SEAT No._____ No. of Printed Pages : 2

[A-20]

SARDAR PATEL UNIVERSITY

B.Sc. EXAMINATION (4th-Semester)
Thursday, 12th April 2018
10:00 a.m. to 01:00 p.m.
Subject: PHYSICS
Course: US04CPHY02
Classical, Quantum and Nuclear Physics

Total Marks:70

N.B: (i) All the symbol have their usual meanings
(ii) Figures at the right side of questions indicate full marks

Q-1 Multiple Choice Questions (Attempt All) (10)

(1) The electrostatic force between two unlike charges are _____
(a) zero (b) attractive
(c) repulsive (d) infinity

(2) The value of universal gravitational constant G is _____
(a) 4×10^{42} Nm^2/Kg^2 (b) $6.67\times10^{+11}$ Nm^2/Kg^2
(c) $9.81cm/sec^2$ (d) 6.67×10^{-11} Nm^2/Kg^2

(3) For circular orbit the value of eccentricity _____
(a) $\epsilon>1$ (b) $\epsilon\geq1$
(c) $\epsilon<1$ (d) $\epsilon=0$

(4) At the turning point in an arbitrary potential field the radial velocity is _____
(a) zero (b) 1
(c) infinity (d) 1/2

(5) The concept of matter wave was suggested by_____
(a) Heisenberg (b) de Broglie
(c) Schrodinger (d) Laplace

(6) The normalized wave function must have _____ norm
(a) infinite (b) zero
(c) finite (d) complex

(7) Any wave function having symmetry property is said to be of _____ parity
(a) Zero (b) Even
(c) Odd (d) Infinite

(8) In alpha-proton reaction _____ particle is bombarded to radioactive nuclei
(a) β- particle (b) α- particle
(c) Υ- particle (d) $_1H^1$ –particle

(9) The some artificial radioactive nuclides emits _____ as well as electrons or positrons
(a) X-rays (b) α-rays
(c) Υ-rays (d) β-rays

(10) The positive electron is known as _____
(a) Electron (b) proton
(c) deuteron (d) positron

Q-2 Short Questions (Attempt any Six) (12)

(1) State the Newton's law of gravitation
(2) Define equipotential surface
(3) State the Kepler's first law of planetary motion
(4) State the Heisenberg's uncertainty principle
(5) Define stationary states of the wave function

[P.T.O.]

	(6)	Define exothermic reaction	
	(7)	What are transuranium elements?	
	(8)	Define stopping power	
Q-3	(a)	Derive the expressions for gravitational fields and potentials	(3)
	(b)	Derive the Gauss' law for electrostatic fields.	(5)
		OR	
Q-3	(a)	State the laws of gravitational and electromagnetic forces	(3)
	(b)	Using the Gauss' law obtain the expression of Laplace equation	(5)
Q-4		Derive the equation of motion of equivalent one body and explain why apple falls toward the earth and not the earth towards the apple?	(8)
		OR	
Q-4		Discuss the motion of a particle in a central force field and prove the conservation laws of linear momentum and total energy	(8)
Q-5	(a)	Discuss the Heisenberg's uncertainty principle	(3)
	(b)	Discuss the normalization and probability interpretation of a wave function	(5)
		OR	
Q-5	(a)	Discuss the box normalization	(3)
	(b)	Discuss the concept of matter wave and show the experimental agreement for electron	(5)
Q-6	(a)	Discuss the stationary states and energy spectra of the quantum mechanical system	(3)
	(b)	Derive the time independent Schrodinger equation	(5)
		OR	
Q-6	(a)	State and prove the Ehrenfest's theorem	(4)
	(b)	Discuss the conservation of probability of the wave function and derive the condition	(4)
Q-7	(a)	Describe the Q-value of nuclear reaction and applying the conservation laws derive the expression of threshold energy	(5)
	(b)	Describe transmutation by neutrons	(3)
		OR	
Q-7	(a)	Describe the experiment for the disintegration of nuclei by α-particle with schematic diagram and illustrate various alpha-proton reactions	(5)
	(b)	Describe transmutation by deuterons	(3)
Q-8	(a)	Discuss the production of electron and positron with necessary conditions of mass and energy	(4)
	(b)	Write note on transuranium elements	(4)
		OR	
Q-8	(a)	Discuss the method of measurement of velocity and energy of α-particle with schematic diagram of the deflection chamber	(4)
	(b)	Discuss the method of measurement of range, ionization and stopping power	(4)

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