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Total No. of Questions : 6] [Total No. of Printed Pages : 4

[4061]-109

F. E. Examination - 2011

APPLIED SCIENCE - II

(PHYSICS)

(2008 Pattern)

Time : 2 Hours] [Max. Marks : 50

Instructions :

(1) All questions are compulsory.

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

(3) Neat diagrams must be drawn wherever necessary.

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

(5) Assume suitable data, if necessary.

Q.1) (A) Classify the following characteristics of DeBroglie Waves into **true** and **false** : **[06]**

(a) DeBroglie Waves are probability waves.

(b) The wavelength of DeBroglie Waves is inversely proportional to the momentum of the particle.

(c) The Group Velocity of the DeBroglie Waves is given $v_g = v_{particle}$.

(d) DeBroglie Waves are significant for subatomic particles.

(e) DeBroglie Waves associated with bounded particles are quantized.

(f) DeBroglie Waves are associated only with moving material particles.

(B) Calculate the Wavelength of a Photon and an Electron both having an energy 1.0 eV.

(Given : Planck's Constant $h = 6.63 \times 10^{-34}$ J-s

Mass of Electron $= 9.1 \times 10^{-31}$ kg.) **[04]**

(C) Obtain the wavefunction for a particle moving in a rigid box. Also obtain the expression for its quantized energy. Highlight the step at which quantization begins to occur. **[6+1=07]**

OR

Q.2) (A) State Schrödinger's Time Independent and Time Dependant Equations and state any one difference between them. What are the basic requirements for solution of the Schrödinger's Equation to be acceptable ? **[3+4=07]**

(B) Identify and mark which of the following statement of the Heisenberg's Uncertainty Principle are incorrect. In front of the incorrect statement write the corrected statements :

$\Delta x \Delta P_y \geq h$

$\Delta \theta \Delta P_x \geq h$

$\Delta x \Delta E \geq h$

$\Delta x \Delta P_x \leq h$

$\Delta x \Delta t \geq h$ **[05]**

(C) Assuming Atomic Nucleus to be a rigid box (infinite potential well), calculate the ground state energy of an electron if it existed inside the nucleus. (Given Planck's Constant = 6.63×10^{-34} J-s, Mass of the Electron = 9.1×10^{-31} kg. and size of the nucleus $\sim 10^{-15}$m. Using this result, argue that electron cannot exist inside the nucleus. Given, maximum binding energy per nucleon = 8.8 MeV) **[05]**

Q.3) (A) Define following concepts : **(Any Three)** **[3x2=06]**

(a) Spontaneous Emission

(b) Stimulated Emission

(c) Metastable State

(d) Population Inversion

(e) LASING