-ENGINEERING

PHYSICS.

-

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Date

Teacher = Dr Arun Sharma

Unit 1

Unit 2 →

Unit 3 →→

(Ouantum Mechanic Electromagnetic field theory wave optics

Unit 4→ Fibre optics

Unit 5 Superconductors material

·Interference

Le diffraction

Lo later

L Nano Material

CH=1

⇐

QUANTUM

MECHANICS **→**

0 In educary of classical Mechanics

• Planks theory of black body radiation (14alitative) 3 Crompton effect

C Debrogil Concept of matter cave

C deviation and gormer experiment

*6*

phone velocity and group velocity

4 Time dependent & Time Independent schrodinger

coque equation

D

physical interpretation of wave function

D

particle in 1-d box.

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Clasic Mechanics could not explain the behaviour of systum such as atom, molecules and nuclei. There are following Imp points the clausical physics could not explain.

OH Couldn't explain the stability of atom. @ It couldn't hold in the region of atomic dimention, © It couldn't explain the black body radiation spectrum. @ It Couldn't explain the observe variation of

specific heat of metals and gaves.

classical mechanics could at explain a large no of phenomenon such as

Photoelectric effect, crompton effect and Raman effect.

☆ BLACK BODY RADIATION

A body which can absorbs completely all the radiation incident up on it is called black body. when this body is heated to a suitable high temp It emits radiation which is known as Black body Radiation.

J

Absence for all

wavelengths

Radiation for all wave

length.

A BLACK BODY RADIATION SPECTRUM →→

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The distribution energy in black body radiation for diff wavelength and at various temp was determined experimentally by limen and porchen

in 1899.

A graph was plotted blw Interuity of radiation s wavelength (2) at diff temp.

E2T

@ The energy distribution is the radiation spectauon of

a black body is not uniform as the temp of BB rise the interity of the radiation for each wavel- length is increased.

C At a given temp the interity of radiation ↑ with

↑ in λ.

3 The point of max energy shift towards the softer

2. as temp ↑

Page No.

Dale

зерде

9 for a given the total energy of radiation is

-sented by the area b/w the curve and horizontal axis is the 1. of temp and

of temp and ↑ in itself directio proportional to the 4th power of absolute Temp.

is

ExTy

A Stefen's law-

Total amount of heat radi Oded by a perfect black body per unit area per sec [AIS] is directly proportional to 4th power of absolute. Temp.

EXTY

Еготи

F Wiens Law ->

(m)

Acc to wein law The product of wavelength corresponding to max energy of radiation and absolute Temp of a black body is comitent

am XT = comitant

amz comitant

T

дата

1

T

of

The wavelength corresponding to max energy black body radiation of a black body radiation is inverely proportional to

also Temp

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#Limitation

Application only for shorter & not **for** longer

\* Raylaugh- Jeanes Law -

The energy distribution of a black body is direing proportional to abso Temp and Invernely propor.

tional to 24.

ଓ୪

EXα T-O E q x 1

Eaα I

24

(22

24

E a = 8 x kt

24

Exda = 8 xKT d λ

# Limitation

29

This law applicable for longer wavelength not for shorter.

☆ Plank Theory of Black Body Radiation

when classical theory is failed to explain the energy. spectrum of a black body plank suggested that at the explanation of energy distribution of a black body with following alsumptions.

Page No

Dade

a black body **is** composed of a large **no** of loscillating particles which can

possible frequencies.

• An oscillator cannot ernit energy

(3)

vibrate with all

in a continu

manner. It can emit energy in the multiple of small unit called photon. of energy **(hv**)

E= nhu - Frequency

(01112-~)

planks.com

An oscillator can emit or absorb energy only in descrete amount of hy that is ohy The abu nhu

☆ Plank Radiation formula-

The Energy denuity (Ex) of heat radiation emitted from a black body as Temp (T) in the a range (λ to atdal

Eadλ = =

8xhc

da

Exdt = SKkKK (दम-11

5

୦୪

or Eadλ = 8Thc =

da

25

we I For Shorter wavelength*.*

helak

[enelART \_1] = e

че

helakt

neglect 1

holakt

fromero

Eda

8xhc

Care II for longer wavelength...

