SUBJECT : CHEMISTRY (SET-II)

Time : 3 Hrs.

M.M.: 70

General Instructions :

i)   All questions are compulsory.

ii) Question numbers 1 to 5 are very short answer type questions carrying 1 mark each.

iii) Question numbers 6 to 10 are short answer type questions carrying 2 marks each.

iv) Question numbers 11 to 22 are also short answer type questions carrying 3 marks each.

v)   Question numbers 23 is a value based question carrying 4 marks.

vi) Question numbers 24 to 26 are long answer type questions carrying 5 marks each.

vii) Use log tables, if necessary. Use of calculators is not allowed.

Q1. Write the number of significant figures in 2.653×10^4.

Q2. Assign the position of the element having outer electronic configuration $(n-1) \, d^2 \, ns^2$ for $n=5$.

Q3. Calculate the number of oxygen atoms present in 0.5 mol of oxygen gas.

Q.4 Convert

     1mg to ng

Q.5 Calculate the radius of the 5th orbit of He^+.

Q6. Define dipole moment and explain, why BeH_2 molecule has a zero dipole moment although the Be–H bonds are polar.

(1)

Q7. Explain why cations are smaller and anions are larger in radii than their parent atoms.

Q.8 Which out of NH_3 and NF_3 has higher dipole moment and why?

Q.9 Would you expect the first ionization enthalpies of two Isotopes of the same element to be the same or different. Also give reason for your answer.

Q10. Find energy of each photon which
(a) corresponds to light of frequency 3×10^{15} Hz
(b) has wavelength of 0.50 A°.

Q11. The increasing order of reactivity among group 1 elements is Li < Na < K < Rb < Cs, whereas that among group 17 elements is F > Cl > Br> I. Explain.

Q12. An organic liquid having carbon, hydrogen, nitrogen and oxygen was found to contain
C = 41.37%; H = 5.75%; N = 16.09% and the rest oxygen. Calculate the molecular formula of the liquid if its vapour density is 43.5. [Given At. mass of C = 12μ, H = 1μ, N = 14μ and O = 16μ]

Q13. (a) Why has chlorine higher electron gain enthalpy than fluorine?
(b) Why the ionization potential of nitrogen is more than that of oxygen?
(c) Why noble gases tend to be less reactive?

Q14. (a) Discuss the shapes of the following molecules using VSEPR theory :
(i) H_2O
(ii) PCl_5
(b) Write one difference between sigma and pi bond.

Q.15 (a) State Heisenberg's uncertainty principle.
(b) Calculate the uncertainty in position of dust particle with mass equal to 1mg if the uncertainty in velocity is 5.5×10^{-20} ms^{-1}.

Q.16 Write the electronic configuration of the following elements
(a) Copper (29)
(b) Chromium (24)
(c) Silicon (14)

Q.17 (a) How many electrons in an atom may have the following quantum numbers?
(i) $n=4$, $m_s=-1/2$ (ii) $n=3$, $l=0$
(b) The third period contains only 8 elements. Justify.

Q.18 (a) Define electronegativity and electron gain enthalpy.
(b) Expain how the electronegativity and electron gain Enthalpy vary along the period and down the group.

Q19. Commercially available concentrated sulphuric acid contains 98% H_2SO_4 by mass. What is the molarity of this solution if its density is 1.84 gcm^{-3}?

Q20. (a) State de Broglie relationship. For what purpose is it used?

(3)

(b)   Calculate the wavelength associated with an electron (mass = 9.1×10^{-31} Kg) moving with a velocity of 10^3 m sec^{-1}. (h = 6.6×10^{-34} Kg m^2 sec^{-1})

Q.21   What is meant by dual nature of electrons? Calculate the energy and wavelength of the photon emitted by hydrogen atom when electrons make a transition from n=2 to n=1 level. Given that $E_n = -2.18 \times 10^{-18}/n^2$ J/atom and h= 6.6×10^{-34} Js.

Q.22   (a)   Both H_2O and CO_2 are triatomic but H_2O is bent while CO_2 is linear. Explain.

        (b)   Give differences between sigma and pi bonds(Any three)

Q.23   Ramesh's uncle had set up an industrial unit for the production of Sulphuric acid. It was found that the molarity of the acid supplied by his uncle was different at different places.Due to this reason he was incurring huge losses.Ramesh suggested his uncle to sell the acid in terms of molality.

        (a)   Why do you think that there was difference in the molarities.

        (b)   Why did Ramesh suggest him to express the concentration in terms of molality?

        (c)   What values are associated with Ramesh's suggestion?

Q.24   (a)   The given $CaCO_3$ solution is 20% (w/w). Calculate the molality of the solution.

        (b)   A 10 M HCl solution is to be diluted to form 500mL of 6M solution. Calculate the volume of concentrated 10M HCl and water required for this dilution.

OR

Calcium carbonate reacts with aqueous HCl to give $CaCl_2$ and CO_2 according to reaction

        $CaCO_{3\,(s)} + 2HCl_{(aq)} \rightarrow CaCl_{2\,(aq)} + CO_{2(g)} + H_2O_{(l)}$
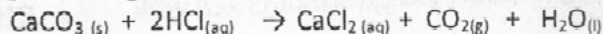
    (a)   What mass of $CaCl_2$ will be formed when 250mL of 0.76M HCl reacts with 1000g of $CaCO_3$?

    (b)   Name the limiting reagent .

    (c)   Calculate the number of moles of $CaCl_2$ formed in the reaction.

Q25. (a) The work function for caesium atom is 1.9ev. Calculate (i) the threshold wavelength and (ii) the threshold frequency of the radiation. ($1ev = 1.602 \times 10^{-18}$ J)

(b) State Hund's Rule of maximum multiplicity.

(c) Which of the following orbitals are possible?

1p, 2s, 2p and 3f.

OR

(a) The energy associated with the first orbit in the hydrogen atom is -2.18×10^{-18} J atom^{-1}. What is the energy associated with the fifth orbit? Also calculate the radius of Bohr's fifth orbit for hydrogen atom.

(b) What is meant by isoelectronic species?

(c) Write the electronic configuration of Cr^+ ion.

Q26. (a) Define hybridisation. Making use of the concept of hybridisation draw the diagram showing the formation of triple bond between carbon atoms in C_2H_2 molecule.

(b) Why NH_3 has higher boiling point than PH_3?

(c) All the C-O bonds in carbonate ion (CO_3^{2-}) are equal in length. Explain

OR

(a) Compare the relative stabilities of N_2, N_2^+ and N_2^- on the basis of their bond order and also indicate their magnetic properties.

(b) Is there any change in the hybridisation of B and N atoms as a result of the reaction

$BF_3 + NH_3 \rightarrow F_3B.NH_3$