Instructions: Answer all questions within the space provided.
Max Marks: 11 (3 + 2+ 2 + 2 + 2)

(1) Following is a potential energy contour corresponding to two degrees of freedom. The six minima are labelled already. Identify and trace the most probable paths by which (a) tt goes to $g^{+}c$; (b) $g^{-}t$ goes to $g^{-}c$; (c) Identify one second order saddle point and the corresponding two transition states to which the second order point connects.

(2) State and explain variational theorem.

(3) The Schrodinger equation of H_2 molecule cannot be solved analytically even after using the Born-Oppenheimer approximation. Write the Schrodinger equation and explain.

(4) Write the internal coordinate representation for CH_3-NH_2.

(5) Write the complete Hamiltonian for $[He\text{-}H]^+$ molecule.