

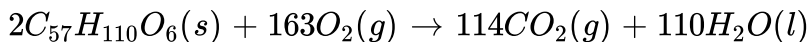
CHEMISTRY

BOOKS - DISHA PUBLICATION CHEMISTRY (HINGLISH)

CHAPTERWISE NUMERIC/INTEGER ANSWER QUESTIONS

Chapter 1 Some Basic Concepts Of Chemistry

1. What is the mass of water (in g) produced from 445 g of $C_{57}H_{110}O_6$ in the following reaction?



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2. The amount of suga ($C_{12}H_{22}O_{11}$) required to prepare 2L of its 0.1 M aqueous solution is

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3. 5 moles of AB_2 weigh 125×10^{-3} kg and 10 moles of A_2B_2 weigh 300×10^{-3} kg. What is the sum of molar mass of A (M_A) and molar mass of B (M_B) in $g\text{mol}^{-1}$?

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4. 5.0 g of a certain element X forms 10.0 g of its oxide having the formula X_4O_6 . What is the atomic mass of X

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5. A 100% pure sample of a divalent metal carbonate weighing 2g on complete thermal decomposition releases 44g of carbon dioxide at STP. The equivalent mass of the metal is

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6. The specific heat of a metal is $0.16 \text{ cal } g_1$. The equivalent mass of the metal is 20.04. What is the correct atomic mass of the metal in grams?

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7. 1.500g of hydroxide of a metal gave 1.000g of its oxide on heating. What is the equivalent mass of the metal ?

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8. Limestone ($CaCO_3$) decomposes into quicklime (CaO) on strong heating. How much quantity of limestone will be required to prepare 100 kg of quicklime?

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9. 1 mole of mixture of CO and CO_2 requires exactly 28 g KOH in solution for complete conversion of all the CO_2 into K_2CO_3 . How much amount more of KOH will be required for conversion into K_2CO_3 ? If one mole of mixture is completely oxidised to CO_2 .

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10. 1 mol of N_2 and 4 mol of H_2 are allowed to react in a sealed container and after the reaction some water is introduced in it. The aqueous solution formed required 1 L of 1 M HCl for neutralization. Calculate the mole fraction of the gaseous product in the mixture after the reaction.

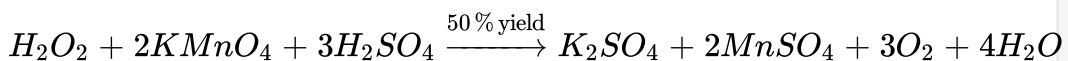
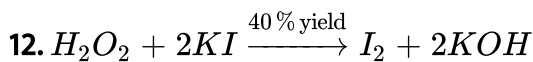
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11. 6.2 g of a sample containing $NaHCO_3$, $NaHCO_3$ and non-volatile inert impurity on gentle heating loses 5% of its mass due to reaction $2NaHCO_3 \rightarrow Na_2CO_3 + H_2O + CO_2$. Residue is dissolved in water and formed 100 mL solution and its 10 mL portion requires 7.5 mL of 0.2

M aqueous solution of $BaCl_2$ for complete precipitation of carbonates.

Determine mass (in gram) of Na_2CO_3 in the original sample .

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150mL of H_2O_2 sample was divided into two parts. First part was treated with KI and formed KOH required 200 mL of $M/2H_2SO_4$ for neutralisation. Other part was treated with $KMnO_4$ yielding 6.74 litre of O_2 at 1 atm. and 273 K. Using % yield indicated find volume strength of H_2O_2 sample used.

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13. 5 g sample contain only Na_2CO_3 and Na_2SO_4 This sample is dissolved and the volume made up to 500 mL. 25 mL of this solution

neutralizes 20 mL of 0.1 M H_2SO_4 . Calculate the percentage of Na_2SO_4 in the sample.

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14. A mixture of FeO and Fe_2O_3 is completely reacted with 100 mL of 0.25 M acidified $KMnO_4$ solution. The resultant solution was then treated with Zn dust which converted Fe^{3+} of the solution to Fe^{2+} . The Fe^{2+} required 1000 mL of 0.10 $MK_2Cr_2O_7$ solution. Find out the weight % Fe_2O_3 in the mixture.

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15. An impure sample of sodium oxalate ($Na_2C_2O_4$ weighing 0.20 g is dissolved in aqueous solution of H_2SO_4) and solution is titrated at $70^\circ C$, requiring 45 mL of 0.02 M $KMnO_4$ solution. The end point is overrun, and back titration is carried out with 10 mL of 0.1 M oxalic acid solution. Find the purity of $Na_2C_2O_4$ in sample:

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Chapter 2 Structure Of Atom

1. The ground state energy of hydrogen atom is -13.6eV . The energy of second excited state of He^+ ion in eV is

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2. what is the work function of the metal if the light of wavelength 4000\AA generates photoelectrons of velocity $6 \times 10^5\text{ms}^{-1}$ from it ?

(Mass of electron = $9 \times 10^{-31}\text{kg}$)

Velocity of light = $3 \times 10^8\text{ms}^{-1}$

Planck's constant = $6.626 \times 10^{-34}\text{Js}$

Charge of electron = $1.6 \times 10^{-19}\text{jeV}^{-1}$

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3. Monochromatic radiation of specific wavelength is incident on H-atoms in ground state. H-atoms absorb energy and emit subsequently radiations of six different wavelength. Find wavelength of incident radiations:

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4. In a measurement of quantum efficiency of photosynthesis in green plants, it was found that 10 quanta of red light of wavelength 6850 \AA were needed to release one molecule of O_2 . The average energy storage in this process for 1 mol O_2 evolved is 112 Kcal.

What is the energy conversion efficiency in this experiment?

Given: $1 \text{ cal} = 4.18 \text{ J}$, $N_A = 6 \times 10^{23}$, $h = 6.63 \times 10^{-34} \text{ J}\cdot\text{s}$

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5. The given diagram indicates the energy levels of certain atoms. When the system moves from 2E level to F, a photon of wave length λ is emitted.

Calculate the wave-length of photon produced during its transition from

$\frac{4E}{3}$ level to E in terms of λ



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6. An element undergoes a reaction as shown $sx + 2e^- \rightarrow x^{-2}$

Energy released = 30.87 eV/atom. If the energy released is used to dissociate $4g$ to H_2 molecules equally into H^+ and H^+ is excited state of H atoms where the electron travels in orbit whose circumference equal to four times its de Broglie's wavelength. Determine the minimum number of moles of x that would be required.

Given IE of $H = 13.6$ eV/atom, bond energy of $H_2 = 4.526$ eV/molecule

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7. Two fast moving particles X and Y are associated with de Broglie wavelengths 1 nm and 4 nm respectively. If mass of X is nine times the

mass of Y, then calculate ratio of kinetic energies of X and Y.

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8. An electron has a speed of $30,000 \text{ cm sec}^{-1}$ accurate upto 0.001%.

What is the uncertainty (in cm) in locating it's position?

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9. What is the sum of radial and angular nodes in the following orbitals of H-atom?

(i) Ψ_{2px} , (ii) Ψ_{2s} , (iii) Ψ_{3d_x} , (iv) $\Psi_{3d_{x^2-y^2}}$

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10. Determine the Bohr orbit of Li^{2+} ion in which electron is moving at speed equal to the speed of electron in the first Bohr orbit of H-atom

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11. A certain day absorbs lights of $\lambda = 400 \text{ nm}$ and then fluorescence light of wavelength 500 nm . Assuming that under given condition 40% of the absorbed energy is re-emitted as fluorescence, calculate the ratio of quanta absorbed to number of quanta emitted out.



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12. Infrared lamps are used in restaurants to keep the food warm. The infrared radiation is strongly absorbed by water, raising its temperature and that of the food. If the wavelength of infrared radiation is assumed to be 1500 nm , and the number of quanta of infrared radiation produced per second by an infrared lamp (that consumes energy at the rate of 100 W and is 12% efficient only) is $(x \times 10^{19})$, then the value of x is :

(Given: $h = 6.665 \times 10^{-34} \text{ J} \cdot \text{s}$)



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13. When an electron makes transition from $(n + 1)$ state to n state the wavelength of emitted radiations is related to n ($n > > > 1$) according to $\lambda \propto n^x$.

What is the value of x ?

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14. A gas absorbs a photon of $355nm$ and emits at two wavelengths . If one of the emission is at $680 nm$, the other is at :

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15. Calculate the minimum potential (eV) which must be applied to a free electron so that it has enough energy to excite, upon impact, the electron in a hydrogen atom from its ground state to a state of $n = 5$.

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1. The boiling point of Kr and Rn are -152°C and -62°C respectively. Find the approximate boiling point of Xe.

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2. How much energy in joules must be needed to convert all the atoms of sodium to sodium ions present in 2.3 mg of sodium vapours ?

