[3661]-107

F. E. (Semester - II) Examination - 2009
APPLIED SCIENCE - II
(June 2008 Pattern)

Time : 3 Hours]   [Max. Marks : 100

Instructions :

   *(1) Answers to the **two** sections should be written in **separate** answer books.*

   (2) Neat diagrams must be drawn wherever necessary.

   (3) Black figures to the right indicate full marks.

   (4) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket is allowed.

   (5) Assume suitable data, if necessary.

SECTION - I

Q.1) (A)   What is Power Alcohol ? Give methods of preparation, merits and demerits of Power Alcohol.   [06]

    (B)   Write note on Hydrogen Gas as a Fuel.   [05]

    (C)   In Boy's gas calorimeter's experiment when $0.1 m^3$ of a fuel gas is burnt during which 25 kg of water is circulated. Temperature of incoming water and outgoing water is $20°C$ and $33°C$ respectively. Weight of steam condensed is 250 gm. Calculate gross calorific value and net calorific value, if heat liberated in condensing water vapour and cooling the condensate is 586 kcal/kg.   [03]

    (D)   Explain the Kjeldahl's method for the determination of nitrogen from coal sample. Also give significance of analysis.   [03]

OR

Q.2) **(A)** What is Calorific Value of Fuel ? Explain Bomb Calorimeter method for determination of a non-volatile solid fuel. **[06]**

(B) What is ultimate analysis of coal ? Give method's for determination of carbon, hydrogen and sulphur from coal. Give significance of it. **[06]**

(C) Write note on 'Refining of Crude Oil'. **[05]**

Q.3) **(A)** Differentiate between Anodic and Cathodic Coating. **[03]**

(B) What is Electroplating ? Explain process of Electroplating, its advantages and applications. **[05]**

(C) Define Corrosion. Give types of it and explain mechanism of Dry Corrosion. **[05]**

(D) Write note on 'Pourbaix Diagram'. **[03]**

OR

Q.4) **(A)** Define Corrosion and explain different factors affecting Corrosion Process. **[06]**

(B) Write note on Galvanic Protection Method with its applications. **[04]**

(C) What is Blacodizing ? Describe its process, advantages and application. **[06]**

Q.5) **(A)** What is Hardness of Water ? Give the reasons behind hardness of water and explain the EDTA Method for determination of Hardness of Water. **[05]**

(B) A zeolite softner was completely exhausted and was regenerated by passing 100 litre of NaCl containing 120 gm/lit of NaCl. How many litres of a sample of water of hardness 500 ppm can be soften by this softner ? **[04]**

(C) Write note on Ion Exchange Method for demineralization of water. **[05]**

(D) 50 ml of a chloride water sample is titrated against 0.01 M $AgNO_3$ solution by Mohr's Method. The burette reading is 5.8 ml. Calculate quantity and chloride ions per litre of the water sample. **[03]**

OR

Q.6) **(A)** What is Priming and Foaming ? What are disadvantages of Priming and Foaming ? How can be they prevented ? [06]

(B) What is meant by Softening of Water ? Explain the Zeolite Method of Water Softening. [05]

(C) 50 ml of water sample requires 3.7 ml of 0.025 N H_2SO_4 upto phenolphthalein end point and further 4.8 ml upto methyl orange end point during the titration. Calculate the types and amounts of alkalinities in the water sample. [03]

(D) Explain phosphate conditioning for Water Softening. [03]

SECTION - II

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

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

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

Q.7) **(A)** Derive equation of energy and wave function when a free particle is trapped in an infinite potential well. [07]

(B) State Heisenberg's Uncertainty Principle and illustrate it by electron diffraction at a single slit. [06]

(C) Find the Energy of Neutron in units of electron volt whose de-Broglie Wavelength is 1 A°.

(Given : Mass of Neutron $= 1.674 \times 10^{-27}$ kg.) [04]

OR

Q.8) **(A)** What is Schrodinger's wave equation ? Derive Schrodinger's time independent wave equation. [07]

(B) Explain de-Broglie Hypothesis of matter waves and obtain the equation of de-Broglie Wavelength of Matter Wave in terms of Energy by analogy with radiation. Also obtain equation of de-Broglie wavelength of an electron. [06]

(C) Explain the physical singnificance of Ψ and $|\Psi|^2$. [04]

Q.9) (A) Explain the operation of Ruby Laser with neat labelled diagram. [06]

(B) Explain the following properties of Super-conductors : [06]

(a) Meissner Effect

(b) Critical Field

(C) Explain any one application of Laser. [04]

OR

Q.10) (A) Explain the terms : [06]

(a) Stimulated Emission

(b) Population Inversion

(c) Persistent Current

(B) What are the special properties of Laser ? Hence explain the working of Semi-conductor Laser. [06]

(C) Explain the BCS Theory of Superconductors. [04]

OR

Q.11) (A) Explain Hall Effect in Semi-conductors. Derive the equations of Hall Voltage and Hall Coefficient. [07]

(B) Explain any two properties of Nano-materials. [06]

(C) Calculate the conductivity of Ge specimen if donor impurity is added to the extent of one part in 10^8 Ge atoms at room temperature. (Given : Atomic Weight of Ge = 72.6, Density of Ge : 5.32 gm/cm^3, Mobility of Electrons = 3800 cm^2/v-sec., Avagadro Number = 6.02×10^{23} atoms/mole) [04]

OR

Q.12) (A) Comparing with zero basis explain the working of PN Junction diode in forward bias and reverse bias on the basis of energy level diagram. [07]

(B) (a) Explain briefly how colloids are synthesized by a chemical route. [03]

(b) Discuss any one application of Nano Technology. [03]

(C) In an N-type semi-conductor the Fermi level lies 0.3 eV below the conduction band at room temperature. If the temperature zis raised to 330 k, find the position of term level. [04]