Scilab Textbook Companion for Fundamentals Of Physical Chemistry by H. D. Crockford, J. W. Nowell, H. W. Baird And F. W. Getzen[1]

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Book Description

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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.

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Chapter 2

Gases

Scilab code Exa 2.1 chapter 2 example 1

```
clc
//initialisation of variables
P= 730 //mm
V= 20 //litres
T= -20 //C
P1= 760 //mm
T1= 0 //C
//CALCULATIONS
V1= P*V*(273+T1)/((273+T)*760)
//RESULTS
printf ('volume at STP = %.1f litres',V1)
```

Scilab code Exa 2.2 chapter 2 example 2

```
clc
//initialisation of variables
N= 6*10^23 //molcules
R= 0.0821 //lit atm mole^-1
```

```
V= 20 //lit
P= 730 //mm of Hg
T= -20 //C
//CALCULATIONS
M= N*P*V/(760*R*(273+T))
//RESULTS
printf ('Molecules = %.2e molecules',M)
```

Scilab code Exa 2.3 chapter 2 example 3

```
clc
//initialisation of variables
P= 100 //cm
m= 2*10^20 //molecules
N= 6*10^23
R= 0.0821 //lit atm mole^-1
T= 27 //C
//CALCULATIONS
V= m*R*(T+273)*760*100/(N*P)
//RESULTS
printf ('Volume = %.2f cm^3',V)
```

Scilab code Exa 2.4 chapter 2 example 4

```
clc
//initialisation of variables
P= 752 //mm
V= 0.2 //lit
T= 21 //C
R= 0.0821 //lit atm mole^-1
m= 0.980 //gms
//CALCULATIONS
M= m*R*(T+273)*760/(V*P)
```

```
//RESULTS
printf ('molecular weight of chloroform = %.1f gmsper mole',M)
```

Scilab code Exa 2.5 `chapter 2 example 5`

```
clc
//initialisation of variables
m= 7 //gms
m1= 16 //gms
m2= 3.03 //gms
M= 32 //gms
M1= 28 //gms
M2= 2.02 //gms
T= 50 //C
V= 80 //lit
R= 0.0821 //atm lit mole^-1
//CALCULATIONS
Pn= m*R*(T+273)/(M1*V)
Po= m1*R*(T+273)/(M*V)
Ph= m2*R*(T+273)/(M2*V)
P= Pn+Po+Ph
//RESULTS
printf ('Partial pressure of nitrogen = %.3f atm',Pn)
printf ('\n Partial pressure of oxygen = %.3f atm',Po)
printf ('\n Partial pressure of hydrogen = %.3f atm',Ph)
printf ('\n total pressure = %.3f atm',P)
```

Scilab code Exa 2.6 `chapter 2 example 6`

```
clc
//initialisation of variables
P= 23.8 //mm
V= 0.5 //lit
R= 0.0821 //lit atm mole^-1
T= 25 //C
//CALCULATIONS
P1= 760-P
n= P1*V/(760*R*(273+T))
V1= V*1000*P1*273/(760*(T+273))
//RESULTS
printf ('Volume of oxygen = %.f ml',V1)
```

Scilab code Exa 2.7 chapter 2 example 7

```
clc
//initialisation of variables
t= 20 //min
t1= 19.4 //min
M= 32 //gms
//CALCULATIONS
x= M*t1^2/t^2
//RESULTS
printf ('molecular weight of ethane = %.1f gms',x)
```

Scilab code Exa 2.8 chapter 2 example 8

```
clc
//initialisation of variables
R= 8.31*10^7 //ergs mole^-1
T= 27 //C
M= 28 //gram per mole
//CALCULATIONS
```

```
c= sqrt(3*R*(273+T)/M)
//RESULTS
printf ('root-mean-square velocity = %.2e cm per
   sec',c)
```

Scilab code Exa 2.9 `chapter 2 example 9`

```
clc
//initialisation of variables
V= 5.16*10^14 //cm per sec
M2= 28 //gms
M1= 2.02 //gms
//CALCULATIONS
c1= V*sqrt(M2/M1)
//RESULTS
printf ('Velocity of hydrogen molecule = %.1e cm
   per sec',c1)
```

Scilab code Exa 2.10 `chapter 2 example 10`

```
clc
//initialisation of variables
V= 0.5 //lit
T= 50 //C
n= 1//mole
R= 0.0821 //lit atm mole^-1
a= 4.28*10^-2 //litres mole^-1
b= 3.6 //arm mole^-2 lit^2
//CALCULATIONS
P= n*R*(273+T)/V
P1= (n*R*(T+273)/(V-n*a))-(b/V^2)
//RESULTS
printf ('Pressure = %.f atm',P)
```

```
printf(' \n Pressure using vanderwals equation= %.1
    f atm',P1)
```

Chapter 3

Liquids

Scilab code Exa 3.1 chapter 3 example 1

```
clc
//initialisation of variables
p= 388.6 //mm
p1=26.5 //mm
T= 60 //C
R= 1.99 //cal mole^-1 A^-1
//CALCULATIONS
Lv= log10(p/p1)*2.303*R*273*(273+T)/(T)
//RESULTS
printf ('heat of vapourisation of benzene= %.f cal
    per mole',Lv+2)
```