Given : Ionisation energy of sodium is 495 kJ mol^{-1}

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3. The ionization energy of lithium is 520 kJ mol^{-1} . Find the amount of energy (in kJ) required to convert 70 mg of lithium atoms in gaseous state into Li^+ ions.

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4. The electron affinity of bromine (g) is 3.9 eV. How much energy in kJ is released when 10.0 g of bromine is converted completely to Br^- in gaseous state?

[Given. Atomic mass of Br = 80, $1 \text{ eV} = 96.3 \text{ kJ mol}^{-1}$].

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5. How many pairs are, in which first species has lower ionisation energy than second species:

(i) N and O

(ii) Br and K

(iii) Be and B

(iv) I and I^-

(v) Li and Li^+

(vi) O and S

(vii) Ba and Sr.

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6. How many elements of the following are electropositive element(s)?

Sodium, calcium, germanium and polonium and chlorine.

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7. An element 'X' has its electronic configuration of 'K' shell is $(n - 5)s^2$ and it has total number of electrons in its outermost, penultimate and antipenultimate shell are 2, 8 and 25 respectively then find out total number of unpaired electrons in element 'X' in their ground state.

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8. Total number of element(s) which have only single oxidation state (other than zero) in their corresponding stable compounds: Cs, Ba, F, Zn, Be, Al, Sr, Ga, Pb.

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9. Consider the following order:

(i) $HF > HCl > HBr > HI$: Lewis basic character

(ii) $CH_4 < CCl_4 < CF_4$: Electronegativity of central 'C'- atom

(iii) $Mg^{2+} < K^+ < S^{2-} < Se^{2+}$ Stable oxidation state

(vi) $LiF > NaF > KF > RbF$, Lattice energy

(vii) $F^-(aq) > Cl^-(aq) > Br^-(aq) > I^-(aq)$, Electrical conductance

(viii) $Li^+ < Mg^{2+} < Al^{3+}$: Hydration energy

(ix) $Cl > Br > F > I$: Electron affinity

(x) $BeCl_2 < AlCl_3 < SiCl_4$: Lewis acidic character

Then calculate value of (x-y), where x and y are correct and incorrect order respectively.



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10. Among the following, the number of elements showing only one non-zero oxidation state is:

O, Cl, F, N, P, Sn, Tl, Na, Ti



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1. A diatomic molecule has dipole moment of $1.2D$. If the bond distance is 1\AA what percentage of covalent in the molecule is

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2. The dipole moments of a diatomic molecule AB is $10.4D$ and bond distance is 2.82\AA , calculate the % ionic character of AB

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3. Bond angle between two hybrid orbitals is 105° Percentage of s-orbital character of hybrid orbital is between

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4. In O_2^- , O_2 and O_2^{2-} molecular species, the total number of antibonding electrons respectively are

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5. There are two groups of compounds A and B. Group A contains three compounds Px_4 , Qy_3 , Rz_2 . Group B also contains three compounds Sx_4 , Ty_3 , Uz_2 . Hybridization of each central atom of group A compounds is same as that of iodine in $IBrCl^-$ while in group B compounds it is same as that of iodine $IBrCl^+$. Substituents X, Y and Z exhibit covalency of one in ground state. Then find the value of x/y .

Where, x and y are total number of lone pair present at central atoms of compounds of group A and B respectively.

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6. Consider the following three compounds (i) AX_{2n}^{n-} , (ii) AX_{3n} and (iii) AX_{4n}^{n+} , where central atom A is 15th group element and their maximum

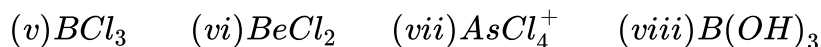
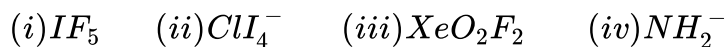
covalency is $3n$. If total number of proton in surrounding atom X is n and value of n is one, then calculate value of $x^3 + y^2 + z^2$. (where x, y and z are total number of lone pair at central atom in compounds (i), (ii) and (iii) respectively.

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7. Calculate the value of " $x+y-z$ " here x, y and z are total number of non-bonded electron pair (s), pie (π) bond(s) and sigma (σ) bonds in hydrogen phosphite ion respectively.

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8. Consider the following compounds :



Then calculate value of " $x+y-z$ ", here, x, y and z are total number of compounds in given compounds in which central atom used their all

three p-orbitals, only two p-orbitals and only one p-orbital in hybridisation respectively .

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9. Total number of species which used all three p-orbitals in hybridisation of central atom and should be non-polar also.

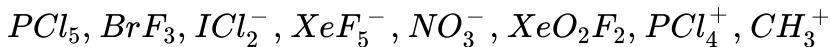
XeO_2F_2 , $SnCl_2$, IF_5 , I_3^+ , XeO_4 , SO_2 , XeF_7^+ , SeF_4

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10. Consider the following orbitals $3s$, $2p_x$, $4d_{xy}$, $4d_{z^2}$, $3d_{x^2-y^2}$, $3p_y$, $4s$, $4p_z$ and find total number of orbital (s) having even number of nodal plane.

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11. For the following molecules :



Calculate the value of $\frac{a + b}{c}$

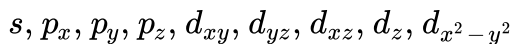
a = Number of species having sp^3 d-hybridisation

b = Number of species which are planar

c = Number of species which are non-planar

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12. Find total number of orbital which can overlap colaterally, (if inter nuclear axis is z):



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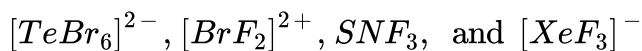
13. The total number of lone-pairs of electrons in melamine is.

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14. Among the triatomic molecules/ions $BeCl_2$, N_3^- , N_2O , NO_2^+ , O_3 , SCl_2 , ICl_2^- , I_3^- and XeF_2 , the total number of linear molecules (s)/ion(s) where the hybridisation of the central atom does not have contribution from the d - orbitals (s) is [atomic number of $S = 16$, $Cl = 17$, $I = 53$ and $Xe = 54$]

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15. The sum of the number of lone pair of electrons on each central atom in the following species is



(Atomic number : N = 7, F = 9, S = 16, Br = 35, Te = 52, Xe = 54)

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1. 20dm^3 of SO_2 diffuse through a porous partitions in 60 second What volume be O_2 will diffuse under similar conditions in 30 second ? .

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2. 4.5 g of PCl_5 on vapourisation occupied a volume of 1700mL at atmosphere pressure and 227°C temperature. Calculate it: degree of dissociation.

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3. A spherical balloon of 21 cm diameter is to be filled up with hydrogen at 1 atm, 273 K from a cylinder containing the gas at 20 atm and 27°C . If the cylinder can hold 2.82 litre of water, calculate the number of balloons that can be filled up completely.

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4. At 27°C , hydrogen is leaked through a tiny hole into a vessel for 20 min . Another unknown gas at the same temperature and pressure as that of hydrogen is leaked through the same hole for 20 min . After the effusion of the gases, the mixture exerts a pressure of 6atm . The hydrogen content of the mixture is 0.7mol . If the volume of the container is 3L , what is the molecular weight of the unknown gas?

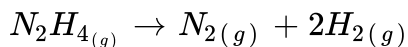
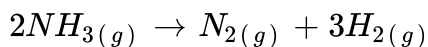
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5. A bubble of gas released at the bottom of a lake increases to four times its original volume when it reaches the surface. Assuming that atmospheric pressure is equivalent to the pressure exerted by a column of water 10 m high, what is the depth of the lake?

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6. A mixture of $\text{NH}_3(g)$ and $\text{N}_2\text{H}_4(g)$ is placed in a sealed container at 300K . The total pressure is 0.5atm . The container is heated to 1200K , at

which time both substances decompose completely according to the equations:



After decomposition is complete, the total pressure at $1200K$ is found to be 4.5atm . Find the amount (mole) per cent of $N_2H_{4(g)}$ in the original mixture.



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7. If 250 mL of N_2 over water at $30^\circ C$ and a total pressure of 740 torr is mixed with 300 mL of Ne over water at $25^\circ C$ and a total pressure of 780 torr, what will be the total pressure if the mixture is in a 500 mL vessel over water at $35^\circ C$.

(Given : Vapour pressure (Aqueous tension) of H_2O at $25^\circ C$ and $35^\circ C$ are 23.8, 31.8 and 42.2 torr respectively. Assume volume of $H_2O(l)$ is negligible in final vessel)



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8. At 300 K, the density of a certain gaseous molecule at 2 bar is double to that of dinitrogen (N_2) at 4 bar. The molar mass of gaseous molecule is:

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9. Calculate the total pressure (in atm) in a 10.0 L cylinder which contains 0.4 g helium, 1.6 g oxygen and 1.4 g nitrogen at 27 °C.

