

**MALAPPURAM DISTRICT HIGHER SECONDARY CHEMISTRY
TEACHERS ASSOCIATION**

OXYCHEMISTRY 3.0

FIRST YEAR CHEMISTRY MODEL EXAMINATION

PART-1 (ANSWER KEY)

Time: 2.5 Hour

Score: 60 Marks

Answer any 6 questions from 1-12. Each carries 2 scores (6x2=12)

1. Define 1 amu. (2)

Answer: It is the mass equal to 1/12th mass of Carbon-12 atom

2. There are many atomic models (1)
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

3. State modern periodic law. (2)

Answer: Modern periodic law states that the properties of elements are the periodic function of their atomic numbers

4. VSEPR theory gives idea about shape of molecules (1)
a) The geometry of H₂O molecule is..... (1)
b) Give an example for a molecule having octahedral geometry. (1)

Answer: a) Bent shape or V-shape b) SF₆

5. Define Boyle Temperature. (2)

Answer: The temperature at which real gas behave like ideal gas is called Boyle Temperature.

6. 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

7. Write the expression for K_c of the following reactions. (2)

- a) $\text{N}_{2(g)} + 3\text{H}_{2(g)} \rightleftharpoons 2\text{NH}_{3(g)}$
b) $\text{CaCO}_{3(s)} \rightleftharpoons \text{CaO}_{(s)} + \text{CO}_{2(g)}$

Answer: a) $K_c = \frac{[\text{NH}_3]^2}{[\text{N}_2][\text{H}_2]^3}$ b) $K_c = [\text{CO}_2]$

8. 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)

9. 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.

10. 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 $\text{JK}^{-1}\text{mol}^{-1}$

11. 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

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

Answer: Number of moles = $88/44=2$ mole. Therefore number of molecules = $2 \times \text{NA}$

Answer any 8 questions from 13-28. Each carries 3 scores (8x3=24)

13. The combination of elements is based on laws of chemical combination.

a) Who proposed law of Definite proportion. (1)

b) State the above law. (2)

Answer: a) Joseph proust b) It states that every compound has a fixed ratio by its weight.

14. 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) $1s$

15. 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)

16. 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) Dipole moment is the product of magnitude of the charge and distance of separation b) Zero

17. Write the modified form of ideal gas equation applicable to all gases and explain each terms. (3)

Answer: Vander Waal's equation

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

Where P= pressure, n= number of moles, V= volume, R= gas constant, T=Temperature, a, b are Vander Waal's constants.

18. The spontaneity of a process is explained in terms of change in free energy.

a) What is meant by Gibbs free energy? (2)

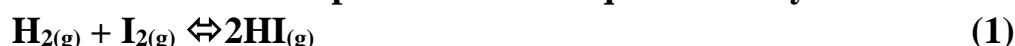
b) How standard free energy change is related to equilibrium constant. (1)

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

19. Lechatelier principle is related to an equilibrium system

a) State the above principle. (2)

b) What is the effect of pressure in the equilibrium system



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

20. Mole concept help to determine the number of particles.

a) Define 1 mole. (1)

b) Calculate the number of moles present in 224L Ammonia at STP. (2)

Answer: a) It is the amount of substance containing Avogadro number of particles b) $224/22.4 = 10$ mole

21. 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 $\Delta X. \Delta P \geq h/4\pi$

22. Electronegativity is a periodic property

a) What you mean by electro negativity? (2)

b) Which element shows highest electro negativity? (1)

Answer: a) It is the ability of an atom to attract shared pair of electrons towards Itself b)Fluorine

23. Write the molecular orbital configuration of O₂ molecule and give its magnetic behaviour. (3)

Answer: $\sigma 1s^2 \sigma^* 1s^2 \sigma 2s^2 \sigma^* 2s^2 \sigma 2pz^2 \pi 2px^2 = \pi 2py^2 \pi^* 2px^1 = \pi^* 2py^1$
due to the presence of unpaired electrons it is paramagnetic

24. 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)

25. 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.

26. 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:BF₃ Base is a substance which can donate electron pair E.g.: NH₃

27. A photon has mass of 8.6×10^{-30} Kg. Calculate its wave length [h=6.626x10⁻³⁴ JS] (3)

Answer: Here wave length $\lambda = h/mv = (6.626 \times 10^{-34}) / (8.6 \times 10^{-30} \times 3 \times 10^8)$
 $= 0.25 \times 10^{-12} m$

28. Compare the dipole moment of NH₃ and NF₃. (3)

Answer: NH₃ shows more dipole moment than NF₃ because in NH₃ molecule both orbital dipole moment and bond dipole moments are in the same direction but in NF₃ molecule both orbital dipole moment and bond dipole moments are in opposite direction.

