Scilab Textbook Companion for Quantum Mechanics by M. C. Jain[1]

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Book Description

Title: Quantum Mechanics

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Scilab numbering policy used in this document and the relation to the above book.

Exa Example (Solved example)

Eqn Equation (Particular equation of the above book)

AP Appendix to Example(Scilab Code that is an Appednix to a particular Example of the above book)

For example, Exa 3.51 means solved example 3.51 of this book. Sec 2.3 means a scilab code whose theory is explained in Section 2.3 of the book.

Contents

List of Scilab Codes

Chapter 2

Particle nature of Radiation The origin of Quantum theory

Scilab code Exa 2.2 No of photons emitted per second

```
////Given
E=40                                    //W
lembda=6000*10**-10                     //m
h=6.63*10**-34                          //Js
c=3*10**8                               //m/s

//Calculation
n=(E*lembda)/(h*c)

//Result
printf("\n Number    of photons emitted per second
   are given by  %0.2f *10**19",n*10**-19)
printf("\nThe answers vary due to round off error")
```

Scilab code Exa 2.3 Kinetic energy of the photoelectron

```
////Given
a=3.2                                          //ev
energy=3.8                                     //ev
e=1.6*10**-19

//Calculation
c=energy-a
Energy=c*e

//Result
printf("\n Kinetic energy of the photoelectron is
   given by  %e Joule",Energy)
```

Scilab code Exa 2.4 Maximum wavelength of photon

```
////Given
W=3.45                                           //ev
h=6.63*10**-34                                    //Js
c=3*10**8                                         //m/s
e=1.6*10**-19

//Calculation
lembda=(h*c)/(W*e)

//Result
printf("\n Maximum wavelength of photon is  %0.0f A"
   ,lembda*10**10)
```

Scilab code Exa 2.5 Stopping potential

```
////Given
W=3                                            //ev
h=6.63*10**-34
```

```
e=1.6*10**-19
lembda=3.0*10**-7                           //m
c=3*10**8                                   //m/s

//Calculation
v0=(W*e)/h
v=c/lembda
E=h*(v-v0)
E1=(h*(v-v0))/(1.6*10**-19)
V0=E/e

//Result
printf("\n (a) Threshold frequency  %0.2f *10**15 HZ
   ",v0*10**-15)
printf("\n (b) Maximum energy of photoelectron  %0.2
   f eV",E1)
printf("\n (c) Stopping potential  %0.2f V",V0)
```

Scilab code Exa 2.6 frequency

```
////Given
v0=6*10**14                                  //s**-1
h=6.63*10**-34
e=1.6*10**-19
V0=3

//Calculaton
W=h*v0
W0=(h*v0)/e
V=(e*V0+h*v0)/h

//Result
printf("\n work function is given by  %0.3f ev",W0)
printf("\n frequency is given by  %0.2f *10**15 s-1"
   ,V*10**-15)
```

Scilab code Exa 2.7 energy of incident photon

```
////Given
lembda=6800.0*10**-10                              //m
h=6.6*10**-34
W=2.3                                              //ev
c=3*10**8                                          //m/s

//Calculation
E=((h*c)/lembda)/1.6*10**-19

//Result
printf("\n Energy is  %0.2f ev",E*10**38)
printf("\n since the energy of incident photon is less then the work function of Na, photoelecrticemession is not possible with the given light.")
```

Scilab code Exa 2.8 metal B will yield photoelectrons

```
////Given
lembda=3500*10**-10                                //m
h=6.6*10**-34
c=3*10**8                                          //m/s

//calculation
E=((h*c)/lembda)/1.6*10**-19

```

```
//Result
printf("\n Energy is  %0.2f ev",E*10**38)
printf("\n 1.9 ev < E < 4.2 ev,only metal B will
   yield photoelectrons")
```

