Final Assessment Test – June 2023

VIT Vellore Institute of Technology

Course: BCHY101L - Engineering Chemistry

Class NBR(s): 4476 / 4478 / 4543 / 4545 / 4547 / 4611 / 4740 / 4613

Slot: B1+TB1

Time: Three Hours

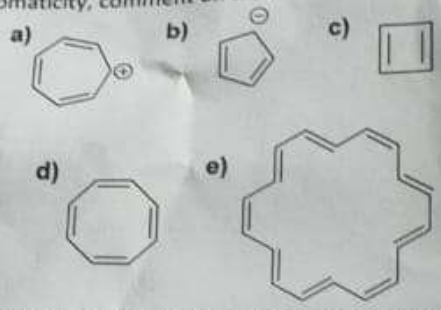
Max. Marks: 100

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

Answer any TEN Questions

(10 X 10 = 100 Marks)

1. Describe the first and second laws of thermodynamics with appropriate expressions and examples. Derive the expression for work done in an isothermal expansion.
2. Predict the hybridization, geometry, magnetic property and crystal field stabilization energy (CFSE) of the anionic complexes $[Co(CN)_6]^{3-}$ and $[CoF_6]^{3-}$.
3. How are the aromatic, anti-aromatic and non-aromatic compounds differentiated? According to the aromaticity, comment on the stability of the following molecules:



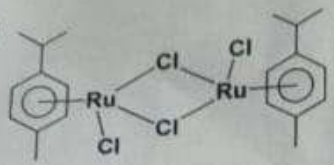
4. Elaborate on the suitable methods used for the preparation of polycrystalline and single-crystal silicon materials from the impure SiO_2.
5. What are the different general approaches available for the fabrication of nanomaterials? Explain the preparation of nanoparticles by sol-gel process.
6. What is required for an organic molecule to absorb UV radiation? Explain the possible electronic transitions and the factors influencing the absorption of UV-Visible light.
7. Discuss the working principle chemistry and re-generation of ion-exchange resins employed in the water treatment process.
8. "Some polymers conduct electricity from one end of the polymer chain to the other end." How is this achieved efficiently? Explain the mechanistic aspects and the factors influencing this.
9. Discuss the significance and working principle associated with sacrificial anodic protection and impressed current cathodic protection methods.
10. a) The decomposition of dimethyl ether, $(CH_3)_2O$ at 510 °C is a first-order process with a rate constant of $6.8 \times 10^{-4}\ s^{-1}$ as given below: **[5]**

$$(CH_3)_2O(g) \rightarrow CH_4(g) + H_2(g) + CO(g)$$

If the initial pressure of $(CH_3)_2O$ is 135 torr, what is its pressure after 1420 sec?

b) Find out the oxidation state of the metal, number of valance electrons, and stability of the following organometallic complexes: **[5]**

a)



b)

[5]

11. a) Calculate $E^{\circ}_{Cu^{2+}/Cu}$, if $E_{Cu^{2+}/Cu} = 0.296$ V and $[Cu^{2+}] = 0.015$ M. at 27 °C [5]

b) Briefly discuss the factors affecting the stability of the free radicals. [5]

12. a) A sample of coal containing 80% C, 15% H and 5% ash is tested in a bomb calorimeter. The following results were obtained. [5]

Weight of coal burnt = 0.98 g
Weight of water = 1000 g
Water equivalent of bomb and calorimeter = 2500 g
Rise in temperature = 2.5 °C
Cooling correction = 0.02 °C
Fuse wire correction = 8.0 calories
Acid correction = 50 calories
Assuming the latent heat of condensation of steam as 580 cal/ g, calculate the HCV and LCV of the fuel.

b) Is the reverse osmosis process superior to other water purification techniques for potable water? Justify. [5]

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