QB365

Model Question Paper 1

11th Standard CBSE

Chemistry Reg.No. : | | | | | | |

Time : 02:00:00 Hrs

Total Marks : 100

Section-A

1) Volume of a solution changes with change in temparature, then will the molality of the solution be affected by temparature? Give reason for your answer. **1**

2) What is the difference netween molality and molarity? **1**

3) What will be the molarity of a solution, which contains 5.85 g of NaCl(s) per 500 mL? **1**

4) How many moles of iron can be made from $Fe_2O_3$by the use of 15 moles of carbon monoxide in the following reaction? **1**

$Fe_2O_3 + 3CO \longrightarrow 2Fe + 3CO_2$

5) If 2 L of N_2 is mixed with 2 L of H_2at a constant temperature and pressure,then what will be the volume of NH_3 formed? **1**

6) One mole of oxygen gas at STP is equal to? **1**

7) Give an example of molecule in which the ratio of the molecular formula is six times the empirical formula. **1**

8) Caluculate the mass percentage of C in C_2H_4. **1**

9) Round up the following upto three significant figures **1**

38.216

10) Which of the following will not show deflection from the path on passing through an electric field? Proton, cathode rays, electron, neutron **1**

11) Neutrons can be found in all atomic nuclei except in one case. Which is this atomic nucleus and what does it consist of ? **1**

12) Nickel atom can lose two electrons and from Ni^{2+} ion. The atomic number of Ni is 28 . from which orbital will nickel lose two electrons? **1**

13) Write the electronic configuration of a divalent ion of a coinage metal. **1**

14) A boy has reported the radii of Cu,Cu^+ and Cu^{2+} as 0.096 nm,0.122 nm and 0.072 nm respectively.However, it has been noticed that he interchanged the values by mistake. Assign the correct values to different species. **1**

15) Which of the following species will have the largest and the smallest size? Mg, Mg^{2+}, Al,Al^{3+} **1**

16) Electron gain enthalpy usually becomes less negative from top to bottom in a group. Is there any exception to this generalisation? Comment. **1**

17) Write the significance of a plus and a minus sign shown in representing the orbitals **1**

18) In PO_4^{3-} ion, formal charge on each O-atom of P-O bond is **1**

19) Is it correct to say that bond order always increases when an electron is lost? **1**

20) Why is π-bond weaker than a σ--bond? **1**

Section-B

21) Which of the following combinations of atomic orbitals will give antibonding π- molecular orbital (assume Z-axis as internuclear axis.) **2**

2s+2p_z

22) Convert the following into kg. **2**

700g (mass of human DNA molecule)

23) $Fe_2(SO_4)_3$ is used in water and sewage treatment to aid the removal of suspended impurities. Calculate the mass percentage of iron and sulphur in this compound. **2**

24) Calculate the atomic mass (average) of hydrogen using the following data. **2**

Isotope	**% natural abundance**	**Molar mass**
^1H	99.985	1
^2H	0.015	2

25) Calculate the number of moles in the following masses **2**

(i) 1.46 metric ton of Al (1 metric ton = 10^3 Kg)

26) Chlorophyll present in green leaves of plants absorbs light at 4.620x10^{14} Hz.Calculate the wavelength of radiation in nanometer. Which part of the electromagnetic spectrum does it belong to? **2**

27) Wavelengths of different radiations are given below. **2**

$\lambda(A) = 300 \quad nm, \quad \lambda(B) = 300 \quad \mu m, \quad \lambda(C) = \quad 3 \quad nm, \lambda(D) = 30\overset{\circ}{A}$

Arrange these radiations in the increasing order of their energies.