[chull

# he t

акт

hc

from eq

акт

Page No

Edλ= 8xhe. akt da

25

be

Eadλ = 8 xh I da

24

WAVE-PARTICLE DUALITY →

Phenomenon such as

Interference diffraction s

polarisation can be explain by wave theory of light however pot phenomenon such as photoelectric effect unit crompton effect can be explain by particle theory of light.

as a wave

on

Acc to Eeinitein the energy of light is concentrated in small bundles called photon hence light behave

one hand and as particle on the other hand this show that light posses wave as well as particle nature this nature of light is known as dual nature and a phenomenon is called wave-particle duality.

☆ De Broglies concept of Matter wave →

On the balis of dual nature of light as broglie Suggested that dud nature is not only of light but each moving material particle have dual nature. He assume a wave to be also cicdel with moving & material particle which is calle

Matter wave*.*

if sonall p is the momentum of the particle the wavelength is,

# Pro

@Mat

part

2 Deb

ligh

W91

3 Deb

510

mo

λ=h

P

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we know that the energy of photon of frequency

*12*

E = hv - ©

But ace to Ecintein may energy Relation

Ez Mc2

ёя

hoz Mc2

2

mz hv C2

-

12

Now, the Momentum of the photon,

pzmv p = mx c

P=

2

z hv x c C2

Pz hv

с Ci

The velocity of

Photon is c

V=C

Pz he

h

ас

а

༡࿐h

P

# Properties of Matter Wave→

1 Matter wave are generated only when material

particle is in motion.

2 Debrogiles wavelength or a

wave ayociated with a

light moving particle is greater than the wavelength of heavy moving particle.

3 Debrogiles wavelength of a wave associated with a

Slow moving particle is greater than the fast moving particle.

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Debrogile wave are not electromagnetic waves. 5 Matter wave are generated when

change

a

particle as well as neutral particle **in** motion.

A Debrogiles Wavelength in termy of Energy→

The kienetic Energy of material particle of move mn moving with velocity V can be written as :-

E=keinetic Energy

2

E = 1mv2

=

2

V2 = 2 E

**2**

2

အာ

M

Momentum pz m v

Pz mu P 2 M RE

[RE

Pa√MER

M

Acc to Debrogile wavelength

λ=h

.h

P

√2ME

+ Debrogiles wavelength in terms of Temp

Acc to kienetic theory of gales the average kienetic energy is given by.

E = 1 mv2 = 1 m2 v2

2

2m

E 2

**2**

(

M

*2*

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for thermal equilibrium the kienetic Energy

eqs Q

E = 3kt-20

2

22

Lm

2

3 KT

Z

p2 = 3MKT

2

P2 √3mKT

Ace to Debrogile wavelength

2=h P

2

h

√OMKT

\*

#Show that Debrogile a of a charge particle

Inversely proportional to square root of accelerating particle?

W=ev

<E=

k⋅ E = E = 10m2

**2**

२

evz Imv

२

2

Im2 V2

2

2.M

p2

2

evz

2

2m

amev

2. Jamev

p =

1

0

Acc to debrogile a

g=h

P

2=

h

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force

√ R0nev

λπ 6.6X10

-34

√2x9-1x 10-31 x 1-6X 10-19 XV

Charge

Mau of e (m) = 9x15 c2 (e) **=** (+6x10"

а

Z

6.64x10

-34

√2x9·1×1-6X105°

6-64X10

5.396√V

6-64×10-9

129-120

ч

12027X10-10

V V

12-27 A

√√

WAVE PACKET→

group of several waves of slightly diff velocity I diff

a.

group velocity = The velocity with which a packet moves forward in the medium.

