

Scilab Textbook Companion for  
Quantum Physics Of Atoms, Molecules, Solids,  
Nuclei And Particles  
by Eisberg And R. Resnick<sup>1</sup>

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# Book Description

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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                                     | 4  |
| 1 Thermal Radiation and Plancks Postulate                | 5  |
| 2 Photons particle like properties of radiation          | 7  |
| 3 De Broglies postulate wave like behaviour of particles | 11 |
| 4 Bohrs Model of the Atom                                | 14 |
| 6 Solutions of time independent schroedinge equations    | 17 |
| 8 Magnetic dipoles moments spin and transition rates     | 20 |
| 9 Multi electron atoms ground satate and xray excitation | 22 |
| 10 Multi electron atoms optical excitations              | 25 |
| 11 Quantum statistics                                    | 27 |
| 12 Molecules   | 29 |
| 13 Solids Conductors and semiconductors                  | 31 |
| 14 Solids super conductors and magnetic properties       | 33 |

|   |    |
|---|----|
| 15 Nuclear Models                       | 35 |
| 16 Nuclear decay and nuclear reactions  | 38 |
| 17 Introduction to elementary particles | 43 |
| 18 More elementary particles            | 46 |

# List of Scilab Codes

|          |   |    |
|----------|---|----|
| Exa 1.1  | Surface temperature calculation . . . . .         | 5  |
| Exa 1.6  | Continous or dis continious energy . . . . .      | 5  |
| Exa 2.1  | Time to absorb energy . . . . .                   | 7  |
| Exa 2.2  | Work function for sodium . . . . .                | 7  |
| Exa 2.3  | Photons striking metal plate . . . . .            | 8  |
| Exa 2.4  | X ray beam . . . . .                              | 8  |
| Exa 2.5  | Determine plancks constant . . . . .              | 9  |
| Exa 2.6  | Energy and wavelength . . . . .                   | 9  |
| Exa 3.1  | Find de broglie wavelength . . . . .              | 11 |
| Exa 3.2  | Mass of Helium and wavelength . . . . .           | 11 |
| Exa 3.3  | Speed of the bullet . . . . .                     | 12 |
| Exa 3.5  | Fractional width and uncertainty . . . . .        | 13 |
| Exa 4.1  | Calculating wavelength . . . . .                  | 14 |
| Exa 4.2  | Average deflection . . . . .                      | 14 |
| Exa 4.6  | Binding energy of hydrogen atom . . . . .         | 15 |
| Exa 4.9  | Muon nucleus seperation . . . . .                 | 15 |
| Exa 4.10 | Double nucleus mass effect . . . . .              | 16 |
| Exa 6.1  | Kinetic energy and penetration distance . . . . . | 17 |
| Exa 6.2  | Penetration distance . . . . .                    | 17 |
| Exa 6.3  | Probablity of neutron . . . . .                   | 18 |
| Exa 6.4  | Calculation of number . . . . .                   | 18 |
| Exa 6.6  | Value of energy . . . . .                         | 19 |
| Exa 8.1  | Energy supplied . . . . .                         | 20 |
| Exa 8.2  | Transverse deflection . . . . .                   | 20 |
| Exa 8.3  | Energy deflection . . . . .                       | 21 |
| Exa 8.4  | Deflection . . . . .                              | 21 |
| Exa 9.5  | Electric field . . . . .                          | 22 |
| Exa 9.7  | ionization energy . . . . .                       | 22 |

|           |   |    |
|-----------|---|----|
| Exa 9.8   | Calculating wavelength . . . . .                | 23 |
| Exa 9.9   | Energy of K shell . . . . .                     | 23 |
| Exa 10.1  | Calculating wavelength . . . . .                | 25 |
| Exa 10.5  | Displace energy . . . . .                       | 26 |
| Exa 10.6  | Magnetic energy . . . . .                       | 26 |
| Exa 11.3  | Boltzan factor . . . . .                        | 27 |
| Exa 11.5  | Fermi energy . . . . .                          | 27 |
| Exa 12.1  | Energy calculation . . . . .                    | 29 |
| Exa 12.3  | Calculation of energy and temperature . . . . . | 29 |
| Exa 13.1  | Electron per unit volume . . . . .              | 31 |
| Exa 13.3  | Angle . . . . .                                 | 31 |
| Exa 14.1  | Calculating wavelength and gap energy . . . . . | 33 |
| Exa 14.3  | Unpaired electrons . . . . .                    | 33 |
| Exa 14.4  | Energy and wavelength . . . . .                 | 34 |
| Exa 15.2  | Calculating wavelength and angle . . . . .      | 35 |
| Exa 15.4  | Atomic mass . . . . .                           | 35 |
| Exa 15.5  | Binding energy . . . . .                        | 36 |
| Exa 15.7  | Blank . . . . .                                 | 36 |
| Exa 15.8  | Density and potential . . . . .                 | 36 |
| Exa 16.1  | Total energy . . . . .                          | 38 |
| Exa 16.2  | Elapsed time . . . . .                          | 38 |
| Exa 16.4  | Life time . . . . .                             | 39 |
| Exa 16.5  | Value of beta . . . . .                         | 39 |
| Exa 16.7  | Value of delta and tou . . . . .                | 40 |
| Exa 16.9  | Neutron produced . . . . .                      | 40 |
| Exa 16.10 | Events detected . . . . .                       | 41 |
| Exa 16.11 | Free electron . . . . .                         | 41 |
| Exa 17.1  | Kinetic energy . . . . .                        | 43 |
| Exa 17.3  | value of pi . . . . .                           | 43 |
| Exa 17.5  | Value of K . . . . .                            | 44 |
| Exa 18.2  | Variable values . . . . .                       | 46 |

