



VIT

Vellore Institute of Technology

Final Assessment Test - April 2025

Course: BCHY101L - Engineering Chemistry
 Class NBR(s): 4301 / 4303 / 4304 / 4317 / 4320 / 4321 /
 4323 / 4327 / 4328

Slot: E2+TE2

Max. Marks: 100

Time: Three Hours

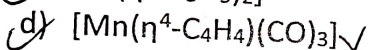
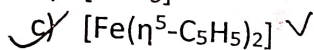
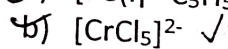
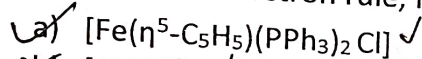
- KEEPING MOBILE PHONE/ANY ELECTRONIC GADGETS, EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE
 ➤ DON'T WRITE ANYTHING ON THE QUESTION PAPER

Answer ALL Questions
 (10 X 10 = 100 Marks)

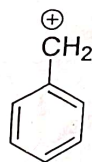
1. a) Explain the Carnot cycle and analyse how the temperature difference between the heat source and heat sink influences the efficiency of a heat engine.

b) Describe the role of a biocatalyst with a proper mechanism, in protecting human cells from oxidative damage caused by reactive oxygen species.

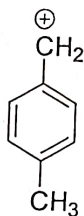
2. Using the 18-electron rule, find the stability of the following metal complexes.



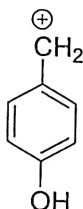
3. Arrange the following carbocations based on their stability and justify. Explain any two factors which influence the stability of the carbocation.



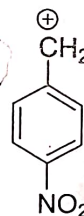
I



II



III



IV

4. Describe the intercalation mechanism of the battery used in a laptop during the charging and discharging processes. Explain the benefits and drawbacks of the battery.

5. Classify conducting polymers. How can the conductivity of polyacetylene be improved? Discuss with proper mechanism.

6. With a neat diagram explain the principle and various electronic transitions involved in UV-visible spectroscopy. How does chromophore and auxochrome effects the λ_{max} .

7. Using a neat diagram explain in detail a water softening method which can chemically soften both acid and alkaline water. List its pros and cons.

8. a) One mole of an ideal gas undergoes a reversible expansion from a volume of 4 dm^3 at a temperature of 40°C to a volume of 8 dm^3 at a temperature of -10°C . Calculate the entropy change for the process. Given $C_v/R=3/2$.

b) If 10.0 g of substance 'A' decomposes over 60 minutes, and the mass of unreacted 'A' remaining is 2.0 g , calculate the half-life of the reaction if it follows first-order kinetics.

9. a) Distinguish between thermoplastics and thermosetting plastics, providing suitable examples. Explain the synthesis and applications of a polymer used in the manufacturing of electric switch-boards.

[OR]

9. b) Discuss how the properties of nanomaterials differ from those of bulk materials? Explain a method for converting silicon precursor into nanosilica.

10. a) i) Describe a suitable method for converting seawater into potable water and discuss its advantages.
ii) Explain the available techniques which prevents corrosion of a metal by turning the metal into a cathode.

[OR]

10. b) i) Describe a suitable method for determining the calorific value of a solid fuel.
ii) A sample of coal containing 75% C, 18% H, and 7% ash is tested in a Bomb calorimeter. The following results were obtained:

- Weight of coal burnt = 1.2 g
 - Weight of water taken = 1200 g
 - Water equivalent of Bomb & calorimeter = 3000 g
 - Rise in temperature = 3.0°C
 - Cooling correction = 0.03°C
 - Fuse wire correction = 10 calories
 - Acid correction = 60.0 calories
 - Latent heat of condensation of steam = 580 cal/g
- Calculate the Higher Calorific Value (HCV) and Lower Calorific Value (LCV)