

- N.B. : (1) Question No. 1 is compulsory.
 (2) Attempt any **four** questions from Q. Nos. 2 to 7.
 (3) **All** the sub questions pertaining to a main question should be attempted **together**.
 (4) At. Wts. : C = 12, O = 16, S = 32, N = 14, H = 1, Cl = 35.5, Ba = 137.3.

1. Answer any **five** :- 15
(5x3)
- Can octane rating of a fuel be more than 100 ? Explain.
 - What is Alclad ? Why is it done ?
 - What are composite materials ? Give their classification.
 - Give the reaction of "Trans esterification". Mention why is it required ?
 - List the characteristics of an ideal catalyst.
 - 1.5 g of a sample of coal was taken for C and H estimation by combustion method. The increase in weights of tube containing anhydrous CaCl_2 and bulb containing KOH was found to be 1.25 g and 4.88 g respectively. Calculate the percentage of C and H.
 - Calculate the percentage atom economy for the following reaction with respect to Allyl chloride.

$$\text{CH}_3 - \text{CH} = \text{CH}_2 + \text{Cl}_2 \longrightarrow \text{Cl} - \text{CH}_2 - \text{CH} = \text{CH}_2 + \text{HCl}$$

Allyl chloride
 - Three Faraday of electricity is passed through aqueous solution of AgNO_3 , NiSO_4 , CrCl_3 kept in three vessels using inert electrodes. What is the ratio in moles in which the metals Ag, Ni, Cr will be deposited ?
2. (a) What is powder metallurgy ? What are the steps involved in it ? Mention the aim of each step. Give the advantages and disadvantages of powder metallurgy. (Two each). 5
- With a neat labeled diagram explain the anodic protection method. 5
 - What mass of chlorine can be produced by the electrolysis of molten NaCl with a current of 1.2 A for 18 min. The electrode reaction is $\text{Cl}^- \longrightarrow \text{Cl}_2 + 2\text{e}^-$. 5
3. (a) What is cracking ? Give the schematic diagram of moving bed catalytic cracking and mention the temperature, pressure, catalyst used and the quality of gasoline obtained by this method. 5
- What is catalysis ? Give the various types with one example each. 5
 - 1.95 g of a coal sample was taken for nitrogen estimation by Kjeldahl method. The ammonia liberated required 9.5 ml of 0.4N H_2SO_4 for neutralization. The same sample of coal weighing 1.5 g in a Bomb calorimeter experiment produced 0.35 g of BaSO_4 . Calculate percentage of N and S. 5
4. (a) Giving conventional and green chemistry route of production of Adipic acid, highlight the green chemistry principles addressed in this case. 5
- What are the necessary conditions for electrochemical corrosion ? Give the mechanism of electrochemical corrosion in acidic medium with diagram and electrode reactions. 5
 - With a suitable example explain application of green chemistry in waste utilization.

5. (a) Explain the adsorption theory of Catalysis. 5
 (b) Explain in brief the various tests done under proximate analysis of coal giving the significance of each. 5
 (c) A coal sample has the following composition by weight. C = 84 %, H = 6 %, S = 1 %, O = 8 % and remaining ash. Calculate the minimum quantity of air required both by weight and volume for the complete combustion of 2 kg of this fuel. (Mol. Wt. of air = 28.94). 5
6. (a) How does a catalyst affect the establishment of equilibrium state and activation energy of a reaction ? Explain with necessary graphs. 5
 (b) What are ceramic powders ? Explain the method of manufacture of any one ceramic powder. 5
 (c) What are metallic coatings ? Name the different ways of application of metallic coatings. Distinguish between anodic coating and cathodic coating. 5
7. (a) What are structural composites ? Give their types and applications. 5
 (b) Write short notes on :-
 (i) Paints (Definition and most important two ingredients with their job and example). 2.5
 (ii) Commercial brass 2.5
 (c) What are fibre reinforced composites ? Explain their types. 5
