

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**B.E. Sem-III (Rubber Technology) Examination December 2009**  
**Subject code: 132603**

**Subject Name: Thermodynamics of Elastomers & Polymers**

**Date: 23 / 12 / 2009**

**Time: 11.00 am – 1.30 pm**

**Instructions:**

**Total Marks: 70**

1. **Attempt all questions.**
2. **All notations used have conventional meaning.**
3. **Make suitable assumptions wherever necessary.**
4. **Figures to the right indicate full marks.**

- Q.1** (a) Define the following terms: State of system, State and Path functions, Isochoric, Isobaric and Isentropic process. **07**
- (b) Derive the formula for work done (W) in reversible isothermal process involving ideal gas. **04**
- (c) Calculate the standard heat of formation of acetylene from heat of combustion of  $C_2H_2$ , C (graphite) and  $H_2$  being -1300 kJ/mol, -395 kJ/mol, and -286 kJ/mol respectively. **03**
- Q.2** (a) Write a note on Flame and Explosion Temperature. Also derive the formula for the same. **07**
- (b) Discuss on Carnot's Theorem. **07**
- OR**
- (b) Describe in detail "Entropy". Relate entropy with disorder, unavailable energy and probability. **07**
- Q.3** (a) Derive the formula for entropy change of an ideal gas. **08**
- (b) An inventor claims to have developed an engine which is capable of delivering 10000 J/sec of power while operating between heat source at 400 °K and heat sink at 200 °K. The engine receives 18000 J/sec. Justify Inventor's claim. **06**
- OR**
- Q.3** (a) Show that in the mixing of two ideal gases, the maximum entropy increase results when  $X_1=X_2=0.5$ . **07**
- (b) 20 g of water at 35 °C is converted into steam at 200 °C. Calculate the entropy change. Data: **07**  
 Heat capacity of superheated steam = 1.98 J/g K  
 Heat capacity of water = 4.2 J/g K  
 Latent heat of vaporization at 100 °C = 2260 J/g
- Q.4** (a) Derive Gibbs Helmholtz equation. **07**
- (b) At what temperature will water boil when the atmosphere pressure is 528 mm Hg? Latent heat of vaporization of water is 545.5 cal/g. **07**
- OR**
- Q.4** (a) Derive Maxwell thermodynamic relations. **07**
- (b) Explain the concept of ceiling temperature. List four important possibilities of polymerization. **07**
- Q.5** (a) Write the Phase rule equation. Give the merits and demerits of Phase rule. **07**
- (b) List the characteristics of a good fuel. **07**
- OR**
- Q.5** (a) Explain the Law of Mass Action. Also give the relation between  $K_p$  and  $K_c$ . **07**
- (b) Discuss Vapor Compression cycle of refrigeration. **07**

\*\*\*\*\*