Scilab code Exa 2.9 Maximum kinetic energy of photoelectron

```
////Given
lembda=6.2*10**-6
W=0.1                                          //ev
h=6.6*10**-34                                  //Js
c=3*10**8                                      //m/s
e=1.6*10**-19

//Calculation
E=((h*c)/(lembda*e))-W

//Result
printf("\n Maximum kinetic energy of photoelectron
   %0.1f ev",E)
```

Scilab code Exa 2.10 Value of plank s constant

```
////given
e=1.60*10**-19                                  //C
slope=4.12*10**-15                              //Vs

//Calculation
h=slope*e

//Result
printf("\n Value of planks constant  %e Js",h)
```

Scilab code Exa 2.11 frequency of incident radiation

```
////Given
W=2.26*1.6*10**-19                                //ev
v=10**6                                           //m/s
m=9*10**-31
h=6.6*10**-34
//Calculation
V=((1/2.0)*m*v**2+W)/h

//Result
printf("\n frequency of incident radiation  %0.2f
   *10**15 HZ",V*10**-15)
```

Scilab code Exa 2.12 the stopping potential

```
////given
V1=.82                                            //volts
V2=1.85                                           //volts
lembda1=4.0*10**-7                                //m
lembda2=3.0*10**-7
e=1.6*10**-19
c=3.0*10**8                                       //m/s

//Calculation
lembda=(1/lembda2)-(1/lembda1)
h=(e*(V2-V1))/(c*lembda)

```

```
//Result
printf("\n (a) planks constant  %e Js",h)
printf("\n (b) no, because the stopping potential
   depends only on the wavelength of light and not
   on its intensity.")
```

Scilab code Exa 2.13 Photoelectric current

```
////given
h=6.62*10**-34                                    //Js
c=3*10**8                                         //m/s
lembda=4560.0*10**-10                              //m
p=1*10**-3                                        //W
a=0.5/100
e=1.6*10**-19

//calculation
E=(h*c)/lembda
N=p/E                                             //Number
    of photons incedent on the surface
n=N*a
I=n*e

//result
printf("\n Photoelectric current  %0.2f *10**-6 A",I
   *10**6)
```

Scilab code Exa 2.14 angle at which the recoil electron appears

```
////given
m0=9.1*10**-31                                  //Kg
c=3*10**8                                      //m/s
h=6.6*10**-34                                  //Js
```

```
v1=2.0*10**-10                                    //m

//Calculation
//
v= (h/(m0*c))*(1-(cos(90))*3.14/180.0)
v2=v+v1
v0=v2-v1
E=(h*c*(v0))/(v1*v2)
b=(1/(sin(90)*3.14/180.0))*((v2*10**-10/v1)-cos(90)*3.14/180.0)
angle=3.14/2.0-atan(b)

//Result
printf("\n (a) the wavelength of scattered photon is %0.3f A",v2*10**10)
printf("\n (b) The energy of recoil electron is %0.2f *10**-17 J",E*10**17)
printf("\n (c) angle at which the recoil electron appears %0.2f degree",angle)
```

Scilab code Exa 2.15 energy of scattered photon

```
////Given
E=0.9                              //Mev
a=120                              //degree
m=9.1*10**-31                      //Kg
c=3*10**8                          //m/s

//calculation
b=((m*c**2)/1.6*10**-19)*10**32
energy=E/(1+2*(E/b)*(3/4.0))

//Result
printf("\n energy of scattered photon %0.3f Mev",energy)
```

Scilab code Exa 2.16 Energy of the recoiul electron

```
////Given
v1=2.000*10**-10                                    //m
v2=2.048*10**-10                                    //m
a=180                                               //degree
a1=60                                               //degree
h=6.6*10**-34
c=3*10**8

//Calculation
//
b=(v2-v1)/(1-cos(a*3.14/180.0))
V=v1+b*(1-cos(60*3.14/180.0))
E=(h*c*(V-v1))/(V*v1)

//Result
printf("\n (a) wavelength of radiation scattered at
   an angle of 60 degree  %0.3f A",V*10**10)
printf("\n (b) Energy of the recoil electron is  %0
   .2f *10**-18 J",E*10**18)
```