(Va)

Amplitude

wave

XON'S

=

Vg = dw or DW

dk

DK

τ

phate velocity / wave velocity = The velocity of advan -ment of a monochromatic wave in a medium

→ (p)

Vp = w

K

propogation Corutant

Dispersive

Medium

= Those medium who

depends upon v.

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# Show that V11 • Vpzc2?

Acc to phate velocity (The velocity of advencement of a monochromatic wave in a medium).

Vp = w

K

Acc to Debrogile wave length

2

h

て

h

P

mv

2

But propagation constant

K = 2x

λ

3

Putting the values of a in eq ®

k = 2 x Mu

h

-

if E is the energy of the particle

E=hv

2

or vz E

h

Acc to Angular frequency

W = 2πV

Wz 2XE

h

1

6

But Aec to Mars energy relation

2

Ez Mc2

from e

W= 2xMc2

h

putting the value of k is w in eq

Vp = w

2 xmc2 x K

2

*C*

K

K X Q X M V

V

☆

Vp

2

C

if Vis the group velocity

Ve Vg

2

Vp X Vg = c2

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Relation blw group velocity s phone velocity in displosive Medium →

Ace to phate velocity

Vpz w

K

W=KVp-O

--

similarly group velocity Vg = dw - @

Putting the value of win eg

Vg = d (kVp)

dk

Vg = Vp + KdVp -3

dk

dk

k is propogation content

k= 2x

2

from eq ®

Yg ż V p + 2 x d V p

a

But dri

1/2 = )

z

Vp + JOND

a d(a)

Ida

44) = -1 da

이익)

from er @

32

Vg 2 Vp - AdVp

29

da

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This is the required relation b/w group velocity and phone velocity in Date

dispersive Medium

In a medium in which the phone velocity **in** inde- -pendent of frequency.

Therefore

d Vp

zo

da

Vg = Vp

Hence in a non-dispersive medium or in free space the group velocity is equal to phone velocity.

\* Numericals on (Debrogile a) →

@01 = A particle of charge @ and may (m) is accelerated

from rest through a potential calculate its debrogile wavelength if the particle is an eo s potential

diff Sov?

given diff potential Vzsovol

De brogile wavelength.

Az 12·27A

√V

नेट

02= Find debrogile a of a 6·6x10-34 Joule second

7= h

Vame

2

て

އ

12-27

て

√50

అ

1skeve and plank contant and mass of c° 9.x 603kg? 6·6x10-34

3

√2X9×10-31 X15X10 3 x 1.6 x 10-19

6.6X10-34

√2X9X15X1-6x10 - 9

606X10-39

√432X10-47

λ= 0·1Å

Date

**003** = calculate the velocity and kienetic Page No. energy of a neutron having debrojile Wavelength IĤ?

De brogite wavelength = IA.

velocity V = ?

K⋅E (E) = ?

1-67x10-27

Mau of neutron = 1.67 x 10-27 kg Acc to De-brogile wavelength

Vz h

Mr

2

az h

Mv

6·63×10-34 1-67X10-27 x 1X 10 -7° X1X100

V=3·95x103 mls

1 mv2

2

K⋅E = ↓

2

KE = 1 X1•67x10-87×(3.95×103

२

ке

KE =

-21 13.15X10

J

with

D4= calculate debrogile wavelength auociated a

proton moving with 1/20th velocity of light?

Speed of light C = 3x 108 m/s

given f

Vp = 1 X3X10

20

8

Vp = 0.15X108 m/s

man of proton Mp = 1.67 × 10-27 kg

momentum of proton p = Mp Vp

λ = h

P

P = 1·67X10-27×0.15X108 Pz·2·505×10-20

-34

26

= 6·624X 10 = 2.834x101 m

2.505 X 10-20

Davission

Germmer Experiment →

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# Explain the *principle* of Davission!

germmer Experiment How does this experiment support Debroglie hypothesis of Motter wave?

