



KEEPING MOBILE PHONE/SMART WATCH, EVEN IN 'OFF' POSITION, IS TREATED AS EXAM MALPRACTICE

Answer any **TEN** Questions

(10 X 10 = 100 Marks)

1. a) Heat supplied to a Carnot engine is 2097.8 kJ. How much useful work can be done by an engine which works between 0 °C and 100 °C. [5+5]
b) If 5.0 g of substance 'A' decomposes for 56 minutes, the mass of unreacted 'A' remaining is found to be 0.375 g. What is the half-life of this reaction if it follows first-order kinetics.
2. a) Identify the state and path functions: U, W, Q, H. A gas expands at a constant temperature. Apply the first law and arrive at an expression for the work done
i) in a reversible isothermal expansion [10]
ii) in a free expansion
iii) if the gas expands against a constant pressure.
b) Out of these three processes, which one would yield the largest amount of work done? Support your answer with a suitable plot.
3. Explain at least one application of coordination complexes in the area of analytical chemistry, metallurgy, catalysis, paint industry and estimation of hardness of water. [10]
4. Provide an overview on the acetyl salicylic acid emphasizing on its synthetic mechanism and application. [10]
5. a) "*Organometallic compounds are generally hydrolyzed via nucleophilic attack by water*". Justify this above statement. Also, discuss any three applications of organometallic compounds [5+5]
b) Which of the following intermediates have planar and pyramidal molecular geometries? Explain with diagrams.
i) Alkyl carbocation, ii) alkyl carbanion and iii) alkyl free radical
6. a) A cell using copper, cadmium electrodes, copper sulphate and cadmium sulphate solutions is constructed. The cell EMF is determined to be 0.79V. Concentration of copper sulphate solution is 0.5M. Determine the concentration of cadmium sulphate solution used. Standard reduction potential values of copper and cadmium are 0.34 V and -0.4 V respectively. [5+5]
b) Explain how the combination of H₂ and O₂ in a fuel cell leads to energy generation with diagrammatic representation. Mention its applications.
7. a) Identify an electrical energy source for industrial utility that uses a solid electrolyte. Describe its functioning with a diagram. [5+5]
b) Beet root extract is used in a solar cell. Elaborate its functioning with a diagram.
8. a) Discuss the synthetic procedure of ABS and Bakelite polymer. [5+5]
b) Explain with an appropriate mechanism, how polyacetylene could be a conducting polymer?

9. Elaborate on thermoplastics and thermosetting plastics. Give two instances of thermoplastics and thermosetting plastics characteristics and engineering applications. [10]
10. Discuss the working principle, limitations and applications of UV-Visible spectrophotometry. [10]
11. Identify and discuss an appropriate softening method that is suitable for both acidic and alkaline water with chemical equations and neat sketch. [10]
12. a) A sample of coal contains C = 93%; H = 6% and ash = 1%. The following data were obtained when the above coal was tested in bomb calorimeter. Weight of coal burnt = 0.92 g, Wt. of water taken = 550 g, water equivalent of calorimeter = 2200 g, rise in temperature = 2.42 °C, fuse wire correction = 10.0 cal, acid correction = 50.0 cal. Calculate gross and net calorific value of the coal, assuming the latent heat of condensation of steam as 580 cal/g. [5+5]
- b) Illustrate with a schematic diagram the principle of impressed current cathodic protection

