

SUBJECT - CHEMISTRY

CLASS - B.Sc(Hons) PART-III

PAPER - V

TOPIC - Collision Theory of reactions

Dr Hari Mohan Prasad Singh

Department of Chemistry

Dr. L.K.V.D College Tajpur Samastipur

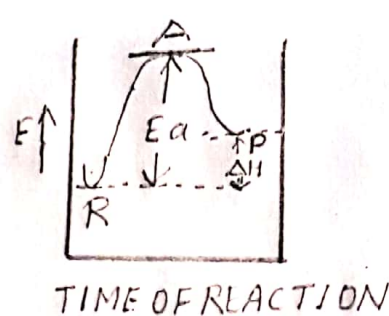
Q Discuss Collision theory of reaction rates. How does temperature influence the rate of reaction?

Ans For a reaction to occur, the reactant molecules must come in close contact or collide. The collision disrupts the existing bond in the reactant molecules and some sort of reshuffling occurs which lead to the formation of products. The collisions which lead to the formation of products are called 'effective collisions' and which do not lead to the formation of products are called 'abortive collisions'. For the occurrence of effective collisions, the reacting molecules must have sufficient energy and proper orientations. During the transformation of reactants into products, there is an energy barrier which has to be overcome by reactant molecules before reactant can pass into the products. If the reacting molecules collide with sufficient energy so as to go up and reach the peak of the energy barrier, they can go to the right side of the slope and in this way, reactant molecules are transformed into products. But if the reacting molecules collide with lesser energy than what is needed to cross the energy barrier, they will not pass over the barrier and naturally come back to reactants. An increase in temperature causes an increase in the number of molecules having energies

greater than or equal to the activation energy which therefore results in the transformation of reactant into products.

The colliding reacting molecules exercise a repulsive force on one another due to the negatively charged electron clouds surrounding them.

This causes the low energy reactant molecules to rebound on collision but a collision between high energy molecules overcomes the forces of repulsion, interpenetration of clouds of the reacting molecules occur and they are brought closer enough to allow the rearrangement of atoms specific for the reaction to occur. A systematic diagram showing the energy changes and progress of reaction can be shown as



Defects of Collision Theory: From the kinetic theory of gases, we know that the number of colliding molecules is approximately the same for all gases and hence if collision is the only factor for the occurrence of reaction then all gaseous reactions should have same enormous rate. But this is not so further the variation of rate of reaction with increasing temperature is much greater than the number of collision due to increased molecular velocities.