.** (24)
8. (C) **9.** (13) **10.** (4)

Atomic Structure

1 (D) **2.** (B) **3.** (2) **4.** (C) **5.** (B) **6.** (B) **7.** (C)
8. (222) **9.** (1758) **10.** (548) **11.** (D) **12.** (D) **13.** (B) **14.** (C)
15. (0) **16.** (B) **17.** (A)

Gaseous State

1. (C) **2.** (750) **3.** (152) **4.** (B) **5.** (B) **6.** (80) **7.** (D)
8. (25) **9.** (C) **10.** (B)

Mole Concept

1. (25) **2.** (A) **3.** (2) **4.** (2120 to 2140) **5.** (B) **6.** (143)
7. (78) **8.** (B) **9.** (18) **10.** (D) **11.** (50) **12.** (C) **13.** (24)
14. (64) **15.** (C) **16.** (14) **17.** (B) **18.** (1125) **19.** (19) **20.** (50)
21. (B) **22.** (42) **23.** (12) **24.** (63)