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10. 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. Calculate the percentage decrease in the partial pressure of O_2

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11. A gaseous mixture contains three gaseous A , B and C with a total number of moles of 10 and total pressure of 10atm . The partial pressure of A and B are 3atm and 1atm respectively and if C has molecular weight of 2g/mol . Then, the weight of C present in the mixture will be :

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12. Two flask A and B of equal volumes maintained at temperature 300K and 700K contain equal mass of $\text{He}(g)$ and $\text{N}_2(g)$ respectively. What is the ratio of total translational kinetic energy of gas in flask A to that of flask B ?

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13. If one mole of a monoatomic gas ($\gamma = 5/3$) is mixed with one mole of a diatomic gas ($\gamma = 7/5$) the value of γ for the mixture is .

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14. A mixture of Ne and Ar kept in a closed vessel at 250 K has a total K.E.=3 kJ. The total mass of Ne and Ar is 30 g. Find mass % of Ne in gaseous mixture at 250 K.

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15. What is the compressibility factor (Z) for 0.02 mole of a van der Waals's gas at pressure of 0.1 atm. Assume the size of gas molecules is negligible.

Given : $RT=20 \text{ L atm mol}^{-1}$ and $a=1000 \text{ atm L}^2\text{mol}^{-2}$

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Chapter 6 Thermodynamics

1. A gas present in a cylinder fitted with a frictionless piston expands against a constant pressure of 1 atm from a volume of 2 L to a volume of

6L. In doing so, it absorbs $800J$ heat form the surroundings. Determine the increases in internal enegy of process.

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2. The heat of neutralisation of strong base and strong acid is 57.0 kJ . Calculate the heat released when 0.5 mole of HNO_3 is added to 0.20 mole of $NaOH$ solution.

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3. 

Based on data provided, find the value of electron gain enthalpy of fluorine.

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4. The standard enthalpy of formation of NH_3 is -46.0 KJmol^{-1} . If the enthalpy of formation of H_2 from its atoms is -436 KJmol^{-1} and that of N_2 is -712 KJmol^{-1} , the average bond enthalpy of $N - H$ bond in NH_3 is

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5. The enthalpy of neutralisation of a weak acid in 1 M solution with a strong base is $-56.1 \text{ kJ mol}^{-1}$. If the enthalpy of ionization of the acid is 1.5 kJ mol^{-1} and enthalpy of neutralization of the strong acid with a strong base is $-57.3 \text{ kJ equiv}^{-1}$, what is the % ionization of the weak acid in molar solution (assume the acid to be monobasic)?

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6. The heat of sublimation of iodine is 24 cal g^{-1} at 50°C . If specific heat of solid iodine and its vapour are 0.055 and 0.031 cal g^{-1} respectively. Calculate the heat of sublimation of iodine at 100°C .



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7. When 0.2 mole of anhydrous $CuSO_4$ is dissolved in water, the heat evolved is 1.451 kcal. If 0.2mole of $CuSO_4 \cdot 5H_2O$ is dissolved in water, the heat absorbed is 0.264 kcal. Calculate the molar heat of hydration of $CuSO_4$



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8. The specific heat of a monoatomic gas at constant pressure is $248.2 \text{ J kg}^{-1} \text{ K}^{-1}$ and at constant volume it is $149.0 \text{ J kg}^{-1} \text{ K}^{-1}$. Find the mean molar mass of the gas.



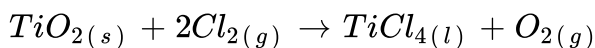
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9. The standard entropies of $CO_{2(g)}$, $C_{(s)}$, and $O_{2(g)}$ are 213.5, 5.740 and 205 JK^{-1} respectively. The standard entropy of formation of CO_2 is _____.



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10. Titanium metal is extensively used in aerospace industry because the metal imparts strength to structures but does not unduly add to their masses. The metal is produced by the reduction of $TiCl_{4(l)}$ which in turn is produced from mineral rutile $[TiO_{2(s)}]$. Can the following reaction for production of $TiCl_{4(l)}$ be carried out at $25^\circ C$?



Given that H_f° for $TiO_{2(s)}$, $TiCl_{4(l)}$, $Cl_{2(g)}$ and $O_{2(g)}$ are -944.7 , -804.2 , 0.0 , $0.0 kJmol^{-1}$. also S° for

$TiO_{2(g)}$, $TiCl_{4(l)}$, $Cl_{2(g)}$ and $O_{2(g)}$ are

50.3 , 252.3 , 233.0 , $205.1 Jmol^{-1}K^{-1}$ respectively.



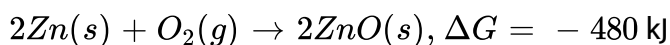
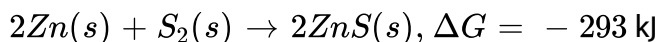
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11. One mole of CH_3COOH undergo dimerization in vapour state at $127^\circ C$ as $2CH_3COOH(g) \rightleftharpoons (CH_3COOH)_2$ if dimer formation is due

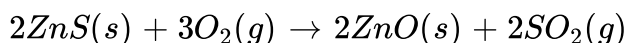
to two H-bonds involved in dimer, each of 33kJ strength and the degree of dimerization of acetic acid 98.2 % which is correct

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12. The factor of ΔG values is important in metallurgy. The ΔG values for the following reactions at 800°C are given as :



Calculate the ΔG for the reaction:



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13. For vaporization of water at 1 atmospheric pressure, the values of ΔH and ΔS are $40.63 \text{ kJ mol}^{-1}$ and $108.8 \text{ JK}^{-1} \text{ mol}^{-1}$ respectively.

The temperature when Gibbs energy change (ΔG) for this transformation will be zero, is :



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14. An ideal gas is allowed to expand from 1 L to 10 L against a constant external pressure of 1 bar. Calculate the work done in kJ.



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15. During compression of a spring the work done is 10 kJ and 2 kJ escaped to the surroundings as heat. The change in internal energy, ΔU (in kJ) is _____.



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Chapter 7 Equilibrium

1. Equilibrium constant K_p for the reaction:

$\text{CaCO}_3(\text{s})$ If 1 mole of CaCO_3 is placed in a closed container of 20L and

heated to this temperature, what amount of $CaCO_3$ in grams would dissociate at equilibrium ?

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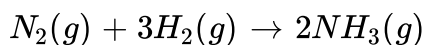
2. An amount of solid NH_4HS is placed in a flask already containing ammonia gas at a certain temperature and 1.0 atm pressure. Ammonium hydrogen sulphide decomposes to yield NH_3 and H_2S gases in the flask. When the decomposition reaction reaches equilibrium, the total pressure in the flask rises to 2 atm. What will be the equilibrium constant for NH_4HS decomposition at this temperature?

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3. Calculate the pH of a solution obtained by diluting 1 mL of 0.10 M weak monoacidic base to 100 mL at constant temperature if K_b of the base is 1×10^{-5} .

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4. 28 g N_2 and 6.0 g of H_2 are heated over catalyst in a closed one litre flask of 450 °C. The entire equilibrium mixture required 500 mL of 1.0 M H_2SO_4 for neutralisation. Calculate the value of K_c in $L^2 mol^{-2}$ for the given reaction.



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5. The equilibrium constant of the reaction of weak acid HA with strong base is 10^{-7} . Find the pOH of the aqueous solution of 0.1M NaA.

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6. For the reaction $C(s) + CO_2(g) \rightarrow 2CO(g)$, $k_p = 63$ atm at 100 K. If at equilibrium $p_{CO} = 10p_{CO_2}$ then the total pressure of the gases at equilibrium is

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7. The pK_a of HCOOH is 3.8 and pK_b of NH_3 is 4.8, find the pH of aqueous solution of 1M HCOONH_4 .

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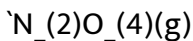
8. In the reaction $\text{AB}(g) \rightleftharpoons \text{A}(g) + \text{B}(g)$ at 30°C , k_p for the dissociation equilibrium is $2.56 \times 10^{-2} \text{ atm}$. If the total pressure at equilibrium is 1 atm, then the percentage dissociation of AB is

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9. Calculate the pH at the equivalence point when a solution of 0.01 M CH_3COOH is titrated with a solution of 0.01 M NaOH. pK_a of CH_3COOH is 4.74

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10. The value of K_p for the equilibrium reaction

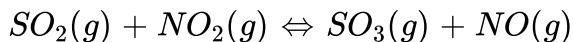


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11. A buffer solution is prepared by mixing 10ml of $1.0M$ acetic acid & 20ml of $0.5M$ sodium acetate and then diluted to 100ml with distilled water. If the pK_a of CH_3COOH is 4.76 . What is the pH of the buffer solution prepared?

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12. At a certain temperature and 2 atm pressure equilibrium constant (K_p) is 25 for the reaction



Initially if we take 2 moles of each of the four gases and 2 moles of inert gas, what would be the equilibrium partial pressure of NO_2 ?