√=54°

electron

gain

*eo* berm

10 f

@

1.scale

Scattered

beam

a

electron

diector galvanometer

Nickel crystal

Davinson & germer perform and experiment to Show an wave nature of electron by their diff Experiment consist of an electron gun fitted with an simple holder and A detector to detect the by majoring current.

In this experiment es Emergeout in the form of a fine beam which is then made to fall on the nickel crystal eC are scattered in all direction by the atom of the crystal.

The Intensity of the e scattered in a particular direction is found by detector by rotating a detecto about an axis the intensity of scattered beam can be major for different angles.

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angle

Various graph can be plotted b/w the scattered d and interity of a scattered beam at diff Voltage

V=Yovolts

Vz 44 volts

'V= 48V0143

1=50°

D

V= 54volts

Vz60 volts

The kink at 54 volt gives the evidence for the existence of e waves, since a strong diffraction pak is observed at $=50° for sy volt. The crystals. surface at like a grating with spacing (d) we know that,

Acc to Braggs egn

2dsinc

n=1

na

for Nickel d= 0.91A

20+0=180

02180-4

2

Or 180-50

0=65'

2

2x0-91× 10-10xsings® = 1xx

2= 1·65A

Now we use debrogile hypothesis,

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λ=

h

√2mev

72

6·64×10-34

√√√2x9-1×10-31×1-6x10-19 x 54

༢ །•༦sė]

Hence the debrogile wavelength of c waves determines by Damission s geummer s those calculated from debrogile hypothers are found to be close.

WAVE FUNCTION*(4*)

To describe the quantitative Mechanical systum,

associated with Matter

is requested known as

function.

wave a Mathematical func

wavefunction or Eigen

4.60. 4A)

4 = P(x, t); e (x, t)

It is a func of position and time

# Properties

• It Should be a single value. Mathematical function.

• It should be finite.

• It should be continuous I differentiable

It should be Normalized in Nature.

Yldz 1

·00

where d z = dx dy d z

Note

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if the total probability of finding the particle

mywhere in the space is unity (once), then the

corresponding wave function will be Normalize Luque function.

# physical significance.

4/3

It may be complex function the square of its gives the probability of finding the particle **within** specify region.

Eg:-

Y = A+iB

2\* = A-iB

2 2pat = (A+iB) CA-IB)

x x = A2 + B2 1

*for (*D)

x21412 dx

X,

p12

for 20 p= [[ ] P/= dx ay

for (3D)

"P=

Jy fx

P = S2 fg Sz | Y | 2 dx dy dz

# Eigen Value and Eigen function →

When an operator is operate Quer a

wave function the fr remain unchanged, then the fume is known as Eigen func and the coefficient of this func is called Eigen values.

ôf.

of

px

function of f = eb x

Ô

Z

рк

Z

d2 dx2

2

epx.p2

р

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all Eigen fin are wave func but all wave

func are not Eigen.

fune...

d2

е

dx2

d2 e dx2

px

2 px p.e

Eigen funs

\*

Eigen value

Schrodinger Wave Equation -

→

Schrodinger Time dependent wave eqå

when a quantam mechanical is in motion is associa- -ted with a wave suppose a particle of may on), Total energy (E), Momentumn (p). is mainly with the velocity V in the x-axis direction. The wave func associated with the particle can be written as.

4 = Ae

Differentiate e

эф

ох

2

7=4

дх дег

824

ax2

2

2

て

z

Z

Ae

2xi [Et - px].

h

partially twice with respect to x

-2xi [Et-px]

Ае

и

-2x1 [Et-px]

2

=4x2p2 4

h2

2

p2 4 = b2x24

2

2

4x2xx2

-

*-*(2

Raip

h

叮

2x [p]

2

Z

I

h

diff en partially w⋅r to (t)

ау at

24

at

Z

A e 3x4 [Et px*]*

| - ર×દ

-axiE

h

E 4

-h24

(3)

