

1. Ideal bir atomli gaz uchun kanonik statistik summa $Q = \frac{1}{N!} q^N$, bu yerda $q = \left(\frac{2\pi mkT}{h^2}\right)^{\frac{3}{2}} V$. Erkin energiyani topib uni sistema ichidagi kimyoviy potensialni μ topish uchun qo'llang.
2. Monatomik gaz molekulaning statistik summa uchun $q(V, T) = \left(\frac{2\pi mkT}{h^2}\right)^{\frac{3}{2}} V$ ifodani keltirib chikaring.
3. Lejandr transformatsiyani ichki energiya uchun $U(S, V, N)$ foydalanib erkin entalpiya $G = G(T, P, N)$ uchun ifodani keltirib chikaring.
4. Bir atomli kristallarning Eynshteyn modelida kanonik statistik summa $Q(N, V, T) = \exp\left(-\frac{N\varphi(0)}{2kT}\right) q^{3N}$. Bu yerda $q = \frac{\exp\left(-\frac{\Theta}{2T}\right)}{\exp\left(\frac{\Theta}{T}\right) - 1}$, $\Theta = \frac{h\nu}{k}$. Erkin energiya $A = -kT \ln Q$ dan foydalanib, sistemaning energiyasini toping.
5. Ideal bir atomli gazning ichki energiya darajalari.
6. Ideal gaz uchun entalpiya $H(S, P, N) = \frac{5}{3} U_0 \left(\frac{N}{N_0}\right) \left(\frac{p}{p_0}\right)^{\frac{2}{5}} \exp\left\{\frac{2}{5} \left(\frac{S}{Nk} - s_0\right)\right\}$. Shu ifodani foydalanib ximeviy potencial uchun $\mu(S, p, N)$ ifodani toping.
7. Binar aralashma ideal gazning kanonik statistik summasi $Q = \frac{q_1^{N_1}}{N_1!} \frac{q_2^{N_2}}{N_2!}$. Bunda $q_1 = \left(\frac{2\pi m_1 kT}{h^2}\right)^{\frac{3}{2}} V$ va $q_2 = \left(\frac{2\pi m_2 kT}{h^2}\right)^{\frac{3}{2}} V$. N_1 va N_2 lar sistema ichidagi har bir komponentaning ichidagi atomlar soni. Yuqoridagilarni hisobga olib $pV = (N_1 + N_2)kT$ bo'lishini ko'rsating.
8. Klassik statistik mexanikani bir o'lchamli garmonik ossilyatorning statistik summani topish uchun qollaning.
9. Ideal bir atomli gaz uchun kanonik statistik summa $Q = \frac{1}{N!} q^N$, bu yerda $q = \left(\frac{2\pi mkT}{h^2}\right)^{\frac{3}{2}} V$. Erkin energiyani topib uni sistema ichidagi energiya $E = \frac{3}{2} NkT$ bo'lishini ko'rsating.
10. Real gazning Van-der-Vaals tenglamani keltirib.
11. Klassik statistik mexanikani V hajmga ega bo'lgan kub ichidagi zarraning statistik summani toppish uchun qollaning.

12. Molekulyar- kinetic nazariyadan kelib chikib bosim uchun ifodani keltirib chikaring.

13. Ideal bir atomli gaz uchun kanonik statistik summa $Q = \frac{1}{N!} q^N$, bu yerda $q = \left(\frac{2\pi mkT}{h^2}\right)^{\frac{3}{2}} V$. Erkin energiyani topib uni sistema ichidagi bosimni topish uchun qo'llaning.

14. Molekulyar- kinetic nazariyadan kelib chikib ideal gaz tenglamasin keltirib chikaring.

15. Bir atomli kristallarning Eynshteyn modelida kanonik statistik summa

$Q(N, V, T) = \exp\left(-\frac{N\varphi(0)}{2kT}\right) q^{3N}$. Bu yerda $q = \frac{\exp\left(-\frac{\Theta}{2T}\right)}{\exp\left(\frac{\Theta}{T}\right)-1}$, $\Theta = \frac{h\nu}{k}$. Erkin energiya $A = -kT \ln Q$ dan foydalanib, sistema entropiyasini toping.

