**TIME : 3 Hrs**                                                                                    **MAX MARKS:70**

**GENERAL INSTRUCTIONS** :

- **All questions are compulsory.**
- **Section-A: Question number 1 to 5 are very short-answer questions and carry 1 mark each.**
- **Section-B: Question number 6 to 12 are short-answer questions and carry 2 marks each.**
- **Section-C: Question number 13 to 24 are also short-answer questions and carry 3 mark each.**
- **Section-D: Question number 25 to 27 are long-answer questions and carry 5 marks each.**
- **Use log tables, if necessary. Use of calculators is not allowed.**
- **Total number of printed pages - 4**
- **Total number of Questions-    27**

| | **SECTION -A** | |
|---|---|---|
| **Q1** | Write the number of unpaired electrons in $Fe^{3+}$? [Atomic number of Fe= 26] | 1 |
| **Q2** | What are the necessary conditions for any system to be aromatic? (Any 2) | 1 |
| **Q3** | For the reaction $2Cl(g) \rightarrow Cl_2(g)$, what are the signs of $\triangle H$ and $\triangle S$? | 1 |
| **Q4** | The value of $\triangle_f H^0$ for $NH_3$ is 91.8 KJ/mole. Calculate the enthalpy change for the following reaction.   $2NH_{3(g)} \rightarrow N_{2(g)} + 3H_{2(g)}$ | 1 |
| **Q5** | Write the expression for $K_c$. $CH_3COOC_2H_{5(aq)} + H_2O_{(l)} \rightarrow CH_3COOH_{(aq)} + C_2H_5OH_{(aq)}$ | 1 |
| | **SECTION -B** | |
| **Q6** | a)Nitrogen has positive electron gain enthalpy whereas oxygen has negative. Explain. b)Arrange the following in the increasing order of their size: $Cl^-, S^{2-}, Na^+, Mg^{2+}$. | 2 |
| **Q7** | The first and second ionization enthalpies of three elements A, B, C are given below – <br><br> Identify the element which is likely to be [a] non – metal [b] an alkali metal [c] an alkaline earth metal. [d] Give general configuration of **A** | 2 |
| **Q8** | a) Explain why $BeH_2$ molecule has zero dipole moment although the B-H bonds are polar. b)Using Molecular orbital theory, predict which is paramagnetic, $O_2$ or $O_2^{2-}$. | 2 |
| **Q9** | Find out the value of $K_c$ for the following reaction from the value of $K_p$ $CaCO_{3(s)} \rightleftarrows CaO_{(s)} + CO_{2(g)}$  ($K_p$ = 167 at 1073 K and R= 0.0831 bar $dm^3$ /Kmole) | 2 |
| **Q10** | Balance the following reaction in **basic** medium: $MnO_4^- + Br^- \rightarrow MnO_2 + Br_2$ <br> **OR** <br> Balance the following reaction in **acidic** medium: $I^- + O_2 + H_2O \rightarrow I_2 + OH^-$ | 2 |
| Q11 | a) Why are potassium and caesium, rather than lithium used in photoelectric cells? | 2 |

Table for Q7:

| | A | B | C |
|---|---|---|---|
| $1^{st}$ IE | 403 | 549 | 1142 |
| $2^{nd}$ IE | 2640 | 1060 | 2080 |