Qxi It

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The Total Enery of particle

F= k⋅ E+ p⋅E

Multiply by 4

2

p2 + v

2007

EY= p2 4 +0 4 —℗

201

putting the value of p2y and E4 in eq ©

-524

と

-h?

a2 4x + v4

Qxi ət

in aq ż

-b2 22 + v1

२८ 2x It

8x2m 2x2

2

2

8x2m dx2

\* Schrodinger Time Independent wave eq

schrodinger Time dep wave eg can be written o4-

eq

२x

in 24

Ət

**ट**

62

8x2m

Then soln of eq

με Ae

*224* +u4-0

2х2

-2xi (Et-px]

*n*

wing wave func property

2

4(x,t) = 46)*,* 4(t)

(3

2 xi px 4z Ac

-2xl t

h

e

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заври

Put Ac h

4% (x) = 40

fune of 2

-2xi Et

4 = 4% e

Now 224 JxZ

Z

224%e

диг

-2xiEt h

©

-2xi Et

h

24 at

4% e

-2xi E

ર× i

6

h

in x 4% *e*

2x

-

2xIE h

putting the value of 4**,** 224

-2xX Et ѝ

24 in el C

2

2x2

87

-271E+

-2xiet

2

-h2 xa2 40 &

8x2m

2x2

n

+ Vee

E4% =-h

2

2

84% +V4。

2

8x2m ax2

(E-V)4% =

-

2

-b2 024。

こん

2

8x2m əx2

8x2m (E-U) 4 = 82 4%

h2

2

Əx 3

924% + 8x2m [E-V) % = 0

zo

2х2

h2

2

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\* Particle in *1*-dimension Potential Box →

# find an expreision for the energy state of a parti

in one dimensional box?

let cu comider a particle of mass (m) is trapped in box of length (L) The box restricted the particle to move along the x direction. b/w x=0 to x=L

3ZW

3=E

Vzo

m

220

X=2

Suppose the walls of the box is infinitely hard the particle does not lose energy suppase, the potential energy invide the box is os Total energy (E)

The schrodinger wave equation inside the box com be

written as

*224* + 8 =2 MCE-V) 4 = 0

8x2

[v=o]

2

h2

224 + 8x2m E4=0 -0

dx2

2

hz

2

put 8x2ME = K

h2

a24 + K2 4= 0 3

2x2

C

The solution of eg1 3 *is*

=z

2

(2

4 = Asinka + Bloskx-Q

where A & B corutant

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The value of comitant ASB can be determined wing

Boundary Condition.

1

Apply boundary condition

4z0 at x=0

from er

Or Asino + Bcosko

Oz

B=O

AXO+BXI

putting B=O in eq @

-4= Asinkx

&

Apply @ Boundary: Condition

4=0 at x=L

from er Oz AsinkL

A70 Sinkleo

sink L= sinnx [1=1, 2,0\_\_]

KLZ NX

kent

L

or K2 m2x

ᄌ -16

L2

2

putting K = mx in y©

L

Үч Asin nах

nxx

L

eq3 = eqC

872 ME

2

-

2

Q

8ME

h2

2

n2 22

Ez m2 h2

8022

h2

**2**

L2

8

100

1136

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The content A of equ can be obtained wing

Condition.

00

*-∞*

| 412 dt = **1**

Nor Melis

2

1412 dx = 1

=)

1220

A

A2sin2 mocxxdx.

し

[ cost = 1-28 in 2x

sin2x

= -1 (1-cos2x)

2

1

= 12 = [1 - cos2nxx dx = | J[1-cos2nxx

२ 0.

A2

2

*L*

L sinanax 72

2nx

z1

-) A2 [(2-0) *- (0-0*) ] = 1

२

=) A2 L = 1

2

=) A2 = 2

A:

Z

froom eq

L

२

1

L

1

L

0

Фе

२ sin nxx

VL

L

The first 3 normaliset wavefunction 4,42,43 along with their correponding propabilites 14,12, 1412 14312

I

14312

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2-3

14212

222

N=2

14,12

3=-1

N=1

001= find the energy of an eR having motion in one

dimentional in an infinitely high potential box of width 1A mais of eo=9·11x 10-31

kg s plank Coru 1977+

6.63X10-34 Joule/see?

