1.   Which of the following are Lewis acids?
        H_2O, BF_3, H^+ and OH^- (1)

2.   What will be the conjugate base for the bronsted acids : HF, HSO_4^-.   (1)

3.   List any two characteristics of chemical equilibrium.   (1)

4.   Differentiate between:
        a)   Homogeneous and heterogeneous equilibria.
        b)   Valency and oxidation number.   (2)

5.   In qualitative analysis, NH_4Cl is added before adding NH_4OH solution for testing Fe^{3+}, Cr^{3+}
        and Al^{3+}.   Give reason.   (2)

6.   a)   Write expression for equilibrium constant, K_c
                    $3Fe\ (s)\ +\ 4H_2O\ (g)\ \rightarrow\ Fe_3O_4(s)\ +\ 4H_2\ (g)$

        b)   What are strong electrolytes? Give an example.   (2)

7.   On the basis of Le-Chatelier's Principle, predict the effect of temperature and pressure on
        the following equilibrium,
                    $2SO_2(g)\ \ +\ O_2(g)\ \rightleftharpoons\ 2SO_3\ (g)$ $\Delta H\ =\ -189\ KJ$ (2)

8.   If Solubility Product of CaF_2 is 1.7×10^{-10} at 298K, Calculate the solubility in mol L^{-1}.   (2)

9.   Calculate pH of a sample of soft drink whose hydronium ion concentration is 3.8×10^{-3} M.   (2)

10.   Balance the following redox reaction :
                    $Fe^{2+}\ +\ Cr_2O_7^{2-}\ +\ H^+\ \rightarrow\ Fe^{3+}\ +\ Cr^{3+}\ +\ H_2O$ (acidic medium)   (2)

11.   Draw a labelled diagram for Daniell cell. Also mention the function of salt bridge in the cell. (3)

12.   Calculate hydrogen and hydroxyl ion concentration in
        i)   0.01 M HNO_3 ii)   0.005 M NaOH   (3)

13.   A mixture of 1.57 mol of N_2, 1.92 mol of H_2 and 8.13 mol of NH_3 is introduced into a 20 L
        reaction vessel at 500K. At this temperature, the equilibrium constant, K_c for the reaction

        $N_2(g) + 3H_2(g)\ \rightleftharpoons\ 2NH_3(g)$ is 1.7×10^2.

        Is the reaction mixture at equilibrium? If not, what is the direction of the reaction?   (3)

14.   Can we use a copper vessel to store 1M $AgNO_3$ solution? Given that
        $E°_{Cu^{2+}/Cu}$ = +0.34V and $E°_{Ag^+/Ag}$ = +0.80V.   (3)

15.   Calculate the degree of dissociation and hydronium ion concentration of 0.1M solution of
        acetic acid. Ka for acetic acid is 1.8×10^{-5}.   (3)

16.   Two moles of PCl_5 were heated to $327^{\circ}C$ in a closed two litre vessel and when equilibrium was achieved, PCl_5 was found to be 40% dissociated into PCl_3 and Cl_2. Calculate the equilibrium constants K_p and K_c for this reaction. (R = 0.0821 L atm K^{-1} mol^{-1})   (3)

17.   a)   What is an Electrochemical series?

      b)   Given the standard electrode potentials, K^+/K = -2.93V, Ag^+/Ag = 0.80V, Hg^{2+}/Hg = 0.79V, Mg^{2+}/Mg = -2.37V, Cr^{3+}/Cr = -0.74V. Arrange these metals in their increasing order of reducing power.

      c)   An electrochemical cell is set up between zinc rod dipped in zinc sulphate solution and cadmium rod dipped in cadmium sulphate solution.
            Given that $E^o_{Zn^{2+}/Zn}$ = -0.76 V and $E^o_{Cd^{2+}/Cd}$ = -0.40 V.

            i)   Write cell reaction and cell representation.

            ii)   Calculate standard emf of the cell.   (5)

-x-x-x-x-x-x-x-