11-CHEMISTRY

SOME BASIC CONCEPTS OF CHEMISTRY

1. Calculate the mass percent of different elements present in sodium sulphate (Na_2SO_4).

2. Determine the empirical formula of an oxide of iron which has 69.9% iron and 30.1% dioxygen by mass.

3. Calculate the amount of carbon dioxide that could be produced when
   i) 1 mole of carbon is burnt in air.
   ii) 1 mole of carbon is burnt in 16 g of dioxygen.

   iii) 2 moles of carbon are burnt in 16 g of dioxygen.

4. How much copper can be obtained from 100 g of copper sulphate ($CuSO_4$)?

5. In three moles of ethane (C_2H_6), calculate the following:
   (i) Number of moles of carbon atoms.

   (ii) Number of moles of hydrogen atoms.

   (iii) Number of molecules of ethane.

6. Dinitrogen and dihydrogen react with each other to produce ammonia according to the following chemical equation:
      $N_{2(g)} + H_{2(g)} \rightarrow 2NH_{3(g)}$
   (i) Calculate the mass of ammonia produced if 2.00×10^3 g dinitrogen reacts with

     1.00×10^3 g of dihydrogen.

   (ii) Will any of the two reactants remain unreacted?

   (iii) If yes, which one and what would be its mass?

7. Calculate the molarity of a solution of ethanol in water in which the mole fraction of ethanol is 0.040 (assume the density of water to be one).

8. What will be the mass of one 12C atom in g?

9. Calculate the number of atoms in each of the following
   (i) 52 moles of Ar   **(ii)** 52 u of He   **(iii)** 52 g of He.

10. Calcium carbonate reacts with aqueous HCl to give $CaCl_2$ and CO_2 according to the reaction, $CaCO_3(s) + 2\ HCl_{(aq)} \rightarrow CaCl_{2(aq)} + CO_{2(g)} + H2O_{(l)}$
   What mass of $CaCO_3$ is required to react completely with 25 mL of 0.75 M HCl?

THERMODYNAMICS

1. The enthalpy of combustion of methane, graphite and dihydrogen at 298 K are, –890.3 kJ mol^{-1} –393.5 kJ mol^{-1}, and –285.8 kJ mol^{-1} respectively. Enthalpy of formation of $CH_4(g)$ will be
    (i) –74.8 kJ mol^{-1} (ii) –52.27 kJ mol^{-1}
    (iii) +74.8 kJ mol^{-1} (iv) +52.26 kJ mol$^{-1.}$

2. In a process, 701 J of heat is absorbed by a system and 394 J of work is done by the system. What is the change in internal energy for the process?

3. The reaction of cyanamide, $NH_2CN(s)$, with dioxygen was carried out in a bomb calorimeter, and ΔU was found to be –742.7 kJ mol^{-1} at 298 K. Calculate enthalpy change for the reaction at 298 K.

4.The equilibrium constant for a reaction is 10. What will be the value of ΔG^0 ?
(R = 8.314 JK–1 mol–1, T = 300 K.)

5. Calculate the entropy change in surroundings when 1.00 mol of $H_2O(l)$ is formed under standard conditions. $\Delta_f H^0$ = –286 kJ mol–.Calculate $\Delta r G^0$ for conversion of oxygen to ozone, $3/2\ O_2(g) \rightarrow O_3(g)$ at 298 K. if K_p for this conversion is 2.47×10^{-29} .

6. For an isolated system, ΔU = 0, what will be ΔS ?

7. State II law of thermodynamics.

8. When ΔH >0 and ΔS< 0, reaction is never spontaneous. Explain.

9.State III lae of thermodynamics.

10. How can you justify q and w are not state functions , yet (q+w) is a state function?.

11. Derive an expression for the work of expansion of a gas (w = $P\Delta V$)

12. Derive $\Delta H = \Delta U + \Delta ngRT$.

13. Define Hess's law.

14. Define Lattice energy.

15. Predict in which of the following, entropy increases/decreases :
(i) A liquid crystallizes into a solid.
(ii) Temperature of a crystalline solid is raised from 0 K to 115 K.
iii $2NaHCO_{3(s)} \rightarrow Na_2CO_{3(s)}\ CO_2(g)\ H_2O_{(g)}$ (iv)$H_{2(g)} \rightarrow$ 2H(g)