Scilab code Exa 3.2 chapter 3 example 2

```
clc
//initialisation of variables
d= 0.789 //gram per cc
r= 0.010 //cm
```

```
h= 5.76 //cm
g= 980.7 // cm /sec^2
//CALCULATIONS
R= d*h*r*g/2
//RESULTS
printf (' Surface tension= %.1f dynes per cm',R)
```

Scilab code Exa 3.3 `chapter 3 example 3`

```
clc
//initialisation of variables
W= 0.220 //gms
g= 980.7 //cm per sec62
f= 0.98
l= 4 //cm
//CALCULATIONS
T= W*g/(2*l)
Tc= T*f
//RESULTS
printf (' apparent surface tension= %.1f dynes per
    cm',T)
printf (' \n exact surface tension= %.1f dynes per
    cm',Tc)
```

Scilab code Exa 3.4 `chapter 3 example 4`

```
clc
//initialisation of variables
n2= 10.05*10^-3 //poise
d1= 0.879 //gms cm^-3
t= 88 //sec
d2= 1 //gms cm^-3
t1= 120 //sec
```

```
//CALCULATIONS
n1= d1*t/(d2*t1)
//RESULTS
printf (' relative viscosity= %.3f ',n1)
```

Chapter 4

Solutions Nonelectrolytes

Scilab code Exa 4.1 chapter 4 example 1

```
clc
//initialisation of variables
m= 164.2 //gms
M= 60 //gms
V= 0.8 //lit
d= 1.026 //g/cc
mw= 18.02 //gms
//CALCULATIONS
M1= m/M
n= M1/V
G= V*1000*d
G1= G-m
m1= M1*1000/G1
n1= G1/mw
x= M1/(M1+n1)
y= 1-x
p= x*100
p1= y*100
P= m*100/G
//RESULTS
printf (' molarity= %.3f M',n)
```

```
printf (' \n molality= %.3f m',m1)
printf (' \n mole fraction of solute= %.4f ',x)
printf (' \n mol per cent of solute= %.2f per cent',p)
printf (' \n mol per cent of solvent= %.2f per cent',p1)
printf (' \n mol per cent acetic acid by weight= %.2f per cent',P)
```

Scilab code Exa 4.2 chapter 4 example 2

```
clc
//initialisation of variables
m= 0.0346 //gms
V= 800 //ml
P= 742 //mm
M= 32 //gms
p= 400 //mm
//CALCULATIONS
c= m*1000/V
g= c*760/(P*M)
K= g*22.4
k= c/P
c1= k*p
//RESULTS
printf (' concentration of oxygen= %.4f gram per litre',c)
printf (' \n moles dissolved = %.5f moles',g)
printf (' \n Bunsen absorption = %.4f litre',K)
printf (' \n grams of oxygen dissolved = %.4f gram per litre',c1)
```

Scilab code Exa 4.3 chapter 4 example 3

```
clc
//initialisation of variables
mn= 0.0134 //gms
mo= 0.0261 //gms
mh= 0.0081 //gms
T= 30 //C
P= 3 //atm
r= 4/5
//CALCULATIONS
V= mn*(273+T)*1000/273
V1= V*r
V2= V1*P
V3= mo*(273+T)*(1-r)*P*1000/273
V4= mh*(273+T)*r*1000/273
V5= V4*P
V6= V2-V1
V7= V5-V4
//RESULTS
printf (' volume of oxygen= %.1f ml',V)
printf (' \n volume of nitrogen= %.1f ml',V3)
printf (' \n volume of helium = %.1f ml',V5)
printf (' \n volume of nitrogen and helium would be
    expelled = %.1f ml',V7)
```

Scilab code Exa 4.4 Chapter 4 example 4

```
clc
//initialisation of variables
p= 214 //mm
M= 112.5 //gms
m= 18 //gms
m1= 10 //gms
//CALCULATIONS
P= 760-p
M1= m1*P*m/(p*M)
```

```
//RESULTS
printf ('quantity of water= %.2f gms',M1)
```

Scilab code Exa 4.5 chapter 4 example 5

```
clc
//initialisation of variables
p = 17.4 //mm
m= 1000 //gms
M= 18 //gms
n= 2 //moles
//CALCULATIONS
P= p*((m/M)/((m/M)+n))
P1= p*(n/((m/M)+n))
dp= p-P1
//RESULTS
printf ('vapour pressure of solution= %.2f mm',P1)
```

Scilab code Exa 4.6 chapter 4 example 6

```
clc
//initialisation of variables
m= 92.13 //gms
M= 78.11 //gms
n= 1 //moles
p= 119.6 //mm
p1= 36.7 //mm
//CALCULATIONS
n1= m/M
x= n/(n+n1)
y= 1-x
P= y*p
P1= x*p1
```

```
P2= P+P1
m1= P/P2
m2= 1-m1
//RESULTS
printf (' mole fraction of benzene= %.3f ',m1)
printf (' \n mole fraction of toulene= %.3f ',m2)
```

Chapter 5

Solutions Osmotic Pressure

Scilab code Exa 5.1 chapter 5 example 1

```
clc
//initialisation of variables
T= 20 //C
R= 0.082 //li-atm per mole per degree
V= 2 //lit
m= 6 //gms
M= 60 //gms
//CALCULATIONS
P= m*R*(273+T)/(M*V)
//RESULTS
printf ('osmotic pressure= %.1f atm',P)
```