28) The ionisation energy of H-atom (in the ground state) is xkJ. Find the energy required for an electron to jump from second to third energy level **2**

29) The work function (W_0) of some metals is listed below. Count the number of metals which will show photoelectric effect when light of 300nm wavelength falls on the metal. **2**

Metal	Li	Na	K	Mg	Cu	Ag	Fe	Pt	W
W_0(eV)	2.4	2.3	2.2	3.7	4.8	4.3	4.7	6.3	4.75

30) An ion with mass number 37 possesses one unit of negative charge. If the ion contains 11.1% more neutrons than the electrons than the electrons, find the symbol of the ion. **2**

31) (i) How do the electronic configurations of the elements with Z=107 to 109 differ from one another? **2**

(ii) Rn (Z=86) is the last noble gas discovered. Predict what will be the atomic number of the next noble gas to be discovered. Write its symbol.

32) State any two significant features of the Mendeleev's periodic table. **2**

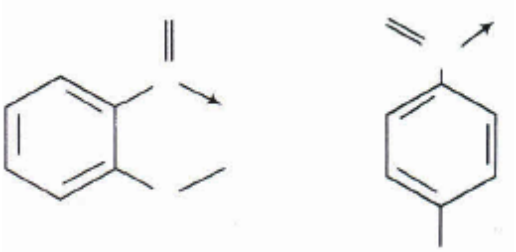
33) Arrange the following in order of decreasing bond angles. **2**

CH_4,NH_3,H_2o,BF_3,C_2H_2

34) All the C-O bonds in carbonate ion $\left(CO_3^{2-}\right)$ are equal in length. Explain. **2**

35) Structure of molecules of two compounds are given below: **2**

Which of the two compounds will have intermolecular hydrogen bonding and which compound is expected to show intramolecular hydrogen bonding?



36) On the basis of intermolecular force and thermal energy, explain why **2**

gases have high compressibility but liquids and solids have poor compressibility?

37) A gaseous mixture contains 2.2 bar He, 1.1 bar H_2 and bar N_2.What is mole fraction of N_2? **2**

38) For real gases the relation between *p*,Vand T is given by van der Waals'equation **2**

$$\left(P+\frac{an^2}{V^2}\right)(V-nb)=nRT$$

Where 'a' and 'b' are van der Waals' constants,'nb' is approximately equal to the total volume of the molecules of a gas. 'a' is the measure of magnitude of intermolecular attraction

Arrange the following gases in the increasing order of 'b' Given reason

O_2,CO_2,H_2,He

39) Calculate the pressure exerted by 10.2 g of NH_3 in a 3.0 dm^3 vessel at 25^0C **2**

Using van der Waals' equation

The van der Waala ' constants are

a = 4.17 dm^6 atm mol^{-2}

b = 0.0371 dm^3 mol^{-1}

40) Calculate the total number of electrons present in 1.4g of dinitrogen gas **2**

Convert the given mass into mole with the help of the formula, moles= $\frac{mass}{molecular\quad mass}$

1 mole=$6.022\times10^{23}molecule$

Section-C

41) Calculate the wavelength of an electron that has been accelerated in a particle accelerator through a potential difference of 100 million volts. **5**

$\left[1\quad eV=1.6\times10^{-19}J, m_e=9.1\times10^{-31}kg, h=6.6\times10^{-34}Js, c=3.0\times10^8ms^{-1}\right]$

42) Calculate the wavelength of an electron moving at $3.0\times10^{10}cms^{-1}$. (Mass of the electron = $9.11\times10^{-31}kg, h=6.6\times10^{-34}kgm^2s^{-1}$). **5**

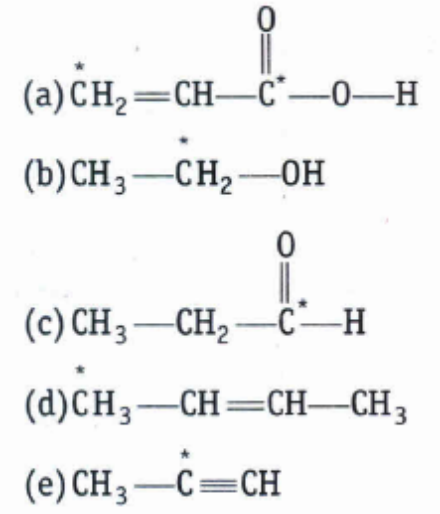
43) Calculate the ratio between the wavelength of an electron and a proton if the proton is moving with half the velocity of electron. **5**

(Mass of proton =$1.67\times10^{-27}kg$ and mass of electron =$9.11\times10^{-31}kg$).