16. Ideal bir atomli gaz uchun kanonik statistik summa $Q = \frac{1}{N!} q^N$, bu yerda $q = \left(\frac{2\pi mkT}{h^2}\right)^{\frac{3}{2}} V$. Erkin energiyani topib uni sistema ichidagi entropiyani topish uchun qo'llang.

17. Muvozanatli va muvozanatsiz xolatlar. Kaytar va kaytmas processlar.

18. Gibbs-Duxem tenglamadan ideal gazning ximeviy potencial uchun ifodani keltirib chikaring. Entropiya uchun ifodani foydalaning

$$S(N, T, p) = Nk s_0(T_0, p_0) + Nk \ln \left\{ \left(\frac{T}{T_0} \right)^{5/2} \left(\frac{p_0}{p} \right) \right\}.$$

19. Ideal bir atomli gaz uchun kanonik statistik summa $Q = \frac{1}{N!} q^N$, bu yerda $q = \left(\frac{2\pi mkT}{h^2}\right)^{\frac{3}{2}} V$. Erkin energiyani topib uni sistema ichidagi energiyani toping.

20. Izotermik processlardagi ish uchun ifodani toping.

21. $S(N, V, T) = -k \sum P_j \ln P_j$ entropiya formulasiga kanonik ansamblning

ehtimollik $P_j = \frac{\exp(-\beta E_j)}{\sum \exp(-\beta E_j)}$ formulasini qo'yib erkin energiya uchun $A(N, V, T) = -kT \ln Q(N, V, T)$ formulasini toping. Bu yerda Q – kanonik statistik summa.

22. Ideal bir atomli gaz uchun kanonik statistik summa $Q = \frac{1}{N!} q^N$, bu yerda $q = \left(\frac{2\pi mkT}{h^2}\right)^{\frac{3}{2}} V$. Erkin energiyani topib uni sistema ichidagi energiya $E = \frac{3}{2} NkT$ bo'lishini ko'rsating.

23. Differencial formadagi termodinamikaning 1 konunnan foydalanib ideal gaz uchun adiabatic tenglamalarni toping.

24. Karno sikl uchun $\frac{\Delta Q_1}{T_h} + \frac{\Delta Q_3}{T_c} = 0$ formulani keltirib chikaring. Bu erda $\Delta Q_1, \Delta Q_3$ – Karno sikldagi izotermik processlardagi issiklik mikdorlari.

25. Ideal bir atomli gaz uchun kanonik statistik summa $Q = \frac{1}{N!} q^N$, bu yerda $q = \left(\frac{2\pi mkT}{h^2}\right)^{\frac{3}{2}} V$. Erkin energiyani topib uni sistema ichidagi ximiyeviy potentsialni topish uchun qo'llaning.

26. Karno sikl uchun issiklik mashina effektivligi $\eta = \frac{T_h - T_c}{T_h}$ kursating. Bu erda T_h, T_c – isitqish va muzlatqish temperaturalari.

27. Eyler tenglamadan Gibbs-Duxem tenglamani keltirib chikaring.

28. Ideal bir atomli gaz uchun kanonik statistik summa $Q = \frac{1}{N!} q^N$, bu yerda $q = \left(\frac{2\pi mkT}{h^2}\right)^{\frac{3}{2}} V$. Erkin energiyani topib uni sistema ichidagi energiya toppish uchun qollaning.

29. Gibbs ansamblar metodi. Gibbs postulatlar.

30. Mumkin bo'lgan kvant holatlar soni $\Omega(n) = \frac{[\sum n_j]!}{\prod n_j!}$ uchun maksimum shartni va

Lagranj noaniq ko'paytuvchilar metodini qo'llab $P_j = \frac{\exp(-\beta E_j)}{\sum \exp(-\beta E_j)}$ ehtimollikni toping.