Scilab code Exa 2.17 Wavelength of incident photon

```
////Given
E=4*10**3*1.6*10**-19
m0=9.1*10**-31
b=6.4*10**-16
d=102.39*10**-16
h=6.3*10**-34
c=3*10**8
```

```

//Calculation
//
p=sqrt(2*m0*E)
d=b+d
lembda=(2*h*c)/d

//Result
printf("\n Wavelength of incident photon is  %0.2f A",lembda*10**10)
```

Scilab code Exa 2.19 energy of the scattered photon

```
////Given
E=1.02                                    //Mev
b=0.51

//Calculation
//
alpha=E/b
a=1/(sqrt(2*(alpha+2)))
angle=2*(asin(a)*180/3.14)
e=E/(1.0+alpha*(1-(cos(angle*3.14/180.0))))

//Result
printf("\n (a) Angle for symmetric scattering is  %0.1f degree",angle)
printf("\n (b) energy of the scattered photon is  %0.2f Mev",e)
```

Chapter 3

Atoms and the Bohr model

Scilab code Exa 3.1 Angular momentum of electron

```
////Given
E=-3.4                                          //ev
h=6.63*10**-34                                  //Js

//Calculation
//
n=sqrt(-13.6/E)
M=(n*h)/(2.0*%pi)

//Result
printf("\n Angular momentum of electron is given by
    %e  Js" ,M)
```

Scilab code Exa 3.2 Energy of photon emitted in the transition

```
////Given
E=13.6                          //ev
n1=4
```

```
n2=2

//Calculation
energy=E*((1/2.0**2)-(1/4.0**2))

//Result
printf("\n Energy of photon emitted in the
    transition is  %0.3f ev",energy)
```

Scilab code Exa 3.3 `Wavelength`

```
////Given
n1=3
n2=2
E1=-1.5                                          //ev
E2=-3.4                                          //ev
h=6.63*10**-34                                   //Js
c=3*10**8                                        //m/s
e=1.6*10**-19

//Calculation
v=(h*c)/((E1-E2)*e)

//Result
printf("\n Wavelength is  %d Armstrom",v*10**10)
printf("\nthe answers vary due to round off error")
```

Scilab code Exa 3.4 `Wavelength of the second line`

```
////Given
v=1200                                //A
R=1.097*10**7                         //m-1
n1=2.0
```

```
n2=3.0

//Calculation
v1=(R*(1-(1/n1**2)))
v2=(R*(1-(1/n2**2)))
V=v1/v2
V1=V*v

//Result
printf("\n Wavelength of the second line is  %0.3f A
   ", V1)
```

Scilab code Exa 3.5 shortest wavelength

```
////Given
R=1.097*10**7                                    //m-1
n=2

//Calculation
v=n**2/(3.0*R)
v1=1/R                                           // for n=
   infinite

//Result
printf("\n longest wavelength is  %0.0f A",v*10**10)
printf("\n shortest wavelength is  %0.1f A",v1
   *10**10)
```

Scilab code Exa 3.6 Atomic number of the atom

```
////Given
E=47.2                                     // 3ev
n1=2
```

```
n2 =3

//Calculation
//
Z=sqrt(E/(13.6*((1/2.0**2)-(1/3.0**2))))

//Result
printf("\n Atomic number of the atom is  %0.0f ",Z)
```

Scilab code Exa 3.7 comparison

```
////Given
Z=1.0
n=1.0
Z1=4                                          //for Be++
n1=2.0

//Calculation
//
n1=sqrt((n**2/Z)*Z1)
r=(Z1**2/n1**2)/(Z**2/n**2)                   //Ratio of two energies

//Result
printf("\n nBe++=  %0.3f ", n1)
printf("\n comparison is  %0.3f ",r)
```

Scilab code Exa 3.8 orbital ratio of two states

```
////Given
Z=3.0
n=3                                              //for Li++
```

```
Z1=1.0
n1=1                                            //for
   hydrogen

//Calculation
r=(n**2/Z)/(n1**2/Z1)

//Result
printf("\n orbital ratio of two states  %0.3f ",r)
```

