PSCCHT03 - Physical Chemistry

P. Pages : 2

Time : Three Hours

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GUG/W/23/11185

Max. Marks : 80

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Notes : 1. All questions are compulsory and carry marks as indicated.

1. a) i) Prove that eigen values of a Hermitian operators are real. **8**

   ii) What are the postulates of quantum mechanics.

   b) Derive an expression for the energy of a rigid rotor using the Schrodinger wave equation. **8**

<div align="center">OR</div>

   c) Which of the following function is eigen functions of the operator (d/dx). **4**
   i) e^{ikx} ii) coskx
   iii) K   iv) KX

   d) Describe the properties of well behaved wave function. **4**

   e) Explain one dimensional simple harmonic oscillator. **4**

   f) Write application of Schrodinger wave equation for 3-dimensional box. **4**

2. a) Derive Maxwell relations and give an application of one of them. **8**

   b) What is meant by chemical potential? How does chemical potential vary with temperature and pressure? Derive the Gibbs Duhem equation. **8**

<div align="center">OR</div>

   c) Derive condition of exactness of pfaff differential equation. **4**
   Show that $dF = \dfrac{-RT}{P^2}\, dP + \dfrac{R}{P}\, dT$ is an exact differential.

   d) What is fugacity? How fugacity can be determined? **4**

   e) What is the Residual entropy and explain it with example. **4**

   f) Derive Gibb's Duhem Mergules equation. **4**

3. a) Explain phase diagram of two components system in which the two components form a compound with incongruent melting points. **8**

   b) Describe the first and second order phase transitions and lambda line observed in liquid Helium system. **8**

<div align="center">OR</div>

c)	Explain the phase diagram of carbon system.		**4**
d)	What is phase rule? Explain degree of freedom by taking example of any system.		**4**
e)	Explain the following :		**4**

     i)   Transition point   ii)   Congruent melting point

     iii) Invariant system   iv) Degrees of freedom

f)	Discuss the phase diagram of three component system with suitable example.	**4**
4. a)	Explain transition state theory. Write application of transition state theory.	**8**
b)	Discuss the kinetics of photochemical hydrogen-bromine reaction.	**8**

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OR

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c)	Derive an expression for the rate constant on the basis of collision theory for bimolecular reaction.	**4**
d)	What is meant by the energy of Activation? Explain how energy of activation is determined with the help of the Arrhenius Equation?	**4**
e)	What is quantum yield? Give the reasons of high and low quantum yield.	**4**
f)	Derive Michaelis Menten equation.	**4**
5. a)	What is tunneling effect?	**2**
b)	What is normalized and orthogonal wave function?	**2**
c)	Define intensive and extensive properties.	**2**
d)	Explain third law of thermodynamics in brief.	**2**
e)	What is reduced phase rule?	**2**
f)	Define the terms : i) Phase ii) Component	**2**
g)	Explain photosensitizer?	**2**
h)	Explain the effect of pH on enzyme catalyzed reaction.	**2**

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