MALAPPURAM DISTRICT HIGHER SECONDARY CHEMISTRY TEACHERS ASSOCIATION

FIRST YEAR CHEMISTRY MODEL EXAMINATION

PART-1 (ANSWER KEY)

Time:2.15 Hour   Score: 60 Marks

Answer any 8 questions from 1-11. Each carries 2 scores   (8x2=16)

1. There are many atomic models
    a) Who proposed nuclear model of atom.   (1)
    b) Give one limitation of the above model.   (1)

    Answer: a) Rutherford   b) it fails to explain stability of an atom or it   fails to explain hydrogen spectrum or any other limitation

2. State modern periodic law.   (2)
    Answer: Modern periodic law states that the properties of elements are the periodic function of their atomic numbers

3. VSEPR theory gives idea about shape of molecules
    a) The geometry of H_2O molecule is…..   (1)
    b) Give an example for a molecule having octahedral geometry.   (1)

    Answer: a) Bent shape or V-shape   b) SF_6

4. Define Boyle Temperature.   (2)
    Answer: The temperature at which real gas behave like ideal gas is called Boyle Temperature.

5. What you mean by an isolated system? Give an example.   (2)
    Answer: The system which cannot exchange both energy and matter with surroundings is called isolated system. E.g: Hot tea in a thermos flask

6. Write the expression for Kc of the following reactions.   (2)
    a) $N_{2(g)} + 3H_{2(g)} \Leftrightarrow 2NH_{3(g)}$
    b) $CaCO_{3(s)} \Leftrightarrow CaO_{(s)} + CO_{2(g)}$

    Answer: a) Kc= $[NH_3]^2/ [N_2][H_2]^3$ b) Kc= $[CO_2]$

7. Write any two limitations of octet rule.   (2)
    Answer: Incomplete octet of central atom, expanded octet, odd electron molecule, compounds of noble gases, it fails to explain shape and Geometry of molecules (any two)

8. State Dalton's law of partial pressure.   (2)
    Answer: Dalton's law states that the total pressure exerted by a mixture of non reacting gases is equal to the sum of partial pressures exerted by individual gases.

9. Define entropy and Give its unit. (2)

Answer: It is the property of a system which measure degree of Freedom or disorder or randomness. Its unit is $JK^{-1}mol^{-1}$

10. Give the Arrhenius concept of acid and Base. (2)

Answer: Acid is a substance which can donate H^+ ions in aqueous solution and base is a substance which can donate OH^- ions

11. Calculate the number of molecules present in 88g CO_2. (2)

Answer: Number of moles = 88/44=2mole. Therefore number of molecules = 2xNA

Answer any 8 questions from 12-23. Each carries 3 scores (8x3=24)

12. Atomic orbitals are distinguished by Quantum numbers.
   a) Name the four quantum numbers. (2)
   b) Represent the orbital n=1 and l=0 (1)

Answer: a) Principal Quantum number, Azimuthal Quantum number, Magnetic momentum Quantum number, spin quantum number   b) 1s

13. Write any three factors affecting ionization enthalpy. (3)

Answer: Factors affecting ionization enthalpy are atomic size, nuclear charge, shielding effect, presence of half filled or fully filled orbitals (any three)

14. Polarity is related to shape of molecules
   a) Define dipole moment. (2)
   b) What is the dipole moment of $BeCl_2$ molecule? (1)

Answer: a) Diploe moment is the product of magnitude of the charge and distance of separation   b) Zero

15. The spontaneity of a process is explained in terms of change in free energy.
   a) What is meant by Gibbs free energy? (2)
   b) How standard free energy change is related to equilibrium constant. (1)

Answer: a) It is the maximum available energy of a system that can be converted to useful work   b) $\Delta G° = -2.303RT \log Kc$

16. Le Chatelier principle is related to an equilibrium system
   a) State the above principle. (2)
   b) What is the effect of pressure in the equilibrium system
      $H_{2(g)} + I_{2(g)} \Leftrightarrow 2HI_{(g)}$ (1)

Answer: a) Lechatelier principle states that if there is any change in concentration, temperature and pressure of an equilibrium system, the system Will try to attain a new equilibrium by nullifying such changes b) Here pressure has no effect

17. State Heisenberg's uncertainty principle and give its mathematical expression. (3)

Answer: It is impossible to Determine accurately and simultaneously both position and momentum of a fastly moving microscopic particles like electrons. Its mathematical expression is $\Delta X . \Delta P \geq h/4\pi$

18. Write the molecular orbital configuration of O_2 molecule and give its magnetic behaviour. (3)

Answer: $\sigma 1s^2 \, \sigma^*1s^2 \, \sigma 2s^2 \, \sigma^*2s^2 \, \sigma 2p_z^2 \, \pi 2p_x^2 = \pi 2p_y^2 \, \pi^*2p_x^1 = \pi^*2p_y^1$

due to the presence of unpaired electrons it is paramagnetic

19. Write any three postulates of kinetic molecular theory of gases. (3)

Answer: Every gas contains a large number of minute and elastic particles (atoms or molecules).

The actual volume of the molecules is negligible compared to the volume of the gas.

There is no force of attraction between the gas particles.

The particles of a gas are in constant and random motion in straight line.

