

Total No. of Questions : 12]

[Total No. of Printed Pages : 4

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F. E. (Semester - I) Examination - 2009

APPLIED SCIENCE - I

(June 2008 Pattern)

Time : 3 Hours]

[Max. Marks : 100

Instructions :

- (1) Answer **any three** questions from each section.
- (2) Answers to the **two sections** should be written in **separate answer-books**.
- (3) Black figures to the right indicate full marks.
- (4) Neat diagrams must be drawn wherever necessary.
- (5) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
- (6) Assume suitable data, if necessary.

Constants : $h = 6.63 \times 10^{-34}$ J.sec.

$m = 9.1 \times 10^{-31}$ kg

$e = 1.6 \times 10^{-19}$ C

$c = 3 \times 10^8$ m/sec.

SECTION - I

- Q.1) (A) Define and explain the Vulcanization of Natural Rubber. [06]
- (B) Classify the Polymer on the basis of Heat Effect and Number of Monomers. [06]
- (C) Write short note on Biodegradable Polymer. [05]

OR

- Q.2) (A) Explain the Compounding of Polymer. [06]
- (B) Give the polymerization reaction, properties and applications of any two : [06]
- (1) Polystyrene
 - (2) PF Resin
 - (3) Silicon Rubber
 - (4) ABS Plastic
- (C) Give the difference between Addition Polymerization Reaction and Condensation Polymerization Reaction. [05]

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P.T.O.

- Q.3)** (A) What are the types of Symmetries in Crystal ? Discuss them with respect to Cubic Crystal. [06]
- (B) Define the following terms : [06]
- (1) Unit Cell
 - (2) Anisotropy
 - (3) Co-ordination Number
 - (4) Radius Ratio
- (C) (1) Calculate APF for BCC. [03]
- (2) Draw the following planes in simple Cubic System : (111) and (110) [02]

OR

- Q.4)** (A) (1) Explain the structure and properties of Fullerene. [04]
- (2) Give the Structure of Polypyrrole and justify its conducting nature. [03]
- (B) What is Point Defect ? What are their types and explain the Point Defect in Ionic Crystal. [06]
- (C) At what glancing angle, would the first order diffraction from (110) plane of KCl can be observed by using X-ray of wavelength 0.715 \AA . The Unit Cell dimension is 3.1 \AA . [04]
- Q.5)** (A) How are the pH of titration mixture calculated at various stages during weak acid - strong base ? [06]
- (B) Define : [06]
- (1) Normality
 - (2) Molarity
 - (3) Equivalence Point
 - (4) Primary Standard
 - (5) Indicator
 - (6) End Point
- (C) Calculate the equivalent weight of $\text{K}_2\text{Cr}_2\text{O}_7$ and $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$. (Given Mole wt. $\text{K}_2\text{Cr}_2\text{O}_7 = 294$ and $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O} = 248$) [04]

OR

- Q.6)** (A) What are types of Complexometric Titration ? Explain any one of them with suitable example. [06]
- (B) Write note on Redox Titration. [06]
- (C) 20ml of standard solution of 0.04M KCl takes 35.5 ml of AgNO_3 from burette, during standardization of the AgNO_3 . 100ml of water sample requires 12.5 ml of the AgNO_3 solution. Calculate the quantity of chloride ions per liter in the given water sample. [04]

SECTION - II

- Q.7)** (A) Derive the expression for brightness and darkness for a monochromatic light beam reflected from a thin parallel film of transparent material. [07]
- (B) Explain the motion of an electron in a transverse magnetic field. Obtain an expression for the displacement produced. [06]
- (C) Two optically plane glass strips of length 10cm are placed one over the other. A thin foil of thickness 0.010mm is introduced between the plates at one end to form an air film. If the light used has wavelength 5900 \AA , find the separation between consecutive bright fringes. [04]

OR

- Q.8)** (A) Prove that in Newton's Rings by reflected light the diameters of bright rings are proportional to the square root of the odd natural numbers. [06]
- (B) What is Velocity Selector ? How this principle is used in Bainbridge Mass Spectrograph to determine the mass of the isotope ? [07]
- (C) Electrons accelerated by a potential difference of 200V enter in an electric field at an angle of 60° with the normal to the interface of the higher potential region and gets refracted at an angle of 45° with the normal. Find the potential difference between the plates. [04]

- Q.9)** (A) What is Ultrasonics ? Explain how Piezo-electric Effect can be used for generating Ultrasonic Waves. [07]
- (B) Explain :
- (1) Diffraction of Light
 - (2) Rayleigh's Criterion of Resolution [06]
- (C) An ultrasonic pulse of frequency 80 kHz is sent down towards the seabed. The echo is recorded after 0.7 sec. If the velocity of sound in sea water is 1500 m/s. Calculate the depth of the sea and the wavelength of the pulse. [04]

OR

- Q.10)** (A) Obtain the conditions for principal maximum and minimum in Fraunhofer diffraction due to a single slit. [07]
- (B) Describe any two engineering applications of Ultrasonic Waves. [06]
- (C) Find the maximum value of resolving power of a diffraction grating 3 cm wide having 5000 lines per cm if the wavelength of light used is 5890\AA . [04]
- Q.11)** (A) Define Plane of Polarisation and Plane of Vibration. Explain the phenomenon of double refraction in calcite. [06]
- (B) What is meant by Nuclear Fusion ? Give an account of Carbon-Nitrogen Cycle in Fusion Reaction. [06]
- (C) Two polarising plates have polarising directions parallel so as to transmit maximum intensity of light. Through what angle must either plates be turned if the intensity of the transmitted beam is one third the intensity of the incident beam. [04]

OR

- Q.12)** (A) Explain the working of Betatron. Obtain the Betatron Condition. [06]
- (B) What are Retardation Plates. Deduce the thickness of a quarter wave plate for a given λ in terms of its refractive index. [06]
- (C) If the frequency of the a.c. potential applied to the dees of a cyclotron is 9 MHz, calculate the magnetic flux density required to accelerate α - particles. Given the mass of α - particles to be 6.643×10^{-27} kg. [04]