Scilab Textbook Companion for Principles of Physics by P .V. Naik[1]

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Book Description

Title: Principles of Physics

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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 1

Motion

Scilab code Exa 1.e.1 Tensions in the cables

```
clc
clear
//Input data
w=50//Weight in N
a=[40,50]//Angles made by two cables in degrees

//Calculations
//Solving two equations obtained from fig. 1.10 on
   page no.10
//-T1cos40+T2cos50=0
//T1sin40+T2sin50=50
A=[-cosd(a(1)) cosd(a(2))
    sind(a(1)) sind(a(2))]//Coefficient matrix
B=[0
   w]//Constant matrix
X=inv(A)*B//Variable matrix

//Output
printf('Tensions in all three cables are %3.2f N, %3
   .2f N, %i N',X(1),X(2),w)
```

Scilab code Exa 1.e.5 Acceleration of the block

```
clc
clear
m=100//Mass of block in kg
F=500//Force in N
q=30//Angle made with the horizontal in degrees
u=0.4//Coefficient of sliding friction

//Calculations
R=m*9.8//Reaction force in N
f=(u*R)//Frictional force in N
a=(F*cosd(q)-f)/m//Acceleration of the block in m/s^2

//Output
printf('The acceleration of the block is %3.2f m/s^2',a)
```

Scilab code Exa 1.e.6 Acceleration and Tension

```
clc
clear
//Input data
m=[20,80]//Masses of blocks in kg
F=1000//Force with which 20kg block is pulled in N

//Calculations
a=(F/(m(1)+m(2)))//Acceleration of the block in m/s^2
T=F-(m(1)*a)//Tension in the string in N

```

```
//Output
printf('The acceleration produced is %i m/s^2 \n The
    tension in the string connecting the blocks is
   %i N',a,T)
```

Scilab code Exa 1.e.8 Weight of the person

```
clc
clear
//Input data
w=588//Weight of the person in N
a=3//Acceleration in m/s^2

//Calculations
m=(w/9.8)//Mass of the person in kg
P=(w+(m*a))//Weight of the person when the elevator
    is accelerated upwards in N

//Output
printf('Weight of the person when the elevator is
    accelerated upwards is %i N',P)
```

Scilab code Exa 1.1 Orbital speed and centripetal acceleration

```
clc
clear
//Input data
d=180//Distance of satellite above the surface of
    earth in km
t=90//Time taken to complete one revolution of the
    earth in minutes
r=6400//Radius of the earth in kms

```

```
//Calculations
R=(r+d)*1000//Total distance in m
T=t*60//Time in seconds
v=(2*3.14*R)/T//Orbital speed in m/s
a=(v^2/R)//Centripetal acceleration in m/s^2

//Output
printf('Orbital speed is %i m/s \n Centripetal acceleration is %3.1f m/s^2',v,a)
```

Scilab code Exa 1.2 Speed

```
clc
clear
//Input data
m=0.05//Mass of the stone in kg
r=0.4//Radius of the string in m

//Calculations
vh=sqrt(9.8*r)//Minimum speed when the stone is at the top of the circle in m/s
vl=sqrt((2/m)*(((1/2)*m*vh^2)+(m*9.8*2*r)))//Minimum speed when the stone is at the bottom of the circle in m/s

//Output
printf('Minimum speed when the stone is at the top of the circle is %3.2f m/s \n Minimum speed when the stone is at the bottom of the circle is %3.2f m/s',vh,vl)
```

Scilab code Exa 1.3 Tension and acceleration

```
clc
clear
//Input data
m=0.2//Mass of the ball in kg
r=1.5//Radius of vertical circle in m
q=35//Angle made by the ball in degrees
v=6//Velocity of the ball in m/s

//Calculations
T=(m*((v^2/r)+(9.8*cosd(q))))//Tension in the string
    in N
at=9.8*sind(q)//Tangential acceleration in m/s^2
ar=(v^2/r)//Radial acceleration in m/s^2
a=sqrt(at^2+ar^2)//Acceleration in m/s^2

//Output
printf('Tension in the string is %3.1f N \n
   Tangential acceleration is %3.2f m/s^2 \n Radial
   acceleration is %i m/s^2',T,at,ar)
```

Scilab code Exa 1.4 Acceleration

```
clc
clear
//Input data
//A small ball is released from height of 4r
   measured from the bottom of the loop, where r is
   the radius of the loop

//Calculations
ar=(6*9.8)//Radial acceleration in m/s^2
at=(9.8*sind(90))//Tangential acceleration in m/s^2

//Output
printf('Radial acceleration is %3.1f m/s^2 \n
```

```
    Tangential acceleration is %3.1f m/s^2',ar,at)
```

Scilab code Exa 1.5 Period of rotation

```
clc
clear
//Input data
l=0.95//Length of the strring in m
m=0.15//Mass of the bob in kg
r=0.25//Radius of the circle in m

//Calculations
h=sqrt(l^2-r^2)//Height of the pendulum in m
t=2*3.14*sqrt(h/9.8)//Period of rotation in s

//Output
printf('The period of rotation is %3.4f s',t)
```

Scilab code Exa 1.6 Coefficient of limiting friction

```
clc
clear
//Input data
N=40//Minimum speed of rotor in rpm
r=2.5//Radius of rotor in m

//Calculations
t=60/N//Time period in s
u=(9.8*t^2)/(4*3.14^2*r)//Coefficient of limiting
    friction

//Output
```

```
printf('The coefficient of limiting friction between
    the object and the wall of the rotor is %3.4f',u
   )
```

Scilab code Exa 1.7 Speed

```
clc
clear
//Input data
a=30//Angle of inclination in degrees
t=3//Time in s

//Calculations
a=(9.8*sind(a))//Acceleration in m/s^2
v=(0+a*t)//Velocity in m/s

//Output
printf('Speed of the block after %i s is %3.1f m/s',
   t,v)
```

Scilab code Exa 1.8 Coefficient of static and kinetic friction

```
clc
clear
//Input data
m=10//Mass of the block in kg
F1=40//Horizontal force to start moving in N
F2=32//Horizontal force to move with constant
   velocity in N

//Calculations
u1=(F1/(m*9.8))//Coefficient of static friction
u2=(F2/(m*9.8))//Coefficient of kinetic friction
```

```

//Output
printf('Coefficient of static friction is %3.3f \n
   Coefficient of kinetic friction is %3.3f',u1,u2)
```

Scilab code Exa 1.9 Tension and coefficient of friction

```
clc
clear
//Input data
m=[3,12]//Masses of the blocks in kg
q=50//Angle made by the string in degrees
a=3//Acceleration of 12kg block in m/s^2

//Calculations
T=m(1)*(9.8+a)//Tension in the string in N
u=(m(2)*(9.8*sind(q)-a)-T)/(m(2)*9.8*cosd(q))//
   Coefficient of kinetic friction

//Output
printf('Tension in the string is %3.1f N \n The
   coefficient of kinetic friction between %i kg
   block and the plane is %3.3f',T,m(2),u)
```

