



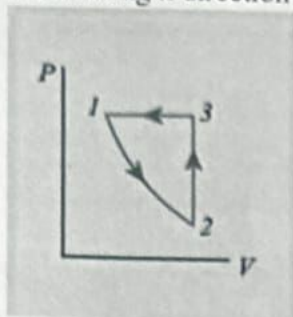
Final Assessment Test (FAT) – June 2022

Programme	B.Tech	Semester	Winter Semester 2021-22
Course Title	ENGINEERING CHEMISTRY	Course Code	BCHY101L
Faculty Name	Prof. Dr.Sujoy Sarkar	Slot	A1+TA1
Time	3 Hours	Class Nbr	CH2021222300065
		Max. Marks	100

Section A (10 X 10 Marks)

Answer any 10 questions

1. (i) Draw (with explanation) the same cyclic process qualitatively in the V-T diagram where T is taken along x direction and V is taken along y-direction. (6 marks) [10]



- (ii) An inventor claims to have invented a device which absorbs 2500 J of heat and produces 2000 J of work. If the heat sink for the device is ice water (32 F), what would be the minimum source temperature? (4 marks)
2. i) Nitrous oxide, N_2O , can be decomposed thermally. The following values for the rate constant k were determined at the following temperatures: [10]

k [$cm^3/(molecule \cdot second)$] $T(K)$

6.79×10^{-16} 2056

8.38×10^{-16} 2095

1.03×10^{-15} 2132

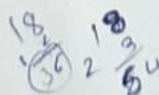
1.39×10^{-15} 2173

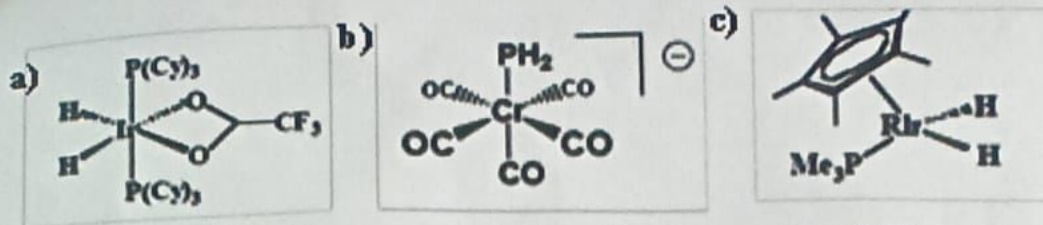
Does this reaction follow the Arrhenius equation? What is the estimated pre-exponential factor or? (use graph paper if needed) (6 marks)

- ii) What is Lineweaver-Burk Plot? What information can be extracted from this plot? Explain (4 marks)
3. i) Show that the structure of $[Cu(NH_3)_4]SO_4$ using VBT can't be defined. (3 marks) [10]

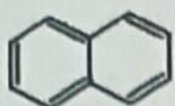


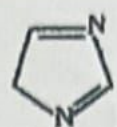

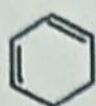
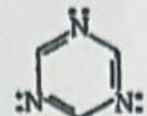



ii) $[PdCl_4]^{2-}$ is square planar and $[NiCl_4]^{2-}$ is tetrahedral. In terms of CFSE diagram explain their variation in stability and property. (4 marks)

- iii) Which of the following molecule/s do/does not obey 18 electron rule? [Ir (77); Cr(24); Rh (45)] (3 marks)

