

Group A
(Compulsory)

1. Answer the following multiple choice questions $2 \times 10 = 20$

(i) All natural processes are irreversible. This is a direct consequence of

- (a) First law of Thermodynamics
- (b) 2nd law of Thermodynamics
- (c) Third law of Thermodynamics
- (d) Gibb's paradox

Ans. \rightarrow (b) 2nd law of Thermodynamics

(ii) The relation between Boyle's Temperature and critical temperature is

(a) $2T_B = \frac{8}{27} T_c$ (b) $T_B = \frac{27}{8} T_c$

(c) $T_B = \frac{3}{2} T_c$ (d) $3T_B = \frac{5}{13} T_c$

Ans. \rightarrow $T_B = \frac{27}{8} T_c$

(iii) The P-V relation for a monoatomic ideal gas undergoing an adiabatic process

(a) $PV^{2/3} = \text{constant}$ (b) $PV^{4/3} = \text{constant}$

(c) $PV = \text{constant}$ (d) $PV^{5/3} = \text{constant}$

Ans. \rightarrow (d) $PV^{5/3} = \text{constant}$

(iv) Specific heat of a gas at constant volume (c_v) and at constant pressure (c_p) are related as

(a) $\frac{c_p}{c_v} = 1 - \frac{R}{J}$ (b) $c_p - c_v = \frac{R}{J}$

(c) $c_p - c_v = \frac{J}{R}$ (d) $c_p + c_v = \frac{R}{J}$

Ans → (b) $c_p - c_v = \frac{R}{J}$

(v) A reversible heat engine can have 100% efficiency if the temperature of sink is

(a) less than that of source

(b) equal to that of source

(c) 0°K

(d) 0°C

Ans → (c) 0°K

(vi) The area of the Carnot cycle on a P - V diagram represents

(a) heat absorbed from the source

(b) work done in a cycle

(c) heat rejected to the sink

(d) efficiency of the engine

Ans → (b) work done in a cycle.

Teacher's Signature.....

(vii) The thermodynamical relation expressing $T ds$ equation

(a) $T ds = c_v dT - T \left(\frac{\partial P}{\partial T} \right)_V dV$

(b) $T ds = c_v dT + T \left(\frac{\partial P}{\partial T} \right)_V dV$

(c) $T ds = c_v dT + T \left(\frac{\partial S}{\partial V} \right)_T$

(d) $T ds = c_v dT - T \left(\frac{\partial S}{\partial V} \right)_T$

Ans → (b) $T ds = c_v dT + T \left(\frac{\partial P}{\partial T} \right)_V dV$

(viii) Under equilibrium condition, the thermodynamic variable, associated with black body radiation at Temperature (T) which reduces to

(a) entropy (b) Helmholtz free energy

(c) Gibb's free energy (d) pressure

Ans (c) Gibb's free energy

(ix) Entropy remain constant in

(a) isothermal process

(b) adiabatic process

(c) cyclic process

(d) none of above

Ans → (b) adiabatic process

(x) Which of the following is not the transport phenomenon of ideal gas

- (a) Viscosity (b) Friction (c) Thermal conductivity (d) Diffusion

Ans (b) Friction

Group B

Answer any four question from the following ~~450~~

$$4 \times 5 = 20$$

2. Zeroth law of Thermodynamics
3. Derive an expression for work done during Isothermal process
4. Carnot's Theorem
5. Define entropy. Prove that change in entropy of Reversible process is zero
6. Differentiate first and second order phase transitions with examples
7. Derive Tds equations
8. What are RMS and most probable speeds
9. What is Boyle Temperature? Find an expression for it

Group C

Answer any two question from the following

$$15 \times 2 = 30$$

Teacher's Signature.....

~~10. Describable~~

10. Describe the construction and working of Carnot Reversible Heat Engine. Derive an expression for its efficiency.
11. What are Thermodynamic Potentials. Derive expression for Internal energy, Enthalpy, Helmholtz free energy and Gibbs free energy.
12. Derive Maxwell's Thermodynamic Relations.
13. Derive Van der Waal's equation of state for Real Gases and find the values of critical constants. What are Law of corresponding states?