# Chapter 1

## Thermal Radiation and Plancks Postulate

Scilab code Exa 1.1 Surface temperature calculation

```
1 //Example 1.1, page 24
2 clear
3 //For sun
4 sigma=5.67*10^-8//w/m^2-k^4
5 T=5700//in K
6 ST_sun=sigma*T^4
7 printf("\n Surface temperature of sun is %e W/m^2.",
      ST_sun)
8 //For north star
9 T=8300//in K
10 ST_Northstar=sigma*T^4
11 printf("\n Surface temperature of sun is %e W/m^2.",
      ST_Northstar)
```

---

Scilab code Exa 1.6 Continious or dis continious energy



```
1 //Example 1.6, apge 39
2 clc
3 g=9.8//in m/s^2, constant
4 l=.1//in m
5 m=0.01//in kg
6 h=6.63*10^-34//Joule-sec
7 theta=0.1//in radians
8 v=(1/(2*%pi)*sqrt(g/l))
9 printf("\n Oscillation frequency of pendulam %f per
    sec.",v)
10 E=m*g*l*(1-cos(theta))
11 printf("\n Energy of pendulum at its maximum
    potential %e Joule.",E)
12 Delta_e=h*v
13 printf("\n Delta E %e Joule",Delta_e)
```

---

## Chapter 2

# Photons particle like properties of radiation

Scilab code Exa 2.1 Time to absorb energy

```
1 //Example 2.1, page 47
2 clc
3 P=1//power in j/s
4 r=10^-10//Radius in m^2
5 R=(P*pi*r^2)/(4*pi)//Rate at which energy falls in
   J/sec
6 R_e=3.4*10^-19//in Joule, rate at energy removed
7 t=R_e/R
8 printf("\n Time required for energy to clear is %e
   sec",t)
```

---

Scilab code Exa 2.2 Work function for sodium

```
1 //Example 2.2, page 49
2 clc
3 h=6.63*10^-34//Joule-sec
```

```

4 vo=5.6*10^14
5 w=h*vo
6 printf("\npower is %e per sec",w)
7 ev=(1/(1.6*10^-19))
8 wo=w*ev
9 printf("\nEnergy is %f ev",wo)

```

---

### Scilab code Exa 2.3 Photons striking metal plate

```

1 //Example 2.3, Page no 50
2 p=1//j/s
3 r=1//radius in m
4 h=6.63*10^-34//Joule-sec
5 c=3*10^8//m/sec
6 lambda=5.89*10^-7//m
7 R=p/(4*%pi*r^2)
8 E=(h*c)/lambda
9 Rate_R=R*(1/E)
10 printf("\nRate at which photons strike unit area of
    place %e photons/m^2-sec",Rate_R)

```

---

### Scilab code Exa 2.4 X ray beam

```

1 //Example 2.4, page 57
2 clc
3 disp('Part a')
4 h=6.63*10^-34//Joule-sec
5 c=3*10^8//m/sec
6 m_o=9.11*10^-31//in kg
7
8 delta_h=(h*(1-cosd(90)))/(m_o*c)
9 printf("\n Compton shift is %e m",delta_h)
10 disp('Part b')

```

```

11 delta1=1*10^-10
12 K=(h*c*delta_h)/(delta1*(delta1+delta_h))
13 printf("\n X-ray beam is %e Joule",K)
14 delta2=1.88*10^-12
15 K=(h*c*delta_h)/(delta2*(delta2+delta_h))
16 printf("\n X-ray beam is %e Joule",K)
17 disp('Part c')
18 E1=(h*c)/delta1
19 E1_ev=(6.241509*10^18)*E1
20 printf("\n X-ray energy is %f ev",E1_ev)
21 E2=(h*c)/delta2
22 E2_ev=(6.241509*10^18)*E2
23 printf("\n X-ray energy is %f ev",E2_ev)
24 Per1=(100*.295*10^3)/E1_ev
25 Per2=(100*378*10^3)/E2_ev
26 printf("\n Energy lost in percentage %f ",Per1)
27 printf("\n Energy lost in percentage %f ",Per2)