44) Calculate the total number of electrons present in one mole of methane. **5**

45) What is hydrogen bond? What requirements should a molecule fulfil for the formation of hydrogen bond? Explain the formation of hydrogen bond in HF and NH_3 molecules. Discuss intramolecular hydrogen bond. **5**

46) What is the type of hybridisation of carbon atoms marked with star? **5**



47) Which hybrid orbitals are used by C-atoms in the following molecules? **5**

(i)CH_3-CH_3

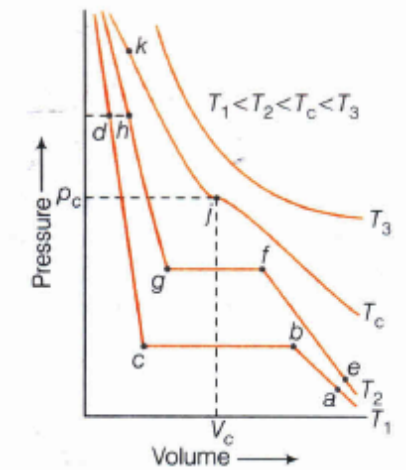
(ii)$CH_3CH=CH_2$

(iii)CH_3CH_2OH

(iv) CH_3CHO

(v) CH_3COOH

48) Isotherms of carbon dioxide at various temperatures are represented in the figure. Answer the following questions based on the figure. **5**



In which state will CO_2 exist between the points a and b at temperature T_1?

****

Section-A

1) **1**

No, molality of solution does not change with temperature since mass remains unaffected with temperature.

2) . **1**

3) 1

Since,molarity (M) is calculated by following formula. Molarity = $\frac{weight \times 1000}{molecular \quad weight \times voulme(mL)}$

[molecular weight of NaCl=58.5g] $= \frac{5.85 \times 1000}{58.5 \times 500} = 0.2 molL^{-1}$

4) 1

$Fe_2O_3 + 3CO \longrightarrow 2Fe + 3CO_2$ 3 moles of CO are used to make 2 moles of Fe. Hence,16 moles of CO are used to make $\frac{2}{3} \times 16 = 10.67 mol$

5) 1

$N_2(g) + 3H_2(g) \longrightarrow 2NH_3(g)$ 1 L of N_2 reacts with 2 L of H_2. Therefore, 2 L of N_2 will react with 6 L of H_2,but we have only 2 L of H_2,therefore,$H_2$is the limiting reactant. 3 L of H_2 gives 2 L of NH_3. 2 L of H_2 gives = $\frac{2}{3} \times 2 = \frac{4}{3} = 1.33$ L of NH_3

6) 1

1 mole of O_2 gas at STP = 6.022 $\times$ 1023 molecules of O_2 (Avogadro number) = 32 g of O_2 Hence , 1 mole of oxygen gas is equal to molecular weight of oxygen as well as Avogadro number.

7) The compound is glucose.Its molecular formula is $C_6H_{12}O_6$ while empirical formula is CH_2O. 1

8) A = 8.5 71 % 1

9) 38.2 1

10) Neutron is a neutral practice. Hence it will not be deflected on passing through an electric field 1

11) In case of hydrogen atom, there is no neutron. It consists of only one proton 1

12) 1

$28^{NI} = 1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 3d^8, 4s^2$; Nickel will lose 2 electrons from 4s(outermost shell) to form Ni^{2+} ion.