Chapter 2

Work Energy and Power

Scilab code Exa 2.1 Workdone

```
clc
clear
//Input data
F=[6,2]//Constant force in vector form 6i+2j in N
s=[3,5]//Displacement in vector form 3i+5j in N

//Calculations
W=(F(1)*s(1))+(F(2)*s(2))//Workdone in J
q=acosd(W/(sqrt(F(1)^2+F(2)^2)*sqrt(s(1)^2+s(2)^2)))//Angle between Force and displacement in degrees

//Output
printf('Workdone by the force is %3.0f J \n Angle between Force and displacement is %3.1f degrees',W,q)
```

Scilab code Exa 2.2 Workdone

```
clc
clear
//Input data
m=10//Mass of block in kg
q=40//Angle made by the force with horizontal in degrees
s=5//Horizontal displacement of the block in m
u=0.3//Coefficient of kinematic friction

//Calculations
F=(u*m*9.8)/(cosd(q)+(u*sind(q)))//Pulling force in N
W=(F*cosd(q))*s//Workdone by the pulling force in J

//Output
printf('Workdone by the pulling force is %3.2f J',W)
```

Scilab code Exa 2.3 Workdone

```
clc
clear
//Input data
r1=[0,1]//Interval in m
r2=[1,2]//Interval in m
r3=[2,4]//Interval in m
r4=[0,5]//Interval in m
y=[6,12]//Y- coordinates from the graph 2.5 on page no. 27

//Calculations
a1=(1/2)*(r1(2)-r1(1))*y(1)//Area under the curve in J
a2=(r2(2)-r2(1))*y(1)//Area under the curve in J
a3=((r3(2)-r3(1))*y(1))+((1/2)*((r3(2)-r3(1))/2)*(y(2)-y(1)))+(((r3(2)-r3(1))/2)*(y(2)-y(1)))//Area
```

```
    under the curve in J
a4=(a1+a2+a3+((1/2)*y(2)*(r4(2)-r3(2))))//Area under
    the curve in J

//Output
X=[0,1,2,3,4,5]//X- coordinate is distance in m
Y=[0,6,6,12,12,0]//Y- coordinate is Force in N
plot(X,Y)//Graph shown in figure 2.5 on page no.27
xtitle('Distance versus Force','Distance in m','
    Force in N')

printf('The work done in the intervals: \n (a)%i<=x
    <=%i m is %i J \n (b)%i<=x<=%i m is %i J \n (c)%i
    <=x<=%i m is %i J \n (d)%i<=x<=%i m is %i J \n',
    r1(1),r1(2),a1,r2(1),r2(2),a2,r3(1),r3(2),a3,r4
    (1),r4(2),a4)
```

Scilab code Exa 2.4 Kinetic energy

```
clc
clear
//Input data
m=0.05//Mass of the body in kg
v=[3,5]//Velocity in vector form 3i+4j in m/s

//Calculations
ke=(1/2)*m*(v(1)^2+v(2)^2)//Kinetic energy in J

//Output
printf('Kinetic energy is %3.2f J',ke)
```

Scilab code Exa 2.5 Workdone

```
clc
clear
//Input data
k=50//Spring force constant in N/m
x=-0.02//Length of compression in m

//Calculations
W=(1/2)*k*(x)^2//Work done by the spring in J

//Output
printf('Work done by the spring when the block comes
    from the compressed position to the equilibrium
   position is %3.2f J',W)
```

Scilab code Exa 2.6 Force constant of the spring

```
clc
clear
//Input data
x=0.03//Length stretched by the spring in m
m=0.25//Mass of the body in kg

//Calculations
k=(m*9.8)/x//Force constant of the spring in N/m

//Output
printf('Force constant of the spring is %3.2f N/m',k
   )
```

Scilab code Exa 2.7 Speed of the block

```
clc
clear
```

```
//Input data
m=5//Mass of block in kg
F=20//Constant force in N
x=6//Distance moved by the block in m

//Calculations
W=(F*x)//Workdone by the block in J
v=sqrt((2*W)/m)//Speed of the block in m/s

//Output
printf('Speed of the block when it moves through a
    distance of %3.0f m is %3.2f m/s',x,v)
```

Scilab code Exa 2.8 Workdone and average power

```
clc
clear
//Input data
m=50//Mass of the object in kg
v=8//Speed in m/s
t=4//Time taken in s

//Calculations
a=(v-0)/t//Acceleration in m/s^2
s=(v^2/(2*a))//Distance in m
W=(m*a*s)//Workdone in J
P=(W/t)//Power delivered in watt

//Output
printf('Workdone on the object is %i J \n The
    average power delivered by the force in the first
     %i s is %i watt',W,t,P)
```

Chapter 3

Potential Energy

Scilab code Exa 3.1 Potential energy

```
clc
clear
//Input data
m=0.04//Mass of stone in kg
vi=25//Initial velocity in m/s
vf=0//Final velocity in m/s
yi=0//Initial height in m

//Calculations
Ui=(m*9.81*yi)//Initial potential energy in J
Ki=(1/2)*m*vi^2//Initial kinetic energy in J
Etotal=(Ui+Ki)//Total energy in J
h=(Etotal/(m*9.8))//Maximum height in m
//when the stone is at (2/3)h, total energy is again same
v=sqrt((Etotal-(m*9.8*(2/3)*h))/((1/2)*m))//Velocity at (2/3) of its maximum height in m/s

//Output
printf('Maximum height it will reach is %3.1f m \n Potential energy at that height is %3.1f J \n
```

```
velocity when it is at the two−third of its
maximum height is %3.2f m/s',h,Etotal,v)
```

Scilab code Exa 3.2 Potential energy

```
clc
clear
//Input data
m=0.5//Mass of the sphere in kg
vi=100//Initial velocity in m/s
vf=20//Final velocity in m/s

//Calculations
h=(vi^2-vf^2)/(2*9.8)//Height in m
PE=(m*9.8*h)//Potential energy in J

//Calculations
printf('Potential energy of the sphere is %i J',PE)
```

Scilab code Exa 3.3 Potential Energy

```
clc
clear
//Input data
m=0.5//Mass of the block in kg
x=0.05//Distance to which block is pulled in m
k=300//Force constant of the spring in N/m

//Calculations
U=(1/2)*k*x^2//Potential energy of the block in J
v=x*sqrt(k/m)//Velocity of the block in m/s

//Output
```

```
printf('Potential energy of the block when spring is
    in stretched position is %3.3f J \n Velocity of
   the block when it passes through the equilibrium
   position is %3.2f m/s',U,v)
```