```

---

### Scilab code Exa 2.5 Determine plancks constant

```

1 //Example2.5, page 61
2 clc
3 e=1.6*10^-19//in coul
4 v=4*10^4//in V
5 lambda=3*10^-11//in m
6 c=3*10^8//m/sec
7 h=(e*v*lambda)/c
8 printf("\n Plancks constant is %e Joule-sec",h)

```

---

### Scilab code Exa 2.6 Energy and wavelength

```

1 //example 2.6, page 62
2 clc

```

```
3 e=1.6*10^-19//in coul
4 B=2*10^-1//weber/m2
5 r=2.5*10^-2//in m
6 p=e*B*r
7 printf("\n Momentum of electron %e Kg-m/sec",p)
8 x=1.5//in Mev, ie c^2*p^2
9 y=.51//in Mev
10 E_minus=sqrt(x^2+y^2)
11 E=2*E_minus//h*v
12 h=6.63*10^-34//Joule-sec
13 c=3*10^8//m/sec
14 lambda=(h*c)/(10^6*E*1.6*10^-19)
15 printf("\n Photons wavelength is %e m",lambda)
```

---

## Chapter 3

# De Broglies postulate wave like behaviour of particles

Scilab code Exa 3.1 Find de broglie wavelength

```
1 //Example 3.1, page 74
2 clc
3 m=1//in kg
4 h=6.63*10^-34//Joule-sec
5 v=10//in m/sec
6 lambda=h/(m*v)
7 disp('part a')
8 printf("\n De broglie wavelength for v=10m/sec %e m"
        ,lambda)
9 disp('part b')
10 //For KE=100ev
11 m=9.1*10^-31
12 K=100*1.6*10^-19//in Joules
13 lambda=h/sqrt(2*m*K)
14 printf("\n De broglie wavelength is %e m",lambda)
```

---

### Scilab code Exa 3.2 Mass of Helium and wavelength

```
1 //Example 3.2, Page 80
2 clc
3 h=6.63*10^-34//Joule-sec
4 v=1.635*10^3//m/s
5 M=4*10^-3//in kg/mole
6 No=6.02*10^23//atom/mole
7 m=M/No
8 printf("\n Mass of Helium atom is %e kg",m)
9 lambda=h/(m*v)
10 printf("\n De broglie wavelength is %e m",lambda)
```

---

### Scilab code Exa 3.3 Speed of the bullet

```
1 //Example 3.3, Page 87
2 clc
3 //For electron
4 m1=9.1*10^-31//in kg
5 v=300//in m/s
6 h=6.6*10^-34//in joule-sec
7 p1=m1*v//delta v
8 delta_p1=.0001*p1//m*delata_v in kg-m/sec
9 delta_x1=(h)/(4*pi*delta_p1)
10 printf("\n Position of electron %e m",delta_x1)
11
12 //For bullet
13 m2=0.05//in kg
14 p2=m2*v
15 delta_p2=0.0001*p2//in kg-m/s
16 delta_x2=(h)/(4*pi*delta_p2)
17 printf("\n Position of bullet %e m",delta_x2)
```

---

### Scilab code Exa 3.5 Fractional width and uncertainty

```
1 //Example 3.5, page no 94
2 clc
3 disp('part b')
4 lambda=5890*10^-8//in cm
5 c=3*10^10//in cm/s
6 v=c/lambda
7 del_v=8*10^6//per s
8 x=del_v/v
9 h=4.14*10^-15//in ev-sec
10 printf("\n Fractional width of either line(del_v/v)
    %e ",x)
11 //Calculate uncertainty
12 disp('part c')
13 del_t=10^-8
14 del_e=(h)/(4*pi*del_t)
15 printf("\n Uncertainty is %e ev ",del_e)
```

---



# Chapter 4

## Bohrs Model of the Atom

Scilab code Exa 4.1 Calculating wavelength

```
1 //Example 4.1, Page 105
2 clc
3 disp('Part b')
4 rho=9*10^9//in nt-m2/coul2
5 e=1.6*10^-19//coul
6 r=1*10^-10//in m
7 k=(rho*e^2)/(r^3)//nt/m
8 m=9.11*10^-31//in kg
9 c=3*10^8//in m/s
10 v=(1/(2*pi))*sqrt(k/m)
11 lambda=c/v
12 printf("\n The wavelength is %e m ",lambda)
```