13) 1

14) Cu [0.122 nm],Cu^+ [0.096 nm],Cu^{2+} [0.072 nm]. $\therefore \quad size \propto \frac{1}{positivecharge}$ 1

15) 1

Mg and Al belongs to same period (i.e. third period) and along a period, atomic radii decreases. Thus the order of size of Mg and Al is Al < Mg Futher, the size of a cation is always smaller than its parent atom and in case of isoelectronic species, size decreases as the nuclear charge increases. Thus, the size of Mg^{2+} > Al^{3+} $\therefore$ The correct order of size is Al^{3+} <Al<Mg^{2+}<Mg. Thus, Mg is the largest atom and Al^{3+} is the smallest ion.

16) 1

The $\Delta_{eg}H$ of N is positive while the $\Delta_{eg}H$ of other elements of group 15 becomes more and more negative down the group from P to Bi.

17) 1

Orbitals are represented by waves functions. A plus sign in an orbital represents a positive wave function and a minus sign represents a negative wave function. Combination of two waves function having similar sign give bonding molecular orbitals, while that having opposite sign give antibonding molecular orbitals

18) In PO_4^{3-} ion, formal charge on each O-atom of P-O $bond = \frac{total \quad charge}{Numbers \quad of \quad O-atom} = -\frac{3}{4} = -0.75$ 1

19) 1

Bond order may increase or decrease, when an electron is lost depending upon whether the electron is lost from bonding or antibonding molecular orbital

20) 1

Section-B

21) 2

22) 0.7 kg 2

23) Fe=28% ; s=24% 2

24) 2

Many naturally occuring elements exist as more than one isotope.When we take into account the existence of these isotopes and their relative abundance (percent occurence) , the average atomic mass of the element can be calculated as.Average atomic mass

$= \frac{(Naturalabundanceof^1Hmolarmassof^1H)+(Naturalabundanceof^2Hmolarmassof^2H)}{100}$

$= \frac{99.985\times1+0.015\times2}{100}$

$= \frac{99.985+0.030}{100}$

$= \frac{100.015}{100}$

= 1.00015 u

25) 1.46 metric ton of Al = $1.46\times103\times10^3$ g of AL 2

$= 1.46\times10^6$ g

Atomic mass of Al = 27

Moles of Al = $\frac{massofAl}{atomicmass}$

$= \frac{1.46\times106}{27}$

$= 5.41\times10^4$ mol

$= 5.41\times10^4$ mol

26) $\lambda = \frac{c}{v} = \frac{3.0\times10^8ms^{-1}}{4.620\times10^{14}s^{-1}} = 649.4nm$ 2

Thus, it lies in the visible light.

27) (A)$\lambda = 300nm = 300\times10^{-9}m$ 2

(B)$\lambda = 300\mu m = 300\times10^{-6}m$

(C)$\lambda = 3nm = 3\times10^{-9}m$

(D)$\lambda = 30\overset{\circ}{A} = 30\times10^{-9}m = 3\times10^{-9}m$

$\because$ Energy, $E = \frac{hc}{\lambda} or E \propto \frac{1}{\lambda}$

$\therefore$ Increasing order of energy is B<A<C<=D

28) Energy in second level, E_2 =- $\frac{x}{2^2}$=-$\frac{x}{4}$ 2

Energy in third energy level, E_3= $= -\frac{x}{3^2} = -\frac{x}{9}$

Energy required for an electron to jump,

$(E_3 - E_2) = -\frac{x}{9} + \frac{x}{4} = \frac{5x}{36}$

29) **2**

Given that wavelength is

$\lambda = 300nm = 3 \times 10^{-7}m$

Therefore, energy is

$E = hv = \frac{hc}{\lambda} = \frac{6.626 \times 10^{-34} \times 3 \times 10^{8}}{3 \times 10^{-7} \times 1.6 \times 10^{-19}} = 4.1eV$

For a metal to show photoelectric effect, its work function has to be less than or equal to 4.1 eV So, the number of metals having work function less than 4.1 eV are 4, i.e. Li, Na, K and Mg.