Scilab code Exa 3.4 Speed

```
clc
clear
//Input data
l=0.8//Length of a simple pendulum in m
q=30//Angle with the vertical through which the bob
   is released in degrees
q1=10//Required angle in degrees

//Calculations
v=sqrt(2*9.8*l*(cosd(q1)-cosd(q)))//Speed in m/s

//Output
printf('Speed when the bob is at the angle of %i
   degrees with the vertical is %3.2f m/s',q1,v)
```

Scilab code Exa 3.5 Rest and total energy

```
clc
clear
//Input data
m=(9.1*10^-31)//Mass of the electron in kg
v=(3*10^8)//Velocity of light in m/s
c=(1.6*10^-19)//Charge of the electron in coloumbs

//Calculations
Re=(m*v^2)/(c*10^6)//Rest energy in MeV
```

```
E=(Re/sqrt(1-0.9^2))//Total energy in MeV

//Output
printf('Rest energy of the electron is %3.3f MeV \n
    Total energy is %3.4f MeV',Re,E)
```

Chapter 4

Rotational motion of Rigid Objects

Scilab code Exa 4.1 Moment of inertia and Kinetic energy

```
clc
clear
//Input data
w=4//Angular velocity in rad/s
m=[1,2,3,4]//Masses in kg from the figure 4.17 on
   page no.54
r=[2.5,1.5]//Centre position in m

//Calculations
I=(m(1)+m(2)+m(3)+m(4))*(r(1)^2+r(2)^2)//Moment of
   inertia in kg.m^2
KE=(1/2)*I*w^2//Kinetic energy of the system in J

//Output
printf('The moment of inertia is %i kg.m^2 \n
   Kinetic energy of the system is %i J',I,KE)
```

Scilab code Exa 4.2 Velocity and acceleration

```
clc
clear
//input data
q=30//Angle of inclination in degrees
h=1//Height in m

//Calculations
v=sqrt((10/7)*9.8*h)//Velocity in m/s
a=(5/7)*9.8*sind(q)//Acceleration in m/s^2

//Output
printf('Velocity and acceleration of the centre of
   mass of the sphere is %3.2f m/s and %3.1f m/s^2',
   v,a)
```

Scilab code Exa 4.3 Period of oscillation

```
clc
clear
//Input data
m=1.2//Mass of the rod in kg
l=0.8//Length of the rod in m

//Calculations
T=2*3.14*sqrt((2*l)/(3*9.8))//Time period in s

//Output
printf('Period of oscillation is %3.2f s',T)
```

Scilab code Exa 4.4 Period of oscillation

```
clc
clear
//Input data
r=0.2//Radius of uniform disc in m
d=0.15//Distance from the centre in m

//Calculations
T=2*3.14*sqrt((17*r)/(12*9.8))//Period of
    oscillations in s

//Output
printf('The period of oscillation is %3.2f s',T)
```

Scilab code Exa 4.5 Angular speed of rotation

```
clc
clear
//Input data
m=3//Mass of the rotor in kg
I=0.03//Moment of inertia in kg.m^2
d=0.25//Distance of pivot from the centre in m
p=30//Precession in rpm

//Calculations
T=m*9.8*d//Torgue in N.m
w=(p*2*3.14)/60//Angular velocity in rad/s
w1=(T/(I*w))//Angular speed of rotation of the rotor
     in rpm

//Output
printf('Angular speed of rotation of the rotor is %i
     rpm',w1)
```

Chapter 5

Properties of Matter

Scilab code Exa 5.1 Period of pendulum

```
clc
clear
//Input data
m=1//Mass of torsional pendulum in kg
R=0.06//Radius of torsional pendulum in m
l=1.2//Length of the wire in m
r=0.0008//Radius of wire in m
S=(9*10^9)//Modulus of rigidity of the material in N
    /m^2

//Calculations
I=(1/2)*m*R^2//Moment of inertia in kg.m^2
C=(3.14*S*r^4)/(2*l)//Couple per unit twist in N.m
T=2*3.14*sqrt(I/C)//Period of pendulum in s

//Output
printf('Period of pendulum is %3.1f s',T)
```

Scilab code Exa 5.2 Work done

```
clc
clear
//Input data
l=0.8//Length of the wire in m
d=(1.8*10^-3)//Diameter of the wire in m
a=1.5//Angle of twist in degrees
S=(1.8*10^11)//Modulus of rigidity of the material
    in N/m^2

//Calculations
r=(a*3.14)/180//Angle of twist in radians
W=((3.14*S*(d/2)^4*r^2)/(4*l))/10^-5//Work required
    to twist the wire in J*10^-5

//Output
printf('Work required to twist the wire is %3.2f
    *10^-5 J',W)
```

Scilab code Exa 5.3 PProperties of Material

```
clc
clear
//Input data
l=2//Length of wire in m
d=(0.4*10^-3)//Diameter of the wire in m
x=(1.03*10^-3)//Extension in length in m
L=2//Load in kg
C=(4.52*10^-6)//Couple in N/m
a=0.03//Twist angle in radians

//Calculations
Y=((L*9.8*l)/(x*3.14*(d/2)^2))/10^11//Young's
    modulus in N/m^2*10^11
S=((C*2*l)/(3.14*(d/2)^4*a))/10^11//Modulus of
    rigidity in N/m^2*10^11
```

```
s=(Y/(2*S))-1//Poisson's ratio

//Output
printf('Youngs modulus is %3.2f*10^11 N/m^2\nModulus
    of rigidity is %3.2f*10^11 N/m^2\nPoissons ratio
    is %3.4f',Y,S,s)
```

Scilab code Exa 5.4 Excess pressure

```
clc
clear
//Input data
r=0.003//Radius of drop of glycerine in m
T=(63.1*10^-3)//Surface tension of glycerine in N/m

//Calculations
P=((2*T)/r)//Excess pressure inside the drop of
   glycerine in N/m^2

//Output
printf('Excess pressure inside the drop of glycerine
    is %3.2f N/m^2',P)
```

Scilab code Exa 5.5 Rate of change of pressure

```
clc
clear
//Input data
r1=0.001//Initial radius in m
r2=0.004//Final radius in m
t=2*10^-3//Time in s
s=(7*10^-2)//Surface tension of water in N/m

```

```
//Calculations
P=((2*s)*((1/r2)-(1/r1)))/(t*10^4)//Rate of change of pressure in N/m^2.s*10^4

//Output
printf('Rate of change of pressure is %3.2f*10^4 N/m^2.s',P)
```

