FIRST YEAR CHEMISTRY MODEL EXAMINATION 3.3
BASED ON FOCUS AREA 2021

Time : 2 Hours   *Cool Off Time : 20 Minutes*   *Maximum Score : 60*

Answer any 6 questions from 1 to 12. Each carries 2 scores.   (6 X 2 = 12)

1. calculate the mass of SO_3 produced when 500 gram of SO_2 reacts with 200 gram of oxygen

   according to the equation. $2SO_2 + O_2 \rightleftharpoons 2SO_3$ (2)

2. a) What is photoelectric effect?   (1)

   b) Write any two observations of photoelectric effect   (1)

3. Account for the following

   a) Electron gain enthalpy of noble gases is positive   (1)

   b) Chlorine has the highest electron gain enthalpy   (1)

4. Explain the structure of water based on VSEPR theory.   (2)

5. Write 4 differences between sigma and pi bonds   (2)

6. What is compressibility factor?   (2)

7. Name the law represented by the following graph. Give the significance of point marked „A"   (2)
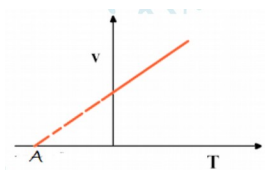
8. What is meant by "dead burnt plaster"? Why is it called so?   (2)

9. What is allotropy? What are the chief allotropes of carbon?   (2)

10. What is metamerism? Write the metamers of $C_4H_{10}O$ (2)

11. Write the chemical equation and name the following reactions .

   a) Benzene to toluene   (1)

   b) Benzene to nitrobenzene   (1)

12. Hydrogen combines with oxygen to form water(H_2O) and hydrogen peroxide(H_2O_2)

   (a) Which law is illustrated here?   (1)

   (b) State the law.   (1)

Answer any 8 questions from 13-28 carries 3 scores each. **(8 X 3 = 24)**

13. (a) Define limiting reagent. (1)

    (b) How can you detect the presence of carbon and Hydrogen in an organic compound? (2)

14. (a) What are the important observations and conclusions made by Rutherford from his

    alpha ray scattering experiment? (2)

    (b) Give any two limitations of Rutherford nuclear model of atom. (1)

15. (a) State Heisenberg's Uncertainty Principle. (1)

    (b) calculate the uncertainty in the velocity of a cricket ball of mass 130g, if the uncertainty in

    its position is of the order of 1.2 A^0. (2)

16. (a) State modern periodic law. (1)

    (b) what are isoelectronic species? (2)

17. (a) What do you meant by ionization enthalpy? (1)

    (b) why the ionization enthalpy of nitrogen is higher than oxygen? (2)

18. (a) Draw the molecular orbital diagram for O_2. (2)

    (b) calculate the bond order of O_2. (1)

19. What are the causes for the deviation of real gases from ideal behavior? (3)

20. For the reaction of $4Fe(s) + 3O_{2(g)} \rightarrow 2Fe_2O_{3(s)}$ the entropy change is -549JK⁻mol^{-1} at 298K.

    In spite of the negative entropy change, why the reaction is spontaneous? (3)

    (Given enthalpy change of the reaction is -1648KJ/mol.)

21. For the equilibrium, $2NOCl_{(g)} \rightleftharpoons 2NO_{(g)} + Cl_{2(g)}$, the value of equilibrium constant Kp is 1.8 x10^{-2} bar

    at 500K. Calculate K_c for the reaction at the same temperature. (R = 0.083 litre bar K^{-1} mol^{-1}) (3)

22. Explain the disproportionation reaction with suitable example. (3)

23. Briefly explain the different types of hydrides. (3)

24. Briefly explain the following (3)

        (a) Syn gas (1)

        (b) producer gas (1)

        (c) coal gasification (1)

25. Match the following

      1.$CaSO_4.1/2H_2O$ A)Limestone

      2. $CaCO_3$ B) Quick lime

      3. $Na_2CO_3 .10H_2O$ C) Slaked lime

      4. $NaHCO_3$ D) Washing soda

      5. CaO E) Baking soda

      6. $Ca(OH)_2$ F) Plaster of paris   (3)

26. (a) What are silicones?   (1)

    (b) CO_2 is a gas but SiO_2 is a solid, explain.   (2)

27. Briefly explain the following

    (a) Green house effect

    (b) Acid rain

    (c) BOD   (3)

28. Write the general formula of the following homologous series.

    1) Alkene   2) Alcohol   3) Chloroalkane   (3)

Answer any 6 questions from 29 to 40 carries 4 scores each.   *(6X 4 = 24)*

29. a) You are given an organic compound containing nitrogen. Explain how you will proceed to

    determine the presence of nitrogen.   (3)

    b) $2CH_3Br + 2Na \xrightarrow{\text{Dry ether}}$ ....   (1)

30. a) i) Write the electronic configuration of copper (z = 29)   (1)

     ii) Find the number of electrons in the subshell with azimuthal quantum number $l =2$.   (1)

    b) Give the shrodingers wave equation and explain the terms involved.   (2)

31. The geometry of the molecule is decided by the type of hybridization.

    a) Discuss the shape of PCl_5 molecule using hybridization.   (2)

    b) Give the reason for the high reactivity of PCl_5.   (2)

32. a) What are buffer solutions? Give an example for a buffer solution.   (2)

    b) The concentration of H^+ ion in a sample of soft drink is 3.8×10^{-3}M. Determine its pH.   (2)

33. a)Draw the Newman Projections of the eclipsed and staggered conformations of ethane molecule.   (2)

    b)Give the chemical equations for the steps involved in the ozonolysis of propene.   (2)

34. a) Give the structural formula of functional group isomers of the compound C_3H_6O (2)

   b) Give the IUPAC name of the above isomers   (2)

35. Lithium and Magnesium show diagonal relationship.

   a) Give any two similarities between Li and Mg.   (2)

   b) What happens when Na is treated with   i) water and ii) Liquid NH_3?   (2)

36.a)What are the products obtained when HBr is added to propene   (2)

   b)which is the major product and name the principle behind it   (2)

37. a) The oxidation number of sulphur in SO_4^{2-} is ....   (1)

   b) Balance the following equation using half reaction method.

     $Cr_2O_7^{2-} + SO_3^{2-} \longrightarrow Cr^{3+} + SO_4^{2-}$ [In acidic medium]   (3)

38.a) Le-Chatlier's principle helps to explain the effect of change in conditions on equilibrium.

   Discuss the effect of pressure in the following equilibrium on the basis of Le-Chatlier's principle:

        $CO_{(g)} + 3H_{2(g)} \rightleftharpoons CH_{4(g)} + H_2O_{(g)}$ (2)

   b) What are conjugate acid – base pairs? Illustrate using a suitable example.   (2)

39. When BF_3 is treated with LiH at 450K, a hydride of boron is formed..

   a) Identify the hydride of boron formed in the above reaction.   (1)

   b) Briefly explain the structure of the above mentioned hydride.   (2)

   c) Boron compounds behave as Lewis acids. Why?   (1)

40. a) Give the criteria for spontaneity of a process in terms of free energy change (ΔG).   (1)

   b) State the first law of thermodynamics.   (1)

   c) Find the temperature above which the reaction $MgO_{(s)} + C_{(s)} \rightarrow Mg_{(s)} + CO_{(g)}$.

     becomes spontaneous. (Given $\Delta_r H^0 = 490$ kJ mol^{-1} and $\Delta_r S^0 = 198$ J K mol^{-1}).   (2)