| | b)Draw the structure of $BeCl_2$ in solid state. | |
|---|---|---|
| **Q12** | The value of $K_c$ for the reaction $3O_{2(g)} \leftrightarrows 2O_{3(g)}$, is $2 \times 10^{-50}$. If the equilibrium concentrations of $O_2$ is $1.6 \times 10^{-2}$, what is the concentration of $O_3$?<br><br><div align="center">**OR**</div><br>For the reaction $CH_{4(g)} + 2H_2S_{(g)} \leftrightarrows CS_{2(g)} + 4H_2$<br>The magnitude of $K_c=3.6$. Decide whether reaction mixture is at equilibrium . If not, in which direction it should go?<br>$[CS_2] = 1.25$ M, $[H_2]=1.75$ M, $[CH_4]=1.45$M and $[H_2S]=1.29$M | 2 |
| | <div align="center">**SECTION-C**</div> | |
| **Q13** | a)For the reaction, $4Fe + O_2 \longrightarrow 2Fe_2O_3$, 4.8 gm of oxygen is used to burn 8.4 of Iron. What mass of $Fe_2O_3$ will be produced?(Mass of Fe=56)<br>b)A solution is prepared by dissolving 18.25 gm of NaOH in distilled water to give 200 ml of solution. Calculate the Molarity of the solution and give it's unit. | 3 |
| **Q14** | a)Using (n+l) rule arrange the following in increasing order of their energies: 4d,4f,5s and 5p<br>b) Write the formula for calculating the energy of Bohr's fifth orbit in an hydrogen atom .<br>c) Why is the electronic configuration of oxygen written as $1s^2\,2s^2\,2px^2\,2py^1 2pz^1$ and not as $1s^2\,2s^2\,2px^2\,2py^2$ ? Name and state the rule governing this type of distribution . | 3 |
| **Q15** | a)Why $NH_3$ has a higher boiling point than $PH_3$?<br>b)State the hybrization of : Cl in $ClF_3$<br>c) Calculate the formal charge on **N** atom in $NO_2^{-1}$. | 3 |
| **Q16** | Account for the following:<br>i)The solubility of metal carbonates of group II elements decreases down the group.<br>ii) Beryllium and magnesium do not give colour to flame whereas other alkaline earth metals do so. Why ?<br>iii) $BeCO_3$ is less stable than $MgCO_3$<br><div align="center">**OR**</div><br>Explain why?<br>i) Lithium on being heated in air mainly forms the monoxide and not peroxide.<br>ii) Sodium metal is stored under kerosene.<br>iii)Solubility of alkaline earth metal hydroxides in water increases down the group. | 3 |
| **Q17** | a)Draw the cis and trans structures for hex-2-ene. Which isomer will have higher boiling point and why?<br>b) How will you convert benzene into acetophenone? | 3 |
| **Q18** | a)Calculate the oxidation number of Mn in $KMnO_4$.<br>b)$SO_2$ can act as oxidising as well as reducing agent but $HNO_3$ can act as only oxidising agent. Why?<br>c)Justify the following reaction as disproportionate reaction:<br>$Cl_2 + 2OH^- \rightarrow ClO^- + Cl^- + H_2O$ | 3 |

| Q19 | a) Classify the following into electrophiles and nucleophiles: $H^+$, $NH_3$, $AlCl_3$, $NO_2^+$ <br> b)Name the type of organic reaction involved in the following reaction: <br> $CH_3CH_2I + KOH(aq) \rightarrow CH_3CH_2OH + KI$ <br> c)Arrange the following in the increasing order of their stability: <br> $^+CH_3, {}^+CH_2Br, {}^+CHBr_2, {}^+CBr_3$ | 3 |
|---|---|---|
| Q20 | a)Write the hybridisation each carbon of $CH_3-CHO$ <br> b)Draw the structure of (i) 4-cyano -3-ethyl-hexanoic acid (ii)4-keto-hexanal <br> c)Which of the two $O_2NCH_2CH_2O^-$ or $CH_3CH_2O^-$ is expected to be more stable and why? <br> <br> **OR** <br> a) Draw the various resonating structure associated with $C_6H_5OH$ <br> b) From the structures given below, answer the questions. <br> I. $CH_3 – CH_2 – CH(OH) – CH_3$ <br> II. $CH_3 – CH_2 – CH_2 – CH_2 – OH$ <br> III. $CH_3 – O – CH_2 – CH_2 – CH_3$ <br> IV. $CH_3 – CH_2 – O – CH_2 – CH_3$ <br> i)The pair of compounds that represent position isomerism. <br> ii)The pair of compounds that represents metamers. | 3 |
| Q21 | Give reason: <br> a)Boron is unable to form $BF_6^{3-}$. <br> b)B-F bond length in $BF_3$ is smaller as compared to $BF_4^-$. <br> c) Atomic radius of Ga is less than that of Al. Explain | 3 |
| Q22 | a)What do you understand by inert pair effect? <br> b)Compounds of Nitrogen do not form pentahalide. Why? <br> c)Why does $NO_2$ dimerise? | 3 |
| Q23 | a)Define the term Entropy. <br> b)For a reaction : $2A(g) + B(g) \rightarrow 2D(g)$ (Temperature = 298 K) <br> $\triangle^0U = -10.5$ KJ/mole and $\triangle^0S = -44.1$ J/K. Calculate $\triangle^0G$ for the reaction and predict whether the reaction is spontaneous or not? <br> **OR** <br> a)Define absolute Entropy. <br> b) Calculate the standard enthalpy of formation of $CH_3OH$ from the following data <br> i) $CH_3OH + 3/2 O_2 \rightarrow CO_2 + 2H_2O$ ($\Delta H = -726$ KJ/mol) <br> ii)$C + O_2 \rightarrow CO_2$ ($\Delta H = -393$ KJ/mol) <br> iii)$H_2 + 1/2 O_2 \rightarrow H_2O$ ($\Delta H = -286$ KJ/mol) | 3 |
| Q24 | a)Calculate standard Gibb's energy change for the following reaction: <br> $Zn(s) + Cu^{2+}_{(aq)} \rightarrow Zn^{2+}_{(aq)} + Cu(s)$ <br> Given that $\triangle_fG^0$ for $Cu^{2+}$ and $Zn^{2+}$ as 65 KJ/mol and -147.2 KJ/mole respectively. <br> b)For oxidation of Magnesium, $2 Mg + O_2 \rightarrow 2 MgO$ ($\triangle^0H_r = -1202$ KJ/mole) <br> Entropy change is - 217 J/K at 298 K. Inspite of negative entropy change of this reaction, why is the reaction spontaneous? | 3 |
| | **SECTION-D** | |

