3. (a) State the Heisenberg's Uncertainty Principle. Explain its significance with the help of examples.

nceFpeveyeie keâ DeeveeMÛelelee keâ emeæevle keâe ØekeâLeve keâeepeS~ GoenjCee Éeje Fmekeâe cenlJe mecePeeFS~

(b) Find the expression for group velocity of matter waves.

õJÙe lejie keâ mecen Jeie keâe JÙepekeâ Øeehle keâeepeS~

Unit-II / FkeâeF-II 7½

4. (a) What are expectation values?

Dehee#ele ceuÙe keÙee n?

(b) State and prove Ehrenfest theorem.

Sjveheâmš ØeceÙe eueeKeS leLee emeæ keâeepeS~

5. Solve the Schrodinger wave equation for a particle in a square well potential defined by:

$V(x)=0$ for $x<-a$

$V(x)=V_0$ for $-a<x<a$

$V(x)=0$ for $x>a$

A (Printed Pages 7)

Roll No. _____

S-606

B.Sc.(Part-II) Examination, 2015

(Regular & Exempted)

PHYSICS

Third Paper

(Elements of Quantum Mechanics & Atomic Spectra)

Time Allowed : Three Hours] [Maximum Marks : 50

Note : Question No.1 is compulsory. Attempt one question from each of the Units I, II, III and IV. Answer five questions in all.

ØeMve me. 1 DeeveJeeÙe n~ ØelÙekeâ FkeâeF I, II, III SJe IV me Skeâ ØeMve keâeepeS~ keâue heeÙe ØeMvee keâ Gòej oeepeS~

1. Attempt all parts : 2×10=20

meYee Yeeie keâeepeS :

(i) Write laws of photoelectric emission and Einstein's photoelectric equation.

ØekeâeMe JeÅele Glmepeve keâ eveÙece leLee DeeFmeŠeve keâe ØekeâeMe JeÅele meceekeâjCe eueeKeS~

(ii) What is Compton wavelength?

keâechešve lejie oOÙe keÙee nelee n?

(iii) What is the importance of de-Broglie's matter waves?

[eyeeieuee õJÙe lejie keâe cenlJe keÙee n?

(iv) What are the defects of Bohr's theory of hydrogen atom?

neF[epeve hejcæeCe keâ eueS yeenj emeæevle keâe $eeŠÙee keÙee n?

(v) Find the number of quantum states of 2p subshell.

2p GhekeâeMe keâ eueS keJeeŠce mleje keâe ieCevee keâeepeS~

(vi) In the study of space quontization, draw possible orientation for J=2

mheMe keJeeŠeFpeMeve keâ DeOÙeÙeve ce J=2 keâ eueS mecYeJe DeeejÙeCŠMeve eÛee$ele keâeepeS~

(vii) What are eigen values and eigen functions?

DeeFepeve JeuÙe leLee DeeFepeve heâueve keÙee nele n?

(viii) What is meant by L-S coupling?

L-S Ùeiceve keÙee n, mecePeeFS?

(ix) Differentiate between continuous and characteristic X-rays.

melele leLee eJeue#eCe Skeme ekeâjCe ce Delej eJeYeo keâeepeS~

(x) Calculate normal Zeeman shift of the Line (6438A^{o}) in a magnetic field of 0.5T.

0.5T Ûecyekeâe Ùe #e$e ce jKee (6438A^{o}) keâ eueS meeceevÙe peeceve eJemLeeheve keâe ieCevee keâeepeS~

Unit-I / FkeâeF-I 7½

2. (a) Derive an expression for Compton shift.

keâechešve eJemLeeheve keâ eueS JÙepekeâ Øeehle keâeepeS~

(b) Why is it not possible to observe Compton effect with visible light?

keâechešve ØeYeeJe ÂMÙe ØekeâeMe keâ meeLe keÙee vene Øeehle ekeâÙee pee mekeâlee n?

Is there any possibility for a particle to exist outside the potential well?

Skeâ Sme keâCe keâ eueS ßeee[iej lejie meceekeâjCe keâe mLeehevee keâeepeS, pee Skeâ Jeieekeâej eJeYeJe keâhe ce evecve Øekeâej me emLelen :

$V(x)=0$ for $x<-a$

$V(x)=V_0$ for $-a<x<a$

$V(x)=0$ for $x>a$

keÙee keâCe keâ yeenj jnve keâe keâeF mecYeeJevee n?

Unit-III / FkeâeF-III 7½

6. Find the velocity of an electron in the n^{th} Bohr Orbit. Prove that for an electron :

(i) PE = 2kE (numerical value)

(ii) $E_n = -\frac{Rhcz^2}{n^2}$

Where symbols have their usual meaning.

n Jee yeenj keâ#ee ce FuekeŠeve Jeie evekeâeeueS~ FuekeŠeve keâ eueS emeæ keâeepeS :

(i) emLelee Tpee = 2 ieelepe Tpee (Deeekeâkeâ ceeve)

(ii) $E_n = -\frac{Rhcz^2}{n^2}$,

penle mekeâlee keâe ØeÛeeuele DeLe n~

7. (a) The quantum numbers of the two optical electrons in an atom are :

$n_1 = 5,\ l_1 = 0,\ S_1 = ½$

$n_2 = 4,\ l_2 = 1,\ S_2 = ½$

(i) Assuming L-S coupling, find the possible values of L and hence J.

(ii) Assuming J-J coupling, find the possible values of J

Skeâ hejceeCe keâ oe ØekeâeeMekeâ Fuekeševe keâ keJeešce meKÙee n :

$n_1 = 5,\ l_1 = 0,\ S_1 = ½$

$n_2 = 4,\ l_2 = 1,\ S_2 = ½$

(i) L-S meueivelee ceevele nS, L keâ meYeeeJele ceeve %eele keâjle nS J Yee Øeehle keâeepeS~

(ii) J-J meueivelee ceevele nS, J keâ meYeeeJele ceeve Øeehle keâeepeS~

(b) Find Lande g factor for $^2S_{½}$ energy level.

$^2S_{½}$ Tpee mlej keâ eueS uevee g heâkešj keâe ieCevee keâeepeS~

Unit-IV / FkeâeF-IV 7½

8. (a) What are characteristic X-rays? Explain their origin, derive Mosley law.

DeeYeuee#eeCekeâ Skeme ekeâjCe keÙee nelee n? Fvekeâe Glheeòe meceePeele nS ceemeue eveÙece keâe eveieceve keâeepeS~

(b) If the K_a radiation of Mo (z=42) has a wavelength of 0.71 Å, calculate the wavelength of the corresponding radiation of Cu(z=29).

Ùee0 Mo (z=42), K_a eJeekeâjCe keâe lejie oOÙe 0.71 Å n, lee Cu(z=29) keâ eueS meiele eJeekeâjCe lejie oOÙe keâe ieCevee keâeepeS~

9. (a) What is Paschen-Back effect? Explain.

heMeve yekeâ ØeYeeJe keÙee nelee n? meceePeeFS~

(b) Explain splitting of D_1 and D_2 lines when. Na source of light is put in magnetic field.

Na ØekeâeMe œeele keâe Ûecyekeâeòe #e$e ce jKeve hej D_1leLee D_2 jKeeDee keâe heLekekeâekeâjCe meceePeeFS~