31. Differencial formadagi termodinamikaning 1 konundan ideal gazning entropiya ifodasini keltirib chikaring.

32. Monatomik kristallarning atomning statistic summasi uchun $q = \frac{\exp(\frac{h\nu}{2kT})}{\exp(\frac{h\nu}{kT}) - 1}$

ifodani keltirib chikaring. Atomni garmonik oscilyator energiyalarga

$\varepsilon_n = (n + \frac{1}{2}) h \nu$ ega deb xisoblang.

33. Ichki energiyaning ekstensivlik xususiyatidan foydalanib Eyler tenglamani keltirib chikaring.

34. Kanonik ansambl uchun ehtimollikning boshqa turi $P_E = \frac{\Omega(N,V,E) \exp(-\frac{E}{kT})}{\sum \Omega(N,V,E) \exp(-\frac{E}{kT})}$.

$x = \frac{E}{kT}$ deb hisoblaganda va $\Omega \sim E^{\frac{3N}{2}}$ qabul qilganda, $P_E = C x^{\frac{3N}{2}} e^{-x}$ bo'ladi. Shu funksiyani maksimumlik shartini qo'llab, $E = \frac{3NkT}{2}$ ko'rsating.

35. Eyler tenglamadan Gibbs-Duxem tenglamani keltirib chikaring.

36. Binar aralashma ideal gazning kanonik statistik summasi $Q = \frac{q_1^{N_1} q_2^{N_2}}{N_1! N_2!}$. Bunda

$q_1 = \left(\frac{2\pi m_1 kT}{h^2}\right)^{\frac{3}{2}} V$ va $q_2 = \left(\frac{2\pi m_2 kT}{h^2}\right)^{\frac{3}{2}} V$. N_1 va N_2 lar sistema ichidagi har bir komponentaning ichidagi atomlar soni. Yuqoridagilarni hisobga olib sistemaning entropiyani toping.

37. Monatomik gaz molekulaning statistic summa uchun $q(V, T) = \left(\frac{2\pi m kT}{h^2}\right)^{3/2} V$ ifodani keltirin.

38. Monatomik gaz molekulaning statistic summa uchun $q(V, T) = \left(\frac{2\pi m kT}{h^2}\right)^{3/2} V$ ifodani keltirin.

39. Ideal gazning erkin energiya ifodasi quidagicha

$F(T, V, N) = NkT \left[\frac{3}{2} - s_0 - \ln \left(\left(\frac{T}{T_0} \right)^{3/2} \frac{N_0}{N} \frac{V}{V_0} \right) \right]$. Entropiya uchun $S(T, V, N)$ ifodani toping.

40. Bir atomli kristallarning Eynshteyn modelida kanonik statistik summa

$Q(N, V, T) = \exp\left(-\frac{N\varphi(0)}{2kT}\right) q^{3N}$. Bu yerda $q = \frac{\exp(-\frac{\Theta}{2T})}{\exp(\frac{\Theta}{T}) - 1}$, $\Theta = \frac{h\nu}{k}$. Erkin energiya

$A = -kT \ln Q$ dan foydalanib, sistemaning energiyasini toping.

41. Ideal bir atomli gazning ichki energiya darajalari.

42. Ideal bir atomli gaz uchun kanonik statistik summa $Q = \frac{1}{N!} q^N$, bu yerda

$q = \left(\frac{2\pi mkT}{h^2} \right)^{\frac{3}{2}} V$. Erkin energiyani topib uni sistema ichidagi bosimni topish uchun qollaning.

43. Ideal gazning erkin energiya ifodasi quidagicha

$F(T,V,N) = NkT \left[\frac{3}{2} - s_0 - \ln \left(\left(\frac{T}{T_0} \right)^{3/2} \frac{N_0}{N} \frac{V}{V_0} \right) \right]$. Bosim uchun $p(T,V,N)$ ifodani toping.