| Q25 | a) In a solid, 'A' occupy corners and B is present at face centers and C is present in the body. What is the simplest formula of the solid. <br> b) An element of atomic mass 98.5 g mol$^{-1}$ occurs in fcc structure. If its unit cell edge length is 500 pm and its density is 5.22 g cm$^{-3}$. Calculate the value of Avogadro constant. <br> c)Calculate the volume occupied by 8.8 gm of $CO_2$ at 31.1$^0$C and 1 bar pressure. <br> (R= .083 bar L/Kmol <br><br> **OR** <br><br> a) An element has body centred cubic (bcc) structure with cell edge of 288 pm. The density of the element is 7.2 gm/cc . Calculate the molar mass of the element. <br> b)What are F centres with respect to crystalline solid? <br> c)A mixture of hydrogen and oxygen at 1 bar pressure contain 20 % by mass of hydrogen. Calculate the partial pressure of hydrogen. | 5 |
|---|---|---|
| Q26 | a)How following conversion take place:   Sodium ethanoate to Methane <br> b) What happens when 1-bromopropane is heated with alcoholic KOH? Write the equation. <br> c) Complete the following reaction: CH≡CH  + $H_2O$ $\xrightarrow{\text{HgSO}_4/\text{H}^+}$ <br> d)Arrange the following in order of their decreasing reactivity with an electrophile: <br> Chlorobenzene, 2, 4 di nitrochorobenzene,  para nitro chloro benzene. <br> e)Write IUPAC names of the products obtained by the ozonolysis of  1 phenyl but-1-ene. <br><br> **OR** <br><br> a)How following conversion take place: Methyl Iodide to  Ethane <br> b)Complete the following reaction: $CH_3$- CH=C$(CH_3)_2$ + HBr → <br> c) What happens when ethene is treated with alkaline KMnO4 solution (cold)? Write the equation. <br> d)Suggest a route for the preparation of $C_6H_5NO_2$ from CH≡CH. <br> e)Arrange the following in increasing boiling point: 2-methyl butane, pentane and 2,2dimethyl propane. | 5 |
| Q27 | a)What is the conjugate base of $HCO_3^-$ and $H_2O$? <br> b)  Explain common ion effect with an example? <br> c)The pH of 0.1 M HCOOH is 2.34. Calculate the $H_3O^+$ ion concentration  and its degree of ionization. (Antilog of 0.66 =4.571) <br> d)The degree of ionization of 0.1 M bromoacetic acid solution is 0.132. Calculate the pH of the solution. (log of 1.32 =0.1206 ) <br><br> **OR** <br><br> a)Identify the lewis acid and lewis base : $NH_3$ and $BF_3$ <br> b) Write Ksp expression for $PbCl_2$? <br> c)It has been found that the pH of 0.01 M solution of an organic acid is 4.15. Calculate the concentration of the hydronium ion and the ionization constant ($K_a$) of the acid . <br> (Antilog of 0.85=7.08 ) <br> d) The ionization constant of acetic acid is 1.74 x 10$^{-5}$. Calculate the degree of dissociation of acetic acid in its .05 M solution. Calculate the concentration of acetate ion in the solution . | 5 |