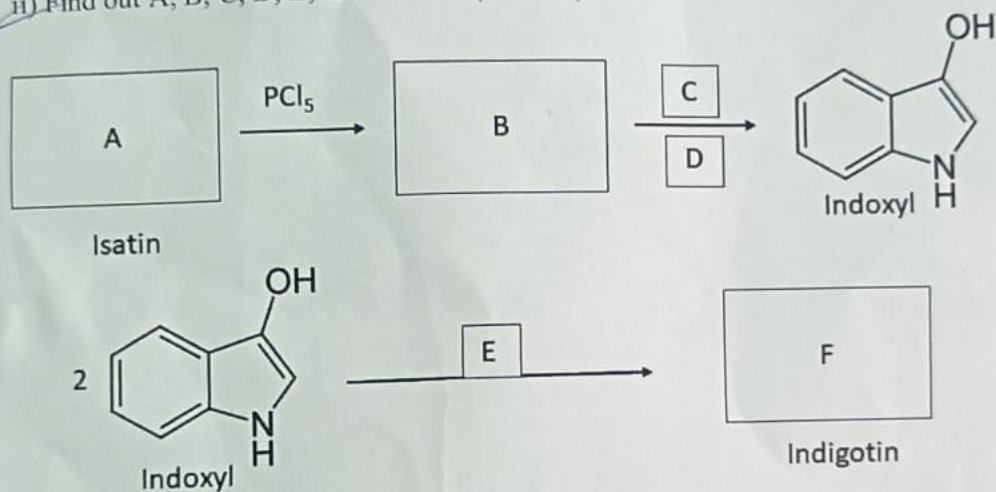




4. (i) Determine if the following compounds are Aromatic, Anti-aromatic or NOT Aromatic (6 marks) [10]

(a)		(b)	$C_8H_8^{-2}$	(c)	
(d)		(e)		(f)	
(g)		(h)		(i)	$C_3H_3^{+1}$
(j)		(k)		(l)	

ii) Find out A, B, C, D, E, and F (4 marks)



5. i) Calculate E°_{cell} and ΔG° for the reaction $- \Delta G^\circ = nFE^\circ$

$2Br^-(aq) + F_2(g) \rightarrow Br_2(l) + 2F^-(aq)$

Given the following reduction potentials:

$Br_2 + 2e^- \rightarrow 2Br^-$; $E^\circ = 1.06 \text{ V}$

$F_2 + 2e^- \rightarrow 2F^-$; $E^\circ = 2.87 \text{ V}$

Is the reaction spontaneous? (4 marks)

ii) If you want to prepare n-type and p-type semiconductor from an intrinsic semiconductor. (4 marks)

What are the doping materials will you preferred and why?

- iii) A device that was used by NASA in the space shuttle for the electrical power system. Draw the structure of the cell. (2 marks)
6. i) Write down the difference between primary, secondary batteries and supercapacitor. (6 marks) [10]
- ii) How does Si-based solar cells work? Explain with suitable drawing. (4 marks)
7. (i) Write five difference between Thermosetting and Thermoplastic polymers with examples. (6 marks) [10]
- (ii) How can you increase the conductivity of PANI- discuss in detail. (4 marks)
8. i) Discuss the different types of composite materials with suitable examples. (4 marks) [10]
- ii) Discuss the AB type of crystals with examples. (4 marks)
- iii) Write down advantages and disadvantages of ball-milling process. (2 marks)
9. i) Determine the nature of A, B, C, and D and related transitions based on the corresponding wavelengths [10]

S. No.	Materials	Wavelength
1.	A	125 nm
2.	B	150-250 nm
3.	C	300-450 nm
4.	D	500-700 nm

- (4 marks)
- ii) Explain red shift and blue shift with suitable example. (3 marks)
- iii) Estimate the crystallite size of the given nano material using p-XRD data: Peak position $2\theta = 21.61^\circ$, FWHM of sample = 2.51° , $k = 0.9$ and $\lambda = 1.5406$ Å (3 marks)
10. i) In electron microscopy, electron is used as source instead of light- explain the reason behind it. (4 marks) [10]
- ii) When electron beam strikes to the sample in the Scanning Electron Microscopy (SEM), what are the different types of emission observed and to detect that what are the detector present inside the instrument. (6 marks)
11. i) To make the water soft, ion exchange resin and mixed bed deionizers are equally active. Discuss the regeneration process of these methods. (6 marks) [10]
- ii) Industrial waste water with biological pollutants can be cleaned using reverse osmosis method which is not possible using ion exchange method- justify this statement. (4 marks)
12. i) Israel, Saudi Arabia are surrounded by sea and they are converting the sea water into drinking water. Explain the method by which the sea water is converting into drinking water. (6 marks) [10]
- ii) A gas is poisonous but heavily used in the fire extinguisher. Discuss the engineering of the gas detector. (4 marks)



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