Time: 2 hours **Max. Marks 60**

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N.B. 1. Question No.1 is compulsory.

2. Attempt any three from Q.2 to Q.6

3. Draw a neat diagram and write chemical reactions where necessary.

Q.1 Atomic weights: H = 1, C = 12, N = 14, O = 16.

a Define octane number, knocking and cetane number.

b Differentiate between Galvanizing and Tinning.

c Explain the principle "Design degradable products" of green chemistry.

d What are the energies associated with molecule that are useful for its spectroscopic study?

e Define Standard Electrode potential, Reference electrodes, Electrolytic Cell.

f Why does aluminium even though placed higher in galvanic series show extra resistant to corrosion?

g A coal sample was subjected to ultimate analysis.3 g of coal sample on combustion in bomb calorimeter produced 0.45g of $BaSO_4$.Calculate the % of sulphur.

Q.2 a What is Electrochemical corrosion? Explain the mechanism of Electrochemical corrosion by the evolution of hydrogen. 6

b Calculate higher and lower calorific value of coal sample containing C-90%, O-5%, H-8%, S-1.5%, N=5% and the remaining is ash. 5

Explain conventional and greener pathways for the synthesis of Carbaryl.
Highlight the Green Chemistry principle involved.

c What are anti-knocking agents? Write a note on unleaded petrol and role of catalytic converter. 4

Q.3 a Define corrosion and explain the basic reason due to which, most of metals corrode. 6

How does following factors affect rate of corrosion?

(i) pH

(ii) Relative areas of anodic and cathodic part of metal.

b Explain conventional and greener pathways for the synthesis of Carbaryl. Highlight the Green Chemistry principle involved. 5

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c Write the cell reactions and calculate standard emf of the following reaction: 4
Zn/Zn^{2+} (aq.1M) //Ag^{+} (aq1M) /Ag(s). Calculate the emf of the cell at 25^0C.
Given: $E^0_{Zn/Zn2+}$ = -0.73 V and $E^0_{Ag+/Ag}$ = +0.83 V

Q.4 a Calculate the volume and weight of air required for complete combustion of $1m^3$ of 6
gaseous fuel having the following composition: CO = 10%, C_2H_4 = 4%, CH_4 =35%, N_2 = 2%, H_2 = 45%, CO_2 = 2%, Remaining Ash.(Molecular weight of air =28.949).

b What is Biodiesel? Give transesterification reaction in the preparation of biodiesel. 5
Also write the advantages of biodiesel.

c Explain Intergranular corrosion with the help of a diagram. 4

Q.5 a What is Fluorescence and phosphorescence? Explain the phenomena of 6
Fluorescence and phosphorescence with the help of Jablonski diagram.

b Calculate the percentage atom economy for the following reaction with respect to 5
acetanilide.
$C_6H_6 + Cl_2 \rightarrow C_6H_5Cl + HCl$
Given Atomic Weights: C = 12, H = 1, O = 16, Cl = 35.5

c Explain impressed current cathodic protection of corrosion control. 4

Q.6 a What is an electrochemical cell? Give construction and working of Standard 6
Hydrogen Electrode with the help of diagrams and reactions.

b 2.5 g of coal sample was taken in a silica crucible and heated in an oven maintained 5
at 110^0 C for one hour. The weight after heating was 2.41g. The same sample was analysed for volatile matter and the weight obtained was 1.98 g, the sample was further heated to get the fixed weight of 0.246 g. Calculate the percentage results of the above analysis.

c What is the selection rule? Distinguish between allowed and forbidden transition. 4

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