Scilab code Exa 5.2 chapter 5 example 2

```
clc
//initialisation of variables
T= -0.2 //C
T1= 25 //C
```

```
T2= 1.86 //C
R= 0.082 //li-atm per mole per degree
//CALCULATIONS
P= -T*R*(T1+273)/T2
//RESULTS
printf ('osmotic pressure= %.2f atm',P)
```

Chapter 6

Solutions Solutions of Electrolytes

Scilab code Exa 6.1 chapter 6 example 1

```
clc
//initialisation of variables
T= 25 //C
R= 0.0821 //li-atm per mole per degree
M= 0.5 //m
n= 2
m= 0.680
V= 1 //lit
//CALCULATIONS
P= R*(273+T)*M*n*m/V
//RESULTS
printf ('osmotic pressure= %.2f atm',P)
```

Scilab code Exa 6.2 chapter 6 example 2

```
clc
```

```
//initialisation of variables
M= 0.001 //molar
M1= 0.002 //molar
M2= 0.004 //molar
n= 1 //moles
n1= 2 //moles
v= 0.509
//CALCULATIONS
Is= 0.5*(M*n^2+M1*n^2+M1*n1^2+M2*n^2)
r= 10^(-v*n^2*sqrt(Is))*M
r1= 10^(-v*n1^2*sqrt(Is))*M1
//RESULTS
printf (' ionic strength= %.3f ',Is)
printf (' \n activity of sodium = %.4f molar',r)
printf (' \n activity of barium = %.4f molar',r1)
```

Chapter 7

Conductivity

Scilab code Exa 7.1 chapter 7 example 1

```
clc
//initialisation of variables
R= 10 //ohms
V= 5 //v
t= 20 //min
//CALCULATIONS
I= V/R
Q= I*t*60
E= Q*V
//RESULTS
printf ('current= %.1f amp',I)
printf ('\n coloumbs of electricity will pass= %.f
    coloumbs',Q)
printf ('\n energy expended= %.f joules',E)
```

Scilab code Exa 7.2 chapter 7 example 2

```
clc
```

```
//initialisation of variables
I= 50 //amp
t= 1 //hr
F= 96500 //amp-sec
mh= 1.01 //gms
mc= 35.46 //gms
ms= 107.88 //gms
mb= 79.9 //gms
mf= 55.85 //gms
V= 11.2 //lit
e= 8 //v
//CALCULATIONS
N= I*t*60*60/F
Mh= mh*N
Mc= mc*N
Ms= ms*N
Mb= mb*N
Mf= mf*N
v= N*V
E= e*I*60*60
//RESULTS
printf (' quantity of hydrogen produced= %.2f gms',Mh)
printf (' \n quantity of chlorine produced= %.2f gms',Mc)
printf (' \n quantity of silver produced= %.2f gms',Ms)
printf (' \n quantity of bromine produced= %.2f gms',Mb)
printf (' \n quantity of ferrous ion  produced= %.2f gms',Mf)
printf (' \n Volume occupied by gases= %.1f lit',v)
printf (' \n energy expenditure= %.f joules',E)
```

Scilab code Exa 7.3 chapter 7 example 3

```
clc
//initialisation of variables
i= 20 //amp
t= 50 //min
F= 96500 //coloumb
we= 8 //gms
Mo= 32 //gms
M= 27 //gms
n= 3
//CALCULATIONS
nf= i*t*60/F
V= we*22.4/Mo*nf
G= M/n
q= G*nf
//RESULTS
printf ('volume of oxygen produced= %.2f lit',V)
printf ('\n quantity of aluminium produced= %.2f
    grams',q)
```

Scilab code Exa 7.4 chapter 7 example 4

```
clc
//initialisation of variables
L= 0.025 //ohms
k= 0.0112 //ohms
//CALCULATIONS
C= k/L
//RESULTS
printf ('cell constant= %.3f ',C)
```

Scilab code Exa 7.5 chapter 7 example 5

```
clc
```

```
//initialisation of variables
m= 0.01 //M
CB= 235 //mm
R= 426.3 //ohms
M= 265
C= 0.448
//CALCULATIONS
k= M*C/(R*CB)
A= k*1000/m
//RESULTS
printf (' equivalent conductance= %.1f ohms',A)
```

Chapter 8

Chemical Equlibrium

Scilab code Exa 8.1 chapter 8 example 1

```
clc
//initialisation of variables
x= 3.33
n= 5 //moles
//CALCULATIONS
N= x^2/(n-x)^2
//RESULTS
printf (' moles of water and ester formed= %.f ',N)
```

Scilab code Exa 8.2 chapter 8 example 2

```
clc
//initialisation of variables
n= 1 //mole
x= 3
y= 4
//CALCULATIONS
r= x^2/n^2
```

```
z= n/x
n= n+z
n1= x-z
//RESULTS
printf ('moles of acid and alcohol= %.2f moles',n)
printf ('\n moles of ester and water= %.2f moles',
  n1)
```

Scilab code Exa 8.3 chapter 8 example 3

```
clc
//initialisation of variables
k= 1.1*10^-5
V= 600 //ml
n= 0.4 //mole
//CALCULATIONS
m= n*1000/V
x= (-k+sqrt(k^2+4*4*0.67*k))/(2*4)
M= 2*x
P= x*100/m
//RESULTS
printf ('molar concentration of NO2= %.1e mol per
  litre',M)
printf ('\n per cent dissociation= %.2f per cent',P
  )
```

