**Sample Questions for reference (Engineeri.ng Chemistry)**

**ENERGY**

* Discuss the necessity of renewable energy resources in India (5 points). State any two challenges in their implementation.
* What is calorific value? Explain the process of experimental determination of % carbon and % Hydrogen using combustion technique (diagram not expected).
* Discuss the process of refining of petroleum from crude oil (diagram not required). State the advantages of catalytic cracking over thermal cracking (any 4).
* What is unleaded petrol? State its advantages.
* State: a) Octane number b) Cetane number
* A sample of coal contains: C = 90 %, H = 5 %, O = 2 %, S = 2 %, N = 1 %. Calculate, GCV and LCV of coal in cal/g.
* An air dried coal weighing 3.5 gm was taken for volatile matter determination. After loss of volatile matter the coal sample weighed 2.03 gm. If it contains 5 % moisture find the % Volatile matter present in this coal sample.
* State any four important characteristics of an ideal fuel.
* A coal sample contains, C = 80 %, H2 = 4 %, O2 = 3 %, N2 = 3 %, S = 2 %, Ash = 4 %, Moisture = 4 %. Calculate the quantity of air required for the complete combustion of 3 kg of coal, if 30 % excess air is supplied.
* Explain the construction and working of solar photo-voltaic cell with neat labeled diagram.
* Calculate GCV of coal sample containing C = 70%, H = 8%, S = 3%, N = 8%, ash = 5%
* 1.8 gram of coal sample is heated in combustion tube experiment. The vapour released during experiment was absorbed in CaCl2 tube and KOH bulb. The increase in mass of CaCl2 tube and KOH bulb was found to be 0.8 g and 2.96 g respectively. Calculate the percentage carbon in coal sample.
* A coal has C = 72%, H = 8%, N = 6%, S = 3%, O = 5% and remaining ash Calculate the amount of air required for combustion of 5 Kg of coal.
* Explain construction and working of flat plate collector. Give to advantages.
* Knocking b) Octane number c) Gross calorific value d) Centigrade heat unit e) Cetane number
* Explain five advantages and challenges in utilizing solar energy. Explain the traditional and green way to synthesize Indigo dye. Identify which principle of Green Chemistry is justified.
* 2.2 gram of coal in Kjeldahl’s method gave NH3 gas which required 15 ml of 0.5 N H2SO4 for neutralization. 1.8 g of coal in bomb calorimeter experiment gave 0.35 gram of BaSO4 residue. Calculate the % N and % S of coal.

**SPECTROSCOPY**

* What is conductometric titration? Explain the determination of equivalence point for titration of weak acid and strong base
* What is finger print region in IR spectroscopy? Write IR frequencies of following functional group.
* Carbonyl group C=O bond b) Ether C-O bond c) alkane C-H bond
* What are frequencies for near, mid and far IR spectroscopy? What is the condition for a molecule to absorb IR frequencies?
* Why there is a need of standardization of pH electrode? Discuss the process of standardization of pH meter using various buffer solutions.
* State five applications of UV-Visible spectroscopy. Give five limitations of Beer-lambert’s law.
* Give the IR frequencies of following :
  1. C-Br (in haloalkanes) b) N-H stretching (in amines) c) C-O stretching (in ethers) d) =C-H stretching (in alkenes) e) CN stretching (in cyanides)
* Calculate the fundamental modes of vibrations for the following molecules:

a) Benzene b) Carbon dioxide c) Phenol d) Water e) Anisole

* Explain the importance of tetra-methylsilane in NMR spectroscopy. How protons are classified as equivalent and non-equivalent protons in 1H-NMR spectroscopy?
* Explain the principle involved in conductometric titration. When HCl is titrated with NH4OH solution, having 0.1 N concentrations each, explain the nature of graph of conductance VS volume of base added.
* 6.5 x 10-4 M solution of an absorbing species is placed in a cell of path length 1 cm. Transmittance measured is 62 %. Calculate the absorbance and molar absorptivity of the solution?
* With the help of schematic diagram explain construction and working of single beam spectrophotometer.
* State Beer-Lambert’s law. Calculate the molar absorptivity of 2.3 x 10-4 mol dm-3 solution which absorbs 60 % of incident light measured in cuvette of 1 cm path length.
* Calculate the number of fundamental modes of vibration for:

1. Toluene b) Benzene

* The transmittance of 2.5 x 10-4M solution was found to be 80 % in path length of 1 cm.
* Calculate the a) absorbance b) Molar absorptivity c) % T for the path length of 2 cm.
* What is Finger Print region in IR spectroscopy, explain its significance.
* Explain with the help of suitable graphical diagram, Coductometric titration of acetic acid versus ammonium hydroxide.
* Explain with the help of graph the conductometric titration of mixture of strong acid and weak acid against strong base.