2018

ENGG. CHEMISTRY

Paper : CY 201

Full Marks : 100

Time : Three hours

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

*Answer Q1 and **any four** from the rest.*

1. (a) Choose the correct answer :   1×5=5

    (i)   The minimum energy necessary to
    permit a reaction is —

    A.   internal energy

    B.   free energy

    C.   threshold energy

    D.   activation energy

(ii) With the increase in concentration of the reactant the rate of reaction

A. decreases

B. increases

C. remains unaffected

D. none

(iii) The cell reaction is spontaneous if the cell potential is —

A. zero

B. positive

C. negative

D. infinite

(iv) Standard hydrogen electrode has been assigned a potential of —

A. 100 volts

B. 1 volt

C. 0 volt

D. −ve voltage

(v) A catalyst increases the rate of reaction because it

A. decreases the activation energy

B. increases the activation energy

C. decreases the collision diameter

D. supplies heat to the reaction.

(b) Fill in the blanks :   1×5=5

(i) _____ defect is found in the crystals of NaCl and _____ defect is seen in the crystals of AgCl.

(ii) In mass spectroscopy, the most stable ion usually gives _____ peak.

(iii) An ethylenic group is an example of _____, while an alcoholic group is an example of _____, in terms of UV-visible spectroscopy.

(c) Explain what do you understand by Gross and Net Calorific Values.   3

(d) Write down the differences between order of a reaction and molecularity of a reaction.   3

(e) What is inductive effect ? Give two applications with examples.   1+3=4

2. (a) Deduce the rate expression for first order reaction. Also prove that the time for half decomposition of a first order reaction is independent of the initial concentration of the reactants.

3+2=5

(b) How temperature affects the rate of reaction? Draw the energy profile diagram of both endothermic and exothermic reaction with clear mention of activation energy and threshold energy.

2+4=6

(c) What are the main features of Transition State Theory.

3

(d) A Zinc rod is dipped in $0.1 (M)$ $ZnSO_4$ solution at $25°C$. Write the electrode reaction and calculate the electrode potential. $\left[E^0_{Zn^{+2}/Zn} = -0.76V \right]$

3

(e) Write down the differences between dry and wet corrosion.

3

3. (a) State Beer's law and explain how does it differ from Lambert's law.

4

(b) Describe the positional and intensity shifts of absorption maximum in UV-Visible spectroscopy with a suitable diagram.

5

(c) Why TMS is used as reference in H^1NMR spectroscopy? Draw the H^1NMR spectrum of CH_3CH_2OH and $(CH_3)_2CHOH$.

3+4=7

(d) Give a schematic diagram to represent the instrumentation of UV-visible spectrophotometer.

4

4. (a) Write short notes on SN^1 and E^1 reactions. Give two differences between SN^1 and E^1 reactions. Also, draw the energy profile diagram of SN^1 and E^1 reactions.

3+1+2=6

(b) What is Saytzeff's rule? Give example with reaction.

1+2=3

(c) What is Markovnikoff and anti-Markovnikoff rules? Give examples with reactions.

2+2=4

(d) How you define nucleophilic and electrophilic reagents? Give examples of positively and negatively charged species.

2+2=4

(e) What is carbene intermediate species? What are decomposition products of ketene and diazomethane.

1+1+1=3

5. (a) The first order decomposition of H_2O_2 in a suitable medium is characterised by a rate constant 3×10^{-2} min^{-1}. Find the time to complete one third of the reaction. 4

(b) What is reversible and irreversible cells? Explain with example. 4

(c) Describe the construction and working principle of standard calomel electrodes. 4

(d) What is emf of the following cell:

$$Zn/Zn^{+2} (0.01M) \| Ni^{+2} (0.5M)/Ni ?$$
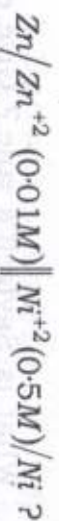
Given : Standard reduction potential of Zn and Ni electrodes are $-0.76V$ and $-0.25V$ respectively. 4

(e) Explain the process of carbonization of coal. 4

6. (a) Explain the hybridisation involved in CH_4, C_2H_4 and C_2H_2 molecules. 6

(b) What is a Catalyst? Differentiate between homogeneous and heterogeneous catalysts with suitable examples. 2+4=6

(c) What are n-type and p-type semiconductors? Give proper examples. 2+2=4

(d) Mention the properties of an ideal fuel. 4

7. (a) Give structure and examples of linear, branched and cross linked polymers. 3+3=6

(b) Write the definition of isotactic, syndiotactic and atactic polymers. Write their models or structures. 3+3=6

(c) Write preparation and application of Buna-S rubber. 2

(d) In a polymer, there are 100 molecules of molecular weight 100, 200 molecules of molecular weight 1000 and 300 molecules of molecular weight 10,000. Find M_n, M_w and PDI. 6

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