



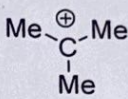


Time: Three Hours

Max. Marks: 100

KEEPING MOBILE PHONE/ELECTRONIC DEVICES EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE  
 DON'T WRITE ANYTHING ON THE QUESTION PAPER

 Answer ALL Questions  
 (10 X 10 = 100 Marks)

1. "Catalysis industry is contributing in global GDP", validate the statement. Explain the mechanism for the generation of oxygen from hydrogen peroxide utilizing bio-catalytic process.
2. Evaluate the nature of bonding structure and magnetic behaviour of the following complexes:  
 a)  $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$  and  $[\text{Cr}(\text{CN})_6]^{3-}$  [5]  
 b)  $[\text{Co}(\text{CN})_6]^{3-}$  and  $[\text{CoF}_6]^{3-}$  [5]
3. Analyze and arrive at the stability order of the organic reactive intermediates mentioned as below:
- a)  (i)  (ii)  $\text{CH}_2=\text{CH}-\text{CH}_2^-$  (iii)  $(\text{CH}_3)_2\text{CH}^-$  (iv) [5]
- b)  $\text{CH}_3\text{CH}_2^+$  (i)  $(\text{CH}_3)_2\text{C}^+-\text{CH}=\text{CH}-\text{CH}=\text{CH}_2$  (ii)  (iii)  $(\text{CH}_3)_2\text{C}^+-\text{CH}=\text{CH}_2$  (iv) [5]
4. Identify and elaborate the working mechanism with a neat sketch of an energy device that can supply water to the astronauts in space vehicles and also state its 'pros and cons'.
5. "Nanomaterials are so different and intriguing", justify the statement. Suggest a chemical method for the synthesis of nano-silica.
6. Illustrate the principle, instrumentation and applications of UV-Visible spectroscopy with appropriate sketches.
7. Elaborate on the water purification processes using ion-exchange resins with the help of an appropriate diagram and compare the quality of resulted water with 'RO' treated water.
8. a) Calculate the change in entropy of 1.2 moles of an ideal monoatomic gas that expands reversibly and isothermally from a volume of  $6 \text{ dm}^3$  to  $18 \text{ dm}^3$  at  $30^\circ\text{C}$ . [5]  
 [Given:  $R = 8.314 \text{ J/K-mol}$ ]
- b) A first order reaction takes 6 hours for its 90% completion. Calculate the time required to complete its 75% only. [5]

9.a) Differentiate thermoplastic and thermosetting polymeric resins and discuss on the synthesis and applications of phenol-formaldehyde resin.

[OR]

9.b) "Doping techniques are essential to improve the conductivity of polymers", corroborate the statement with relevant examples.

10.a) Illustrate the appropriate corrosion protection techniques utilized in ship and crude oil industries.

[OR]

10.b) Explain a suitable method to determine the calorific value of a coal sample. Subsequently, calculate the gross and net calorific values in **Joules/gm** of an anthracite coal sample (C = 90%, H = 8% and ash = 1%) while considering the following experimental observations:

Weight of coal sample burnt = 0.95 g

Weight of water taken = 650 g

Water equivalent of copper calorimeter = 2500 g

Rise in temperature = 4.5 °C

Fuse wire correction = 50 cal

Acid correction = 150 cal

Latent heat of condensation of steam = 587 cal/g

⇔⇔⇔ D/L/TX ⇔⇔⇔