During this motion they collide with each other and also with the walls of the container (any three)

20. Give the differences between exothermic reactions and endothermic reactions. (3)

Answer: A reaction which proceed by absorbing heat is called endothermic reaction. Reaction which proceed by liberating heat is called exothermic reaction.

21. There are different types of acid base concepts. Briefly explain Lewis concept of acid and base with examples. (3)

Answer: In Lewis concept acid is a substance which can Accept electron pair. Eg:BF_3 Base is a substance which can donate electron pair E.g.: NH_3

22. A photon has mass of 8.6×10^{-30} Kg. Calculate its wave length[h=6.626×10^{-34} JS] (3)

Answer: Here wave length λ=h/mv=$(6.626 \times 10^{-34})/(8.6 \times 10^{-30} \times 3 \times 10^8)$

= 0.25×10^{-12}m

23. Compare the dipole moment of NH_3 and NF_3. (3)

Answer: NH_3 shows more dipole moment than NF_3 because in NH_3 molecule both orbital dipole moment and bond dipole moments are in the same direction but in NF_3 molecule both orbital dipole moment and bond dipole moments are in opposite direction.

Answer any 6 questions from 24-31. Each carries 4 scores each. (5x4=20)

24. Atomic spectrum is helpful for the structural studies
    a) Name the series of lines found in hydrogen spectrum. (2)
    b) Calculate the wave Number of second line in Balmer series of hydrogen spectrum. (2)

b) Wave number=$1/\lambda = R_H \times Z^2[1/n_1^2 - 1/n_2^2]$. here $n_1=2$ $n_2=4$ $R_H=109677cm^{-1}$ $Z=1$ By substituting we will get 20564cm-1 (only equation and substitution required)

25. Atoms can lose or gain electrons to get stability
    a) What you mean by an isoelectronic species? (2)
    b) Arrange the following isoelectronic species based on their ionic radius. Na^+, Mg^{2+}, O^{2-}, F^- (2)

Answer: a) Species having same number of electrons are called isoelectronic species
b) $O^{2-} > F^- > Na^+ > Mg^{2+}$

26. Hybridization is the factor which determine geometry of molecule.
    a) Define hybridization. (2)
    b) Find out the hybridization of H_2O and SF_6. (2)

Answer: a) Hybridization is the concept of intermixing of atomic orbitals having almost same energy to form new sets of hybridized orbitals with equivalent energy and identical shape

 b) H_2O-sp^3 SF_6-sp^3d^2

27. Enthalpy is an extensive property.
    a) Give the difference between extensive properties and intensive properties. (2)
    b) Calculate the enthalpy formation of carbon monoxide(CO) from the following data (2)
       1. $C_{(s)}+O_{2(g)} \rightarrow CO_2$ ΔH= -393.3KJmol^{-1}
       2. $CO_{(g)}+1/2\ O_{2(g)} \rightarrow CO_2$ ΔH= -282.8KJmol^{-1}

Answer: a) Extensive Properties: The properties which depend up on the amount of matter present in the system

Intensive properties: The properties which are independent of the amount of matter present in the system

b) Equation (1)-(2) Then enthalpy of formation is -110.5KJmol^{-1}

28. Buffer solutions are commonly used in laboratory
    a) What you mean by Buffer solutions? (2)
    b) Give any two examples of Buffer solutions. (2)

Answer: a) The solutions which can resist change in pH value with the addition of small amount of acidic or basic substance to it is called buffer solution.   B) Blood and Cosmetics

29. Electronic configuration is based on some rules and principles.

a) Briefly explain Hund's rule of maximum multiplicity with example. (2)

b) Write the stable electronic configuration of Cu and Cr. (2)

Answer: a) it state that electrons in the degenerate orbitals should be singly occupied before start pairing. E.g. For Nitrogen electronic configuration of outer most p orbitals should be $2px^1\ 2py^1\ 2pz^1$

b) $Cu = 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1\ 3d^{10}$ $Cr=1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1\ 3d^5$

30. Weak electrolytes are partially ionisable.
    a) Give an example for a weak electrolyte. (1)
    b) Briefly explain common ion effect with example. (3)

Answer: a) CH_3COOH or NH_4OH

b) The dissociation power of a weak electrolyte is suppressed by the addition of another electrolyte containing a common ion is called common ion effect. E.g. dissociation power of acetic acid can be suppressed by the addition of sodium acetate

31. We can predict the spontaneity of the reaction from free energy change.
    a) What you mean by a spontaneous process? Give an example. (2)
    b) The enthalpy and entropy changes of a reaction are 40.63 KJ mol^{-1} and 108.8 JK^{-1} mol^{-1} respectively. Predict the feasibility or spontaneity of the reaction at 27°C. (2)

Answer: a) A process which takes place by itself without the help of an external agency is called spontaneous process E.g. dissolution of salt in water

b) Here $\Delta H=40.63 KJmol^{-1}= 40630\ Jmol^{-1}$ $\Delta S= 108.8\ JK^{-1}mol^{-1}$

T= 27°C=300K

$\Delta G= \Delta H-T\Delta S=40630-(300\times108.8)=+7990$

Here ΔG is positive. Therefore it is not feasible at 27°C