Scilab code Exa 8.4 chapter 8 example 4

```
clc
//initialisation of variables
pno2= 0.31 //atm
pn2o2= 0.69 //atm
p= 10 //atm
```

```
//CALCULATIONS
Kp= pno2^2/pn2o2
x= (-Kp+sqrt(Kp^2+4*4*p*Kp))/(2*4)
p1= p-x
p2= 2*x
//RESULTS
printf (' Kp= %.2f ',Kp)
printf (' \n N2O4= %.2f ',p1)
printf (' \n NO2= %.2f ',p2)
```

Scilab code Exa 8.5 chapter 8 example 5

```
clc
//initialisation of variables
T= 65 //C
R= 1.98 //cal/mol K
kp= 2.8
kp1= 0.141
T1= 25 //C
//CALCULATIONS
H= log10(kp/kp1)*2.303*R*(273+T1)*(273+T)/(T-T1)
//RESULTS
printf (' average heat of reaction= %.f cal',H+62)
```

Chapter 9

Ionic Equilibria and Buffer Action

Scilab code Exa 9.1 chapter 9 example 1

```
clc
//initialisation of variables
c= 0.1 //M
p= 1.34 //per cent
T= 25 //C
//CALCULATIONS
C1= c*p/100
C2= c*p/100
C3= c-C1
Ka= C1*C2/C3
//RESULTS
printf (' ionization constant = %.2e ',Ka)
```

Scilab code Exa 9.2 chapter 9 example 2

```
clc
```

```
//initialisation of variables
k= 1.8*10^-5
C= 0.2 //M
T= 25 //C
//CALCULATIONS
x= sqrt(C*k)
a= x/C
C1= a*C
//RESULTS
printf (' hydronium-ion concentration = %.1e mole
   per litre',C1)
```

Scilab code Exa 9.3 `chapter 9 example 3`

```
clc
//initialisation of variables
K= 1.8*10^-5
V= 500 //ml
c1= 0.3 //M
c2= 0.2 //M
//CALCULATIONS
x= V*c1/1000
y= V*c2/1000
C= K*y/x
//RESULTS
printf (' hydronium-ion concentration = %.1e mole
   per litre',C)
```

Scilab code Exa 9.4 `chapter 9 example 4`

```
clc
//initialisation of variables
K= 1.4*10^-5
```

```
T= 25 //C
V= 200 //ml
m= 3.7 //gms
m1= 4.8 //gms
M= 74 //gms
M1= 96 //gms
//CALCULATIONS
x= m*1000/(V*M)
y= m1*1000/(V*M1)
X= K*x/y
//RESULTS
printf ('hydronium-ion concentration = %.1e mole
    per litre',X)
```

Scilab code Exa 9.5 chapter 9 example 5

```
clc
//initialisation of variables
c= 0.050 //M
Ksp= 4.3*10^-7
//CALCULATIONS
C= sqrt(Ksp*c)
//RESULTS
printf ('concentration of hydronium-ion = %.1e mole
    per litre',C)
```

Scilab code Exa 9.6 chapter 9 example 6

```
clc
//initialisation of variables
C= 0.050 //M
K= 2.4*10^-17
c= 0.1 //M
```

```
//CALCULATIONS
c1= K*C/c^2
//RESULTS
printf (' concentration of carbonate-ion = %.1e mole per litre',c1)
```

Scilab code Exa 9.7 chapter 9 example 7

```
clc
//initialisation of variables
n= 1.31*10^-4 //mole
T= 25 //C
//CALCULATIONS
N= 2*n
Ksp= N^2*n
//RESULTS
printf (' Ksp = %.e ',Ksp)
```

Scilab code Exa 9.8 chapter 9 example 8

```
clc
//initialisation of variables
Ksp= 1.4*10^-11
V= 200 //ml
M= 24.3 //gms
//CALCULATIONS
x= (Ksp/4)^(1/3)
m= x*M*V/1000
//RESULTS
printf (' grams of Mg+2 present = %.1e gms per mol',m)
```

Scilab code Exa 9.9 `chapter 9 example 9`

```
clc
//initialisation of variables
c= 0.010 //M
Ksp= 1.56*10^-10
M= 108 //gms
C= 10^-3 //M
//CALCULATIONS
K= Ksp/C
m= M*K
m1= M*c
//RESULTS
printf (' quantity = %.2e gms',m)
printf (' \n quantity = %.2f gms',m1)
```

Scilab code Exa 9.10 `chapter 9 example 10`

```
clc
//initialisation of variables
c= 0.1 //M
Kb= 1.8*10^-5
Kw= 10^-14
//CALCULATIONS
C= sqrt(c*Kw/Kb)
//RESULTS
printf (' concentration of hydronium ion = %.1e mol
   per litre',C)
```

Scilab code Exa 9.11 chapter 9 example 11

```
clc
//initialisation of variables
c= 0.050 //M
Kb= 1.8*10^-5
T= 25 //C
Kw= 10^-14
//CALCULATIONS
C= sqrt(Kw*c/Kb)
//RESULTS
printf ('concentration of hydronium ion = %.1e mol
    per litre',C)
```

Scilab code Exa 9.12 chapter 9 example 12

```
clc
//initialisation of variables
kw= 10^-14
Ka= 1.8*10^-5
//CALCULATIONS
Kb= Ka
B= sqrt(kw/(Ka*Kb))
//RESULTS
printf ('degree of hydrolysis = %.1e ',B)
```