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13. Find the pH of a 2 litre solution which is 0.1 M each with respect to CH_3COOH and $(CH_3COO)_2Ba$, ($K_a = 1.8 \times 10^{-5}$).

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14. On addition of increasing amount of $AgNO_3(g)$ to 0.1 M each of NaCl and NaBr in a solution, what % of Br^- ion gets precipitated when Cl^- ion starts precipitating?

Given: $K_{sp}(AgCl) = 1.0 \times 10^{-10}$, $K_{sp}(AgBr) = 1 \times 10^{-13}$.

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15. What can be the maximum possible molarity of Co^{2+} ions in 0.1 M HCl saturated with $H_2S(K_a = 4 \times 10^{-21})$? Given that K_{sp} for CoS is 2×10^{-21} and concentration of saturated $H_2S = 0.1M$

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1. Find the sum of oxidation number of nitrogen in $(NH_4)_2SO_4$, N_2H_4 and N_2O_4 .

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2. Among NH_3 , HNO_3 , N_2 and Mg_3N_2 , the number of molecules having nitrogen in negative oxidation state is :

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3. When $K_2Cr_2O_7$ is converted to K_2CrO_4 , the change in the oxidation state of chromium is

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4. Oxidation numbers of P in PO_4^{3-} , of S in SO_4^{2-} , and that of Cr in $Cr_2O_7^{2-}$ are respectively,

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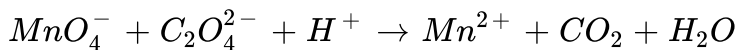
5. In a balance equation $H_2SO_4 + xHI \rightarrow H_2S + yI_2 + zH_2O$, find the ratio of $x+y, y+z$

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6. One mole of N_2H_4 loses ten moles of electrons to form a new compound A . Assuming that all the nitrogen appears in the new compound, what is the oxidation state of nitrogen in A ? (There is no change in the oxidation state of hydrogen.)

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7. For the redox reaction,



the correct coefficients of the reactants for the balanced reaction are

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8. The equivalent weight of a metal is 36. What weight of the metal would give 9.322 gm. Of its chloride ?

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9. Equivalent weight of MnO_4^\ominus in acidic neutral and basic media are in ratio of:

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10. Find the number of moles of $K_2Cr_2O_7$ reduced by three mole of Sn^{2+} ions.

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11. Atomic weight of barium is 137.34 The equivalent weight of barium is $BaCrO_4$ used as an oxidising agent in acid medium is

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12. In an experiment 50ml of 0.1(M) solution of a salt is reacted with 25ml of 0.1(M) solution of sodium sulphite. The half equation for the oxidation of sulphite ion is $SO_3^{2-}(aq) + H_2O \rightarrow SO_4^{2-}(aq) + 2H^+(aq) + 2e^-$ If the oxidation number of metal in the salt was 3, what would be the new oxidation number of metal?

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13. $N_2 + 3H_2 \rightarrow 2NH_3$ molecular weight and equivalent weight of NH_3 and N_2 are 17.03 g, 14 g and Y_1, Y_2 respectively. Find the value of $(Y_1 - Y_2)$.

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14. An element A in a compound ABD has oxidation number A^{n-} . It is oxidised by $Cr_2O_7^{2-}$ in acid medium. In the experiment 1.68×10^{-3} moles of $K_2Cr_2O_7$ were used for 3.26×10^{-3} moles of ABD . The new oxidation number of A after oxidation is:

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15. Find the oxidation state of Fe in $Fe_4[Fe(CN)_6]_3$.

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1. The molecular formula of diphenyl methane.



How many structural isomers are possible when one of the hydrogen is replaced by a chlorine atom?

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2. 

The positive charge of carbocation can be delocalized over how many oxygen atoms in the resonating structures?

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3. How many carbocations are possible for molecular formula $C_3H_5^+$?

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4. The compound (X) has molecular formula C_4H_7Cl . Find out the number of cyclic isomers (structural and geometrical only excluding optical isomers).

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5. The number of stereoisomers obtained by bromination of trans-2-butene is

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6. From the following compounds/ions, how many are electrophiles?

CH_3^+ , NH_4^+ , BF_3 , NH_3 , $NH_2 - NH_2$, PCl_3 , PCl_5 , $SbCl_5$, $GaCl_3$, $AlCl_3$.

("C" atom of halide)

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7. How many stereocentres are possible for the given compound?



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8. From the given compound, how many are optically inactive?




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9. Write structural formula for all the isomeric alcohols having the molecular formula $C_4H_{10}O$.

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10. How many of the following are not ambiguous? Pentane, Neopentane, sec-Butanol, sec-Pentanol

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11. Compound  is a vicinal diol. How many vicinal diols are possible with the same molecular formula.

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12. Which of the following compound(s) is/are optically active?



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13. Find the number of fractions obtained after the completion of the reaction.



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14. How many cyclic isomers of molecular formula C_7H_{15} can form 1 methylcyclohexan-1-ol on reaction with H_2O /acetone/ Ag^+ {consider only structural isomers)?



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15. How many stereoisomers are possible for 1, 3-dichloro-cyclopentane?



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Chapter 13 Hydrocarbons

1. 

Find the number of monochloro derivatives formed (excluding

stereoisomers) in the above reaction.

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2. Find the total number of trichloroderivatives of the compound 
(excluding stereoisomers).

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3. How many isomers (including geometrical and optical) are possible for bromochlorocyclobutane?

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4. How many stereoisomers are possible for dichlorocyclobutane?

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5. How many enantiomeric pairs are possible in bromochlorocyclopentane?

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6. How many alkyl bromides would yield isopentane on reaction with Grignard reagent followed by treatment with water?

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7. How many free radicals can be produced during following reaction (ignoring resonating structure) ?



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8. 

Find the number of fractions obtained after fractional distillation of product mixture.

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9. 

Calculate sum of number of products formed in the reaction a, b and c.

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10. How many alkenes, alkynes, alkadienes can be hydrogenated to form isopentane (include all isomers)?

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11. The total number of cyclic isomers possible for a hydrocarbon with the molecular formula C_4H_6 is

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12. Write total number of hydrogen atoms on all the carbon atoms which are connected directly by a single bond to benzylic carbon (carbon connected to benzene ring) in the product



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13. Number of monochloro derivatives (excluding stereoisomers), dichloro derivatives and trichloro derivatives of cyclopentane are n_1 , n_2 and n_3 . Find the value of $\frac{n_1 + n_2}{n_3}$.

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14. 

Find the number of alkenes produced in the reaction given

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15. Find the total no. of alkynes that on catalytic reduction gives 3-ethyl-4-methylheptane.

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Chapter 15 The Solid State

1. The edge length of unit cell of a metal having molecular weight 75 g mol^{-1} is 5 \AA which crystallizes in cubic lattice. If the density is 2 g cm^{-3} , then find the radius of metal atom ($N_A = 6 \times 10^{23}$). Give the answer in pm.

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2. In face - centred cubic (fcc) crystal lattice, edge length is 400 pm. Find the diameter of the greatest sphere which can be fitted into the interstitial void without distortion of the lattice.

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3. AB crystallizes in a body centred cubic lattice with edge length a equal to 387pm . The distance between two oppositely charged ions in the lattice is :

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4. If calcium crystallizes in bcc arrangement and the radius of Ca atom is 96 pm, and the volume of unit cell of Ca is $x \times 10^{-30}$ m. Find the value of x .

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5. The radii of Na^+ and Cl^- ions are 100 pm and 200 pm respectively.

Calculate the edge length of NaCl unit cell.

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6. CsBr has bcc like structures with edge length 4.3\AA . The shortest inter ionic distance in between Cs^+ and Br^- is:

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7. A metallic crystal crystallizes into a lattice containing a sequence of layers $ABABAB\dots$. Any packing of spheres leaves out voids in the lattice. What percentage by volume of this lattice is empty space?

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8. A molecule A_2B ($M_w = 166.4$) occupies triclinic lattice with $a = 5\text{\AA}$, $b = 8\text{\AA}$, and $c = 4\text{\AA}$. If the density of AB_2 is 5.2gcm^{-3} , the

number of molecules present in one unit cell is

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9. Consider the bcc unit cells of the solids 1 and 2 with the position of atoms are shown below. The radius of atom B is twice that of atom A. The unit cell edge length is 50% more in solid 2 than in 1. What is the approximate packing efficiency (in %) in solid 2?



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10. Find the sum of number of atoms present in a simple cubic, body centered cubic and face centered cubic structure.

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11. Calculate the radius (in pm) of the largest sphere which fits properly at the centre of the edge of a body centred cubic unit cell. (Given edge length is 100 pm)

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12. A compound $CuCl$ has face – centred cubic structure. Its density is 3.4gcm^{-3} . What is the length of unit cell ?

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13. Molybdenum forms body-centred cubic crystals whose density is 10.3gcm^{-3} . Calculate the edge length of the unit cell. The molar mass of Mo is 95.94g mol^{-1} .