Scilab code Exa 5.6 Work done

```
clc
clear
//Input data
d=0.02//Diamter of soap bubble in m
s=(25*10^-3)//Surface tension in N/m
//Initial surface area of the bubble is zero and final area is 2*4*pie*r^2 where r is the radius of the bubble

//Calculations
W=(s*2*4*3.14*(d/2)^2)/10^-5//Work done in blowing a soap bubble in J*10^-5

//Output
printf('Work done in blowing a soap bubble is %3.2f*10^-5 J',W)
```

Scilab code Exa 5.7 Energy required

```
clc
clear
//Input data
r=0.01//Radius of liquid drop in m
```

```
n=500//Number of drops
s=(63*10^-3)//Surface tension in N/m

//Calculations
r1=(((4*3.14*r^3)/3)/((n*4*3.14)/3))^(1/3)//Radius of one small drop in m
As=(n*4*3.14*r1^2)//Total surface of 500 drops in m^2
as=4*3.14*r^2//Original surface area of the drop in m^2
W=(s*(As-as))/10^-4//Work done in J*10^-4

//Output
printf('Energy required to break up a drop of a liquid is %3.1f*10^-4 J',W)
```

Scilab code Exa 5.8 Speed of flow

```
clc
clear
//Input data
d=0.04//Inside diameter of garden hose in m
D=0.01//Diamter of nozzle opening in m
v1=0.6//speed of flow of water in the hose in m/s

//calculations
a=3.14*(d/2)^2//Area of hose in m^2
A=3.14*(D/2)^2//Area of nozzle in m^2
v2=(v1*a)/A//Speed of flow through the nozzle in m/s

//Output
printf('Speed of flow through the nozzle is %3.1f m/s',v2)
```

Chapter 6

Real gas and Transport Processes in Gas

Scilab code Exa 6.1 Critical constants

```
clc
clear
//Input data
a=(2.1*10^-2)//Vanderwaals constant a for neon gas
    in Nm^4/mol^2
b=(1.71*10^-5)//Vanderwaals constant b for neon gas
    in m^3/mol
R=8.314//Gas constant in J/mol.K

//Calculations
Tc=(8*a)/(27*b*R)//Critical temperature in K
Vc=(3*b)/10^-5//Critical volume in m^3/mol * 10^-5
Pc=(a/(27*b^2))/10^6//Critical pressure in N/m^2 *
    10^6

//Output
printf('Critical temperature is %3.2f K \n Critical
    volume is %3.2f * 10^-5 m^3/mol \n Critical
    pressure is %3.3f * 10^6 N/m^2',Tc,Vc,Pc)
```

Scilab code Exa 6.2 Mean free path

```
clc
clear
//Input data
n=181*10^-6//Coefficient of viscosity of a gas in p
v=3*10^4//Average speed of molecules in cm/s
d=1.2929*10^-3//Density in g/cm^3

//Calculations
lemda=((3*n)/(d*v))/10^-6//Mean free path in cm
   *10^-6

//Output
printf('Mean free path is %3.0f * 10^-6 cm',lemda)
```

Scilab code Exa 6.3 Diffusion coefficient of the gas

```
clc
clear
//Input data
m=(28*1.66*10^-27)//Molecular mass of a gas in kg
d=(3.48*10^-10)//Diameter in m
k=(1.38*10^-23)//Boltzmans constant in J/K
P=1.01*10^5//Pressure at STP in N/m^2
T=273//Temperature at STP in K

//Calculations
D=((1/(P*3*d^2*sqrt(m)))*((2*k*T)/3.14)^(3/2))/10^-5
   //Diffusion coefficient of a gas at STP in m^2/s

```

```
//Output
printf('Diffusion coefficient of a gas at STP is %3.2f * 10^-5 m^2/s',D)
```

Scilab code Exa 6.4 Viscosity of a gas

```
clc
clear
//Input data
m=(32*1.66*10^-27)//Molecular mass of a gas in kg
d=(3.65*10^-10)//Diameter in m
k=(1.38*10^-23)//Boltzmans constant in J/K
P=1.01*10^5//Pressure at STP in N/m^2
T=273//Temperature at STP in K

//Calculations
n=((1/(3.14*d^2))*sqrt((8*k*T*m)/(9*3.14)))/10^-5//Viscosity of gas at STP in N.s/m^2

//Output
printf('Viscosity of a gas at STP is %3.5f *10^-5 N.s/m^2',n)
```

Scilab code Exa 6.5 Thermal conductivity

```
clc
clear
//Input data
v=460//Average speed of molecules in m/s
l=(720*10^-10)//Mean free path in m
Cv=21.06//Specific heat at constant volume in J/K.mol
k=(1.38*10^-23)//Boltzmans constant in J/K
```

```
P=1.01*10^5//Pressure at STP in N/m^2
T=273//Temperature at STP in K
N=6.022*10^23//Avagadro constant

//Calculations
K=((1/3)*(Cv/N)*(P/(k*T))*v*l)/10^-2//Thermal conductivity of the gas at STP in W/m.K *10^-2

//Output
printf('Thermal conductivity of the gas at STP is %3.5f *10^-2 W/m.K',K)
```

Chapter 7

Thin Lens and Coaxial systems and Aberrations

Scilab code Exa 7.1 Position of cardinal points

```
clc
clear
//Input data
f1=-12//Focal length of a converging lens in cm
f2=25//Focal length of a diverging lens in cm
d=8//Distance between the lens in cm

//Calculations
C=(1/f1)+(1/f2)+(d/(f1*f2))//Inverse of focal length in cm^-1
D=(d/f2)+1//Constant value
A=(d/f1)+1//Constant value
O1F1=(-D/C)//Poistion of cardinal point in cm
O2F2=(A/C)//Poistion of cardinal point in cm
O1H1=(1-D)/C//Poistion of cardinal point in cm
O2H2=(A-1)/C//Poistion of cardinal point in cm

//Output
printf('Position of cardinal points are O1F1 = %3.2f
```

```
    cm, O2F2 = %3.2f cm, O1H1 = %3.2f cm, O2H2 = %3
    .2f cm\n The system is in air, therfore, nodal
    points coincide with unit points',O1F1,O2F2,O1H1,
    O2H2)
```

Scilab code Exa 7.2 Focal lengths

```
clc
clear
//Input data
f=15//Focal length of achromatic doublet made up of
    crown and flint glasses in cm
fl=[0.01506,0.02427]//Dispersive power of crown and
    flint glasses respectively

//Calculations
//Solving two equations
//(1/f)=(1/f1)+(1/f2)
//(f1/f2)=(-0.01506/0.02427)
fx=(fl(1)/fl(2))//Ratio of focal lengths
f2=(-(1/fx)+1)/(1/f)//Focal length of converging
    lens in cm
f1=(-fx*f2)//Focal length of diverging lens in cm

//Output
printf('Focal length of converging lens is %3.4f cm
    \n Focal length of diverging lens is %3.1f cm',f2
    ,f1)
```