Scilab code Exa 9.13 chapter 9 example 13

```
clc
//initialisation of variables
k1= 3.5*10^-7
k2= 4.4*10^-11
//CALCULATIONS
```

```
c= sqrt(k1*k2)
//RESULTS
printf (' concentration of solution = %.1e mol per
   litre',c)
```

Scilab code Exa 9.14 chapter 9 example 14

```
clc
//initialisation of variables
c= 1.92*10^-5 //mole per litre
//CALCULATIONS
pH= -log10(c)
//RESULTS
printf (' pH of solution = %.2f ',pH)
```

Scilab code Exa 9.15 chapter 9 example 15

```
clc
//initialisation of variables
pH= 7.36
//CALCULATIONS
C= 10^-pH
//RESULTS
printf (' concentration of solution = %.2e mol per
   litre',C)
```

Scilab code Exa 9.16 chapter 9 example 16

```
clc
//initialisation of variables
```

```
c= 1 //M
Kb= 5.3*10^-5
pKw= 14
//CALCULATIONS
pH= pKw+0.5*log10(Kb)+0.5*log10(c)
//RESULTS
printf (' pH of solution = %.2f ',pH)
```

Scilab code Exa 9.17 chapter 9 example 17

```
clc
//initialisation of variables
c= 0.1 //M
Ka= 6.3*10^-5
pKw= 14
//CALCULATIONS
pH= -0.5*log10(Ka)+0.5*pKw+0.5*log10(c)
//RESULTS
printf (' pH of a buffer solution = %.2f ',pH)
```

Scilab code Exa 9.18 chapter 9 example 18

```
clc
//initialisation of variables
Ka= 1.8*10^-5
a= 0.1 //molar
//CALCULATIONS
pH= -log10(Ka)
//RESULTS
printf (' pH of a buffer solution = %.2f ',pH)
```

Scilab code Exa 9.19 `chapter 9 example 19`

```
clc
//initialisation of variables
pH= 7.10
pH1= 7.21
//CALCULATIONS
r= 10^(pH-pH1)
//RESULTS
printf ('ratio of salt to acid = %.3f ',r)
```

Chapter 10

Electmotive Force

Scilab code Exa 10.1 `chapter 10 example 1`

```
clc
//initialisation of variables
T= 25 //C
M= 0.08 //m
P= 1 //atm
F= 96500 //coloumbs
R= 8.31 //J/mol K
//CALCULATIONS
E= -R*(273+T)*2.3*log10(M)/F
//RESULTS
printf (' oxidation potential of hydrogen elctrode =
    %.4f v',E)
```

Scilab code Exa 10.2 `chapter 10 example 2`

```
clc
//initialisation of variables
E= -0.337 //v
```

```
R= 8.31 //J/mol K
T= 25 //C
F= 96500 //coloums
M= 0.12 //m
//CALCULATIONS
E1= E-(R*(273+T)*2.3*log10(M)/(2*F))
//RESULTS
printf (' oxidation potential of copper elctrode = %
    .3f v',E1)
```

Scilab code Exa 10.3 `chapter 10 example 3`

```
clc
//initialisation of variables
E= -0.771 //v
R= 8.31 //J/mol K
T= 25 //C
F= 96500 //coloums
M= 0.02 //m
M1= 0.1 //m
//CALCULATIONS
E1= E-(R*(273+T)*2.3*log10(M/M1)/F)
//RESULTS
printf (' oxidation potential of copper elctrode = %
    .3f v',E1)
```

Scilab code Exa 10.4 `chapter 10 example 4`

```
clc
//initialisation of variables
E= 0.763 //v
R= 8.31 //J/mol K
T= 25 //C
```

```
F= 96500 //coloums
M= 0.1 //m
M1= 0.01 //m
//CALCULATIONS
E1= E-(R*(273+T)*2.3*log10(M)/(2*F))+R*(273+T)*2.3*
    log10(M1)/F
//RESULTS
printf (' oxidation potential of copper elctrode = %
    .3f v',E1)
```

Scilab code Exa 10.5 chapter 10 example 5

```
clc
//initialisation of variables
E1= 0.126 //v
E2= -1.360 //v
M= 0.02 //m
M1= 1/0.1 //m
R= 8.31 //J/mol K
T= 25 //C
F= 96500 //coloums
//CALCULATIONS
E= (E1-R*(273+T)*2.3*log10(M)/(2*F))-(E2-R*(273+T)
    *2.3*log10(M1)/(F))
//RESULTS
printf (' oxidation potential of copper elctrode = %
    .3f v',E)
```

Scilab code Exa 10.6 chapter 10 example 6

```
clc
//initialisation of variables
E1= 0.763 //v
```

```
c= 0.1 //mol/lit
c1= 0.01 //mol/lit
R= 8.31 //J/mol K
T= 25 //C
F= 96500 //coloums
c2= 1 //molar
c3= 1 //molar
//CALCULATIONS
E= E1-(log10(c*c2/(c1^2*c3))*R*(273+T)*2.3/(2*F))
//RESULTS
printf (' potential of the cell = %.3f v',E)
```

Scilab code Exa 10.7 chapter 10 example 7

```
clc
//initialisation of variables
R= 8.31 //J/mol K
T= 25 //C
F= 96500 //coloums
c= 0.02 //molar
c1= 0.1 //molar
c2= 1 //molar
c3= 1 //molar
E1= 1.486 //v
//CALCULATIONS
E= E1-R*(273+T)*2.3*log10(c*c1^2/(c2*c3))/(2*F)
//RESULTS
printf (' potential of the cell = %.3f v',E)
```