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14. The density of mercury is 13.6 gmL^{-1} . Calculate the approximate diameter of an atom of mercury assuming that each atom is occupying a cube of edge length equal to the diameter of the mercury atom.

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15. In the fluorite structure if the radius ratio is $\left(\frac{\sqrt{3}}{2} - 1\right)$ how many ions does each cation touch?

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Chapter 16 Solutions

1. What is the molar solubility of $\text{Al}(\text{OH})_3$ in 0.2 M NaOH solution? Given that, solubility product of $\text{Al}(\text{OH})_3 = 2.4 \times 10^{-2}$

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2. At room temperature, a dilute solution of urea is prepared by dissolving 0.60 g of urea in 360 g of water. If the vapour pressure of pure water at this temperature is 35 mm Hg, lowering of vapour pressure will be: (molar mass of urea = 60g mol^{-1})

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3. Molal depression constant for a solvent is 4.0K kg mol^{-1} . The depression in the freezing point of the solvent for 0.03mol kg^{-1} solution of K_2SO_4 is: (Assume complete dissociation of the electrolyte)

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4. The osmotic pressure of a dilute solution of a compound XY in water is four times that of a solution of 0.01 M BaCl_2 in water. Assuming complete dissociation of the given ionic compounds in water, the concentration of XY (in mol L^{-1}) in solution is:

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5. Calculate the amount of sodium chloride (in g) which must be added to 1000 mL of water so that its freezing point is depressed by 0.744K. For water, $K_f = 1.86 \text{ K/m}$. Assume density of water to be 1 g mL^{-1} .

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6. What weight of the non-volatile solute urea' ($\text{NH}_2 - \text{CO} - \text{NH}_2$) needs to be dissolved in 100g of water in order to decrease the vapour pressure of water by 25 % ? What will be the molality of the solution?

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7. A bottle of commercial sulphuric acid ($d = 1.787 \text{ gmL}^{-1}$) is 86% by weight.

a. What is molarity of the acid?

b. What volume of the acid has to be used to make 1L of $0.2M H_2SO_4$?

c. What is the molality of the acid?

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8. 0.5 gm of fuming H_2SO_4 (Oleum) is diluted with water. This solution is completely neutralised by 26.7 ml of 0.4 M $NaOH$ solution. Calculate the percentage of free SO_3 in the given sample. Give your answer excluding the decimal places.

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9. The vapour pressure of pure benzene at a certain temperature is $640mmHg$. A non-volatile solid weighing $2.175g$ is added to $39.0g$ of benzene. The vapour pressure of the solution is $600mmHg$. What is the molar mass of the solid substance?

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10. 0.400 g of an acid HA (mol. mass = 80) was dissolved in 100 g of water. The solution showed a depression of freezing point of 0.12 K. What will be the dissociation constant (in multiple of 10^{-3}) of the acid at about 0°C ? Given K_f (water) = 1.86 K Kg mol^{-1} (Assume molarity of solution a molality)

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11. An element X (Atomic mass = 25) exists as X_4 is benzene. 51g of saturated solution of X in benzene was added to 50.0 g of pure benzene. The resulting solution showed a depression of freezing point of 0.55 K. Find the solubility of X per 100 g of benzene. (K_f for benzene = 5.5 K kg mol^{-1})

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12. At 10°C , the osmotic pressure of urea solution is 500mm. The solution is diluted and the temperature is raised to 25°C . when the

osmotic pressure is found to be 105.3mm . Determine the extent of dilution.

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13. A mixture of two immiscible liquids nitrobenzene and water at 99°C has a partial vapour pressure of water 733mm and that of nitrobenzene 27mm . Calculate the ratio of the weights of nitrobenzene to the water in the distillate.

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14. A solution containing 28 g of phosphorus in 315 g CS_2 (*b. p.* 46.3°C) boils at 47.98°C . If K_b for CS_2 is $2.34\text{ K kg mol}^{-1}$. The formula of phosphorus is (at , mass of P = 31).

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15. Calculate the molality of 1 litre solution of 93% H_2SO_4 (weight / volume). The density of solution is 1.84 g mL^{-1} .

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Chapter 17 Electrochemistry

1. The equivalent conductances of sodium chloride, hydrochloric acid and sodium acetate at infinite dilution are 126.45, 426.16 and $91.0 \text{ ohm}^{-1} \text{ cm}^2 \text{ eq}^{-1}$, respectively at 25°C . Calculate the equivalent conductance of acetic acid at infinite dilution.

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2. 2F of electricity is passed through 20 L of a solution of aqueous solution of KCl. Calculate the pH of the solution.

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3. The specific conductivity of a solution containing 1.0 g of anhydrous $BaCl_2$ in 200 cm^3 of the solution has been found to be 0.0058 S cm^{-1} . Calculate the molar conductivity of the solution. (Molecular wt. of $BaCl_2 = 208$).

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4. The equivalent conductivities of acetic acid at 298K at the concentration of 0.1M and 0.001M are 5.20 and $49.2\text{ S cm}^2\text{ eq}^{-1}$ respectively. Calculate the degree of dissociation of acetic acid at these concentrations. Given that, $\lambda^\infty(H^+)$ and $\lambda^\infty(CH_3COO^-)$ are 349.8 and $40.9\text{ ohm}^{-1}\text{ cm}^2\text{ mol}^{-1}$ respectively.

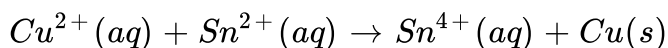
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5. The amount of electricity which release 2.0g of gold from a gold salt is same as that which dissolves 0.967g of copper anode during the

electrolysis of copper sulphate solution. What is the oxidation number of gold in the gold ion ? (At mass of Cu=63.5,Au=197)

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6. If K_c for the reaction



at $25^\circ C$ is represented as 2.6×10^y then find the value of y.

(Given: $E_{Cu^{2+}|Cu}^\circ = 0.34V$, $E_{Sn^{4+}|Sn^{2+}}^\circ = 0.15V$)

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7. If ΔG° for the half cell $MnO_4^- | MnO_2$ in an acid solution is xF then find the value of x.

(Given: $E_{MnO_4^-|Mn^{2+}}^\circ = 0.34V$, $E_{Sn^{4+}|Sn^{2+}}^\circ = 0.15V$)

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8. The standard reduction potential of a silver chloride electrode (metal - sparingly soluble salt electrode) is $0.209V$ and for silver electrode is $0.80V$. If the moles of $AgCl$ that can dissolve in $10L$ of a $0.01M NaCl$ solution is represented as 10^{-z} then find the value of z .

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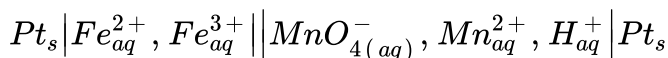
9. Molar conductivity of aqueous solution of HA is $200 S cm^2 mol^{-1}$, pH of this solution is 4. Calculate the value of $pK_a(HA)$ at $25^\circ C$

Given: $\Lambda_M^\infty (NaA) = 100 S cm^2 mol^{-1}$, $\Lambda_M^\infty (HCl) = 425 S cm^2 mol^{-1}$,

$\Lambda_M^\infty (NaCl) = 125 S cm^2 mol^{-1}$.

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10. If electrode potential of following cell:



is X then calculate value of $20X$.

[Given: $E_{MnO_4^- | Mn^{2+}} = 1.51V$,

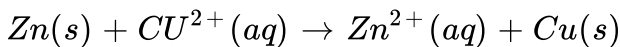
$E_{Fe^{3+} | Fe^{2+}} = 0.78 V$, $(2.303 RT)/F = 0.06$]

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11. A solution of $Ni(NO_3)_2$ is electrolysed between platinum electrodes using 0.1 Faraday electricity. How many mole of Ni will be deposited at the cathode?

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12. The standard Gibbs energy for the given cell reaction is $KJmol^{-1}$ at 298 K is :



$$E^\circ = 2V \text{ at } 298K$$

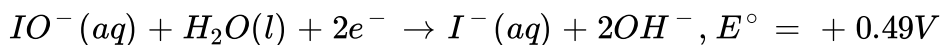
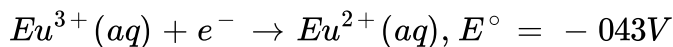
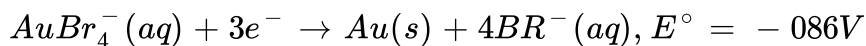
(Faraday's constant, $F = 96000Cmol^{-1}$)

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13. All the energy released from the reaction $X \rightarrow Y$, $\Delta_r G^\circ = -193 \text{ kJ mol}^{-1}$, is used for oxidizing M^+ as $M^+ \rightarrow M^{3+} + 2e^-$, $E^\circ = -0.25 \text{ V}$. Under standard conditions, the number of moles of M^+ oxidized when one mol of X is converted to Y is $\left[F = 96,500 \text{ C mol}^{-1} \right]$

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14. Consider the following half-cell reaction and associated standard half-cell potentials and determine the maximum voltage that can be obtained by combination resulting in spontaneous process :



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15. The standard e.m.f. of the cell $Zn|Zn^{2+}(0.01M)||Fe^{2+}(0.001M)|Fe$ at 298 K is 0.02905 then the value of equilibrium constant for the cell reaction 10^x . Find x.