**2**

given h= 6·63 X 10-34 L= 1A = 1X 1070 m m= 9·11X10-3kg

2

z

E= m2 n2

8ML2

N

と

2

x6·63×10-6812

18x9.11× 10-31 x1x10-20

6·63× 10-68

8X9°11X10-31

43.95x10

72.88

-17

= 0·603× 10-17

N

6·03 x 10-18 J 6.03X10-18 ev

1-6×10-19

E

E

2

37.68ev

D2 = A particle is in motion along A line b/w x=o s

x=α which C potential energy at point for whic x is less than o the wave x is greater than 0. The potential energy is infinite the wave func for the particle in the **8th** State is given by Yn = Asing

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find the expresion for ***the*** normalised waveform.

4- sinnxx

a

applying normalised condition

~ 1412 dx = 1

= 9

KJ (Axinnxx ] + dx - 1

Χτο

2

mx

**A2 ( [**sinnax ]2

die dx = 1

N

= A

2

**&** A2

२

20

9

x

cos anxx dx =**l**

a

1

a रमर

sinensx

= 1

а

0

=) A2

9- a

a\_sinzana

रमन

ег

=) A2 [a

2

[9-0]=1

= 1

२

=) A2a

A

र sinnrx

*२*

*9*

*a*

а

13 = A particle confined to move along x-axis has the

wave func qzqx find the probability that particle can be found b/w 2=0.35 to 0.45?

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Ace to mox Born the probability of finding the particle b/w 2, and X2

X2

Pz

1412 dx

P

Z

0.450

0.35

2

:q2x2 dx = q2

0.45

q2 J x2 dx

0.35

=) a2 x

=)

0045

1337030

0.35

a2/0.4533 - (0.35)?

2

3

a2x0.0483

3

2 = 92×0.161

=0·16192

3

Q4 = find propability of finding an particle trap in

a box of leryth (L) in a vision from 0.452 to 0-552 for ground state and 1st excited State?

On = √3 sin n xx

X2

L

1412 dx

=

P- $197

=) २ L

P =) 1

2

L

0°55L

f

00454

0045L

15

L

0.454

sin2 anxx

L

0-5JL

0.5OL

1-2 (1-cosanxx]

1- cosanxx

L

P

Leimenar Journ

20x

Ground Hate Nr 1

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ACOMPTON EFEECT→

The phenomenon of stattering with change in frequency is called compton effect.

X-Ray Photon

yaris

Scattered photon

> xaxis

E = hw

pz hv

E = hul

Pz hol

Recoil

electron

с

Compton comidered an xray photon strike on an an scattered away from its original direction of motion, if before collision the frequency of the photo is and after collision the frequency is v

1

\*Acc to law of conservation of momentyon

In xaxis

before collision

= after collision

beto

by + o = hv cose + ploso

с

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CPLOSCO = hu- bv'cosq - (

In Yaxis

Before collision after collision

Z

0+ 0 = 'ho' sing - Psing hy'sing

с

CPsino

2

hv'sing

12

Squaring and adding eg

and

p2c2 cos2 α + p2 c2sin2 = b2v2+ h2vi2cos2q-2h2x2 cos4

2

ट

2

+ h2v2sin2o

2

p2 c2 = b2 b2 + h22 — añ2 vv'cos ¢

1

\* Acc to law of Conservation of Energy

hot m2c2

hit E

4

E = hy-ho'+ moc2

Ace to relativistic total energy

2

E = √ √2 c2+ m2 "

from eq ♡ is eq G

eq =

@

-

ero

ho-hu't moc2 =

2

√ p2c?