Scilab code Exa 7.3 Radii of curvature

```
clc
clear
```

```
//Input data
f=20//Focal length in cm
fl=[0.015,0.019]//Dispersive powers of crown and flint glasses respectively
r=[1.495,1.53]//Refractive indices respectively

//Calculations
fx=-(fl(1)/fl(2))//Ratio of focal lengths
//Solving two equations
//(1/f)=(1/f1)+(1/f2)
//(f1/f2)=(-0.015/0.019)
f2=((1/fx)+1)/(1/f)//Focal length of converging lens in cm
f1=(fx*f2)//Focal length of diverging lens in cm
r2=(r(2)-1)*f2//Radius of curvature of convergent lens in cm
r1=1/(((1/f1)/(r(1)-1))+(1/r2))//Radius of curvature of divergent lens in cm

//Output
printf('Radius of curvature of converging lens is %3.4f cm \n Radius of curvature of diverging lens is %3.3f cm',r2,r1)
```

Scilab code Exa 7.4 Radii of curvature

```
clc
clear
//Input data
r=1.5//Refractive index of the material of a thin lens
f=-20//Focal length of the lens in cm
rx=-6//Ratio of radii of curvature of lens

//Calculations
```

```
r1=1/((1/f)/((r-1)*(1-(1/rx))))//Radius of curvature
    of convergent lens in cm
r2=(rx*r1)//Radius of curvature of divergent lens in
    cm

//Output
printf('Radii of curvature of lens are %3.2f cm and
   %i cm',r1,r2)
```

Chapter 9

Interference

Scilab code Exa 9.1 Wavelength

```
clc
clear
//Input data
t=0.2//Thickness of film in micro m
r=1.25//Refractive index of liquid
w=[4000,5000]//Range of wavelength in Angstrom
q=35//Angle observed in degrees

//Calculations
u=asind(sind(q)/r)//Angle of reflection in degrees
w1=(2*t*10^-6*r*cosd(u))/10^-10//Wavelength in
    Angstrom
w2=w1/2//Wavelength in Angstrom

//Output
printf('Wavelength absent in reflected light is %i
    Angstrom',w2)
```

Scilab code Exa 9.2 Thickness of the film

```
clc
clear
//Input data
r=1.39//Refractive index of the film
q=30//Angle observed in degrees
w=[5125,5000]//Wavelengths of two consecutive dark
    bands in Angstrom

//Calculations
r1=asind(sind(q)/r)//Angle of reflection in degrees
n=w(2)/(w(1)-w(2))//Constant value
t=((n*w(1)*10^-8)/(2*r*cosd(r1)))/10^-4//Thickness
    of the film in cm *10^-4

//Output
printf('Thickness of the film is %3.4f *10^-4 cm',t)
```

Scilab code Exa 9.3 Angle of wedge

```
clc
clear
//Input data
r=1.4//Refractive index of the material
w=5893//Wavelength of yellow light in Angstrom
n=10//Number of bands
w1=0.009//Width of band in m

//Calculations
b=asind((w*10^-8)/(2*r*n*w1))//Angle of wedge in
    degrees

//Output
printf('Angle of wedge is %3.4f degrees',b)
```

Scilab code Exa 9.4 Thickness

```
clc
clear
//Input data
r=1//Refractive index
n=4//Number of bands
w=6500//Wavelength in Angstrom

//Calculations
t=(((n+(1/2))*w*10^-8)/(2*r))/10^-4//Thickness of
    wedge shaped air film in cm *10^-4

//Output
printf('Thickness of wedge shaped air film is %3.4f
    *10^-4 cm',t)
```

Scilab code Exa 9.5 Radius of curvature

```
clc
clear
//Input data
d=0.5//Diameter of the ring in cm
n=4//number of bands
w=5893//Wavelength of light in Angstrom
q=30//Angle at which light enters in degrees

//Calculations
R=((d^2*cosd(q))/(2*(2*n+1)*w*10^-8))//Radius of
    curvature of lens in cm

//Output
```

```
printf('Radius of curvature of lens is %3.1f cm',R)
```

Chapter 10

Diffraction

Scilab code Exa 10.1 Width of central band

```
clc
clear
//Input data
D=1//Distance of screen from the slit in m
w=6000//Wavelength in Angstrom
w1=0.6//Slit width in mm

//Calculations
x=((2*D*w*10^-10)/(w1*10^-3))*1000//Width of central
    band in mm

//Output
printf('Width of central band is %i mm',x)
```

Scilab code Exa 10.2 Wavelength

```
clc
clear
```

```
//Input data
d1=6000//Diffraction grating have number of lines
   per cm
q=50//Diffracted second order spectral line observed
    in degrees
n=2//Second order

//Calculations
w=(sind(q)/(d1*n))*10^8//Wavelength of radiation in
   Angstrom

//Output
printf('Wavelength of radiation is %3.1f Angstrom',w
   )
```

Scilab code Exa 10.3 Maximum order of diffraction

```
clc
clear
//Input data
d1=6000//Diffraction grating have number of lines
   per cm
w=6000//Wavelength in Angstrom

//Calculations
n=(1/(d1*w*10^-8))//Maxmum order of diffraction

//Output
printf('Maximum order of diffraction that can be
   observed is %i',n)
```

Scilab code Exa 10.4 Ratio of intensity

```
clc
clear
//Input data
B=(3*3.14)/2//First secondary maxima at B

//Calculations
I=(sin(B)/B)^2//Ratio of intensity of central maxima
    to first secondary maxima

//Output
printf('Ratio of intensity of central maxima to
   first secondary maxima is %3.3f',I)
```

Scilab code Exa 10.5 Distance

```
clc
clear
//Input data
w=6400//Wave length of light in Angstrom
w1=0.3//Slit width in mm
d=110//Distance of screen from the slit in cm
n=3//order

//Calculations
x=((n*w*10^-10*(d/100))/(w1*10^-3))*1000//Distance
   between the centre of the central maximum and the
    third dark fringe in mm

//Output
printf('Distance between the centre of the central
   maximum and the third dark fringe is %3.2f mm',x)
```

Chapter 11

Polarization

Scilab code Exa 11.1 Polarizing angles

```
clc
clear
//Input data
r1=1.538//Refractive index of the crown glass for
   violet
r2=1.52//Refractive index of the crown glass for red

//Calculations
ip1=atand(r1)//Polarizing angle in degrees
ip2=atand(r2)//Polarizing angle in degrees

//Output
printf('Polarizing angles for violet and red are %3
   .2f degrees and %3.2f degrees',ip1,ip2)
```

Scilab code Exa 11.2 Angle

```
clc
```

```
clear
//Input data
I=0.09//Ratio of observed intensity to the initial
    intensity

//Calculations
q=acosd(sqrt(I))//Angle between the plane of
    transmission of the analyser and that of the
    polarizer in degrees

//Output
printf('Angle between the plane of transmission of
    the analyser and that of the polarizer is %3.2f
    degrees',q)
```