Scilab code Exa 3.9 Longest wavelength

```
////Given
v=970.6                                   //A
h=6.63*10**-34                            //Js
c=3*10**8                                 //m/s
e=1.6*10**-19

//Calculation
//
E=((h*c)/(v*e))*10**10
En=-13.6+E
n=sqrt(-13.6/En)
E3=-13.6/(3.0**2)
vmax=(h*c)/((-E3+En)*(1.6*10**-19))

//Result
printf("\n Longest wavelength is  %0.0f A",vmax
   *10**10)
```

Scilab code Exa 3.10 Required stopping potential

```
////Given
```

```
Z=2
E=13.6                                  //ev
E0=10.04                                //ev

//Calculation
Ei=Z**2*E
E1=-Ei
E3=E1/(3.0**2)
Ee=E0+E3

//Result
printf("\n Required stopping potential is %0.0f V",
   Ee)
```

Scilab code Exa 3.11 `Wavelength`

```
////Given
Ei=4*2.2*10**-18                              //Joule
h=6.6*10**-34                                 //Js
c=3*10**8                                     //m/s

//Calculation
E1=-Ei
E2=E1/(2.0**2)
v=(h*c)/(Ei+E2)

//Result
printf("\n Wavelength is %0.0f A",v*10**10)
```

Scilab code Exa 3.12 `Kinetic energy of the photoelectron`

```
////Given
n1=3
```

```
n2 =1
E=13.6                                          //ev

//Calculation
E1=E/(3.0**2)                                   //Binding
   energy of the atom in n=3 state
energy=E-E1                                     //Energy
   required for the atomic electron to jump from n=1
    to n=3 state

//Result
printf("\n The electron beam must, therefore be
   accelerated through a potential difference of  %0
   .2f V",energy)
```

Scilab code Exa 3.13 Ratio of the electron mas to the proton mass

```
////Given
Rh=1.09678*10**7                                     //m-1
Rhe=1.09722*10**7                                    //m-1

//Calculation
Mr=(Rhe-Rh)/(Rh-(Rhe/4.0))                          //ratio
   of electron mass

//Result
printf("\n Ratio of the electron mas to the proton
   mass  %0.2f *10**-4",Mr*10**4)
```

Chapter 4

Wave nature of matter and the need for a wave function

Scilab code Exa 4.1 de Broglie wavelength of electrons

```
////Given
V=100                                          //volts

//Calculation
//
wavelength=12.3/(sqrt(V))

//Result
printf("\n de Broglie wavelength of electrons  %0.3f
    A", wavelength)
```

Scilab code Exa 4.2 de broglie wavelength of electrons

```
////Given
K=100                                          //ev
h=6.63*10**-34
```

```
m=9.1*10**-31
e=1.6*10**-19

//Calculation
//
v=h/(sqrt(2*m*K*e))

//Result
printf("\n de broglie wavelength of electrons  %0.1f
    A",v*10**10)
```

Scilab code Exa 4.3 Kinetic energy of neutron

```
////Given
m=1.675*10**-27                                         //
    mass of neutron in kg
v=1.4*10**-10                                           //de
     broglie wavelength in m
h=6.63*10**-34                                          //Js

//Calculation
K=(h**2/(2*m*(v**2)))/(1.6*10**-19)

//Result
printf("\n Kinetic energy of neutron is  %0.2f
   *10**-2 ev",K*10**2)
```

Scilab code Exa 4.4 de broglie wavelength of the electron

```
////Given
E=-3.4                                                //
    total energy in ev
h=6.63*10**-34                                        //Js
```

```
m=9.1*10**-31
e=1.6*10**-19

//Calculation
//
K=-E
v=h/(sqrt(2*m*K*e))

//Result
printf("\n (a) Kinetic energy %0.3f ev",K)
printf("\n (b) de broglie wavelength of the electron is %0.3f A",v*10**10)
```