---

Scilab code Exa 4.2 Average deflection

```
1 //Example 4.2, page 107
2 clc
3 disp('Part a')
```

```

4 N=10^4//in rad, Number of atoms tarversed
5 theta=(2*10^-2)/sqrt(N)
6 printf("\n Average deflection %e rad ",theta)

```

---

#### Scilab code Exa 4.6 Binding energy of hydrogen atom

```

1 //Example 4.6, Page 120
2 clc
3 rho=9*10^9//in nt-m2/coul2
4 m=9.11*10^-31//in kg
5 e=1.6*10^-19//coul
6 h=1.05*10^-34//in j-sec
7 E=-(rho*m*e^4)/(2*h^2)
8 printf("\n Binding energy is %e Joule ",E)
9 //Answer given in the book is wrong

```

---

#### Scilab code Exa 4.9 Muon nucleus seperation

```

1 //Example 4.9, page 124
2 clc
3 disp('Part a')
4 mu=207//207*me
5 M=1836//183*me
6 u=(mu*M)/(mu+M)
7 D=(1/u)*5.3*10^-11
8 printf("\n Muon nucleus seperation is %e m ",D)
9 disp('Part b')
10 E=-u*13.6
11 printf("\n Binding energy is %f ev ",E)
12 disp('Part c')
13 R=109737//in cm
14 lambda=(1/u)*(1/0.75)*(1/R)
15 printf("\n Wavelength is %e cm ",lambda)

```

---

Scilab code Exa 4.10 Double nucleus mass effect

```
1 //Example 4.10, Page 125
2 clc
3 //For Hydrogen atom
4 R_o=109737//in cm
5 m=1
6 M=1836
7 RH=(R_o)/(1+(m/M))
8 printf("\n Spectrum line for Hydrogen occur at %f /
   cm ",RH)
9 //For Deuterium atom
10 R_o=109737//in cm
11 m=1
12 M=2*1836
13 RD=(R_o)/(1+(m/M))
14 printf("\n Spectrum line for Deuterium occur at %f /
   cm ",RD)
```

---

# Chapter 6

## Solutions of time independent schroedinge equations

Scilab code Exa 6.1 Kinetic energy and penetration distance

```
1 //Example 6.1, Page 208
2 clc
3 m=4*10^-14//in kg
4 v=10^-2//in m/s
5 KE=(0.5*m*v^2)
6 h=10^-34
7 printf("\\n Kinetic energy (Vo-E) at %e Joule",KE)
8 delta_x=(h)/sqrt(2*m*KE)
9 printf("\\n Value of penetration distance is %e m ",
    delta_x)
```

---

Scilab code Exa 6.2 Penetration distance

```
1 //Example 6.2, page 210
2 clc
3 //KE=4ev, convert to joule
```

```

4 KE=4*1.6*10^-19//in j
5 m=9*10^-31//in kg
6 h=10^-34//in j-s
7 delta_x=(h)/sqrt(2*m*KE)
8 printf("\n Value of penetration distance is %e m ",
        delta_x)

```

---

### Scilab code Exa 6.3 Probablity of neutron

```

1 //Example 6.3 , page 216
2 clc
3 v=50//in Mev
4 E=55//in Mev
5 x=sqrt(1-(v/E))
6 //disp(x)
7 R=((1-x)/(1+x))^2
8 printf("\n Probablity of neutron will be reflected
        is %f ",R)

```

---

### Scilab code Exa 6.4 Calculation of number

```

1 //Example 6.4 , page 220
2 clc
3 m=9*10^-31//in kg
4 h=10^-34//in j-s
5 V=10//in ev
6 a=1.8*10^-10//in m
7 //convert v to joule
8 Vo=V*1.6*10^-19//in Joule
9 N=(2*m*Vo*a^2)/(h^2)
10 printf("\n Numbers given is %d ",N)

```

---

### Scilab code Exa 6.6 Value of energy

```
1 //Example 6.6, page 237
2 clc
3 h=10^-34//in j-s
4 m=10^-30//in kg
5 a=10^-14//in m
6 c=3*10^8//in m/s
7 E=((%pi*h)^2)/(2*m*a*a)
8 printf("\n Energy is %e J ",E)
9 //convert to ev
10 e=E/(1.6*10^-19)
11 printf("\n Energy is %e ev ",e)
12 //Answer difference is due to round off
13 E1=(%pi*c*h)/a
14 printf("\n Zero level Energy is %e J ",E1)
15 e1=E1/(1.6*10^-19)
16 printf("\n Zero level Energy is %e ev ",e1)
17 //Answer difference is due to round off
18 //when A=100
19 A=100
20 r=10^-14//in m
21 x=10^-10//in coul2/nt-m2
22 ec=1.6*10^-19//in c
23 Q=(-(A*ec*ec)/(x*r))*(1/ec)
24 printf("\n Typical value Energy is %e ev ",Q)
```