Chapter 12

Direct Current Circuits

Scilab code Exa 12.e.1 Current

```
clc
clear
//Input data
V=10//voltage in V from fig.12.7 on page no.175
R=10//Resistance in ohms from fig.12.7 on page no
   .175

//Calculations
I=(V/R)//Current in A

//Output
printf('Current in the circuit shown in fig.12.7 is
   %i A',I)
```

Scilab code Exa 12.e.2 Current

```
clc
clear
```

```
//Input data
R=[6,6,3]//Resistances in the circuit from circuit diagram 12.9 on page no. 175 in ohms
V=[24,16]//Voltages in the circuit from circuit diagram 12.9 on page no. 175 in V

//Calculations
Re1=1/((1/R(2))+(1/R(3)))//Equivalent resistance for parallel combination in ohms
Re=R(1)+Re1//Equivalent resistance of the ciriuit in ohms
I1=(V(1)/Re)//Current across the resistors in A
pd=(I1*Re1)//Potential difference across A and B from circuit diagram 12.9 on page no. 175 in V
I2=(pd/R(3))//Current across 3 ohms resistance in A
I3=(V(2)/(R(1)+R(2)))//Current in A
I=I2+I3//Total current

//Output
printf('The current shown in the circiut is %3.1f A',I)
```

Scilab code Exa 12.e.3 Thevenins equivalent circuit

```
clc
clear
//Input data
R=[4,12,2,12]//Resistances from circuit diagram 12.12 on page no. 177 in ohms
V=12//Voltage in V from circuit diagram 12.12 on page no. 177

//Calculations
Rth=((R(1)+R(3))*R(2))/(R(1)+R(3)+R(2))//Equivalent resistance in ohms
```

```
Vth=(V*R(2))/(R(1)+R(3)+R(2))//Equivalent voltage in V
I=(Vth/(Rth+R(4)))//Current in A

//Output
printf('The current through the resistor is %3.1f A',I)
```

Scilab code Exa 12.e.4 Thevenins equivalent circuit

```
clc
clear
//Input data
R=[2,3,6]//Resistances from circuit diagram 12.15 on page no. 178 in ohms
I=2//Current in A from circuit diagram 12.15 on page no. 178

//Calculations
Rth=(R(2)+R(3))//Equivalent resistance in ohms
Vth=(R(3)*I)//Equivalent voltage in V

//Output
printf('Thevenin equivalent resistance is %i ohms \n Thevenin equivalent voltage is %i V',Rth,Vth)
```

Scilab code Exa 12.e.5 Thevenins equivalent circuit

```
clc
clear
//Input data
R=[12,8,3,6]//Resistances from circuit diagram 12.17 on page no.179 in ohms
```

```
V=12//Voltage in V from circuit diagram 12.17 on
    page no.179

//Calculations
Rth=((R(3)*R(1))/(R(3)+R(1)))+((R(2)*R(4))/(R(2)+R
    (4)))//Equivalent resistance in ohms
Vth=2.74//Thevenin voltage taken from the circuit
    diagram 12.19(a) on page no.179 in V

//Output
printf('Thevenin equivalent resistance is %3.2f ohms
     \n Thevenin equivalent voltage is %3.2f V',Rth,
    Vth)
```

Scilab code Exa 12.e.6 Nortons equivalent circuit

```
clc
clear
//Input data
R=[4,12,2,12]//Resistances from circuit diagram
    12.20 on page no.180 in ohms
V=12//Voltage in V from circuit diagram 12.20 on
    page no.180

//Calculations
RN=((R(1)+R(3))*R(2))/(R(1)+R(3)+R(2))//Equivalent
    resistance in ohms
IN=(V/(RN+R(3)))//Equivalent current in A

//Output
printf('Nortons equivalent resistance is %i ohms \n
    Nortons equivalent current is %i A',RN,IN)
```

Scilab code Exa 12.e.7 Nortons equivalent circuit

```
clc
clear
//Inut data
R=[4,5,6]//Resistances from circuit diagram 12.22 on
    page no.181 in ohms
I=2//Current in A from circuit diagram 12.22 on page
    no.181

//Calculations
RN=(R(1)+R(2)+R(3))//Equivalent resistance in ohms
IN=(R(1)*I)/RN//Equivalent curren in A

//Output
printf('Nortons equivalent resistance is %i ohms \n
   Nortons equivalent current is %3.3f A',RN,IN)
```

Scilab code Exa 12.1 Current

```
clc
clear
//Input data
R=[6,6,12]//Resistances from circuit diagram 12.34
   on page no.192 in ohms
V=[5,2]//Voltage in V from circuit diagram 12.20 on
   page no.192

//Calculations
Re=((R(2)*R(3))/(R(2)+R(3)))+R(1)//Equivalent
   resistance in ohms for 5V supply
I=V(1)/Re//Equivalent current in A for 5V supply
Ve=((R(2)*R(3))/(R(2)+R(3)))*I//Voltage across 5V
   supply in V
I1=(Ve/R(3))//Current in A
```

```
Re2=(1/((1/(R(1)))+(1/(R(2)))))+R(3)//Equivalent resistance in ohms for 2V supply
I2=V(2)/Re2//Equivalent current in A for 2V supply
Ix=I1-I2//Current through 12 ohm resistance in A
Iy=1/Ix//For displaying output in fraction

//Output
printf('The current through %i ohm resistor is 1/%i A',R(3),Iy)
```

Scilab code Exa 12.2 Equivalent circuit

```
clc
clear
//Input data
R=[3,5,6,7]//Resistances from circuit diagram 12.36(a) on page no. 193 in ohms
V=12//Voltage in V from circuit diagram 12.36(a) on page no. 193

//Calculations
Vth=(V*R(3))/(R(3)+R(4)+R(2))//Equivalent voltage in V
Rth=R(1)+(((R(2)+R(4))*R(3))/(R(2)+R(4)+R(3)))//Equivalent resistance in ohms

//Output
printf('Thevenin equivalent resistance is %i ohms \n Thevenin equivalent voltage is %i V',Rth,Vth)
```

Scilab code Exa 12.3 Norton equivalent

```
clc
```

```
clear
//Inut data
R=[2,3,4]//Resistances from circuit diagram 12.37(a)
    on page no.194 in ohms
V=5//Voltage in V from circuit diagram 12.37(a) on
    page no.194

//Calculations
RN=((R(1)+R(2))*R(3))/(R(1)+R(2)+R(3))//Equivalent
    resistance in ohms
IN=V/(R(1)+R(2))//Equivalent current in A

//Output
printf('Nortons equivalent resistance is %3.2f ohms
    \n Nortons equivalent current is %i A',RN,IN)
```