Scilab code Exa 4.5 Kinetic energy of a neutron

```
////Given
m=1.672*10**-27                    //mass of neutron in kg
h=6.60*10**-34                     //Js
v=1.0*10**-10                      //de broglie wavelength in m

//Calculation
K=(h**2/(2.0*m*v**2))/(1.6*10**-19)

//Result
printf("\n Kinetic energy of a neutron is %0.2f *10**-2 ev",K*10**2)
```

Scilab code Exa 4.6 wavelength

```
////Given
```

```
m=10*10**-3
    //mass of a ball in kg
v=1
    //Speed in m/s
h=6.63*10**-34
    //Js

//Calculation
V=h/(m*v)
    //Wavelength

//Result
printf("\n de broglie wavelength is  %e m",V)
printf("\n This wavelength is negligible compared to
     the dimensions of the ball. therefore its effect
     can not be observed.")
```

Scilab code Exa 4.7 `de broglie wavelength`

```
////Given
T=27                              //temperature in
    degree c
K=1.38*10**-23                    //boltzmann constant
     in J/K
h=6.63*10**-34                    //Js
m=1.67*10**-27

//Calculation
//
T1=T+273
v=h/(sqrt(2*m*K*T1))

//Result
printf("\n de broglie wavelength is  %0.2f A",v
    *10**10)
```

Scilab code Exa 4.10 `the largest possible value of n`

```
////Given
V=100                                        //ev
a=10                                         //degree
n=1

//Calculation
//
v=12.3/(sqrt(V))                             //De broglie wavelength
d=v/(2*sin(a*3.14/180.0))
n=(2*d)/v

//Result
printf("\n (a) Spacing between the crystal plane is %0.2f A",d)
printf("\n (b) Peaks in the interference pattern is %0.2f ",n)
printf("\n the largest possible value of n is 5")
```

Chapter 5

Wave packets and the uncertainty principles

Scilab code Exa 5.2 Kinetic energy

```
////Given
r=10.0**-14                                          //m
h=1.054*10**-34                                      //Js
m=1.67*10**-27

//Calculation
p=h/r
E=(h**2/(2*m*(r**2)))/(1.6*10**-13)

//Result
printf("\n Kinetic energy  %0.2f Mev",E)
```

Scilab code Exa 5.3 uncertainty in the angle of emergence

```
////Given
clear
```

```
E=100                                    //ev
m=9.1*10**-31
e=1.6*10**-19
h=1.054*10**-34
x=10.0**-6                                //m

//Calculation
//
p=sqrt(2*m*E*e)
p1=h/x
theta=p1/p

//Result
printf("\n uncertainty in the angle of emergence %0
   .1f *10**-4 radians",theta*10**4)
printf("\n 4 seconds of arc")
```

Scilab code Exa 5.4 uncertainty in the angle of emergence

```
////Given
p=0.2*10**-3*10                           //Kg m/s
h=1.054*10**-34
x=1*10**-2                                //m

//Calculation
p1=h/x
a=p1/p

//Result
printf("\n uncertainty in the angle of emergence %e
    radians",a)
printf("\n 1.1*10**-24 seconds of arc")
```

Scilab code Exa 5.5 `position of the bullet`

```
////Given
m=50*10**-3                                    //
   kgram
accuracy=0.01
v=300                                      //m/s
h=1.054*10**-34

//Calculation
p=m*(v*accuracy)/100.0
x=h/p

//Result
printf("\n position of the bullet  %e m",x)
```

Scilab code Exa 5.6 `uncertainity in frequency`

```
////Given
t=10.0**-12                                      //
   s
h1=1.054*10**-34
h=6.625*10**-34

//Calculation
E=h1/t
v=E/h

//Result
printf("\n uncertainity in energy is  %e J",E)
printf("\n uncertainity in frequency is  %e Hz",v)
```