---

# Chapter 8

## Magnetic dipoles moments spin and transition rates

Scilab code Exa 8.1 Energy supplied

```
1 //Example 8.1, page 287
2 clc
3 u=0.927*10^-23//amp-m2
4 B=1//in J/amp-m2
5 E=2*u*B
6 printf("\\n Energy supplied to the dipole is %e J "
    ,E)
```

---

Scilab code Exa 8.2 Transverse deflection

```
1 //Example 8.2, page 293
2 //From previous derivation of formula
3 clc
4 delb_by_delz=10//tesla/m
5 u=0.927*10^-23//amp-m2
6 x=1//in m
```

```

7 k=1.38*10^-23 //j/k
8 T=400 //in K
9 Z=(delb_by_delz*u*x^2)/(8*k*T)
10 printf("\n Transverse deflection that occur is + %e
      m or - %e m ",Z,Z)

```

---

### Scilab code Exa 8.3 Energy deflection

```

1 //Example 8.3, page 298
2 clc
3 m=9*10^-31 //in kg
4 e=1.6*10^-19 //in coul
5 c=3*10^8 //in m/s2
6 four_pi_epsilon=1.1*10^-34 //in j-sec
7 constant=9*10^9 //nt-n2/coul2
8 delta_E=(constant^4*m*e^8)/(54*c*c*(four_pi_epsilon)
      ^4)
9 printf("\n The energy deflection is %e Joule",
      delta_E)
10 //Answer given in the book is wrong

```

---

### Scilab code Exa 8.4 Deflection

```

1 //Example 8.4, page 299
2 clc
3 u_s=10^-23 //amp-m2
4 u_b=10^-23 //amp-m2
5 B=u_s/u_b
6 printf("\n The deflection is %d Tesla ",B)

```

---



# Chapter 9

## Multi electron atoms ground state and xray excitation

Scilab code Exa 9.5 Electric field

```
1 //example 9.5, page 343
2 clc
3 Z=[16 8 3]
4 //Argon numbers
5
6 for n=1:1:3
7 E=-((Z(n))/n)**2)*13.6
8 printf("\n The electric field for n=%d is %f ev",n
9 , E)
9 disp(E)
10 end
11 //Answer differnce is because of round off
```

---

Scilab code Exa 9.7 ionization energy

```
1 //Example 9.7, page 355
```

```

2  clc
3  Z=92
4  n=2
5  E=((Z/n)**2)*13.6//in ev
6  printf("\n The ionization energy is %e ev",E)
7  //Answer difference is because of round off

```

---

### Scilab code Exa 9.8 Calculating wavelength

```

1  //Example 9.8 , page 358
2  clc
3  //Energy of K shell
4  z=26
5  k=2
6  E_k=13.6*(z-k)^2//in ev
7  v=7.8*10^3//in V
8  //for L shell
9  l=10
10 E_l=13.6*(z-l)^2//in ev
11 h=E_k-E_l
12 R_m=1.1*10^7
13 x=R_m*(z-2)^2//x=1/lamda
14 lambda=1/x
15 printf("\n The wavelength is %e m",lambda)

```

---

### Scilab code Exa 9.9 Energy of K shell

```

1  //example 9.9 , page 360
2  //Energy of K shell
3  clc
4  z=82
5  k=2
6  E_k=13.6*(z-k)^2//in ev

```

```
7 printf("\n The energy of K shell is %e ev",E_k)
```

---

# Chapter 10

## Multi electron atoms optical excitations

Scilab code Exa 10.1 Calculating wavelength

```
1 //Example 10.1, page 370
2 clc
3 E3p=-3//in ev
4 E3s=-5.1//in ev
5 E=E3p-E3s
6 E_Joule=E*1.6*10^-19//in Joule
7 h=6.6*10^-34//in J-s
8 c=3*10^8//in m/s
9 disp('Part a')
10 lambda=(h*c)/E_Joule
11 printf("\n The wavelength is %e m",lambda)
12 //Part b
13 disp('Part b')
14 d_lambda=(h*c*E_Joule)/(E_Joule)^2
15 printf("\n The magnitude of seperation is %e m",
    d_lambda)
16 //Answer given in book for part b is wrong
```

---

### Scilab code Exa 10.5 Displace energy

```
1 //Example 10.5, page 386
2 clc
3 a=1*(1+1)
4 x=a+a-a
5 y=2*a
6 g=1+(x/y)
7 u=9.3*10^-24//amp-m2
8 B=1/10//in Tesla
9 delta_E=u*B*g
10 printf("\n The displace energy is %e ev",delta_E)
```