Scilab code Exa 12.4 Parameters

```
clc
clear
//Input data
C=10*10^-6//Capicitance in F
R=10*10^3//Resistance in ohms
e=6//Emf of the battery in V

//Calculations
t=C*R//Time constant in s
Qm=(C*e)/10^-6//Maximum charge in micro C
Im=(e/R)*1000//Maximum current in mA

//Output
printf('Time constant of the circuit is %3.1f s \n
    Maximum charge on the capacitor is %i micro C \n
    Maximum current in the circuit is %3.1f mA \n
    Charge at time t is Q(t) = %i(1-exp(-t/%3.1f))
```

```
micro C \n Currrent at time t is I(t) = %3.1f exp
(-t/%3.1f) mA',t,Qm,Im,Qm,t,Im,t)
```

Scilab code Exa 12.5 Time constant

```
clc
clear
//Input data
L=50//Inductance in mH
R=5//Resistance in ohms
V=6//Volatage of the battery in V
t=5//Time in ms

//Calculations
t1=(L/R)//Time constant in ms
I=(V/R)*(1-exp(-t/t1))//Current in A

//Output
printf('The time constant of the circuit is %i ms \n
    The current in the circuit is %3.2f A',t1,I)
```

Scilab code Exa 12.6 Parameters

```
clc
clear
//Input data
L=6//Inductance in mH
C=12//Capacitance in pF
V=6//Voltage of the battery in V

//Calculations
f=(1/(2*3.14*sqrt(L*10^-3*C*10^-12)))/10^5//
   Frequency of oscillation in Hz*10^5
```

```
Qm=(C*10^-12*V)/10^-12//Maximum charge in C *10^-12
Im=(2*3.14*f*10^5*Qm*10^-12)/10^-6//Maximum current
    in micro A

//Output
printf('Frequency of oscillation is %3.2f *10^5 Hz \
    n The maximum value of charge on capacitor is %i
    *10^-12 C \n The current in the circuit is %i
    micro A',f,Qm,Im)
```

Chapter 13

Alternating Current Circuits

Scilab code Exa 13.1 rms current and maximum current

```
clc
clear
//Input data
Vm=100//Maximum voltage in V
R=50//resitance in ohms

//Calculations
Vrms=(Vm/sqrt(2))//rms voltage in V
Irms=(Vrms/R)//rms current in A
Im=(Vm/R)//Maximum current in A

//Output
printf('rms current is %3.2f A and maximum current
    is %i A',Irms,Im)
```

Scilab code Exa 13.2 rms current

```
clc
```

```
clear
//Input data
c=50//Capacitor in micro F
Vm=220//Maximum voltage in V
f=50//Frequency in Hz

//Calculations
Xc=(1/(2*3.14*c*10^-6*f))//Reactance in ohms
I=(Vm/Xc)//Maximum current in A
Irms=I/sqrt(2)//rms current in A

//Output
printf('rms current is %3.2f A',Irms)
```

Scilab code Exa 13.3 rms current

```
clc
clear
//Input data
L=2//Inductance in H
Vrms=220//rms voltage in V
f=50//Frequency in Hz

//Calculations
Xl=(2*3.14*f*L)//Reactance in ohms
Irms=(Vrms/Xl)//rms current in A

//Output
printf('rms current is %3.3f A',Irms)
```

Scilab code Exa 13.4 Maximum potential difference

```
clc
```

```
clear
//Input data
Vm=220//Maximum voltage in V
f=50//frequency in Hz
R=2000//Resistance in ohms
C=5*10^-6//Capacitor in F

//Calculations
Xc=(1/(2*3.14*f*C))//Reactance in ohms
Z=sqrt(R^2+Xc^2)//Impedence in ohm
Vc=(Vm*Xc)/Z//Maximum potential difference across
    the capacitor in V

//Output
printf('Maximum potential difference across the
    capacitor is %3.2f V',Vc)
```

Scilab code Exa 13.5 rms potential difference

```
clc
clear
//Input data
R=5000//Resistance in ohms
L=2//Inductance in H
Vrms=200//rms Voltage in V
f=50//Frequency in Hz

//Calculations
Xl=(2*3.14*f*L)//Inductive reactance in ohms
Z=sqrt(R^2+Xl^2)//Impedence in ohms
Vl=(Vrms*Xl)/Z//rms potential difference across the
    inductor in V

//Output
printf('rms potential difference across the inductor
```

```
is %3.2f V',Vl)
```

Scilab code Exa 13.6 Parameters

```
clc
clear
//Input data
R=10//Resistance in ohms
L=5*10^-3//Inductance in H
C=10*10^-6//Capacitance in F
V=100//Voltage in V
f=50//Frequency in Hz

//Calculations
Xc=(1/(2*3.14*f*C))//Capacitive reactance in ohms
Xl=(2*3.14*f*L)//Inductive reactance in ohms
Z=sqrt(R^2+(Xl-Xc)^2)//Impedence in ohms
I=(V/Z)//Current in A
q=atand((Xl-Xc)/R)//Phase angle in degrees
Vr=(I*R)//Voltage across resistor in V
Vc=(I*Xc)//Voltage across capacitor in V
Vl=(I*Xl)//Voltage across inductor in V

//Output
printf('Total impedence is %3.1f ohms \n Current is
    %3.3f A \n Phase angle is %3.2f degrees \n
    Voltage across resistor is %3.2f V \n Voltage
    across capacitor is %3.2f V \n Voltage across
    inductor is %3.3f V',Z,I,q,Vr,Vc,Vl)
```

Scilab code Exa 13.7 Resonating frequency and Q factor

```
clc
```

```
clear
//Input data
R=5//Resistance in ohms
L=2*10^-3//Inductance in H
C=25*10^-6//Capacitance in F
V=50//Voltage in V

//Calculations
w=1/sqrt(L*C)//Angular speed in rad/s
f=(w/(2*3.14))//Frequency in Hz
Q=(w*L)/R//Q factor

//Output
printf('Resonating frequency is %3.2f Hz \n Q factor is %3.2f',f,Q)
```

Scilab code Exa 13.8 Capacitance and resistance

```
clc
clear
//Input data
L=(20*10^-3)//Inductance in H
Q=8//Q factor
f=1000//Frequency in Hz

//Calculations
R=(2*3.14*f*L)/Q//Resistance in ohms
C=(1/((2*3.14*f)^2*L))/10^-6//Capacitance in microF

//Output
printf('Capacitance and resistance of coil is %3.2f micro F and %3.1f ohms respectively',C,R)
```