30) Let the number of electrons in an ion =x **2**

Number of neutrons, n=$= x + \frac{11.1}{100}x = 1.111x$

(As the number of neutrons are 11.1% more than the number of electrons.)

Since, the ion carries -1 charge, the number of protons, p=x-1

we know that, mass number =n+p=37

or 1.111x+x-1=37 or 2.111x=37+1=38

$x = \frac{38}{2.111} = 18.0009 \quad \approx 18$

Number of protons=atomic number=18-1=17

Therefore, the symbol of the ion is $^{37}_{17}CI^{-}$

31) **2**

(i) Element with Z=107 has five, Z=108 has six electrons while Z=109 has seven 6d-electrons. thus, these elements differ in the number of electrons in the 6d-subshell.

(ii) 118, Uuo

32) **2**

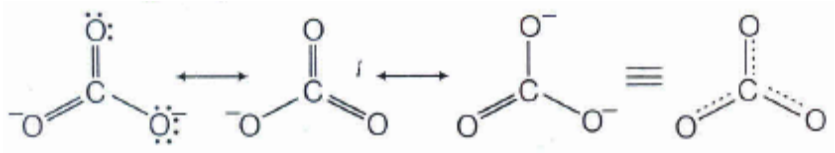
33) **2**

$C_2H_2\left(180^0\right) > CH_4\left(109^028'\right) > BF_3\left(120^0\right) > NH_3\left(107^0\right) > H_2O > \left(104.5^0\right)$This is because all of them involve sp^3 hybridisation. The number of lone pair of electrons present on N-atom are 0,1 and 2 respectively. Greater the number of lone pairs, greater is the repulsion and lesser is the bond angle.

34) **2**

To explain the reason of equal in length of C-O bonds, It should keep in mind about the resonance. As a result of resonance, the bond length in a molecule become equal.

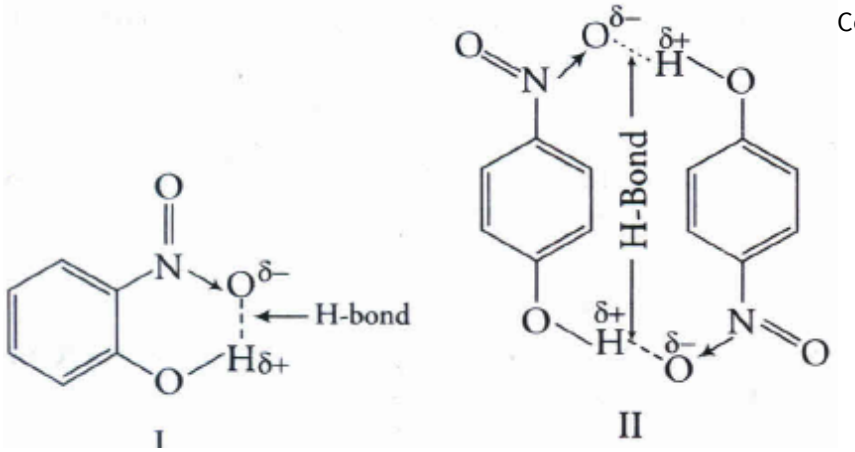
Carbonate ion $\left(CO_3^{2-}\right)$=3 bond pair +1 lone pair =trigonal planar



Due to resonance all C-O bond length are equal

35) **2**

Compound (I) will form intramolecular H-bonding. Intramolecular H-bonding is formed when H-atom, in between the two highly electronegativity atoms, is present within the same molecule. In ortho-nitrophenol (compound, I) H-atom is in between the two oxygen atoms.



Compound II forms intermolecular H-bonding. In para-nitrophenol II there is a gap between NO_2 and OH group. so, H-bond exists between H-atom of one molecule and O-atom of another molecule as depicted below.

