Duration: 2 Hours   **Total Marks: 60**

N.B.: (1) Question no. I is compulsory.
    (2) Attempt any three questions from Q. 2 to Q. 6.
    (3) All questions carry equal marks.
    (4) Figures to the right indicate full marks.
    (5) Atomic weights: H= 1, C =12, O =16, S =32, N =14, Cl = 35.5, Ba =137.3.

1.   Answer any five of the following: **(15)**
    (a) What is passivity? With an example explain how it affects the rate of corrosion?
    (b) Name a green solvent and explain its properties.
    (c) Give the detailed classification of composites with examples.
    (d) A coal sample was found to contain the following constituents:
      C= 81%, H= 6%, S =1%, N= 2%, ash = 4% and rest is oxygen.
      Calculate the minimum weight of air required at STP for complete combustion
      of 1 kg of the coal sample.
    (e) State and explain the Pilling Bedsworth rule.
    (f) Give the classification and composition of plain carbon steels.
    (g) Draw the diagram of the alkaline fuel cell and write the reactions taking place
      at the anode and cathode.

2.   (a) Explain the impressed current cathodic protection method with the help of
      following points:-
      1) Principle and diagram
      2) Explanation of process.
      3) Applications.   **(6)**

    (b) i) 1.5gm of a coal sample was kjeldahlised and the ammonia evolved was absorbed in 49
      ml N/10 H_2SO_4. After absorption the excess H_2SO_4 required 32.5ml of 0.1N NaOH for
      neutralization. 0.5gm of the same coal sample was burnt in a bomb calorimeter
      and on treatment with $BaCl_2$ produced 0.08gm of $BaSO_4$. Calculate the percentage of
      nitrogen and Sulphur in the given coal samples.   **(3)**

      ii) Give an example to explain why it is beneficial to prevent waste formation in chemical
       processes rather than treat waste?   **(2)**

    (c) Classify structural composites and explain their properties and uses along with diagram.
                                                                                                    (4)

3.   (a) Explain fixed bed catalytic cracking with the help of the following points:-

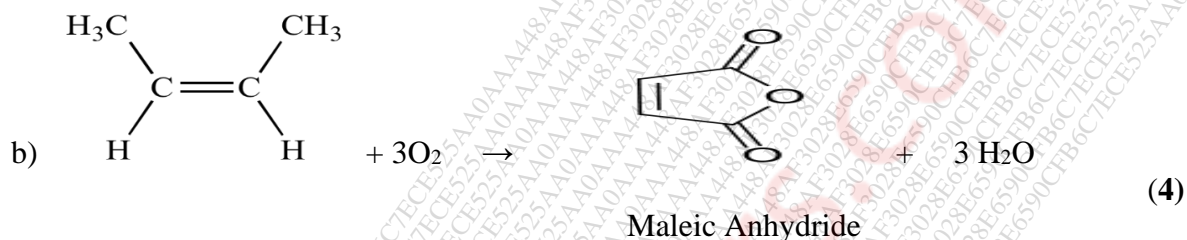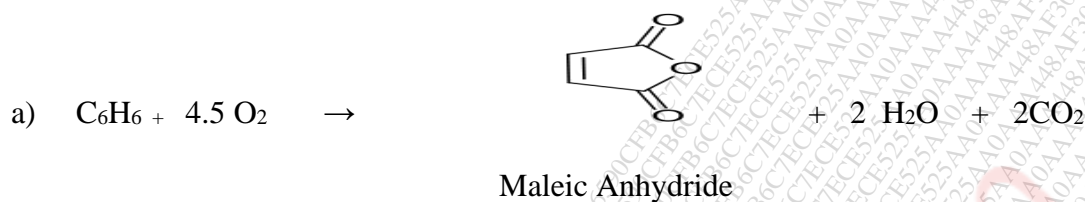   i) Principle ii) Labelled Diagram iii) Flow chart of process.   **(6)**

    (b) i) What are special steels? Explain the properties and applications of any one type

       of special steel.   **(3)**

      ii) Name the type of microscopic corrosion affecting Alpha brass and explain the
        conditions under which it occurs.   **(2)**

67598   Page **1** of **2**

(c) Calculate the percentage atom economy of the following reactions with respect to the target product Maleic Anhydride and state which is the greener reaction.

a) $C_6H_6 + 4.5 O_2 \rightarrow$ [Maleic Anhydride structure] $+ 2 H_2O + 2CO_2$

Maleic Anhydride

b) [structure with H_3C, CH_3, $C=C$, H, H] $+ 3O_2 \rightarrow$ [Maleic Anhydride structure] $+ 3 H_2O$

(4)

Maleic Anhydride

4. (a) How do the following factors affect the rate of corrosion:
   i) Conductance of corroding medium   ii) Relative area of anode and cathode
   iii) Temperature   **(6)**
   (b) i) Give the traditional and green synthesis of adipic acid and compare the starting
   materials used.   **(3)**

   ii) What are the properties of composites which make them popular engineering material.
                                                                                                                       (2)

   (c) Give the composition and properties of **any two**:
   i) German Silver   ii) Magnalium   iii) Wood's Metal   **(4)**

5. (a) A gas has following composition by volume: $H_2 =10\%$, $C_2H_6=25\%$, $CO=16\%$, $H_2O=20\%$,
   $C_2H_2= 15\%$, $CH_4=4\%$, $O_2 = 4\%$ and the rest is CO_2. Calculate the volume of air supplied
   per $2m^3$ of the gas at STP. Also calculate the weight of air to be supplied at STP per $2m^3$
   of the gas. (Average molar mass of air at STP =28.94gm).   **(6)**
   (b) i) Part of an iron nail corrodes inside a piece of wood. Identify the type of corrosion and
   explain the mechanism with a labelled diagram and reactions.   **(3)**

   ii) What is shape memory effect?   **(2)**

   (c) The Bhopal Gas Tragedy was one of the worst industrial disasters. With reactions explain
   the synthesis of the intermediate which caused the tragedy and the final product. Also give
   the alternative route of synthesis of the final product explaining the green chemistry
   principle being adhered to.   **(4)**

6.   (a) What are the steps involved in powder metallurgy? Name the different moulding
   techniques used. Explain any one method of moulding with detailed diagram.   **(6)**

   b) (i) How are particle reinforced composites different from fibre reinforced composites? **(3)**
   (ii) Distinguish between galvanizing and tinning.   **(2)**
   (c) What is knocking? Explain the role of antiknocking agents.   **(4)**

_____