---

### Scilab code Exa 10.6 Magnetic energy

```
1 //Example 10.6, page 387
2 clc
3 h=6.6*10^-34//in J-s
4 v=1*10^10//per sec
5 ub=9.3*10^-24//in amp-m2
6 B=(h*v)/(2*ub)
7 printf("\n The Magentic energy is %e Tesla",B)
```

---

# Chapter 11

## Quantum statistics

Scilab code Exa 11.3 Boltzan factor

```
1 //Example 11.3, page 410
2 clc
3 h=6.6*10^-34//in J-s
4 v=1*10^7//per sec
5 K=1.4*10^-23//in J-K
6 T=300//in K
7 n=exp(-((h*v)/(K*T)))
8 printf("\\n The Boltzan factor is %e Tesla",1-n)
```

---

Scilab code Exa 11.5 Fermi energy

```
1 //Example 11.3, page 424
2 clc
3 disp('Part a')
4 A=108//in g/mole
5 M=10.5//in g/cm3
6 D=6.02*10^23//in atom/mole
7 n=(D*M)/A
```

```

8 h=6.6*10^-34
9 printf("\n The fermi energy is %e electron/cm^3",n)
10 m=9.1*10^-31//in kg
11 n=5.9*10^28//per m^2
12 x=((3*n)/(%pi))^(2/3)
13 Ef=(h^2/(8*m))*x
14 printf("\n The energy is %e J",Ef)
15 disp('part b')
16 K=1.38*10^-23//in J-K
17 T=300//in K
18 z=(n*h^3)/(2*%pi*m*K*T)^(3/2)
19 printf("\n The degeneracy term is %e ",z)
20 //Anser difference is because of round off

```

---

# Chapter 12

## Molecules

Scilab code Exa 12.1 Energy calculation

```
1 //Example 12.1, page 435
2 clc
3 c=9*10^9
4 cm=1.6*10^-19
5 d=2.4*10^-10//in m
6 v=(c*cm*cm)/d
7 e=v/(1.6*10^-19)//in J
8 printf("\n The energy is %e ev",e)
```

---

Scilab code Exa 12.3 Calculation of energy and temperature

```
1 //Example 12.3, page 445
2 clc
3 h=6.63*10^-34//in J-s
4 I=(2*%pi)^2*2.66*10^-47//in kg-m2
5 m_H=1/(6.02*10^26)//in kg
6 E=(h^2)/I
7 printf("\n The energy is %e J",E)
```



```
8 s=.59*10^-19//in J
9 k=1.38*10^-23//in j/k
10 T=(s)/k
11 printf("\n The temperature is %f K",T)
12 //Answer diffrence is because of round off
```

---

# Chapter 13

## Solids Conductors and semiconductors

Scilab code Exa 13.1 Electron per unit volume

```
1 //Example 13.1, Page no 471
2 clc
3 m=9.11*10^-31//in kg
4 h=6.63*10^-34//in j-s
5 ef=4.72*1.60*10^-19//in J
6 n=%pi*(((8*m)/h**2)^(3/2))*((ef**(3/2))/3)
7 printf("\n The number of electron per unit volume in
   lithium is %e /m^3",n)
```

---

Scilab code Exa 13.3 Angle

```
1 //Example 13.3, page 483
2 clc
3 m=9.11*10^-31//in kg
4 h=6.63*10^-34//in j-s
5 c=3*10^8//m/s
```

```
6 ef=4.72*1.60*10^-19//in J
7 pf=sqrt(2*m*ef)
8 tf=pf/(m*c)
9 printf("\n The angle is %e rad",tf)
```

---

# Chapter 14

## Solids super conductors and magnetic properties

Scilab code Exa 14.1 Calculating wavelength and gap energy

```
1 //Example 14.1, page 507
2 clc
3 disp('Part a')
4 k=1.4*10^-23//in J/K
5 Te=4.2//in K
6 eg=3*k*Te
7 printf("\n The gap energy is %e J",eg)
8 h=6.63*10^-34//in j-s
9 c=3*10^8//m/s
10 disp('Part b')
11 lambda=(h*c)/eg
12
13 printf("\n The wavelength is %e m",lambda)
```

---

Scilab code Exa 14.3 Unpaired electrons

```

1 //Example 14.3, Page 514
2 clc
3 u=9.3*10-24//in Tesla
4 B=1//in Tesla
5 Eb=u*B*6.24150934*1018
6 T=300//in K
7 k=8.6*10-5//ev/k
8 x=k*T
9 s=(Eb/x)*100
10 disp('Part a')
11 printf("\\n The percentage is %f",s)
12 disp('Part b')
13 n=2.0*1028//m3
14 k=1.38*10-23//in J/k
15 uo=4*pi*10-7//T-m/amp
16 con=(uo*n*u*u)/(k*T)
17 printf("\\n The number of unpaired electrons is %e",
    con)