Chapter 15

Motion of a charged particle

Scilab code Exa 15.1 Speed

```
clc
clear
//Input data
E=5000//Intensity of electric field in N/C
d=0.02//Distance in m
e=(1.6*10^-19)//Charge of the electron in C
m=(9.1*10^-31)//Mass of the electron in kg

//Calculations
v=sqrt(2*e*E*d/m)/10^6//Speed of the electron in m/s
    *10^6

//Output
printf('Speed of the electron is %3.2f *10^6 m/s',v)
```

Scilab code Exa 15.2 Vertical displacement

```
clc
```

```
clear
//Input data
v=(5*10^6)//Velocity of the electron in m/s
E=2000//Intensity of electric field in N/C
d=0.06//Distance in m
e=(1.6*10^-19)//Charge of the electron in C
m=(9.1*10^-31)//Mass of the electron in kg


//Calculations
y=((-e*E*d^2)/(2*m*v^2))*100//Vertical displacement
    of the electron when it just leaves the electric
    field in cm

//Output
printf('Vertical displacement of the electron when
    it just leaves the electric field is %3.2f cm',y)
```

Scilab code Exa 15.3 Time required

```
clc
clear
v=(4*10^5)//Velocity of the positively charged
    particle in m/s
E=300//Intensity of electric field in N/C
e=(1.6*10^-19)//Charge of the positively charged
    particle in C
m=(1.67*10^-27)//Mass of the positively charged
    particle in kg
q=35//Angle made by the particle in degrees

//Calculations
t=((v*sind(q)*m)/(e*E))/10^-6//Time required by the
    particle to reach the maximum height in the
    electric field in micro s
```

```

//Output
printf('Time required by the particle to reach the maximum height in the electric field is %3.2f micro s',t)
```

Scilab code Exa 15.4 Orbital speed

```
clc
clear
//Input data
r=0.3//Radius of circular orbit in m
B=0.38//Magnetic field strength in T
e=(1.6*10^-19)//Charge of the proton in C
m=(1.672*10^-27)//Mass of the proton in kg

//Calculations
v=((e*B*r)/m)/10^6//Orbital speed of the proton in m/s

//Output
printf('Orbital speed of the proton is %3.0f *10^6 m/s',v)
```

Scilab code Exa 15.5 Pitch of helix and radius of trajectory

```
clc
clear
//Input data
e=(1.6*10^-19)//Charge of the proton in C
m=(1.67*10^-27)//Mass of the proton in kg
B=0.8//Magnetic field strength in T
```

```
v=[4*10^6,3*10^6]//Velocity of charged particle in
   vxi+vyj form in m/s

//Calculations
p=(v(1)*2*3.14*m)/(e*B)//Pitch of the helix in m
R=(m*v(2))/(e*B)//Radius of the trajectory in m

//Output
printf('The pitch of the helix is %3.3f m \n Radius
   of the trajectory is %3.5f m',p,R)
```

Chapter 16

Electrons Ions Isotopes and Nucleus

Scilab code Exa 16.1 Seperation

```
clc
clear
//Input data
E=(200*100)//Electric field in V/m
B=0.2//Magnetic field in T
B1=0.3//Magnetic field in the main chamber in T
q=(1.6*10^-19)//Charge of the electron in coloumbs
m=[12,13]//Carbon isotopes C12 and C13
M=(1.67*10^-27)//AMU(Atomic Mass Unit) in kg

//Calculations
v=(E/B)//Velocity in m/s
s=(2*v*(m(2)-m(1))*M*100)/(q*B1)//Seperation in cm

//Output
printf('Seperation on photographic plate is %3.4f cm
   ',s)
```

Scilab code Exa 16.2 BE per nucleon

```
clc
clear
//Input data
a=20//Atomic number of Ca
m=40//mass number of Ca
M=39.962591//Mass of Ca nucleus in u
mp=1.007276//Mass of proton in AMU
mn=1.008665//Mass of neutron in AMU

//Calculations
BE=(1/m)*((a*mp)+(a*mn)-M)*1000//BE per nucleon in
   MeV

//Output
printf('BE per nucleon is %3.6f MeV',BE)
```

Chapter 17

Quantum Theory

Scilab code Exa 17.1 Maximum kinetic energy

```
clc
clear
//Input data
w=4000//Wavelength of the light in Angstrom units
wf=2.25//Work function of potassium in eV
m=(9.1*10^-31)//Mass of the electron in kg
v=(3*10^8)//Velocity of light in m/s
c=(1.6*10^-19)//Charge of the electron in coloumbs
h=6.626*10^-34//Plancks constant in Js

//Calculations
E=(h*v)/(w*10^-10*c)//Energy of incident photon in
    eV
KE=(E-wf)//Kinetic energy in eV

//Output
printf('Maximum kinetic energy of photoelectron is
    %3.3f eV',KE)
```

Scilab code Exa 17.2 Stopping potential

```
clc
clear
//Input data
wf=1.9//Workfunction of the material in eV
w=3000//Wavelength of the light in Angstrom units
v=(3*10^8)//Velocity of light in m/s
c=(1.6*10^-19)//Charge of the electron in coloumbs
h=6.626*10^-34//Plancks constant in Js

//Calculations
V=(1/c)*(((h*v)/(w*10^-10))-(wf*c))//Stopping
    potential in V

//Output
printf('Stopping potential is %3.2f V',V)
```

Scilab code Exa 17.3 Shortest wavelength

```
clc
clear
//Input data
V=(70*10^3)//Accelerating potential in V
v=(3*10^8)//Velocity of light in m/s
c=(1.6*10^-19)//Charge of the electron in coloumbs
h=6.626*10^-34//Plancks constant in Js

//Calculations
lmin=((h*v)/(c*V))/10^-9//Shortest wavelength of X-
    rays produced in nm

//Output
printf('Shortest wavelength of X-rays produced is %3
    .4f nm',lmin)
```

Scilab code Exa 17.4 Wavelength

```
clc
clear
//Input data
w1=2//Wavelength in Angstrom
Z1=24//Target one
Z2=42//Target two
a=1//Constant value

//Calculations
w2=w1*((Z1-a)/(Z2-a))^2//Wavelength in Angstrom

//Output
printf('Wavelength is %3.2f Angstrom',w2)
```

Scilab code Exa 17.5 Wavelength

```
clc
clear
//Input data
w=3//Wavelength of the light in Angstrom
v=(3*10^8)//Velocity of light in m/s
h=6.626*10^-34//Plancks constant in Js
q=40//Scattering angle in degrees
m=(9.11*10^-31)//Mass of electron in kg
c=(1.6*10^-19)//Charge of the electron in coloumbs

//Calculations
dl=(h/(m*v))*(1-cosd(q))/10^-10//Wavelength in
    Angstrom
```

```
l=(w+dl)//Wavelength of scattered X-rays

//Output
printf('Wavelength of scattered X-rays is %3.6f
    Angstrom',l)
```