

**GUJARAT TECHNOLOGICAL UNIVERSITY****B.E. Sem-III Regular / Remedial Examination December 2010****Subject code: 132603****Subject Name: Thermodynamics of Elastomers and Polymers****Date: 16 /12 /2010****Time: 10.30 am – 01.00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Assume suitable data wherever necessary.

- Q.1** Answer the following **14**
- (i) Write down any two limitations of first law of thermodynamics.
  - (ii) Define the terms: (1) Heat of reaction (2) Heat of formation
  - (iii) List the any two important properties of a refrigerant.
  - (iv) Explain the following terms: (1) Degree of Freedom or Variance  
(2) Polymorphism
  - (v) What do you mean by Eutectic System? Give an example of it.
  - (vi) Write any two characteristics of a chemical equilibrium.
  - (vii) How the proximate analysis of air-dried coal is done?
- Q.2** (a) Explain the polymer solutions in detail with respect to its thermodynamics . **07**
- (b) Solve the following sums:
- (i) 2 gas of CO<sub>2</sub> is contained in a piston cylinder assembly at a pressure of 65bar & a temperature of 300°K. The piston has a mass of 5000kg and a surface area of 1m<sup>2</sup>. The friction of the piston on the walls is significant & can not be ignored. The atmospheric pressure is 1.01325bar. The latch holding a piston in position is suddenly removed & the gas is allowed to expand. The expansion is arrested when the volume is double the original volume. Determine the work appearing in the surroundings. **04**
  - (ii) A man whose weight is 600N takes 2 minutes for climbing up a staircase. **03**  
What is the power developed in him, if the stair case is made up of 20 stairs each 0.18m in height?
- OR**
- (b) Derive any three equations which show Maxwell's thermodynamic equations. **07**
- Q.3** (a) Explain the factors which are taken into consideration during selection of coal. **07**
- (b) Write a short note on Effect of crosslinking on solubility **07**
- OR**
- Q.3** (a) Give the difference between Low temperature carbonization & High temperature carbonization. **07**
- (b) Discuss in about solubility parameter. **07**
- Q.4** (a) How the variation in heat of polymerization of various monomer arises? Explain it in detail. **08**
- (b) Write a short note on Eutectic System. **06**

**OR**

- Q.4 (a)** How the estimation of heat of polymerization is carried out? **07**  
**(b)** Derive the equation of phase rule. **07**

- Q.5 (a)** Derive the equation of law of mass action by using Vant Hoff equilibrium box. **07**  
**(b)** A boiler is fired with a coal with composition: C= 75%, H= 9%,  
S= 2%, O= 4%, N= 3%, ash= 7%. **07**  
Calculate:  
(1) Gross & Net calorific value of 1kg of coal(Latent heat of steam=587kcal/kg)  
(2) Minimum theoretical air required for combustion of 1kg of coal(by weight and by volume)  
(3) Percentage composition of dry flue gas if 25% excess air is used.

**OR**

- Q.5 (a)** State the Le-Chatelier-Braun principle and discuss the factors which are taken into consideration in application of this principle. **07**  
**(b)** An ideal gas undergoes the following sequence of mechanically reversible process: **07**  
(1) From an initial state of 70°C and 1bar,it is compressed adiabatically to 150°C  
(2) It is then cooled from 150°C to 70°C at constant pressure.  
(3) Finally it is compressed isothermally to its original state.  
Calculate W,Q, $\Delta U$ , $\Delta H$  for each of three processes & for entire cycle.(Take  $C_p=7/2*R$ ,  $C_v=5/2*R$ ,  $r=1.4$ )

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