```

---

#### Scilab code Exa 14.4 Energy and wavelength

```

1 //Example 14.4, Page 516
2 clc
3 uo=4*pi*10-7//T-m/amp
4 u=2.2*9.3*10-24//in Tesla
5 x=3*10-10//in m
6 E=(uo*u*u)/(2*pi*x**3)
7 printf("\\n The Energy required is %e Joule",E)
8 k=1.38*10-23//in J/k
9 T=E/k
10 printf("\\n The temperature is %f K",T)

```

---

# Chapter 15

## Nuclear Models

Scilab code Exa 15.2 Calculating wavelength and angle

```
1 //Example 15.2, Page 533
2 clc;
3 c=3*10^8//m/s
4 k=500//Mev
5 p=(k)/(c*6.2*10^12)
6 h=6.63*10^-34//in j-s
7 lambda=h/p
8 angle=0.53//in rad
9 r=lambda/angle
10 printf("\n The wavelength is %e m",lambda)
11 printf("\n The angle is %e m",r)
```

---

Scilab code Exa 15.4 Atomic mass

```
1 //Example 15.4, Page 540
2 clc
3 kb=4.44//in Mev
4 ka=7.70//in Mev
```

```

5 mb=1
6 mB=17
7 ma=4
8 Q=(kb*(1+(mb/mB)))-(ka*(1-(ma/mB)))
9 disp('Part a')
10 printf("\n The value of Q is %f Mev",Q)
11 c=3*10^8//m/s
12 m=Q/(931.5)
13 printf("\n The atomic mass of Q is %e u",m)

```

---

#### Scilab code Exa 15.5 Binding energy

```

1 //Example 15.5, Page 541
2 clc
3 M_He=4.0026033//*u, Mass of helium
4 M1H1=1.00782525//*u, electron mass
5 Mon1=1.0086654//*u, neutron mass
6 Mass=(2*M1H1)+(2*Mon1)
7 delta_M=(Mass)-M_He
8 printf("\n The binding energy of helium is %f *u",
    delta_M)

```

---

#### Scilab code Exa 15.7 Blank

```

1 //Example 15.7, page 547

```

---

#### Scilab code Exa 15.8 Density and potential

```

1 //Example 15.8, page 550
2 clc

```

```
3 N=0.60
4 rho=(N)/((4/3))
5 printf("\n The density is %f /pi*a^3",rho)
6 h=6.63*10^-34//in j-s
7 a=1.1//F
8 M=1
9 ef=43//in Mev
10 En=7//in Mev
11 Vo=ef+En
12 printf("\n The depth of the net nuclear potential
        acting on neutron \n is %d Mev", Vo)
```

---



# Chapter 16

## Nuclear decay and nuclear reactions

Scilab code Exa 16.1 Total energy

```
1 //Example 16.1, page 575
2 clc
3 r=(4**(1/3)+208**(1/3))*1.07
4 printf("\n The sum of radii is %f F",r)
5 e=1.60*10^-19//in coul
6 z=82
7 x=1.1*10^-10//coul2/nt-m2
8 Vo=(2*z*e*e)/(x*r*10^-15)
9 printf("\n The total energy is %e J",Vo)
```

---

Scilab code Exa 16.2 Elapsed time

```
1 //Example 6.2, Page 579
2 clc
3 x=log(exp(.827))
4 t=(log(143))/x
```

```
5 printf("\n The elapsed time is %f *10^9 year",t)
```

---

#### Scilab code Exa 16.4 Life time

```
1 //Example 16.4, Page 589
2 clc
3 // Using formula  $\log_b(m)=n$ 
4 //  $n=b^n$ 
5 F=10^(-5.7)
6 Y=12.3 //yr
7 d=365//day/yr
8 h=24//hr/day
9 m=60//min/hr
10 s=60//sec/min
11 T=(Y*d*h*m*s)/0.693
12 printf("\n The life time is %e s",T)
```

---

#### Scilab code Exa 16.5 Value of beta

```
1 //Example 16.5, Page 591
2 clc
3 h=1.05*10^-34//j-s
4 F=1.2
5 T=10^3//in s
6 m=.91*10^-30//in kg
7 c=3*10^8//in m/s
8 M=1
9 beta_square=(2*pi*pi*pi*(h^7))/(F*T*(m^5)*(c^4))
10 beta=sqrt(beta_square)
11 printf("\n The value of Beta is %e J^2*m^6",beta)
```

