6 SEM TDC CHM M 1

2014

(May)

CHEMISTRY

(Major)

Course : 601

(Physical)

Full Marks : 48
Pass Marks : 19

Time : 3 hours

The figures in the margin indicate full marks for the questions

1. Choose the correct option : 1×5=5

(a) Bioluminescence is a form of

(i) chemiluminescence

(ii) photoluminescence

(iii) electroluminescence

(iv) cathodoluminescence

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(b) A sample of polystyrene has number average molecular weight of 104000. Its number average degree of polymerization is

(i) > 1000

(ii) < 1000

(iii) = 1000

(iv) None of the above

(c) The number of phases, components and degrees of freedom corresponding to the triple points of sulphur system is

(i) (3, 2, 1)

(ii) (3, 1, 0)

(iii) (4, 2, 0)

(iv) (2, 2, 2)

(d) The adsorption theory explains

(i) homogenesous catalysis

(ii) acid-base catalysis

(iii) enzyme catalysis

(iv) heterogeneous catalysis

(e) A collection of a large number of independent assemblies, having same temperature T, volume V, and number of identical systems N is called

(i) micro-canonical ensemble

(ii) canonical ensemble

(iii) grand canonical ensemble

(iv) None of the above

2. Answer the following questions : 2×5=10

(a) What is meant by photosensitization? Give example.

(b) Distinguish between homopolymers and copolymers.

(c) Explain the action of catalytic promoters and catalytic poison.

(d) What do you mean by peritectic phase transition? Give one example.

(e) Define thermodynamic probability. Give the relationship between thermodynamic probability and entropy.

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3. Answer any *two* questions of the following : $3\frac{1}{2}\times2=7$

(a) Define quantum yield. How do you account for the low and high quantum yields in a photochemical reaction? What is laser? $1+2+\frac{1}{2}=3\frac{1}{2}$

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

$$HI + h\nu \rightarrow H + I$$

$$H + HI \rightarrow H_2 + I$$

$$I + I \rightarrow I_2$$

Find the expression for the rate of the reaction. What is the quantum efficiency of the reaction? $3+\frac{1}{2}=3\frac{1}{2}$

(c) Thermodynamically non-spontaneous reaction may also take place spontaneously in presence of light. Explain. $3\frac{1}{2}$

4. Answer *either (a) or (b)* : 5

(a) (i) Define number-average and weight-average molecular weights of polymer. A polymer sample composed of molecules of three sizes. Out of which 10 moles of first size have molecular weight 10000, 80 moles of second size have

molecular weight 50000 and 10 moles of the third size have molecular weight 100000. Calculate the number-average molecular weight of the sample. $2+1\frac{1}{2}=3\frac{1}{2}$

(ii) What is Zeigler-Natta catalyst? Give one example. $1+\frac{1}{2}=1\frac{1}{2}$

(b) (i) Discuss the kinetics of free radical chain growth polymerization. $3\frac{1}{2}$

(ii) What is glass transition temperature? Explain. $1\frac{1}{2}$

5. Answer *either (a) or (b)* : 5

(a) Explain giving examples the theories of acid-base catalysis. Discuss the efficiency of metal nano-particles in heterogeneous catalysis. $3\frac{1}{2}+1\frac{1}{2}=5$

(b) What is enzyme catalysis? Deduce Michaelis-Menten equation for enzyme catalysis. "Enzyme catalysts are highly specific." Explain. $1+3+1=5$

6. Answer any *two* questions of the following : $4\frac{1}{2}\times2=9$

(a) Derive the phase rule thermodynamically. Write the reduced phase rule equation for a condensed system. $4+\frac{1}{2}=4\frac{1}{2}$

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(b) Construct the phase diagram for Zn–Mg system from the following data :

Melting point of Zn = 419 °C

Melting point of Mg = 651 °C

A congruently melting compound Mg_XZn_Y at 15% by mass of Mg melting at 590 °C. The lowest freezing point of Zn observed is 368 °C for composition containing 3·3% Mg by mass and that for Mg at 347 °C for a composition containing 49% by mass of Mg. Determine the molecular formula of the compound Mg_XZn_Y. Comment on the stabillity of the compound Mg_XZn_Y. 2½+1+1=4½

(c) (i) "Melting point curve in the phase diagram of water shows a negative slope." Explain. 1

(ii) Discuss the phase diagram of $KI–H_2O$ system. 3½

7. Answer any *two* questions of the following : 3½×2=7

(a) What do you mean by partition function? Discuss the physical significance of partition function. Define molar partition function. 1+1½+1=3½

(b) Derive an expression for translational partition function for an ideal monatomic gas using particle in a box model. 3½

(c) Derive Sackur-Tetrode equation. 3½

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