Scilab code Exa 5.8 `minimum kinetic energy`

```
////Given
r=5*10**-15                                          //m
h=1.05*10**-34
m=1.67*10**-27
e=1.6*10**-13

//Calculation
xmax=2*r                                             //maximum  uncertainity in the position of the nucleon
pmin=h/xmax                                          //minimum uncertainity in the momentum of particle
Kmin=pmin**2/(2.0*m*e)

//Result
printf("\n minimum kinetic energy is %0.1f Mev",Kmin)
```

Scilab code Exa 5.10 width of a line

```
////Given
v=6000*10**-10                                       //Wavelength in m
t=10**-8                                 //s
c=3*10**8

//Calculation
//
v1=v**2/(2.0*%pi*c*t)

//Result
printf("\n width of a line  %0.15f m",v1)
```

Chapter 7

Particle in a potential well

Scilab code Exa 7.4 `their eigenfunctions`

```
////Given
m=9.1*10**-31                                          //Kg
h=1.05*10**-34                                         //Js
ev=1.6*10**-19
n1=1
n2=2
n3=3
a=10**-10                                              //m

//Calculation
//
E1=((n1**2*%pi**2*h**2)/(8.0*m*a**2))/(1.6*10**-19)
                        //ev
E2=n2**2*E1
E3=n3**2*E1

//Result
printf("\n \n three lowest energy levels are  %0.1f
   ev %0.1f ev and  %0.2f ev",E1,E2,E3)
printf("\n their eigenfunctions are 1/10**-5*cos(pie
   *x/2*10**-10),1/10**-5*sin(pie*x/10**-10) and
```

```
1/10**-5*cos(3*pie*x/2*10**-10)")
```

Scilab code Exa 7.5 these energies

```
////Given
m=10.0*10**-3                                        //
    kgram
l= 10.0*10**-2                                      //
    Length in m
h=1.054*10**-34
n1=1
n2=2
n3=3

//Calculation
E1=(((3.14*h*n1)**2)/(2.0*m*(l**2)))/(1.6*10**-19)
E2=(((3.14*h*n2)**2)/(2.0*m*(l**2)))/(1.6*10**-19)
E3=(((3.14*h*n3)**2)/(2.0*m*(l**2)))/(1.6*10**-19)

//Result
printf("\n energies are %e ev ,%e ev, %e ev",E1,E2,
    E3)
printf("\n these energies are extremely small and
    close together and hence cant be measured")
printf("\nthe answers vary due to round off error")
```

Scilab code Exa 7.7 value of n

```
////Given
L=10**-9                                              //
    Width in m
```

```
v=9.0*10**-9
h=1.054*10**-34 //Js
c=3*10**8 //m/s
m=9.1*10**-31
v1=(9.0+1)*10**-9
v2=(9.0-1)*10**-9

//Calculation
//
n=sqrt((4*c*m*(L**2))/(v*%pi*h))
n1=sqrt((4*c*m*(L**2))/(v1*%pi*h))
n2=sqrt((4*c*m*(L**2))/(v2*%pi*h))

//Result
printf("\n value of n is %0.0f When + sign is taken %0.0f when -ve sign is taken %0.0f ",n,n2,n1)
```

Scilab code Exa 7.8 `Probability for second excited state`

```
////Given
L1=0.4
L2=0.6
L=1 //Say

//Calculation
//
dx=(L2-L1)*L
P1=2/L*(sin(%pi*L/2.0*L))**2*dx
//for first excited state
P2=2/L*(sin(2*%pi*L/2.0*L))**2*dx
//for second excited state
```

```
P3=2/L*(sin(3*%pi*L/2.0*L))**2*dx

//Result
printf("\n (a) probability for ground state  %0.3f "
    , P1)
printf("\n (b) probability for first excited state
    %0.1f ",P2)
printf("\n (c) Probability for second excited state
     %0.3f ", P3)
```

