

KHAIRA COLLEGE, KHAIRA, BALASORE

DEPARTMENT OF PHYSICS

QUESTION BANK

UG 3RD Sem - CC - VI

Answer all questions

1- Answer the following :

[1mark]

- a) $dQ = dU + \underline{\hspace{2cm}}$.
- b) Number of thermodynamics potential is $\underline{\hspace{2cm}}$.
- c) Principle of entropy is $\Delta s \leq 0$. (True/ False).
- d) Landau potential is also known as $\underline{\hspace{2cm}}$ potential.
- e) The dimensionality of phase space $\underline{\hspace{2cm}}$.
- f) Write Clausius – Clapeyron’s latent equation.
- g) $\underline{\hspace{2cm}}$ is the ratio of ordinary volume of the gas to its critical volume.
- h) The dimensions of the constant ‘b’ in Vander Waal’s equation are that of $\underline{\hspace{2cm}}$.
- i) First law of thermodynamics is a consequence of conservation of $\underline{\hspace{2cm}}$.
- j) How entropy changes with disorder?
- k) Give an example of each extensive and intensive thermodynamic variables.
- l) $\underline{\hspace{2cm}}$ is Gibb’s free energy per unit area.
- m) Define Joule-Kelvin coefficient.
- n) A wire is stretched adiabatically, the temperature of wire $\underline{\hspace{2cm}}$ after stretching.
- o) The expression for rms speed of gas molecule is $\underline{\hspace{2cm}}$.
- p) Write the unit of Ven der Waal’s constant.

2- Answer the following (Very short type) :-

[1.5 marks]

- a) Find the temperature at which rms speed of O₂ is same as that of Cl₂ at 127°C.
- b) State Clausius inequality.
- c) Define second order phase transition. Give an example.
- d) Distinguish vapour and gas.
- e) Prove that entropy is an extensive parameter.
- f) Why do many liquids form films on their surface when heated?
- g) Define Joule-Kelvin co – efficient.
- h) State law of equipartition energy.
- i) Prove that $\frac{RT_c}{P_c V_c} = 2.67$, where the symbols have their usual meaning.
- j) Find rms speed of H₂ gas at NTP.
- k) State second law of thermodynamics given by Clausius and Planck's.
- l) Why efficiency of a heat engine cannot be 100%?
- m) What is enthalpy of a thermodynamic system?
- n) Draw temperature versus surface tension graph for a liquid and explain it.
- o) Write first law of thermodynamics in adiabatic process.
- p) Define degree of freedom.
- q) Write the expression for freepath in terms of pressure and temperature.
- r) Define critical temperature.
- s) What are the factors which affect diffusion?
- t) Write Clausius Clayperon's equation. Mention terms used.

3- Answer the following (Sort type) :-

[2 marks]

- a) Why $C_p > C_v$?
- b) Write down the significance of first law of thermodynamics.
- c) State Carnot's theorem.
- d) Write the expression for Helmholtz free energy. Mention the terms used.
- e) Define conduction and diffusion.
- f) State law of corresponding state.
- g) Why it is easier to cook with pressure cooker.
- h) Find the relation between Boyle temperature and temperature inversion.
- i) What is significance of zero value of Vander Waal's constant 'a' ?
- j) Define relation between molar heat capacity ratio and degree of freedom.
- k) State Zeroth law of thermodynamics. Define temperature from it.
- l) Distinguish between first order and second order phase transition.
- m) A Carnot's heat engine absorbed 800 cal of heat from a source of 400K and rejects a part of it to the sink at 300K. Calculate heat rejected to the sink.
- n) What is magnetic work? Write its expression.
- o) Write the difference between real gas and ideal gas.
- p) Find the temperature at which rms velocity of a gas is half of its value at 0°C , when the pressure remain constant.
- q) Find Joule – Thomson coefficient for a perfect gas,
- r) Define Brownian motion. Write some characteristic features of Brownian motion.
- s) Write the expression for specific heat of monoatomic gas and hence find the value of γ .
- t) Write down the limitations of first law of thermodynamics.

4- Answer the followings (Long type) :-

[6marks]

- a) State and explain first law of thermodynamics.
- b) State and prove Carnot's theorem.
- c) Using Maxwell's thermodynamics relation, derive $C_p - C_v = R$.
- d) Derive expression Joule-Kelvin co-efficient for Vander Waal's gas.
- e) Define mean free path and derive Clausius expression for it.
- f) Using Maxwell-Boltzman law of molecular speed, derive expression for most probable and rms speed.
- g) Derive the expression for critical constant of Vander Waal's gas.
- h) Describe Joule's experiment. Explain the entropy change due to adiabatic expansion of perfect gas.
- i) Deduce expression for thermodynamic scale of temperature.
- j) Derive Ehrenfest equation.
- k) Derive expression for Maxwell – Boltzman law of distribution of velocities in an ideal gas.
- l) What do you mean by transport phenomenon? Derive expression for thermal conductivity of a gas.
- m) Discuss Andrew's experiment on CO₂ gas.
- n) Derive Vander Waal's equation of state for real gas.

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