Scilab code Exa 10.8 chapter 10 example 8

```
clc
//initialisation of variables
```

```
R= 8.31 //J/mol K
T= 25 //C
F= 96500 //coloums
c= 0.08 //molar
c1= 0.04 //molar
//CALCULATIONS
E= R*(T+273)*log(c/c1)/(2*F)
E1= 2*E
//RESULTS
printf (' potential of the cell = %.4f v',E)
printf (' \n potential of the cell = %.4f v',E1)
```

Chapter 11

Thermodynamics Some Basic Concepts

Scilab code Exa 11.1 chapter 11 example 1

```
clc
//initialisation of variables
T= 25 //C
T1= 75 //C
k= 6.45 //cal per mole per degree
k1= 1.41*10^-3 //cal per mole per degree k^-1
k2= -8.1*10^-8 //cal per mole per degree k^-2
m= 14 //gms
M= 28 //gms
//CALCULATIONS
Cp= k+k1*(273+T)+k2*(273+T)^2
Cp1= k+k1*(273+T1)+k2*(273+T1)^2
cp= (Cp+Cp1)/2
H= (m/M)*cp*(T1-T)
H1= (m/M)*(k*(T1-T)+(k1/2)*((273+T1)^2-(273+T)^2)+(
   k2/3)*((273+T1)^3-(273+T)^3))
//RESULTS
printf (' Heat required= %.1f cal',H)
printf (' \n value of dH= %.1f cal',H1)
```

Scilab code Exa 11.2 chapter 11 example 2

```
clc
//initialisation of variables
m= 64 //gms
M= 32 //gms
T= 100 //C
T1= 0 //C
cp= 7.05 //cal per mole per degree
cp1= 5.06 //cal per mole per degree
//CALCULATIONS
H= cp*(m/M)*(T-T1)
E= cp1*(m/M)*(T-T1)
//RESULTS
printf ('value of dH= %.f cal',H)
printf ('\n value of dE= %.f cal',E)
```

Scilab code Exa 11.3 chapter 11 example 3

```
clc
//initialisation of variables
n= 2 //moles
R= 1.99 //cal er mole per degree
T= 80 //C
H1= 94.3 //cal per gram
M= 78 //gms per mole
//CALCULATIONS
w= n*R*(273+T)
H= n*M*H1
E= H-w
//RESULTS
```

```
printf (' value of dH= %.f cal',H)
printf (' \n value of dE= %.f cal',E)
```

Scilab code Exa 11.4 chapter 11 example 4

```
clc
//initialisation of variables
m= 9 //gms
T= -10 //C
T1= 0 //C
R= 0.5 //cal per gram per degree
H= 79.7 //cal per gram
R1= 1 //cal per gram per degree
T2= 100 //C
H1= 539.7 //cal per gm
R2= 8.11 //cal per gram per degree
M= 18 //gms
T3= 40 //C
//CALCULATIONS
dH= m*R*(T1-T)
dH1= m*H
dH2= m*R1*(T2-T1)
dH3= m*H1
dH4= (m/M)*R2*(T3-T1)
dH5= dH+dH1+dH2+dH3+dH4
//RESULTS
printf (' value of dH= %.1f cal',dH5)
```

Chapter 12

Thermodynamics Thermodynamic chemistry

Scilab code Exa 12.1 chapter 12 example 1

```
clc
//initialisation of variables
H= -771400 //cal
n= 7 //moles
n1= 7.5 //moles
T= 25 //C
R= 2 //cal mole per degree
//CALCULATIONS
E= H-(n-n1)*R*(273+T)
//RESULTS
printf (' difference between the heat of combustion
    = %.f cal',E)
```

Scilab code Exa 12.2 chapter 12 example 2

```
clc
```

```
//initialisation of variables
H= -94.052 //kcal
H1= -68.317 //kcal
H2= -780.98 //kcal
//CALCULATIONS
H3= 6*H+3*H1-H2
//RESULTS
printf (' Heat of formation = %.3f kcal',H3)
```

Scilab code Exa 12.3 chapter 12 example 3

```
clc
//initialisation of variables
H= -94.052 //kcal
H1= -68.32 //kcal
H2= 11.718 //kcal
//CALCULATIONS
H3= 6*H+3*H1-H2
//RESULTS
printf (' heat of combustion of benzene = %.f cal',
   H3)
```

Scilab code Exa 12.4 chapter 12 example 4

```
clc
//initialisation of variables
H= -66.36 //kcal
H1= 12.5 //k cal
H2= -68.317 //kcal
//CALCULATIONS
H3= H-H1-H2
//RESULTS
printf (' heat of reaction= %.2f cal',H3)
```

Scilab code Exa 12.5 chapter 12 example 5

```
clc
//initialisation of variables
T= 90 //C
T1= 25 //C
Cp= 6.9 //cal per mole per degree
Cp1= 7.05 //cal per mole per degree
Cp2= 18 //cal per mole per degree
H= -68.37 //kcal
//CALCULATIONS
H1= H+(Cp2-Cp-0.5*Cp1)*((T-T1)/1000)
//RESULTS
printf (' heat of formation= %.2f cal',H1)
```