44. Klassik statistik mexanikani bir o'lchamli garmonik ossilyator uchun foydalanib statistic summani toping.

45. Ideal bir atomli gaz uchun kanonik statistik summa $Q = \frac{1}{N!} q^N$, bu yerda $q =$

$\left(\frac{2\pi mkT}{h^2} \right)^{\frac{3}{2}} V$. Erkin energiyani topib uni sistema ichidagi energiya

$E = \frac{3}{2} NkT$ bo'lishini ko'rsating.

46. Ideal gazning erkin energiya ifodasi quidagicha

$F(T,V,N) = NkT \left[\frac{3}{2} - s_0 - \ln \left(\left(\frac{T}{T_0} \right)^{3/2} \frac{N_0}{N} \frac{V}{V_0} \right) \right]$. Ximeyviy potencial $\mu(T,V,N)$ uchun ifodani toping.

47. Klassik statistik mexanikani V hajmga ega bo'lgan kub ichidagi zarra uchun foydalanib statistic summani toping.

48. Lejandr transformatsiayni ichki energiya $U(S,V,N)$ uchun foydalanib entalpiya $H(S,P,N)$ uchun ifodani toping.

49. Ideal bir atomli gaz uchun kanonik statistik summa $Q = \frac{1}{N!} q^N$, bu yerda $q =$

$\left(\frac{2\pi mkT}{h^2} \right)^{\frac{3}{2}} V$. Erkin energiyani topib uni sistema ichidagi bosimni topish uchun qo'llaning.

50. Ideal gaz uchun entalpiya $H(S,P,N) = \frac{5}{3} U_0 \left(\frac{N}{N_0} \right) \left(\frac{p}{p_0} \right)^{\frac{2}{5}} \exp \left\{ \frac{2}{5} \left(\frac{S}{Nk} - s_0 \right) \right\}$ ifodasiga ega. Shuni foydalanib temperature uchun $T(S,p,N)$ ifodani toping.

51. Bir atomli kristallarning Eynshteyn modelida kanonik statistik summa

$Q(N, V, T) = \exp\left(-\frac{N\varphi(0)}{2kT}\right) q^{3N}$. Bu yerda $q = \frac{\exp\left(-\frac{\Theta}{2T}\right)}{\exp\left(\frac{\Theta}{T}\right)-1}$, $\Theta = \frac{h\nu}{k}$. Erkin energiya $A = -kT \ln Q$ dan foydalanib, sistema entropiyasini toping.

52. Ideal bir atomli gaz uchun kanonik statistik summa $Q = \frac{1}{N!} q^N$, bu yerda $q = \left(\frac{2\pi mkT}{h^2}\right)^{\frac{3}{2}} V$. Erkin energiyani topib uni sistema ichidagi entropiyani topish uchun qo'llang.

53. Ideal gaz uchun entalpiya $H(S, P, N) = \frac{5}{3} U_0 \left(\frac{N}{N_0}\right) \left(\frac{P}{P_0}\right)^{\frac{2}{5}} \exp\left\{\frac{2}{5} \left(\frac{S}{Nk} - s_0\right)\right\}$. Shu ifodani foydalanib xajm uchun $V(S, p, N)$ ifodani toping.

2. Kanonik ansamblidagi extimolliq uchun ifodani keltirib chikaring

$$P = \frac{\exp(-\beta E_j)}{\sum_i \exp(-\beta E_i)}.$$

54. Lejandr transformatsiyani ichki energiya $U(S, V, N)$ uchun foydalanib erkin energiya $F(T, V, N)$ uchun ifodani toping.

55. Ideal gaz uchun entlpiya $H(S, P, N) = \frac{5}{3} U_0 \left(\frac{N}{N_0}\right) \left(\frac{P}{P_0}\right)^{\frac{2}{5}} \exp\left\{\frac{2}{5} \left(\frac{S}{Nk} - s_0\right)\right\}$. Shu ifodani foydalanib ximeviy potencial $\mu(S, p, N)$ uchun ifodani toping.