Scilab code Exa 7.9 minimum energy of a nucleon

```
////Given
a=10.0**-14                                        //m
m=1.6*10**-27                                    //mass of a
    nucleon in kg
h=1.054*10**-34                                  //Js

//Calculation
//
Emin=((3*(%pi**2)*(h**2))/(2.0*m*(a**2)))
    /(1.6*10**-19)

//Result
printf("\n minimum energy of a nucleon is  %0.1f Mev
    ",Emin*10**-6)
```

Chapter 8

Scattering of particles by barriers and wells

Scilab code Exa 8.2 `negative value`

```
////Given
b=-32
a=32.0
c=1

//Calculation
//
r=(-b+(sqrt(b**2-(4*a*c))))/(2.0*a)

//Result
printf("\n The ratio of E/V0 =  %0.3f ",r*10**0)
printf("\n -ve value is not possible. ")
```

Scilab code Exa 8.3 `Reflection ratio`

```
////Given
```

```
E=9                                         //ev
v0=5                                        //ev

//Calculation
R=((sqrt(E)-(sqrt(E-v0)))/(sqrt(E)+(sqrt(E-v0))))**2

//Result
printf("\n Reflection ratio is  %0.3f ", R)
```

Scilab code Exa 8.4 `reflection coefficient and transmission coefficient`

```
////Given
E=9                                     //Kinetic energy of
    a particle in ev
v0=10                                   //ev
E1=5                                    //ev
E2=15
E3=10                                   //ev

//calculation
//
R=((sqrt(E2)-(sqrt(E2-v0)))/(sqrt(E2)+(sqrt(E2-v0)))
    )**2
T=1-R

//Result
printf("\n (a) E1 < vo, therefore R=1, T=0")
printf("\n (b) reflection coefficient R= %0.3f \n
    transmission coefficient T= %0.3f ",R,T)
printf("\n (c) E3=v0, therefore R=1 , T=0")
```

Scilab code Exa 8.6 `Transmission coefficient`

```
////Given
E=2                                        //ev
v0=3                                       //ev
m=9*10**-31
a=4*10**-10                                //m
h=1.05*10**-34
b=(v0-E)*(1.6*10**-19)

//Calculation
//
Ka=((sqrt(2*m*(b)))*a)/h
x=sin(Ka*3.14/180.0)
T=(v0**2)/(4.0*E*(v0-E))
T1=1/(1+(T*x**2))

//Result
printf("\n Transmission coefficient is %0.3f ",T1)
```

Scilab code Exa 8.7 `Transmission coefficient`

```
////Given
E=2                                        //ev
v0=3                                       //ev
m=9*10**-31
a=1*10**-10                               //m
h=1.05*10**-34
b=(v0-E)*(1.6*10**-19)

//Calculation
//
Ka=((sqrt(2*m*(b)))*a)/h
x=sin(Ka*3.14/180.0)
T=(v0**2)/(4.0*E*(v0-E))
T1=1/(1.0+(T*x))

```

```
//Result
printf("\n Transmission coefficient is  %0.2f ",T1)
```

Scilab code Exa 8.8 The width of the barrier

```
////Given
E=10*10**6                                    //ev
T=2.0*10**-3
m=6.68*10**-27                                //kg
h=1.054*10**-34                               //Js
e=1.6*10**-19
v0=30.0*10**6                                 //ev

//Calculation
//
K=(sqrt(2*m*(v0-E)*e))/h
a=(1/(2.0*K))*(2.303*log10((16/T)*(E/v0)*(1-(E/v0))))

//Result
printf("\n The width of the barrier is  %e m",a)
printf("\nthe answers vary due to round off error")
```

Chapter 13

Atomic structure I One Electron Atoms

Scilab code Exa 13.1 seperation between the two component

```
////Given
d=0.1                                   //m
v=10.0**3                                 //m/s
a=50                                    //gradient of
    a magnet field Wb/m**2/m
b=9.274*10**-27                         //J/Wb/m**2
h=1.6605*10**-27

//Calculation
M=107.868*h
z=(b/M)*a*(d**2/v**2)

//Result
printf("\n seperation between the two component %0
    .1f mm",z*10**8)
```