Scilab code Exa 12.6 chapter 12 example 6

```
clc
//initialisation of variables
Cp= 2.7 //cal per mole per degree
Cp1= 6.9 //cal per mole per degree
Cp2= 15.4 //cal per mole per degree
H= -20.24 //kcal
T= 200 //C
T1= 25 //C
//CALCULATIONS
H1= H+(Cp2-2*Cp-3*Cp1)*((T-T1)/1000)
//RESULTS
printf (' heat of formation= %.2f cal',H1)
```

Chapter 13

Thermodynamics Entropy and Free Energy

Scilab code Exa 13.1 chapter 13 example 1

```
clc
//initialisation of variables
H= 540 //cal per gram
m= 9 //gms
T= 100 //C
//CALCULATIONS
S= H*m/(273+T)
//RESULTS
printf ('Entropy change = %.2f E.U',S)
```

Scilab code Exa 13.2 chapter 13 example 2

```
clc
//initialisation of variables
m= 9 //gms
H= 79.7 //cal per gram
```

```
T= 0 //C
//CALCULATIONS
S= m*H/(273+T)
//RESULTS
printf (' Entropy change = %.2f E.U',S)
```

Scilab code Exa 13.3 chapter 13 example 3

```
clc
//initialisation of variables
m= 14 //gms
M= 28 //gms
R= 1.99 // cal per mole per degree
V= 30 //lit
v1= 10 //lit
//CALCULATIONS
S1= (m/M)*R*2.303*log10(V/V1)
//RESULTS
printf (' Entropy change = %.2f E.U',S1)
```

Scilab code Exa 13.4 chapter 13 example 4

```
clc
//initialisation of variables
m= 14 //gms
M= 28 //gms
S= 6.94 //cal per mole
T= 127 //C
T1= 27 //C
S1= 4.94 //cal per mole
//CALCULATIONS
dS= (m/M)*S*log((273+T)/(273+T1))
dS1= (m/M)*S1*log((273+T)/(273+T1))
```

```
//RESULTS
printf (' Entropy change = %.2f E.U',dS-0.01)
printf (' \n Entropy change = %.2f E.U',dS1)
```

Scilab code Exa 13.5 chapter 13 example 5

```
clc
//initialisation of variables
Scl= 53.29 //E.U
Sag= 10.21 //E.U
Sagcl= 22.97 //E.U
//CALCULATIONS
dS= Sagcl-Sag-0.5*Scl
//RESULTS
//RESULTS
printf (' Entropy change = %.2f E.U',dS)
```

Scilab code Exa 13.6 chapter 13 example 6

```
clc
//initialisation of variables
Scl= 13.17 //E.U
Sag= 17.67 //E.U
Sagcl= 22.97 //E.U
//CALCULATIONS
dS= Scl+Sag-Sagcl
//RESULTS
printf (' Entropy change = %.2f E.U',dS)
```

Scilab code Exa 13.7 chapter 13 example 7

```
clc
//initialisation of variables
F1= -94260 //cal
F2= -56690 //cal
F3= -7860 //cal
//CALCULATIONS
F= 2*F1+3*F2-F3
//RESULTS
printf (' value of dF = %.f ',F)
```

Scilab code Exa 13.8 `chapter 13 example 8`

```
clc
//initialisation of variables
T= 25 //C
F1= -35180 //cal
//CALCULATIONS
F= F1
//RESULTS
printf (' value of dF = %.f ',F)
```

Scilab code Exa 13.9 `chapter 13 example 9`

```
clc
//initialisation of variables
F= -51180 //cal
T= 25 //C
R= 1.99 //cal/mole K
//CALCULATIONS
K= 10^(-F/(R*(273+T)*2.303))
//RESULTS
printf (' equilibrium constant = %.e ',K)
```

Scilab code Exa 13.10 chapter 13 example 10

```
clc
//initialisation of variables
F= 18430 //cal
F1= -31350 //cal
F2= 26224 //cal
R= 1.99 //cal/mole K
T= 25 //C
//CALCULATIONS
F3= F+F1+F2
Ksp= 10^(-F3/(R*(273+T)*2.303))
//RESULTS
printf ('solubility product = %.1e ',Ksp)
```

Scilab code Exa 13.11 chapter 13 example 11

```
clc
//initialisation of variables
F= -51108 //cal
f= 96500 //coloumbs
n= 2 //moles
//CALCULATIONS
E= -F*4.184/(n*f)
//RESULTS
printf ('value of E = %.3f v',E)
```

Scilab code Exa 13.12 chapter 13 example 12

```
clc
//initialisation of variables
F1= 31350 //cal
F2= 26224 //cal
F= 96500 //coloumbs
//CALCULATIONS
F3= -F1+F2
E= F3*4.184/F
//RESULTS
printf (' value of E = %.4f cal',E)
```

Scilab code Exa 13.13 chapter 13 example 13

```
clc
//initialisation of variables
T= 25 //C
a= 0.2 //molar
P= 1 //atm
F1= -5126 //cal
R= 2 //cal/mole K
//CALCULATIONS
F= F1+R*(273+T)*2.303*log10(a^2)
//RESULTS
printf (' value of F = %.f cal',F)
```