36) **2**

Because of very weak intermolecular forces and high thermal energy, molecules of gases are far apart.That is why gases are highly compressible.

37) χ_{N2} = 0.56 **2**

38) **2**

Molar volume occupied by the gas molecules size of the molecules and van der Waals' constant 'b' represents molar volume of the gas molecules.Hence, value of 'b' increases in the following order

$H_2 < He < O_2 < CO_2$

39) 4.89 atm **2**

40) $n_{N_2} = \frac{14}{28} = 0.05mol$ **2**

$1mol = 6.022 \times 10^{23} \quad molecules$

$0.05mol = 0.05 \times 6.022 \times 10^{23}$

$= 0.3011 \times 10^{23} \quad molecules$

$1 \quad molecules \quad of \quad N_2 \quad contains \quad -14 \quad electrons$

$0.3011 \times 10^{23} \quad 0.3011 \times 10^{23} \quad will \quad contain$

$= 0.3011 \times 10^{23} \times 14 = 4.2154 \times 10^{23} \quad electrons$

Section-C

41) $\lambda = 3.87 \times 10^{-11}m$ **5**

42) $\lambda = 0.24 \times 10^{-11}m$ **5**

43) $\frac{\lambda_1}{\lambda_2} = 916.57$ **5**

44) 1 molecule of methane (CH_4) contains 10 electrons [6 from C and 1 from each H atom] **5**

$\therefore$ 1 mole molecule of methane will contain

$6.022 \times 10^{23} \times 10 = 6.022 \times 10^{24} \quad electrons$

45) **5**

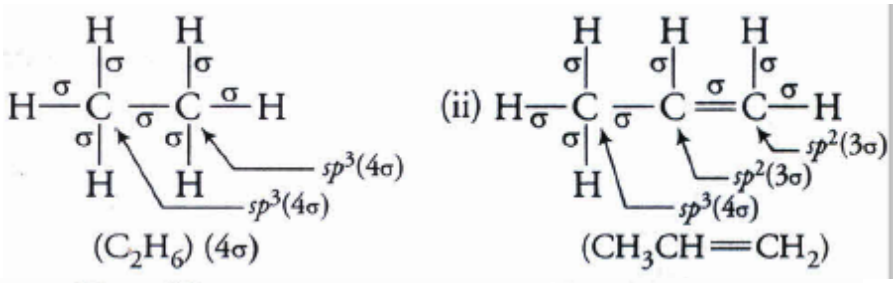
46) **5**

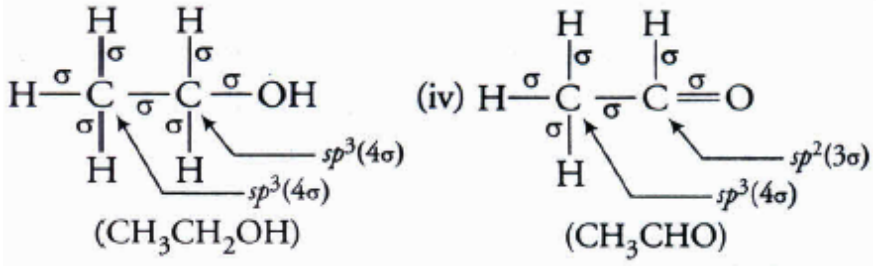
(ii) (a) $\overset{*}{C}H_2 \underset{sp^2\ (3\sigma)}{=} CH - \underset{sp^2\ (3\sigma)}{\overset{\cdot}{C}}(=O) - O - H$;

(b) $CH_3 - \overset{\cdot}{C}H_2 - OH$; ($sp^3\ (4\sigma)$)

(c) $CH_3 - CH_2 - \overset{*}{C}(=O) - H$; ($sp^2\ (3\sigma)$)

47) **5**





48) CO_2 will exist as gaseous state between 'a' and 'b'. **5**