2

2 ५

[h(Q-v') + Moc2 ]2 = p2c2 + m2 c¶

2

2

2

h2 (*v-*vi)2 + mocy + 2n(v-v') m。c2 = p2 c2 + m2 c"

2

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pc2= ho2+ n2vi2 - 2n2 vv!+ shumic2 - 2hum2

Compairing eqCJ 6

2

2

2

2

6

*h2x2* + b22 - ah2 vv'cos & = h2x2 + h22 -2h2 bo't

2

2

2

Rhymoc2 = Rhvimoc2

--

2

h2vv'cos q = h2vv' *- hv* Moc2 + hv' Moc2

22

Divide by hc2

b2VV*'* - Kv Mot2 + kv'Mose

K2VD'Cos hc2

Z

b7c2

C

+

hz ez

heez

c2

N

الالا

Mov + Movi

C2

h

h

**2**

Mo *[D*-V

h

Dz C a

9

V'z c

a

I

(cos $-1)

z *C*

Moc 1-2-2'

h

taking (J common

1-cos &

と

a-λ = h

ᄏᄏᄏ

Тос (я-э!)

Moc

h

(1-cos$)

h (1-cosd)

\_cosd) |

Δλ

Moc

*Date*

@- A photon recay back after striking an electron at rest what is change *in* wavelength of photon

According to compton shift

4λ= h (1-cos)

2

Moc

given $=180°

hz 6-63x16-34-45

Moz

9.1K10-31 C = 3X108 MIS

kg

Aλ = 6-63x10-34

(1-cos 180)

9-11 X 10-31 ×3×108

Δλτ

Q = X-Ray Photon is found to have its wavelength double on

being scattered through 90°, find the a and energy

of the incident photon?

Given λ=Rλ'

Moz 9·11X10

-31

kg

K

C = 3x10 8 m/s, $=90°

ACC to compton effect

sλ = 2 - a = h (1-cos $)

Moc

22-7= 6·63X10-34

(1-C0890)

9-1X 10-31 X 3X10°

6-63X10-34

9·1× 10-31×3×108

a

λ = 0·024 Å

A

Energy *E-*hv

2=C

а

E = hc

2

a

-

E = 6·63X10-31 x 38 12"

C

0-024X10

E = 8-21 × 10-124

J

Pago No.

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Ane is bound in I dimention potential box whic hat width 2-3 X 10-10 mo? Assuming the height of the box to be infinite calculate the lowest To persisted

energy value of the e° ?

L= 2·5X10-10

M

E1 = ?

Nel

E22?

222

E = m2 n2

2

8322

(6·63x10-3472x n2

8×9011×10-31x (2·5x10-10) 2

2

= 0.0963 m2

2

divide by 1.6x/0

-19

to

Ех

6.04n2 ev

change in ev

E1 = ·6.04ev

E22 6.04x(2)2 = 6·04×4 Ezz

E2 = 24-16cv E22

@- A particle in confined to 1-0 infinite potential

Well of width 0.2 x 10-1 m it is found that when the

is 230 ev its eigen func energy of the particle has 5 antinodes find the may of the particle

Show that it can

never

•have energy equal to I kev

criven, L=0-2x10-1m, Es - 230ev, m=?, E = +ikev

て

five antinodes signify that the particle is

fifth quintum State

.". n=5

Es = (5)°*E*,

in

Here

N

Ez Es

द

230 ev z

25

230X 1-6X10-19

25

-18

25

E1 = 1·47×10te J

for mal E = 'm2 h2

Mz

2

h2

8ML2

812€2

Z

E=E

N

z

(6-63X10-342

8X(0·2x10-9)2 X1-47x10-18

43·95X10-68

0.4704×10-36

93·43×10-32

M

= 9:343×10-31

kg

En = Ikev =

*1 ×* 10 3 × 1 - 6 × 10 - 19

1-6X 10-16

n2 z En

E

2

3

103× 1-6×10-19

*1°47*×1078

2

M2 10.43

Z

2

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1°6×10-16 1047x10-18 √1·088X 102