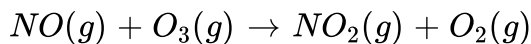
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Chapter 18 Chemical Kinetics

1. For a chemical reaction $2X + Y \rightarrow Z$, the rate of appearance of Z is $0.05 \text{ mol L}^{-1} \text{ min}^{-1}$. The rate of disappearance of X will be

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2. For the reaction at 273K



It is observed that the pressure of $NO(g)$ falls from 700 mmHg to

500mmHg in 250s. Calculate the average rate of reaction in (a) $atms^{-1}$,

(b) $molL^{-1}s^{-1}$.

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3. For a first order reaction, calculate the ratio between the time taken to complete $3/4th$ of the reaction and time to complete half of the reaction.

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4. The half-life period and initial concentration for a reaction are as follows.



What is order of reaction?

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5. The rate of a reaction triples when temperature change from 20°C to 50°C . Calculate the energy of activation.

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6. Sucrose decomposes in acid solution into glucose and fructose according to the first order rate law, with $t_{1/2} = 3.00\text{hr}$. What fraction of sample of sucrose remains after 8hr ?

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7. A reaction takes place in various steps. The rate constant for first, second, third and fifth steps are k_1, k_2, k_3 and k_5 respectively. The overall rate constant is given by:

$k = \frac{k_2}{k_1} \left(\frac{k_1}{k_2} \right)^{\frac{1}{2}}$ activation energy are 40,60, 50 and 10 kJ/mol respectively, find the overall energy of activation (kJ/mol).

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8. The half-life of decomposition of gaseous CH_3CHO at initial pressure of 365mm and 170mm of Hg were 420sec and 880sec respectively. The order of the reaction is:

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9. A gaseous reaction $A_2(g) \rightarrow B(g) + \frac{1}{2}C(g)$ shows increase in pressure from 100mm to 120mm in 5min . What is the rate of disappearance of A_2 ?

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10. The reaction $X \rightarrow Y$ is an exothermic reaction. Activation energy of the reaction for X into Y is 150kJ mol^{-1} . Enthalpy of reaction is 135kJ mol^{-1} . Calculate the activation energy for the reverse reaction, $Y \rightarrow X$ in kJmol^{-1} .

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11. 2 g of a radioactive sample having half-life of 15 days was synthesised on 1st Jan. 2009. What is the amount of the sample left behind on 1st March, 2009 (including both the days) in g?

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12. Half-lives of decomposition of NH_3 on the surface of a catalyst for different initial pressures are given as:



Find the order of the reaction.

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13. The decomposition of ammonia on tungsten surface at 500 K follows zero order kinetics. The half-life period of this reaction is 45 minutes when the initial pressure is 4 bar. Find the half-life period (in minutes) of the reaction when the initial pressure is 16 bar at the same temperature.



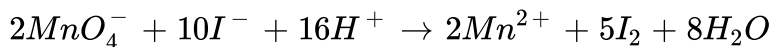
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14. The rate of a reaction starting with initial concentration of 2×10^{-3} and $1 \times 10^{-3} M$ are equal to 2.40×10^{-40} and $0.60 \times 10^{-4} Ms^{-1}$, respectively. Calculate the order of reaction w.r.t. reactant and also the rate constant.



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15. The instantaneous rate of disappearance of the MnO_4^- ion in the following reaction is $4.56 \times 10^{-3} Ms^{-1}$. Then the rate of appearance of I_2 is :



A. $1.14 \times 10^{-3} Ms^{-1}$

B. $5.7 \times 10^{-3} Ms^{-1}$

C. $4.56 \times 10^{-3} Ms^{-1}$

D.

Answer: 0.0114



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Chapter 19 Surface Chemistry

1. How many of the following are colloid? Sodium chloride, Starch solution, Cane sugar and Blood



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2. Which of the following substance gives a positively charged sol?



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3. How many of the following are not a colloid? Chlorophyll, Smoke, Ruby glass and Milk



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4. For the coagulation of 500mL of arsenious sulphide sol, 2mL of 1MNaCl is required. What is the flocculation value of NaCl ?

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5. The gold number of gelatin is 0.01 . Calculate the amount of gelatin to be added to 1000mL of a colloidal sol of gold to prevent its coagulation, before adding 1mL of 10% NaCl solution.

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6. 526.3mL of 0.5MHCl is shaken with 0.5g of activated charcoal and filtered. The concentration of the filtrate is reduced to 0.4M . The amount of adsorption (x/m) is

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7. How many colloidal systems exist in nature in which liquid is dispersed phase?

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8. For soaps critical micelle concentration (CMC) is 10^{-x} (min) to $10^{-\gamma}$ (max.) mol/L what is the value of x?

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9. Graph between $\log \left(\frac{x}{m} \right)$ and $\log P$ is a straight line at angle 45° with intercept OA as shown:



Calculate $\left(\frac{x}{m} \right)$ at a pressure of 2 atm. (Given: $k=2$)

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10. On addition of 1mL solution of 10% NaCl to 10mL gold sol in the presence of 0.0250g of starch, the coagulation is just prevented. What is the gold number of starch?

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11. 3.6 gram of oxygen of adsorbed on 1.2 g of metal powder. What volume of oxygen adsorbed per gram of the adsorbent at 1 atm and 273 K ?

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12. 100 mL of 0.6 M acetic acid is shaken with 2 g activated carbon . The final concentration solution after adsorption is 0.5 M. what is the amount of acetic acid adsorbed per gram of carbon ?

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13. Find the order of the reaction in which a gas is formed at the surface of tungsten due to adsorption.

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14. 1 gm of charcoal adsorbs 100 mL 0.7 M CH_3COOH to form a monolayer, and there by the molarity of CH_3COOH reduces to 0.59. Calculate the surface area of the charcoal adsorbed by each molecule of acetic acid in terms of 10^{-19} . Surface area of charcoal = $3.01 \times 10^2 m^2 / gm$.

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15. Twenty percent of the surface sites of a catalyst is occupied by nitrogen molecules. The density of surface sites is $6.023 \times 10^{14} cm^{-2}$. The total surface area is $1000 cm^2$. The catalyst is heated to $300K$ and nitrogen is completely desorbed at a pressure of 0.001 atm and volume of $2.46 cm^3$. Calculate the number of sites occupied by nitrogen molecules.



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Chapter 21 The P Block Elements Group 15 16 17 18

1. The number of σ bonds in P_4O_{10} is



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2. How many bonding electron pairs are there in white phosphorus ?



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3. The number of $P - O - P$ bonds in cyclic metaphosphoric acid is.



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4. Calculate the total number of bond pairs and lone pairs of electrons present in OF_2 molecule.

A. 10

B. 4

C. 6

D. 8

Answer: 10

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5. How many forms of SO_3 exists

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6. The number of S-S bonds in sulphur trioxide trimer (S_3O_9) is

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7. The number of $P - O - P$ bonds in cyclic metaphosphoric acid is.

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8. The number of P-O-P bonds present in P_4O_6 and P_4O_{10} are respectively

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9. Bleaching powder and bleach solution are produced on a large scale and used in several household products. The effectiveness of bleach solution is often measured by iodometry.

25mL of household bleach solution was mixed with 30mL of 0.50MKI and 10mL of 4N acetic acid. In the titration of the liberated iodine, 48mL of $0.25\text{NNa}_2\text{S}_2\text{O}_3$ was used to reach the end point. The molarity of the household bleach solution is :

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10. The value of n in the molecular formula $Be_nAl_2Si_6O_{18}$ is:

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11. Reaction of Br_2 with Na_2CO_3 in aqueous solution gives sodium bromide bromate with evolution of CO_2 gas. The number of sodium bromide molecules involved in the balanced chemical equation is:

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12. Among the following, the number of compounds that can react with PCl_5 to give $POCl_3$ is $O_2, CO_2, SO_2, H_2O, H_2SO_4, P_4O_{10}$.

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13. What is the number of sigma (σ) and pi (π) bonds present in sulphuric acid molecule ?

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14. H_3PO_2 is the molecular formula of an acid of phosphorus. Its name and basicity respectively are

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15. How many hygroscopic compounds are formed when Cl_2 reacts with hot aqueous NaOH.

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1. The colour of $KMnO_4$ solution is decolourised by Fe^{+2} solution, one mole of Fe^{2+} reacts with x moles of $KMnO_4$ Find x.

