SUBJECT : CHEMISTRY (SET-I)

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 of 1 mark each.*

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

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

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

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

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

Q1.   How many significant figures are present in 0.00250?

Q2.   Which shell would be the first to have 'g' sub-shell?

Q3.   Draw the Lewis dot structure of $SiCl_4$.

Q4.   Calculate the number of Carbon atoms in 60u of Carbon.

Q5.   Why do noble gases have bigger atomic sizes than halogens?

Q6.   What will be the wavelength of a ball of mass 0.1 kg moving with a velocity of 10 ms^{-1}? (Given h = 6.63×10^{-34} Js)

Q7.   Concentrated H_2SO_4 is 98% by weight and has density 1.84g cm^{-3}. Calculate the molarity of the solution.

Q8.   Assign the position of the element in the periodic table having outer configuration :

(i) $ns^2\, np^6$ for n = 3

(ii) $(n-1)\, d^1\, ns^2$ for n = 4

OR

(1)

Consider the following species :

N^{3-}, O^{2-}, F^-, Na^+, Mg^{2+} and Al^{3+}

(a) What is common in them?

(b) Arrange them in the order of increasing atomic radii.

Q9. Which out of NH_3 and NF_3 has higher dipole moment and why?

Q10. Convert **(a) 1 mg to ng** **(b) 1L to dm³**

Q11. A compound contains 54.2% C, 9.2% H and 36.6% oxygen. Determine the molecular formula of this compound if its molecular weight is 88 u. (Atomic weight of C = 12, H = 1, O = 16 u]

Q 12. Explain

(a) Third period of the periodic table consists of eight elements

(b) the difference between valency and oxidation state

(c) the difference between electronegativity and electron gain enthalpy.

Q13. Calculate the energy associated with the first orbit of He^+. What is the radius of this orbit.

OR

What is the wavelength of light emitted when the electron in a hydrogen atom undergoes transition from an energy level with n = 4 to an energy level with n = 2?

(Given $E_n = \dfrac{-2.18 \times 10^{-18}}{n^2}$ J/atom)

Q14. Arrange the following species in order of their increasing stability (on the basis of bond order) and indicate their magnetic behaviour : N_2, N_2^+, N_2^-

Q15. Calculate the molality and mole fraction of a 10% H_2SO_4 solution.

Q16. Among the elements of the third period Na to Ar, pick out the element : (i) that is most reactive non-metal; (ii) with highest first ionization enthalpy; (iii) with most negative electron gain enthalpy.

Q17. State and explain the three rules followed during filling up of atomic orbitals.

Q18. (i) What is limiting reagent?

(ii) Hydrogen reacts with N_2 to produce ammonia according to the equation :

$$N_2 (g) + 3H_2 (g) \rightarrow 2NH_3 (g)$$
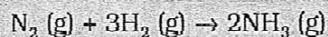
Determine how much ammonia would be produced if 200g of H_2 reacts with excess of N_2. [Atomic weight of N = 14, H = 1u]

Q19. (i) Explain why the second ionization energy of B is significantly higher than the second ionization energy of C, even though the first ionization energy of B is less than carbon.

(ii) Which out of F or Cl has more negative electron gain enthalphy & why?

Q20. Explain the shape and hybridization of C_2H_2 OR C_2H_4 molecule with the help of a diagram.

Q21. Consider the following structure :

$$H_2{}^1C = {}^2CH - {}^3CH_2 - {}^4CH_2 - {}^5C \equiv {}^6CH$$
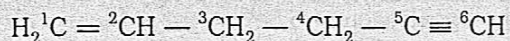
(i) How many σ and π bonds are present in this compound?

(ii) Arrange carbon number 2, 3, 5 in decreasing order of s-character.

(iii) Identify the carbon atoms having same hybridisation state.

Q22. (a) State and explain the Heisenberg's Uncertainty Principle.

(b) Give the two significances of Heisenberg's Uncertainty Principle.

Q23. Mr. Gupta has a manufacturing plant to produce H_2SO_4. He supplies it to the chemical stores all over the country. It was found that the molarity of the same acid solution was different in colder regions like Leh than warmer places like Jaipur. For this reason he was getting complaints from his clients. One day his grandson Nikhil who was a student of class XI suggested him to express the concentration by a different way. Following that all the complaints stopped.

(a) Do you think Mr. Gupta was selling different concentration of acid solution to different parts of the country? Explain your answer.

(b) What advice do you think Nikhil must have given him?

(c) Write the value associated with Nikhil's suggestion.

Q24. (a) A photon of wavelength 4×10^{-7} m strikes on metal surface, the work function of the metal being 2.13 eV. Calculate

(4)

(i)   the energy of the photon (eV)

(ii)   the kinetic energy of the emission of e⁻

(iii)   the velocity of the photoelectron

(1 eV = 1.602×10^{-19} J, mass of e⁻ = 9.1×10^{-31} Kg)

(b)   Using s, p, d notations, describe the orbital with the following quantum numbers :

(i) $n = 1, \ l = 0$

(ii) $n = 4, \ l = 2$

OR

(a)   Write outer electronic configuration of Cr atom. Why are half filled orbitals more stable?

(b)   Which one of the following is not possible and why?
        2s, 2d, 4f, 5p

(c)   Which quantum number will express the difference in the two electrons in K-shell?

Q.25   (a) Define electron gain enthalpy.

(b) State and explain the factors affecting electron gain enthalpy.

(c) How does the electron gain enthalpy vary along the period and down the group?

OR

(a) Define ionization enthalpy.

(b) State and explain the factors affecting ionisation enthalpy.

(c) Which of the two- N or O, will have a higher ionization enthalpy and why?

Q26. (a) Account for the following :

       (i) NF_3 is pyramidal while BF_3 is triangular planar.

       (ii)   All the P–F bonds in PF_5 molecule are not of the same length.

       (iii) Dipole moment of HF is more than that of HCl.

   (b) On the basis of VSEPR theory, predict the shapes of the following molecules :

       (i) PH_3 (ii) SF_6
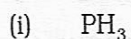
OR

   (a) Describe the change in hybridisation (if any) of the Al atom in the following reaction :

$$AlCl_3 + Cl^- \rightarrow AlCl_4^-$$
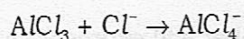
   (b) Draw the resonating structures of CO_3^{2-}

   (c) Although both CO_2 and H_2O are triatomic molecules the shape of H_2O molecule is bent while that of CO_2 is linear. Explain this on the basis of dipole moment.

(6)