**Source Code**

clc;clear;clf;

kb=1.38e-23;e=1.6e-19

E=0.01

n=0:2

np=100:100:500

dT=0.1

T=1:0.1:1000

T1=T; T1(length(T))=[]

T2=T1; T2(length(T1))=[]

for k=1:length(np)

for j=1:length(T)

zt=0

for i=1:length(n)

p(j,i)=exp(-((i-1)\*E\*e)/(kb\*T(j)))

zt=zt+p(j,i)

end

z(j,k)=(zt)^(np(k))

end

U(:,k)=kb.\*T1'.\*T1'.\*diff((log(z(:,k))))./dT

Cv(:,k)=diff(U(:,k))./dT

F(:,k)=-kb.\*T'.\*(log(z(:,k)))

S(:,k)=-diff(F(:,k))./dT

Ef(:,k)=kb.\*T2'.\*T2'.\*Cv(:,k)

end

subplot(2,3,1)

plot(T',z,'linewidth',6)

xlabel('T(K)','fontsize',4)

ylabel('Partition function','fontsize',4)

legend(string(np)+'particles',2)

subplot(2,3,2)

plot(T1',U,'linewidth',5)

xlabel('T(K)','fontsize',4)

ylabel('Average energy','fontsize',4)

legend(string(np)+'particles',2)

subplot(2,3,3)

plot(T1',S,'linewidth',5)

xlabel('T(K)','fontsize',4)

ylabel('Entropy','fontsize',4)

legend(string(np)+'particles',2)

subplot(2,3,4)

plot(T2',Cv,'linewidth',5)

xlabel('T(K)','fontsize',4)

ylabel('Specific heat','fontsize',4)

legend(string(np)+'particles',1)

subplot(2,3,5)

plot(T',F,'linewidth',5)

xlabel('T(K)','fontsize',4)

ylabel('Helmholtz free energy','fontsize',4)

legend(string(np)+'particles',3)

subplot(2,3,6)

plot(T2',Ef,'linewidth',5)

xlabel('T(K)','fontsize',4)

ylabel('Energy fluctuation','fontsize',4)

legend(string(np)+'particles',2)

**Output**