*Answer any 6 questions from 29-40. Each carries 4 scores each.
(6x4=24)*

29. Limiting Reactant is a term related to stoichiometry of equation.

a) What is meant by Limiting Reactant? (2)

b) Identify the limiting reactant when 500g SO_{2(g)} react with 200g O_{2(g)} based on the equation $2\text{SO}_{2(g)} + \text{O}_{2(g)} \rightarrow 2\text{SO}_{3(g)}$ (2)

Answer: a) The reactant which is used up first in a chemical reaction is called Limiting reactant

b) Here 128g SO₂ required 32g oxygen as per the equation. It means 1g SO₂ required 32/128 g oxygen. Therefore 500g SO₂ required $500 \times 32/128 = 125\text{g}$ oxygen. But here 200g oxygen is given. Therefore limiting reactant is SO₂

30. 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)

Answer: a) Lyman, Balmer, Paschen, Brackett, Pfund

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

31. 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⁺, Mg²⁺, O²⁻, F⁻ (2)

Answer: a) Species having same number of electrons are called isoelectronic species b) O²⁻ > F⁻ > Na⁺ > Mg²⁺

32. Hybridization is the factor which determine geometry of molecule.

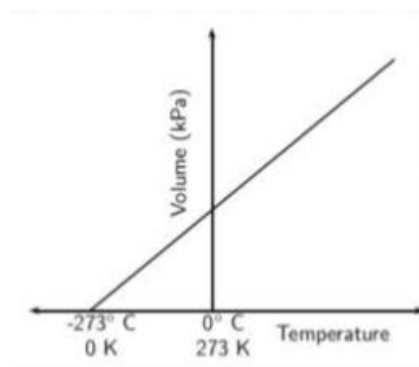
a) Define hybridization. (2)

b) Find out the hybridization of H₂O and SF₆. (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) $\text{H}_2\text{O}-\text{sp}^3$ $\text{SF}_6-\text{sp}^3\text{d}^2$

33. Consider the following graph.



- Identify the gas law represented by the above graph. (1)
- State the law. (2)
- What you mean by absolute zero? (1)

Answer: a) Charles's law

b) The law states that at constant pressure the volume of a fixed amount of gas is directly proportional to Temperature in kelvin scale

c) The temperature at which volume of all gases are assumed to be zero is called absolute zero or OK.

34. Enthalpy is an extensive property.

- Give the difference between extensive properties and intensive properties. (2)
- Calculate the enthalpy formation of carbon monoxide(CO) from the following data (2)
 - $\text{C}_{(\text{s})} + \text{O}_{2(\text{g})} \rightarrow \text{CO}_2 \quad \Delta\text{H} = -393.3\text{KJmol}^{-1}$
 - $\text{CO}_{(\text{g})} + 1/2 \text{O}_{2(\text{g})} \rightarrow \text{CO}_2 \quad \Delta\text{H} = -282.8\text{KJmol}^{-1}$

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}

35. 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

36. 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 $2p_x^1 2p_y^1 2p_z^1$

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

37. pH scale is used to identify whether a solution is acidic or basic.

- a) Define pH scale. (2)
 b) Calculate the pH of a soft drink containing H^+ ion concentration of 3×10^{-3} M. (2)

Answer: a) It is the negative logarithm of concentration of H^+ ion or H_3O^+ ion b) $pH = -\log[3 \times 10^{-3}] = 2.52$

38. Chemical bond formation gives stability to a molecule

- a) Write two differences between sigma bond and pi bond. (2)
 b) Define Bond order. (2)

Answer: a)

Sigma Bond	Pi Bond
It is formed by axial overlapping	It is formed by lateral or sideways overlapping
It is a strong bond	It is a weak bond

b) bond order is the total number of bonds between two combined atoms or $Bond\ order = \frac{1}{2}(N_b - N_a)$

39. 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

40. 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 $40.63 \text{ KJ mol}^{-1}$ and $108.8 \text{ JK}^{-1} \text{ mol}^{-1}$ 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 $\Delta H = 40.63 \text{ KJ mol}^{-1} = 40630 \text{ J mol}^{-1}$ $\Delta S = 108.8 \text{ JK}^{-1} \text{ mol}^{-1}$

$T = 27^\circ\text{C} = 300\text{K}$

$\Delta G = \Delta H - T\Delta S = 40630 - (300 \times 108.8) = +7990$

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