

Please check whether you have got the right question paper.

- N.B:**
1. All questions are **compulsory**.
  2. Use of log tables / non- programmable scientific calculator is allowed.

Useful constants:-

$$c = 2.99 \times 10^8 \text{ m s}^{-1} \quad h = 6.626 \times 10^{-34} \text{ Js}$$

$$N_A = 6.023 \times 10^{23} \text{ mol}^{-1} \quad R = 8.314 \text{ JK}^{-1} \text{ mol}^{-1}$$

$$1 \text{ eV} = 1.602 \times 10^{-19} \text{ J} \quad e = 1.602 \times 10^{-19} \text{ C}$$

$$m_e = 9.11 \times 10^{-31} \text{ kg} \quad m_p = 1.673 \times 10^{-27} \text{ kg}$$

$$k = 1.381 \times 10^{-27} \text{ JK}^{-1}$$

**Q.1 Attempt any five of the following.**

- |  |           |
|--|-----------|
| a) What type of information can be obtained from DTA curve?                | <b>03</b> |
| b) Explain the mechanism of production of KLL Auger electron.              | <b>03</b> |
| c) Explain the term ORD. show the nature of the ORD curve.                 | <b>03</b> |
| d) Why three electrode cell is preferred in electroanalytical experiments? | <b>03</b> |
| e) Write Sand's equation and explain the meanings of the terms involved.   | <b>03</b> |
| f) Distinguish between classical and pulse polarography.                   | <b>03</b> |
| g) Give a brief account of gamma radiography.                              | <b>03</b> |
| h) Why is neutron activation analysis the most sensitive method?           | <b>03</b> |

- Q.2**
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|--|-----------|
| a) Draw the schematic diagram of Atomic Force Microscope and explain its operation in contact mode.  | <b>05</b> |
| <b>OR</b>  |           |
| a) Explain the basic principle of Ultraviolet photoelectron Spectroscopy. What are its limitations?  | <b>05</b> |
| b) Explain the construction and working of Electron Microprobe.  | <b>05</b> |
| <b>OR</b>  |           |
| b) With the help of labeled diagrams, describe the different types of cells used in photo acoustic spectroscopy.   | <b>05</b> |
| c) An ESCA electron was found to have kinetic energy of 1072 eV when a source having wavelength of 0.989 nm was used. The spectrometer had a work function of 17.5 eV. Calculate the binding energy of the emitted electron. | <b>05</b> |

**Q.3** a) Describe the construction and working of membrane based ion selective electrode with the help of suitable example. **05**

**OR**

a) Explain the use of fused salt electrolysis in electrometallurgy with the help of suitable example. **05**

b) What are the applications of Thermo gravimetric Analysis? **05**

**OR**

b) Describe in brief the technique of evolved gas analysis. **05**

c) In a Chronopotentiometric analysis, various parameters have following values **05**

$$n = 6, D = 1.4 \times 10^{-5} \text{ cm}^2\text{s}^{-1} \quad A = 1.61 \text{ cm}^2 \quad i = 1.51 \mu\text{A},$$

Transition time = 41 sec

Calculate the concentration of the solution.

**Q.4** a) **Attempt any two of the following.**

i) Explain the difference between differential pulse polarography and square wave polarography. **05**

ii) Explain the current sampling method in square wave polarography. **05**

iii) Explain what is Adsorptive Stripping Voltammetry. How is it different from Anodic stripping Voltammetry? **05**

iv) Describe TAST polarography in detail. **05**

b) The diffusion current of  $\text{Zn}^{2+}$  ions in an unknown solution was found to be  $26.4 \mu\text{A}$ . When  $2.5 \text{ cm}^3$  of  $1 \times 10^{-3} \text{ M}$  solution of  $\text{Zn}^{2+}$  ions was added to  $25.0 \text{ cm}^3$  of unknown solution, the diffusion current increased to  $45.6 \mu\text{A}$ . Calculate the concentration of  $\text{Zn}^{2+}$  ions in the unknown solution. **05**

**Q.5 Attempt any Three of the following.**

a) Describe the different types of Radiometric titrations. **05**

b) Explain in brief the technique of Radio chromatography. **05**

c) Describe the application of GC-MS technique in environmental analysis. **05**

d) Explain the basic experimental set up used in spectroelectrochemistry. **05**

e) A 30 mg sample of an alloy containing 0.042 % manganese was irradiated in a neutron flux of  $6 \times 10^{13} \text{ n cm}^{-2} \text{ s}^{-1}$  for 45 minutes. Find the activity of the sample in disintegrations per second. **05**

Given: Natural abundance of  $^{56}\text{Mn} = 100\%$   $\sigma = 13.3 \times 10^{-24} \text{ cm}^2$

$T_{1/2}$  of  $^{56}\text{Mn} = 2.58 \text{ hr}$ .

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