56. $S(N, V, T) = -k \sum P_j \ln P_j$ entropiya formulasiga kanonik ansamblning ehtimollik $P_j = \frac{\exp(-\beta E_j)}{\sum \exp(-\beta E_j)}$ formulasini qo'yib erkin energiya uchun $A(N, V, T) = -kT \ln Q(N, V, T)$ formulasini toping. Bu yerda Q – kanonik statistik summa.

57. Lejandr transformatsiayni ichki energiya $U(S, V, N)$ uchun foydalanib erkin entalpiya $G = G(T, P, N)$ uchun ifodani toping.

58. Lejandr transformatsiyani ichki energiya $U(S, V, N)$ uchun foydalanib katta potencial $\Phi = \Phi(T, V, \mu)$ uchun ifodani toping.

59. Monatomik gaz molekulaning statistic summa uchun $q(V, T) = \left(\frac{2\pi mkT}{h^2}\right)^{3/2} V$ ifodani keltirib chikaring.

60. Ideal gazning erkin energiya ifodasi quidagicha

$F(T,V,N) = NkT \left[\frac{3}{2} - s_0 - \ln \left(\left(\frac{T}{T_0} \right)^{3/2} \frac{N_0}{N} \frac{V}{V_0} \right) \right]$. Entropiya uchun $S(T,V,N)$ ifodasini toping.

61. Gibbs ansamblar metodi. Gibbs postulatlar.

62. Mumkin bo'lgan kvant holatlar soni $\Omega(n) = \frac{[\sum n_j]!}{\prod n_j!}$ uchun maksimum shartni va Lagranj noaniq ko'paytuvchilar metodini qo'llab $P_j = \frac{\exp(-\beta E_j)}{\sum \exp(-\beta E_j)}$ ehtimollikni toping.

63. Lejandr transformatsiyani ichki energiya $U(S,V,N)$ uchun foydalanib katta potentsial $\Phi = \Phi(T,V,\mu)$ uchun ifodani toping.

64. Monatomik kristallaning Einshtein modelinda atomning statistic summa uchun

$q = \frac{\exp(\frac{h\nu}{2kT})}{\exp(\frac{h\nu}{kT}) - 1}$ ifodani toping. Atomni garmonik oscillyator energiyalarga

$\varepsilon_n = (n + \frac{1}{2}) h \nu$ ega deb xisoblang.

65. Lejandr transformatsiyani ichki energiya $U(S,V,N)$ uchun foydalanib erkin entalpiya $G = G(T,P,N)$ uchun ifodani toping.

66. Kanonik ansambl uchun ehtimollikning boshqa turi $P_E = \frac{\Omega(N,V,E) \exp(-\frac{E}{kT})}{\sum \Omega(N,V,E) \exp(-\frac{E}{kT})}$.
 $x = \frac{E}{kT}$ deb hisoblaganda va $\Omega \sim E^{\frac{3N}{2}}$ qabul qilganda, $P_E = C x^{\frac{3N}{2}} e^{-x}$ bo'ladi. Shu funksiyani maksimumlik shartini qo'llab, $E = \frac{3NkT}{2}$ ko'rsating.

67. Ideal gaz uchun entalpiya $H(S,P,N) = \frac{5}{3} U_0 \left(\frac{N}{N_0} \right) \left(\frac{P}{P_0} \right)^{\frac{2}{5}} \exp \left\{ \frac{2}{5} \left(\frac{S}{Nk} - s_0 \right) \right\}$. Shu ifodani foydalanib ximeviy potentsial uchun $\mu(S,p,N)$ ifodani toping.

68. Binar aralashma ideal gazning kanonik statistik summasi $Q = \frac{q_1^{N_1}}{N_1!} \frac{q_2^{N_2}}{N_2!}$. Bunda

$q_1 = \left(\frac{2\pi m_1 kT}{h^2} \right)^{\frac{3}{2}} V$ va $q_2 = \left(\frac{2\pi m_2 kT}{h^2} \right)^{\frac{3}{2}} V$. N_1 va N_2 lar sistema ichidagi har bir komponentaning ichidagi atomlar soni. Yuqoridagilarni hisobga olib entropiya $S(N,V,T)$ ni toping.