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2. Use Hund's rule to derive the electronic configuration of Ce^{3+} ion, and calculate its magnetic moment on the basis of spin-only formula.

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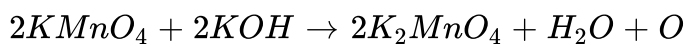
3. A compound of a metal ion M^{X+} ($z = 24$) has a spin only magnetic moment of $\sqrt{15}B.M.$. The number of unpaired electrons in the compound are

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4. The number of ions formed on dissolving one molecule of $FeSO_4(NH_4)_2SO_4 \cdot 6H_2O$ is

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5. In alkaline medium, $KMnO_4$ reacts as follows



Therefore, the equivalent mass of $KMnO_4$ will be

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6. Titanium shows magnetic moment of $1.73B.M.$ in its compounds.

What is the oxidation number of Ti in the compound?

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7. Four successive members of the first series of transition metals are listed below. For which one of the of standard potential ($E_{M^{2+}/M}^{\circ}$) value has a positive sign ?

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8. What is the approximate percentage of iron in mischmetal?

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9. The standard redox potentials for the reactions,

$Mn^{2+} + 2e^{-} \rightarrow Mn$ and $Mn^{3+} + e^{-}$ are -1.18V and 1.51V respectively.

What is the redox potential for the reaction $Mn^{3+} + 3e^{-} \rightarrow Mn$?

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x and y can be :

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11. 12 grams of silver was extracted from a sample of an ore from which the only source of silver was Ag_2S . How many grams of Ag_2S were in the original sample?

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12. The oxidation number of Mn in the product of alkaline oxidative fusion of MnO_2 is

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13. Out of the following, how many oxides are acidic. MnO , Mn_2O_3 , MnO_2 , MnO_3 , Mn_2O_7 .

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14. How many of the transition elements are called Platinum metals.

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15. (A) light blue coloured compound on heating will convert into black (B) which reacts with glucose gives red compound (C) and (A) reacts with ammonium hydroxide in excess in presence of ammonium sulphate give blue compound (D). What is (A), (B), (C) and (D)?

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1. 0.02 mole of $[Co(NH_3)_5Br]Cl_2$ and 0.02 mole of $[Co(NH_3)_5Cl]SO_4$ are present in 200 cc of a solution X. The number of moles of the precipitates Y and Z that are formed when the solution X is treated with excess silver nitrate and excess barium chloride are respectively

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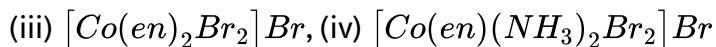
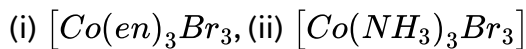
2. 50 ml of 0.2 M solution of a compound with empirical formula $CoCl_3 \cdot 4NH_3$ on treatment with excess of $AgNO_3(aq)$ yields 1.435 g of AgCl. Ammonia is not removed by treatment with concentrated H_2SO_4 . The formula of the compound is

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3. The ion $Co(en)Cl_2Br_2^-$ is expected to have x isomers. Find the value of x.

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4. How many of the following compounds have optical isomers?



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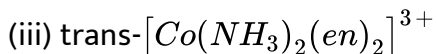
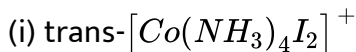
5. Considering H_2O as a weak field ligand, the number of unpaired electrons in $[Mn(H_2O)_6]^{2+}$ will be (At. no. of $Mn = 25$)

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6. What is the crystal field stabilization energy for high spin d^6 octahedral complex?

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7. How many of the following complexes are optically inactive?



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8. The coordination number of Fe (II) in oxyhaemoglobin is

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9. If PQRS are four different ligands, then how many geometric isomers will be found for square planar $[Pt. PQRS]^{2+}$?

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10. Among the following complexes : $K_3[Fe(CN)_6]$, $[Co(NH_3)_6]Cl_3$,
 $Na_3[Co(ox)_3]$, $[Ni(H_2O)_6]Cl_2$, $K_2[Pt(CN)_4]$ and
 $[Zn(H_2O)_6(NO_3)_2]$

The diamagnetic are .

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11. Among
 $[Ni(CO)_4]$, $[NiBr_4]^{2-}$, $[Co(NH_3)_4Cl_2]Cl$, $Na_3[CoF_6]$, BaO_2 and CsO_2
, the total number of diamagnetic compounds is

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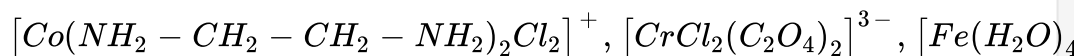
12. The volume (in mL) of $0.1M AgNO_3$ required for complete precipitation of chloride ions present in $30mL$ of $0.01M$ solution of $[Cr(H_2O)_5Cl]Cl_2$, as silver chloride is close to:

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13. $EDTA^{4-}$ is ethylenediamine tetraacetate ion. The total number of $N - CO - O$ bond angles in $[Co(EDTA)]^{-1}$ complex ion is .

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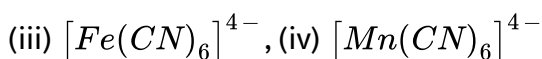
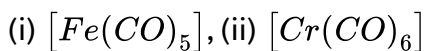
14. Among the complex ions,



and $[Co(NH_3)_4(H_2O)Cl]^{2+}$, the number of complex ion (s) that show(s) cis-trans isomerism is

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15. Find the total no. of unpaired e^- present in the following complexes.



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1. The number of structural and configurational isomers of a bromo compound, C_5H_9Br , formed by the addition of HBr to 2-pentyne respectively, is:

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2. 

Find the sum of total number of isomeric chlorides obtained in these reactions (consider only the major products).

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3. How many total number of alkenes are possible by dehydrobromination of 3-bromo-3-cyclopentylhexane using alcoholic KOH?

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4. How many of the following compounds will give white precipitate with aqueous $AgNO_3$?

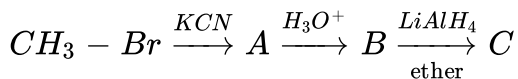


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5. 2-bromopentane is treated with alcoholic KOH solution the reaction respectively are :

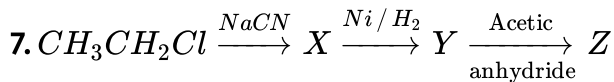
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6. In the following sequence of reactions



How many sp^3 hybridized atoms are present in product C

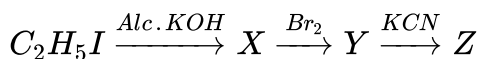
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Find the sum of carbon and hydrogen atoms in product Z.

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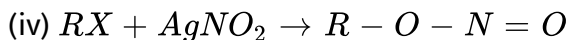
8. Consider the following reaction.



How many CN group are present in product Z?

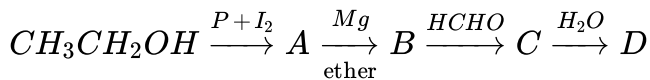
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9. How many following reactions are correct?



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10. In the following sequence of reaction

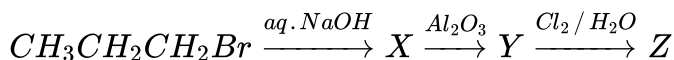


Find the number of -OH group in compound D.



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11. Find the total number of lone pair in compound Z which is formed as follows:



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12. An organic compound A with molecular formula C_4H_9Br on treatment with alcoholic KOH gave two isomeric compounds B and C with the formula C_4H_8 . On ozonolysis, B gave only one product CH_3CHO while C gave two different products. Find the sum of carbon atoms in compound A, B and C.



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13. Consider the following compound:



How many following statements are correct?

- (I) Loss of Br (a) atom in dehydrobromination reaction results in the formation of the most reactive double bond towards hydrogenation reaction.
- (II) Removal of Br (c) atom results in the formation of the most stable carbocation.
- (III) The above compound contains five asymmetric C atoms.
- (IV) The above compound does not show geometrical isomers.

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14. IUPAC name of DDT is 2,2-bis (p-chlorophenyl)-1,1,1 -trichloroethane.

How many reactive chlorine atoms are there in the compound?

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15. How many methylanilines are formed when 3-methylchlorobenzene is treated with sodamide in liquid ammonia?

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Chapter 25 Alcohols Phenols And Ether

1. Among the given hydroxyl compound how many will give precipitate immediately when treated with concentrated hydrochloric acid and anhydrous zinc chloride. 3-methyl-2-butanol, 3-methyl-1-butanol, 1-butanol, 2-methyl-2-butanol, 2,3-dimethyl-2-butanol, 2,3-dimethyl-1-butanol

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2. 

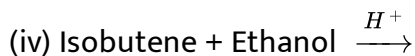
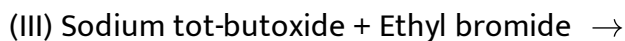
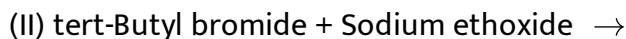
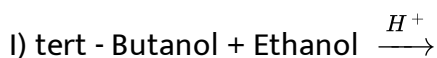
How many products are formed in above reaction?

