

**6 SEM TDC CHM M 1****2 0 1 6****( May )****CHEMISTRY****( Major )****Course : 601****( Physical Chemistry )**Full Marks : 48Pass Marks : 19**Time : 3 hours**

*The figures in the margin indicate full marks  
for the questions*

1. Choose the correct answer : 1×5=5
- (a) Temperature dependence of photochemical reaction is due to
- (i) primary process
  - (ii) secondary process
  - (iii) both primary and secondary processes
  - (iv) None of the above

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- (b) In chain polymers, molecular weight of polymer
- (i) equals the total molecular weight of monomer units
  - (ii) is less than the total molecular weight of monomer units
  - (iii) is greater than the total molecular weight of monomer units
  - (iv) does not depend on the molecular weight of monomer units
- (c) A catalyst increases the rate of a chemical reaction by
- (i) increasing the activation energy
  - (ii) decreasing the activation energy
  - (iii) reacting with the reactant
  - (iv) reacting with the product
- (d) At constant temperature or pressure, the phase rule equation becomes
- (i)  $F = C - P + 2$
  - (ii)  $F = C - P - 1$
  - (iii)  $F = C - P + 1$
  - (iv)  $F = C - P$

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- (e) At high temperature, the value of partition function is

- (i) 1
- (ii) 0
- (iii) less than 1
- (iv) greater than 1



2. Answer the following questions :  $2 \times 5 = 10$

- (a) Distinguish photochemical reaction from thermal reaction. 2
- (b) What do you mean by copolymerization? Mention different types of copolymers.  $1+1=2$
- (c) What are different types of catalysis? Give one example of each type.  $1+1=2$
- (d) What is triple point? How many triple points are there in the phase diagram of sulphur system?  $1+1=2$
- (e) Write Boltzmann distribution law. How can relative populations of two levels be calculated using this equation?  $1+1=2$

3. Answer any *two* of the following questions :

$3\frac{1}{2} \times 2 = 7$

- (a) (i) What is photosensitized reaction? Give one example.  $1+1=2$
- (ii) Explain the phenomenon of chemiluminescence.  $1\frac{1}{2}$

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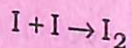
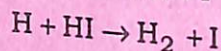
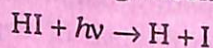
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- (b) What is quantum yield of a photochemical reaction? Under what condition its value is 1? A certain system absorbs  $3 \times 10^{18}$  quanta of radiation per second. On irradiation for 10 minutes,  $3.0 \times 10^{-3}$  moles of the reactant is found to be reacted. Calculate the quantum yield,  $\phi$ .

$$1 + \frac{1}{2} + 2 = 3\frac{1}{2}$$

- (c) The decomposition of HI takes place by the following mechanism :



Deduce the expression for rate of the reaction. What is the quantum efficiency of the reaction?

$$3 + \frac{1}{2} = 3\frac{1}{2}$$

4. Answer any one of the following questions :

- (a) Define weight average and number average molecular weight of a polymer sample. A sample of high polymer consists of 10% by weight of a macromolecule of molecular weight 10,000 and 90% by weight of a macromolecule with molecular weight 1,00,000. Calculate the number average and weight average molecular weight of the sample.

$$2 + 1\frac{1}{2} + 1\frac{1}{2} = 5$$

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- (b) (i) Define degree of polymerization and extent of reaction. 1+1=2

- (ii) Discuss the kinetics of free radical chain polymerization. 3

5. Answer any one of the following questions : 5

- (a) (i) Explain the term catalytic promoter and catalytic poison with one example each. 1\frac{1}{2} \times 2 = 3

- (ii) Discuss the effect of particle size on catalytic activity in heterogeneous catalysis. 2

- (b) What is enzyme catalysis? Derive Michaelis-Menten equation. What are coenzymes? 1+3+1=5

6. Answer any one of the following questions : 9

- (a) (i) Give statement of the phase rule. What are its limitations? Derive phase rule thermodynamically. 1+1+3=5

- (ii) What do you mean by a phase diagram? Draw and explain the phase diagram of a simple eutectic system. 1+3=4

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(b) (i) Draw the phase diagram of water and label each zone and line and explain. What do you mean by metastable equilibrium?  $3+1=$

(ii) Write Clapeyron equation. Explain its application in studying the phase diagram.  $\frac{1}{2}+1\frac{1}{2}=$

(iii) Distinguish the following :  $1\frac{1}{2}\times 2=$

(1) Cryohydric point and Triple point

(2) Congruent melting point and Incongruent melting point

7. Answer any *two* of the following questions :

$3\frac{1}{2}\times 2=$

(a) Deduce Sackur-Tetrode equation for molar entropy of an ideal monatomic gas. 3

(b) Define partition function. Derive the relationship between entropy and partition function.  $1+2\frac{1}{2}=3$

(c) Derive the expression for translational partition function for an ideal monatomic gas using particle in a box model. 3

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