Unit 6 - Week 4

Assignment 4

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2020-10-14, 23:59 IST.

1) In case of isothermal-isobaric ensemble, the isothermal compressibility κ is given by the expression *1 point*

(a) $\kappa = \frac{V}{\bar{N}^2 k_B T}\sigma_N^2$

(b) $\kappa = \frac{1}{V k_B T}\sigma_V^2$

(c) $\kappa = \frac{1}{V\bar{N}^2 k_B T}\sigma_N^2$

(d) $\kappa = \frac{V}{k_B T}\sigma_V^2$

- (a)
- (b)
- (c)
- (d)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(b)

2) Relative energy fluctuations behave with the total number of particle (N) as *1 point*

(a) $N^{1/2}$

(b) $N^{1/3}$

(c) $N^{-1/2}$

(d) N

- (a)
- (b)
- (c)
- (d)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(c)

3) The heat capacity (C_v) at constant volume is related to canonical partition through *1 point*

(a) $C_v = k_B\beta^2 \frac{\partial^2}{\partial\beta^2}\ln Q(N,V,\beta)$

(b) $C_v = k_B\beta \frac{\partial^2}{\partial\beta^2}\ln Q(N,V,\beta)$

(c) $C_v = k_B\beta^2 \frac{\partial}{\partial\beta}\ln Q(N,V,\beta)$

(d) $C_v = -k_B\beta^2 \frac{\partial^2}{\partial\beta^2}\ln Q(N,V,\beta)$

- (a)
- (b)
- (c)
- (d)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(a)

4) For a classical system having N indistinguishable particles, which have coordinates q_i and momenta p_i, partition function is given by *1 point*

(a) $\frac{1}{h^{3N}N!}\int d^{3N}p\, d^{3N}q\, e^{-\beta H(p,q)}$

(b) $\frac{1}{h^{3N}}\int d^{3N}p\, d^{3N}q\, e^{-\beta H(p,q)}$

(c) $\frac{1}{h^{N}}\int d^{N}p\, d^{N}q\, e^{-\beta H(p,q)}$

(d) $\frac{1}{h^{N}N!}\int d^{N}p\, d^{N}q\, e^{-\beta H(p,q)}$

- (a)
- (b)
- (c)
- (d)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(a)

5) The thermal wavelength of Argon at 300 K is _____ Å. (mass of Argon is 39.94 g/mol) *1 point*

- 0.34
- 0.28
- 0.22
- 0.16

No, the answer is incorrect.
Score: 0
Accepted Answers:
0.16

6) For one mole of ideal gas $\left(\frac{\partial P}{\partial T}\right)_V \left(\frac{\partial V}{\partial T}\right)_P \left(\frac{\partial V}{\partial P}\right)_T =$ *1 point*

(a) -1

(b) $-\frac{R^2}{P^2}$

(c) +1

(d) $\frac{R^2}{P^2}$

- (a)
- (b)
- (c)
- (d)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(b)

7) Which of the following relation is valid between number fluctuation $\langle(\partial N)^2\rangle$ and chemical potential (μ) in μ,V,T ensemble *1 point*

(a) $\langle(\partial N)^2\rangle = \left(\partial\langle N\rangle / \partial\beta\mu\right)_{\beta,V}$

(b) $\langle(\partial N)^2\rangle = \left(\partial\langle N\rangle / \partial\beta\mu\right)^{-1}_{\beta,V}$

(c) $\langle(\partial N)^2\rangle = \left(\partial\langle N\rangle / \partial\mu\right)_{\beta,V}$

(d) $\langle(\partial N)^2\rangle = \left(\partial\mu\langle N\rangle / \partial\beta\right)_{\beta,V}$

- (a)
- (b)
- (c)
- (d)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(a)

8) The equilibrium value of any unconstrained internal parameter in a system in diathermal contact with a thermal reservoir minimizes the following quantity *1 point*

- Internal energy
- Gibbs potential
- Helmholtz free energy
- Enthalpy

No, the answer is incorrect.
Score: 0
Accepted Answers:
Helmholtz free energy

9) Consider a container divided into two chambers, one chamber of volume V_1 having N_1 molecules of a monatomic ideal gas at temperature T and pressure P, and the other chamber of volume V_2 having N_2 molecules of a *different* monatomic gas at the *same* temperature and pressure. If the partition between the two chambers is now removed, what is the overall change in the entropy? *1 point*

(a) $\Delta S = N_1 k_B \ln\left(\frac{V_1}{N_1}\right) + N_2 k_B \ln\left(\frac{V_2}{N_2}\right)$

(b) $\Delta S = N_1 k_B \ln\left(\frac{N_1}{V_1}\right) + N_2 k_B \ln\left(\frac{N_2}{V_2}\right)$

(c) $\Delta S = N_1 k_B \ln\left(\frac{V_1+V_2}{N_1+N_2}\right) + N_2 k_B \ln\left(\frac{V_1+V_2}{N_1+N_2}\right)$

(d) $\Delta S = N_1 k_B \ln\left(\frac{V_1+V_2}{V_1}\right) + N_2 k_B \ln\left(\frac{V_1+V_2}{V_2}\right)$

- (a)
- (b)
- (c)
- (d)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(d)

10) For 1 mole of a monoatomic ideal gas, the relation between pressure (P), volume (V) and average molecular kinetic energy ($\bar{\varepsilon}$) is *1 point*

(a) $P = \frac{2N_A\bar{\varepsilon}}{3V}$

(b) $P = \frac{N_A\bar{\varepsilon}}{3V}$

(c) $P = \frac{2N_A}{3V\bar{\varepsilon}}$

(d) $P = \frac{N_A\bar{\varepsilon}}{V}$

- (a)
- (b)
- (c)
- (d)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(a)