

# Physical Chemistry

## 1G ( Thermodynamics )

1. Explain the followings –
  - (i) Open system
  - (ii) Closed system
  - (iii) Isolated system
  - (iv) Isothermal Process
  - (v) Adiabatic process
  - (vi) Isobaric Process
  - (vii) Isochoric Process
  - (viii) Reversible Process
  - (ix) Irreversible Process
2. What is internal energy and enthalpy?
3. Define specific heat and heat capacity.
4. Define  $C_p$  and  $C_v$ . Thermodynamically prove that  $C_p - C_v = R$ .
5. State and explain zeroth law of thermodynamics.
6. Give a statement of the first law of thermodynamics. Write down its mathematical form and explain each term involved.
7. What is Joule Thomson effect? What is Joule Thomson coefficient?
8. Show that Joule Thomson coefficient for ideal gas is zero.
9. What is inversion temperature? Calculate inversion temperature for Vanderwaal's gas.
10. Derive the relation between  $\Delta H$  and  $\Delta U$ .
11. Calculate the work done of the following –
  - (i) Isothermal reversible expansion work.
  - (ii) Isothermal irreversible expansion work.
  - (iii) Adiabatic reversible work
12. Show that reversible work is greater than irreversible work.
13. Show that for an adiabatic process  $PV^\gamma = K$ .
14. The pressure of gas during adiabatic expansion decreases more rapidly than isothermal expansion. Why?
15. Distinguish between isothermal and adiabatic processes.
16. The volume of 45 g of  $N_2$  is expanded isothermally and reversibly at  $25^\circ C$  from 10 L to 20 L. Considering the gas as ideal, calculate work done.
17. Write down and deduce Kirchhoff's equation.
18. For an adiabatic change of an ideal gas, derive the relationship between pressure and temperature.
19. For an adiabatic change of an ideal gas, derive the relationship between volume and temperature.
20. At  $227^\circ C$ , 10 mole of ideal gas expanded isothermally and reversibly from volume 10 l to 100 L . Calculate the work done.
21. Indicate two criteria of spontaneity of chemical reaction.
22. State second law of thermodynamics.
23. Two mole of an ideal gas expanded isothermally and reversibly at  $27^\circ C$  to twice the original volume, Calculate work done,  $q$ ,  $\Delta H$  and  $\Delta U$ .
24. Describe the different steps involved in Carnot's cycle taking one mole of an ideal gas and hence find the efficiency of an engine functioning in this principle.
25. Draw the P-V diagram of Carnot's cycle and from it deduce the relation that express the maximum amount of work obtainable from the heat flowing from T to T<sup>1</sup>
26. 1 mole of an ideal gas expands from 1 L to 2 L at  $27^\circ C$ , calculate the change in entropy.
27. 2 moles of an ideal gas expand reversibly and isothermally at  $27^\circ C$  from 1 L to 10 L. Calculate the work done.
28. 4.2 g of  $N_2$  is expanded isothermally and reversibly at  $27^\circ C$  from 10 atm to 1 atom. Calculate  $q$ ,  $w$  and  $\Delta U$ .
29. What is Gibbs free energy?