Scilab code Exa 13.14 chapter 13 example 14

```
clc
//initialisation of variables
T= 25 //C
F= 1160 //cal
P= 0.1 //atm
P1= 1 //atm
```

```
R= 2 //cal/mole K
//CALCULATIONS
F1= F+R*(273+T)*log(P/P1^2)
F2= F+R*(273+T)*log(P1/P^2)
//RESULTS
printf (' value of F = %.f cal',F1)
printf (' \n value of F = %.f cal',F2)
```

Scilab code Exa 13.15 chapter 13 example 15

```
clc
//initialisation of variables
T= 25 //C
H= -94.05 //kcal
H1= -26.42 //kcal
S= 51.06 //cal per degree
S1= -47.3 //cal per degree
S2= -24.5 //cal per degree
//CALCULATIONS
dH= (H-H1)*1000
dS= S+S1+S2
F= dH-(273+T)*dS
//RESULTS
printf (' value of F = %.f cal',F)
```

Chapter 14

Determination of hydronium ion Concentrations

Scilab code Exa 14.1 chapter 14 example 1

```
clc
//initialisation of variables
E= 0.232 //v
R= 0.0592
p= 1 //atm
R1= 0.0296
P= 740 //atm
//CALCULATIONS
pH= E/R
pH1= (E-R1*log10(P/760))/R
e= pH1-pH
//RESULTS
printf (' error in pH of solution= %.3f ',e-0.002)
```

Scilab code Exa 14.2 chapter 14 example 2

```
clc
//initialisation of variables
e= 0.266 //v
R= 0.0592
//CALCULATIONS
pH= e/R
//RESULTS
printf (' pH of the unkown solution= %.2f ',pH)
```

Scilab code Exa 14.3 chapter 14 example 3

```
clc
//initialisation of variables
e= 0.323 //v
R= 0.0592
c= 0.001 //molar
//CALCULATIONS
pH= (e-R*log10(c))/R
//RESULTS
printf (' pH of the unkown solution= %.2f ',pH)
```

Scilab code Exa 14.4 chapter 14 example 4

```
clc
//initialisation of variables
E= 0.527 //v
T= 25 //C
R= 0.0592
e= -0.246 //v
//CALCULATIONS
pH= -(-E-e)/R
//RESULTS
printf (' pH of the unkown solution= %.2f ',pH)
```

Scilab code Exa 14.5 `chapter 14 example 5`

```
clc
//initialisation of variables
E= 0.034 //v
E1= -0.280 //v
E2= -0.699 //v
E3= 0.0592
//CALCULATIONS
pH= (E1-E-E2)/E3
pH1= (E-E2+E1)/E3
//RESULTS
printf (' pH of the unkown solution= %.2f ',pH)
printf (' \n pH of the unkown solution= %.2f ',pH1)
```

Chapter 16

Oxidation Reduction potentials

Scilab code Exa 16.1 chapter 16 example 1

```
clc
//initialisation of variables
x= 0.02 //m
y= 0.4 //m
R= 0.0592
e= -0.771 //V
e1= -1.520 //v
n= 5 //electrons
z= 0.80 //m
z1= 0.5 //m
//CALCULATIONS
E= e-R*log10(x/y)
E1= e1-(R/n)*log10(z1*z^8/x)
E2= E-E1
//RESULTS
printf (' Redox potential of sample= %.3f v',E)
printf (' \n Redox potential of sample= %.3f v',E1)
printf (' \n Redox potential of sample= %.3f v',E2)
```

Scilab code Exa 16.2 `chapter 16 example 2`

```
clc
//initialisation of variables
E= 0.3500 //v
E1= -0.2788 //v
//CALCULATIONS
e= E+E1
//RESULTS
printf ('Redox potential of sample= %.4f v',e)
```

Scilab code Exa 16.3 `chapter 16 example 3`

```
clc
//initialisation of variables
p= 60 //percent
x= 0.030 //v
E= -0.039 //v
//CALCULATIONS
V= E-x*log10((1-(p/100))/(p/100))
//RESULTS
printf ('Redox potential of sample= %.3f v',V)
```

Chapter 17

Speed of Reaction Catalysis

Scilab code Exa 17.1 `chapter 17 example 1`

```
clc
//initialisation of variables
t= 40 //min
r= 0.274
t1= 50 //min
//CALCULATIONS
k= 2.3*log10(1/(1-r))/t
R=10^( -k*t1/2.3)
R1= 1-R
//RESULTS
printf (' velocity constant= %.4f min^-1',k)
printf (' \n fraction decomposed= %.3f ',R1)
```

Scilab code Exa 17.3 `chapter 17 example 3`

```
clc
//initialisation of variables
t= 10 //min
```

```
c= 0.01 //molar
c1= 0.00464 //molar
//CALCULATIONS
k= (c-c1)/(c*c1*t)
T= 1/(k*0.01)
//RESULTS
printf (' velocity constant= %.1f min^-1',k)
printf (' \n half-time period= %.1f min',T)
```

Chapter 20

Radiochemistry

Scilab code Exa 20.1 chapter 20 example 1

```
clc
//initialisation of variables
t= 4.5*10^9 //years
t1= 1590 //years
//CALCULATIONS
l= log10(2)/(t*0.4343)
l1= log10(2)/(t1*0.4343)
r= l1/l
r1= t/t1
//RESULTS
printf (' disintegration constant= %.2e yr^-1',l)
printf (' \n disintegration constant= %.2e yr^-1',l1
    )
printf (' \n relative proportion= %.2e ',r)
printf (' \n relative proportion= %.2e ',r1)
```