Post Graduate Teaching Department of Chemistry

(An Autonomous Department)

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur

End Semester Examination Winter-2022

M.Sc. (Chemistry)- Physical Chemistry (3T1)

Semester – III (Special Paper -I)

Time: - 3 Hours Maximum Marks: 60

Instructions: -

1) Solve either 'EITHER' part or 'OR' part.
2) Draw neat well labelled diagram wherever necessary.
3) All questions from are compulsory and carry equal marks

Q. 1	A)	Compare microcanonical, canonical and grand canonical ensembles on the basis of Thermodynamic environment.	4M
	B)	Derive the expression for translational partition function	4M
	C)	Calculate the vibrational partition function of molecular hydrogen at 300 K assuming it to be harmonic oscillator. (Given: W=4405 cm^{-1})	4M
		OR	
	D)	Derive the expression for rotational partition function in case of heteronuclear diatomic and unsymmetrical linear polyatomic molecules. Discuss the lose where characteristic rotational temperature is much small than T.	4M
	E)	Write a note on law of equipartition of energies in terms of partition function.	4M
	F)	Estimate the rotational partition function of ethene $H_2C = CH_2$ *at* 298 K The rotational constant are A=4.828, B=1.0012, C=0.8282 cm^{-1}	4M
Q. 2	A)	Discuss the effect of light at semiconductor solution interface.	4M
	B)	Discuss the importance of oxygen depletion and hydrogen evolution in electrocatalytic reactions	4M
	C)	Write a note on electrocardiography	4M
		OR	
	D)	Give detailed account of importance of oxygen reduction and hydrogen evolution reactions.	4M
	E)	Write a note on Hodges-Huxley equation	4M
	F)	What is electrocatalysis? Discuss any one example of electrocatalytic activity	4M
Q.3	A)	Discuss the kinetics and mechanism of oscillatory autocatalytic reactions? Why these are called as feedback reaction?	4M
	B)	Describe the detail accounts of flash photolysis method.	4M
	C)	Discuss the mechanism of decomposition of acetaldehyde.	4M
		OR	

	D)	Describe in detail the kinetics of hydrogen-bromine reaction.	4M
	E)	Consider a following branched chain reactions $$A \xrightarrow{k_1} R$$ $$R + A \xrightarrow{k_2} P + \propto R$$ $$R \xrightarrow{k_3} Destruction$$ Derive the expression for finding the value of [R] and also discuss various cases.	4M
	F)	Write a note on stop flow method.	4M
Q.4	A)	What is Photoluminescence? Describe the detailed explanation of Jablonski diagram	4M
	B)	Explain the detail account of Stern-Volmer relation.	4M
	C)	Explain photochemical oxidation and photochemical substitution reaction with suitable example OR	4M
	D)	Discuss the mechanism of photoexcited donor and acceptor system.	4M
	E)	Write a note on i) Photodimerization ii) photosensitization	4M
	F)	What is chemiluminescence? Describe the mechanism of chemiluminescence in anion-cation reactions.	4M
Q. 5	A)	Write a note on ortho and para hydrogen	3M
	B)	Explain in detail Threshold membrane phenomenon	3M
	C)	Give detail accounts of relaxation methods	3M
	D)	Discuss the photochemistry of ozone layer depletion in our atmosphere.	3M

@ All the Best @