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3. An ether A ($C_5H_{12}O$) when heated with excess hot concentrated HI produced two alkyl halides which on hydrolysis give B and C. Oxidation of B gives an acid D whereas oxidation of C gives ketone E. Both B and C give haloform reaction. Identify A to E along with their structures and the given reactions.

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4. How many of the given reaction will form tert-Butyl ethyl ether?



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5. Which of the following statements is/ are true?

(I) Ethers are soluble in cone. H_2SO_4 but separate out on addition of water.

(II) Ethers are used as solvents for BF_3 and Grignard reagent.

(III) Mononitration of p-methylanisole gives 2-nitro-4-methylanisole

(IV) Monobromination of p-ethoxyphenol gives 2-bromo-4-ethoxyphenol

(V) 4-Chlorophenol (I) will dissolve in NaOH but 4-chloro-1-methyl benzene (II) will not.

(VI) 4-Methyl benzoic (111) acid will dissolve in aq. $NaHCO_3$, but 4-methyl phenol (IV) will not.

(VII) 2,4,6-Trinitrophenol (V) will dissolve in aq. $NaHCO_3$ but 4-methyl phenol (VI) will not.

(VIII) 4-Ethyl phenol (VII) will dissolve in aq. NaOH but ethyl phenyl ether (VI11) will not.




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6. Generally, phenols, 1,3,1,4-benzenediols and 1,3,5- benzenetriols do not react with $NaBH_4/H_3O^+$, However, 1,3,5-benzenetriol (phloroglucinol) gives a high yield of product (B).



The compound (B) has how many functional groups on benzene ring?

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7. $\text{C}_5\text{H}_{10}\text{O}$ (Chiral ether) $\xrightarrow{\text{Hot HI}}$ $\text{C}_5\text{H}_{10}\text{I}_2$ (B) $\xrightarrow{\text{KOH} + \text{EtOH}}$ 

How many members are there in the ring of structure of A?

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8. 

How many among the below given compounds correctly match the products of the given reaction sequence?





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9. The reactivity of compound Z with different halogens under appropriate conditions is given below:



How many among the below given statements correctly explains pattern of electrophilic substitution?

- (I) The steric effect of the halogen.
- (II) The steric effect of the *tert*-butyl group.
- (III) The electronic effect of the phenolic group.
- (IV) The electronic effect of the *tert*-butyl group.
- (V) The mesomeric effect of *tert*-butyl group.



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10. When phenol is reacted with $CHCl_3$ and NaOH followed by acidification, salicylaldehyde is obtained. How many among following

species are involved in the above mentioned reaction as intermediates?



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11. How many total number of carbon has sp^2 hybridization in 5. the compound X and Y?



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12. Total number of isomers, considering only structural isomers of cyclic ethers with the molecular formula C_4H_8O is.....

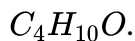
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13. What amount of bromine will be required to convert 2g of phenol into 2, 4, 6 – tribromophenol



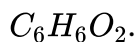
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14. Calculate the number of metamers represented by molecular formula



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15. How many number of dihydric phenols possible with the molecular formula



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Chapter 26 Aldehydes Ketones And Carboxylic Acid

1. Acetic acid is dissolved in water having oxygen as ^{18}O Howmany ^{18}O atom will be present in the product molecule?



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2. 

How many number of sp^2 hybridised carbon atoms are there in the product Z.

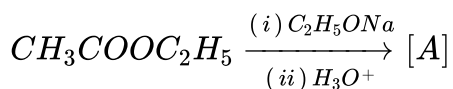
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3. How many membered ring will be formed in the product P of the following reaction.



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4. Compound A is obtained by following reaction.



How many following statement(s) is(are) true about A ?

(i) It gives red colour with blue litmus solution.

(ii) It decomposes $NaHCO_3$, solution and evolves CO_2 gas.

(iii) It decolourises bromine water colour.


(iv) It reacts with 2,4-dinitrophenyl-hydrazine

(v) Product A will undergo acid catalysed halogenation.

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5. How many of the following compound is decarboxyl ated on heating ?

(i) $\begin{array}{c} CH_2COOH \\ | \\ CH_2COOH \end{array}$, (ii) $C_2H_5(COOH)_2$

(iii) CH_3COCH_2COOH , (iv) 

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6. How many of the following compounds can be used as an acylating agent ?

(i) CH_3COCl , (ii) $(CH_3CO)_2O$

(iii) CH_3COOH , (iv) CH_2CH_2COCl .

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7. In the scheme given below, how many number of intramolecular aldol condensation products formed from 'Y'?



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8. Among the following, how many number of reaction(s) produce(s) benzaldehyde?

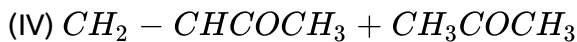


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9. Find the number of reactants among the given options which does not undergo Michael addition?



(III) 



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10. How many number of aldol reaction(s) occurs in the given transformation?



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11. How many number of organic compounds among the following compounds are present in the reaction mixture after the completion of reactions I and II?



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12. Find the total number of product in the given reaction



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13. How many steps are there in the mechanism of the following reaction?



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14. An unknown compound of carbon, hydrogen and oxygen contains 69.77% carbon and 11.63% hydrogen and has a molecular weight of 86. It does not reduce Fehling solution, but forms a bisulphite addition compound and gives a positive iodoform test. How many possible structures can be drawn for the unknown compound?

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15. How many total number of ketonic groups are present in compound C and D in the given reaction sequence?



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Chapter 27 Amines

1. How many alkenes can be formed when n-butylamine is treated with nitrous acid

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2.

How many statements are correct?

(I) Pyrrole is more basic than pyridine.

(II) Pyridine is more basic than pyrrole and aniline.

(III) Aniline is more basic than pyridine.

(IV) All are aromatic bases.

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3. Consider the following reaction:

(i) 

Find the sum of total number of nitrogen atoms, which are present in products A, B, C and D.

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4. Find the difference between the number of products formed in given reactions.

(i) $C_6H_5N^+Me_3OH$

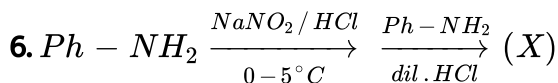
(ii) 

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5. 

Total number of Br atom in product "P" is-

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Find the sum of number of nitrogen atoms present in (X) and the total number of stereoisomers of (X) formed.

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7. 

E has how many halogens?

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8. In following conversion, find the number of carbon atoms in products.





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9. 

Find the number of unsaturated carbon in the product



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Chapter 28 Biomolecules

1. For 'invert sugar', the total number of correct statement(s) is(are)

(Given : specific rotations of (+) -sucrose, (+)-maltose, L(-)-glucose and L-(+) fructose in aqueous solution are $+ 66^\circ$, $+ 140^\circ$, -52° and $+ 92^\circ$ respectively)

(I) 'invert sugar' is prepared by acid catalyzed hydrolysis of maltose.

(II) 'invert sugar' is an equimolar mixture of D-(+)-glucose and D-(-)-fructose.

(III) specific rotation of 'invert sugar' is -20° .

(IV) on reaction with Br_2 water, 'invert sugar' forms saccharic acid as one of the products.

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2. How many dipeptides are possible from two molecules of a typical α -amino acid ?

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3. The total number of basic groups in the following form of lysine is



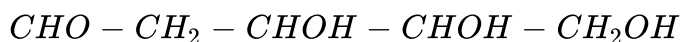
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4. A decapeptide (Mol. Wt. 769) on complete hydrolysis gives glycine (Mol. Wt. 75), alanine and phenylalanine.

Glycine contributes 47.0% to the total weight of the hydrolysed products. The number of glycine units. Present in the decapeptide is.

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5. When the following aldohexose exists in its D-configuration, the total number of stereoisomers in its pyranose form is :



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6. A tetrapeptide has $-COOH$ group on alanine. This produces glycine (Gly), valine (Val), phenyl alanine (Phe) and alanine (Ala), on complete hydrolysis. For this tetrapeptide, the number of possible sequences (primary structures) with $-NH_2$ group attached to a chiral centre is :

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7. The specific optical rotations of pure α - and β -D-mannopyranose are $+29.3^\circ$ and -17.0 , respectively. When either form is dissolved in water, specific optical rotation of the equilibrium mixture is found to be $+14.2^\circ$. Calculate the percentage of α anomer at equilibrium.

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8. Penicillin, the common antibiotic, has following structure :



Find the number of different functional groups present in it.

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9. The enzyme cytochrome C, involved in oxidation-reduction processes in the living system, has 0.43% Fe and 1.48% S. Calculate the number of S atoms in the enzyme per Fe atom.

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10. A strongly alkaline solution of a monoaminodicarboxylic acid contains how many basic groups ?



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