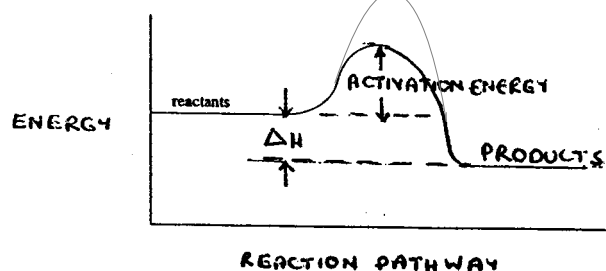


1. State and explain the effect of modifying each of the following on the rate of reaction:
 - a) increasing concentration of reactants will increase chance of collision and therefore rate of reaction
 - b) increasing temperature of the reaction mixture increases speed of particles so more chance of collision; also the energy of particles therefore more chance of activation energy (successful collision) therefore increase rate of reaction
 - c) increasing pressure of the reaction mixture increases concentration, therefore more chance of collision, therefore higher rate of reaction
 - d) increasing surface area (e.g. smaller particles) increases amount of particles available for collision thereby increasing the rate of reaction
 - e) catalysts provide a pathway of lower activation energy. There is therefore in any collision more chance of success, so the rate of reaction increases,
 - f) increasing intensity of light in photochemical reactions increases energy absorbed, which increases speed of particles (increases collisions) and chance of success (collision exceeds activation energy). Therefore, higher rate of reaction.

2. Pathway without catalyst

a)



- b) No. This diagram represents the energy pathway for an individual collision. (At higher temperatures, the particles would be more likely to have energy greater than the activation energy).

3. Enzymes act as catalysts; they provide a reaction pathway with lower activation energy and thereby increase the rate of reaction.

4.

- (a) $\text{ZnCO}_3 + 2\text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2\text{O} + \text{CO}_2$
- (b) Smaller particles (more surface area) of reactant will increase rate of reaction.
- (c) The rate is faster at 1 minute since the slope is greater.
- (d)
 - (i) It will be the same (reason not required but it is that the HCl is in excess already)
 - (ii) Faster (reason not required but higher conc means more collisions)