3K-CSN-20

01/02/2022

Chemical Engineering Thermodynamics

Time: 3 Hours Max Marks-100

Note: Numericals done without showing the working will be awarded zero marks.

1) Attempt any **ten** questions 10×2=20

   (i) Write down two units of Energy.

   (ii) Convert 5 Joules into calories.

   (iii) What is ideal gas law? Write its expression.

   (iv) What is Universal Gas constant? Write its SI units and value.

   (v) What is pressure? Write its units.

   (vi) Convert 2.5 m^3 volume into litres.

   (vii) Convert 25^o Celsius into Kelvin.

   (viii) Write down First Law of Thermodynamics for a closed system and explain each term in it.

   (ix) What is an open system? Give one example.

   (x) Define isobaric processes.

   (xi) A gas expands against a pressure of 2 Pascals from a volume of 1m^3 to 2m^3. Find the work done by the gas.

   (xii) A heat reservoir at a temperature of 500K absorbs 10^5 Joules of heat from its surroundings. Calculate ΔS for the reservoir.

   (xiii) What is Refrigeration?

   (xiv) Define Adiabatic Process.

   (xv) Define Reversible process.

2) Attempt any **five** questions 5×4=20

   (i) What is enthalpy? What are its units? What is its significance?

   (ii) What is entropy? What are its units? What is its significance?

(iii) What is γ (gamma)? What are its values for a monatomic gas and a diatomic gas? What are its units?

(iv) What is specific heat capacity? What are its units? What are its values for diatomic and monatomic gases?

(v) What is latent heat? What are its units? Describe latent heats of vaporization and latent heat of fusion?

(vi) What are the assumptions of Ideal Gas equation? Write down Van der waals equation of state. Explain all the terms in the van der waals equation of state.

(vii) Write down about the different kinds of refrigerants and their characteristics.

(viii) What is Carnot engine? What is its efficiency?

Attempt any **three** questions 3×20=60

3) Write down the second law of thermodynamics? What is the difference between reversible and irreversible processes? What is entropy change for a reversible process and an irreversible process?
4) Describe in detail Vapour compression refrigeration cycle along with a labelled diagram.
5) Describe Air refrigeration system along with a labelled diagram.
6) Describe COP of a refrigerator in detail? Calculate the COP of a Carnot refrigerator operating between 0^{o} Celsius and 27^{o} Celsius. Derive the expression of COP of a Carnot refrigerator in terms of its operating temperatures.
7) Derive in detail the expression for work done in an isothermal process. Explain all terms.
8) Derive in detail the expression for work done in an adiabatic process. Explain all terms.