

Total No. of Questions : 12]

[Total No. of Printed Pages : 4

[3761]-102

F. E. (Semester - I) Examination - 2010

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 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) What are the types of Symmetries in crystal ? Discuss them with respect to cubic crystal. [07]
- (B) Explain the line defects in metallic crystals. State the effects of line defects on the properties of metals. [06]
- (C) X-ray of Wavelength 1.6 \AA are diffracted by a Bragg's crystal spectrometer at angle 14.2° in the first order. What is the spacing of atomic layer in the crystal ? [04]

OR

- Q.2) (A) What is meant by atomic packing factor ? Calculate atomic packing factor for SC, BCC and FCC Structure. [07]
- (B) Explain the Mesomorphic Phase. Give the types and applications of mesomorphic phase of solids. [06]

[3761]-102

1

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- (C) Define :
(1) Unit Cell
(2) Co-ordination Number
(3) Anisotropy
(4) Crystallography [04]

- Q.3) (A) Explain the Titration Curve and calculation of pH for 0.1N HCl and 0.1N NaOH. When indicator can be used for this titration ? [07]
(B) What is the oxidizing and reducing agent? Give the types of redox titration and explain any one type of titration. [06]
(C) 10 ml H_3PO_4 solution on titration against 0.1N NaOH from burette requires 7.6 ml of NaOH for neutralization using Methyl Orange Indicator. Find the normality and strength of H_3PO_4 solution. [04]

OR

- Q.4) (A) (1) 50 ml of NaCl solution requires 38.6 ml of M/50 $AgNO_3$ in Mohr's Method. Calculate amount of chloride ion per litre of NaCl solution. [04]
(2) 25 ml of a solution containing Ca^{++} is titrated against 0.03M disodium EDTA from burette to get the end point 14.8ml in the complexometric titration. Calculate the amount of Ca^{++} ions per litre of the solution. [03]
(B) What is the Mohr's Method for precipitation titration ? Give its procedure and formula for calculation. [06]
(C) Define the terms :
(1) Equivalence Point
(2) Titration
(3) Normality
(4) Molarity [04]

- Q.5) (A) Give the Polymerization Reaction, Properties and Applications any two of the following : [06]
(1) Polystyrene
(2) Phenol - Formaldehyde Resin
(3) Silicon Rubber

- (B) What is the Vulcanization of Rubber ? Give the structural changes taking place on vulcanization. State the effects on properties of rubber on vulcanization. [06]
- (C) Distinguish between thermosoftening and thermosetting resins. [04]

OR

- Q.6) (A) Account shortly on average molecular weight of polymers and any one method to determine it. [04]
- (B) Give the cationic mechanism of Polymerisation. [04]
- (C) What is a Glass transition temperature ? What are the factors affecting on it. State its importance. [04]
- (D) Write a note on **any one** of the following : [04]
- (1) Conducting Polymer
 - (2) Polymer Composite

SECTION-II

- Q.7) (A) With the help of neat labelled diagram explain the principle, construction and working of Michelson's Interferometer. Discuss the types of fringes. [07]
- (B) Explain the Motion of Electron when it is : [06]
- (1) Parallel to Electric Field and
 - (2) Perpendicular to Electric Field
- (C) In Newton's Ring Experiment the diameter of 4th and 12th dark rings are 0.400 cm and 0.700 cm respectively. Deduce the diameter of 20th ring. [04]

OR

- Q.8) (A) Explain with a neat diagram the principle, construction and working of Bainbridge Mass Spectrograph. [07]
- (B) Derive an expression for condition of maxima and minima for reflected light in case of thin transparent film of uniform thickness. [06]
- (C) Electrons Accelerated by a Potential of 150 volt enter in an electric field at an angle of 50° with the normal to the interface of the higher potential and get refracted at an angle of 35° with the normal find the potential difference between the two regions. [04]

- Q.9)** (A) Explain the Fraunhofer Diffraction at a single slit and obtain the condition for principal maximum and minima. Draw the Intensity Distribution Curve. [07]
- (B) What is Piezo-Electric Effect ? Draw a neat diagram and explain the Piezo-Electric Generator for the Production of Ultrasonic Waves. [06]
- (C) What is the highest order spectrum that is visible with light of wavelength 6000\AA by means of a grating having 5000 lines per cm. [04]

OR

- Q.10)** (A) Explaining the Principle of Echo Sounding. Describe any two applications of Ultrasonic Waves. Where this principle is used ? [07]
- (B) Obtain an expression for the Resolving Power of Grating. On what factors does it depend ? [06]
- (C) Calculate the Natural Frequency of Cast Iron Rod of 2.6 cm in length. [04]
- (Given : Density of Rod = $7.23 \times 10^3 \text{ kg/m}^3$,
Young's Modulus = $1.16 \times 10^{11} \text{ N/m}^2$)

- Q.11)** (A) Explain the term Double Refraction and hence explain in the phenomenon of it on the basis of Huygen's Wave Theory. [06]
- (B) With the help of a neat labelled diagram explain the construction and working of a Cyclotron. Obtain the expression for the cyclotron frequency and the maximum energy of the particle. [06]
- (C) A Q.W.P. of thickness $2.275 \times 10^{-3} \text{ cm}$ is cut with its faces parallel to optic axis. The emergent beam of light is elliptically polarized. Find the wavelength of the monochromatic light made incident normally on the plate. [04]
- (Given : $\mu_o = 1.586$, $\mu_e = 1.592$)

OR

- Q.12)** (A) Explain the principle, construction and working of Betatron. [06]
- (B) Distinguish between Polarized and Unpolarized Light. Describe the process of production and detection of Circularly Polarized Light. [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 to accelerate α particles. [04]
- (Given : Mass of α Particle = $6.643 \times 10^{-27} \text{ kg}$)