---

### Scilab code Exa 16.7 Value of delta and tou

```
1 //Example 16.7, Page no 603
2 clc
3 E=0.129//in Mev
4 x=931//uc^2
5 Del_E=(E)**2/(2*x*191)
6 printf("\n The value of delta E is %e ev",Del_E
       *10**6)
7 h=6.6*10^-16//ev-sec
8 T=1.4*10^-10//sec
9 Tou=h/T
10 printf("\n The value of Tou is %e ev",Tou)
```

---

### Scilab code Exa 16.9 Neutron produced

```
1 //Example 16.9, page 607
2 clc
3 Z=0+1+4
4 A=1+9-1
5 printf("\n The value of z is %d",Z)
6 printf("\n The value of A is %d",A)
7 ka=50
8 kb=48.1
9 mB=1
10 ma=1/9
11 mb=1/9
12 x=1/9//ma/mB
13 y=1/9//mb/mB
14 part1=kb*(1+x)
15 part2=ka*(1-y)
16 part3=(2*sqrt(ka*kb*ma*mb))
17 Q=part1-part2-part3
18 printf("\n The value of Q is %f Mev",Q)
19 sq_kb_plus=(1.36+sqrt(1.36**2+(4*1.11*42.5)))
```

```

    /(2*1.11)
20 sq_kb_minus=(1.36-sqrt(1.36**2+(4*1.11*42.5)))
    /(2*1.11)
21 kb_plus=(sq_kb_plus)**2
22 kb_minus=(sq_kb_minus)**2
23 printf("\n The maximum neutron produced at angle 30
    degree is %f Mev",kb_plus)

```

---

### Scilab code Exa 16.10 Events detected

```

1 //Example 16.8, page 615
2 clc
3 n=(1/10)/(54*1.66*10^-27)
4 d_ohm=10^-5/(10^-1)**2
5 d_zigma=(1.3*10^-3)*10^-31 //m2/nucleus
6 P=d_zigma*n
7 //disp(P)
8 I=(10^-7)/(1.6*10^-19)
9 //disp(I)
10 dN=I*P
11 printf("\n The number of events detected per sec is
    s %d",dN)
12 //The answer differnce is because of round off

```

---

### Scilab code Exa 16.11 Free electron

```

1 //Example 16.11, page 624
2 clc
3 E=200*1.6*10^-13 //j/neutron
4 E=10^-11 //Rounding off
5 p=E/(10^-3)
6 P=10^8 //in watt
7 N=P/p

```

```
8 printf("\n The number of free electron present is %e  
",N)
```

---

# Chapter 17

## Introduction to elementary particles

Scilab code Exa 17.1 Kinetic energy

```
1 //Example 17.1, Page 643
2 clc
3 h=1.05*10^-34//j-s
4 M=1.7*10^-27//in kg
5 r=2*10^-15//in m
6 K=(h**2)/(M*r*r)
7 s=K* 6.24150647996E+12//converting to Mev
8 K_total_cm=2*s
9 k_incident=2*K_total_cm
10 printf("\n The kinetic energy of incident nucleon is
    %d Mev",k_incident)
```

---

Scilab code Exa 17.3 value of pi

```
1 //Example 17.3, page 653
2 clc
```

```

3 h=1*10^-34//j-s
4 r=2*10^-15//m
5 c=3*10^8//m/s
6 m_pi=h/(r*c)
7 printf("The value of m pi is %e kg", m_pi)
8 //Answer difference is because of round off

```

---

### Scilab code Exa 17.5 Value of K

```

1 //Example 17.5, page no 664
2 clc;
3 Tz=(1-1)/2
4 //For K+
5 Q=1
6 B=0
7 S=1
8 Tz=1-0.5
9 printf("The value of Tz for K+ is %f \n",Tz)
10
11 //For K-
12 Q=-1
13 B=0
14 S=-1
15 Tz=-1+0.5
16 printf("The value of Tz for K- is %f\n",Tz)
17
18
19 //For Ko
20 Q=0
21 B=0
22 S=1
23 Tz=-0-0.5
24 printf("The value of Tz for Ko is %f \n",Tz)
25
26

```

```
27 //For Ko_dash
28 Tz=0+0.5
29 printf("The value of Tz for Ko- is %f \n",Tz)
```

---



# Chapter 18

## More elementary particles

Scilab code Exa 18.2 Variable values

```
1 //Example 18.2, Page 694
2 clc
3 Q=(2/3) - (1/3) - (1/3)
4 B=(1/3) + (1/3) + (1/3)
5 S=0+0-1
6 T=(1/2) + (1/2) + 0
7 Tz=(1/2) - (1/2) + 0
8 printf("The value of Q is %f \n",Q)
9 printf("The value of B is %f \n",B)
10 printf("The value of S is %f \n",S)
11 printf("The value of T is %f \n",T)
12 printf("The value of Tz is %f \n",Tz)
```

---