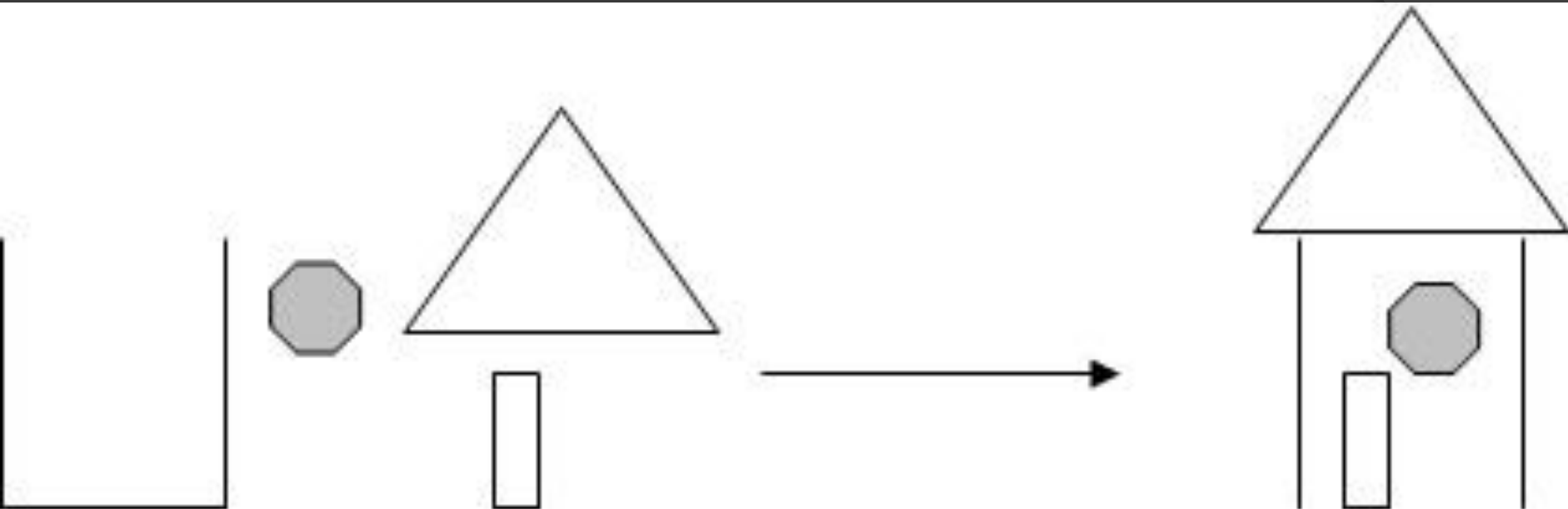


1.9 Reaction Mechanisms



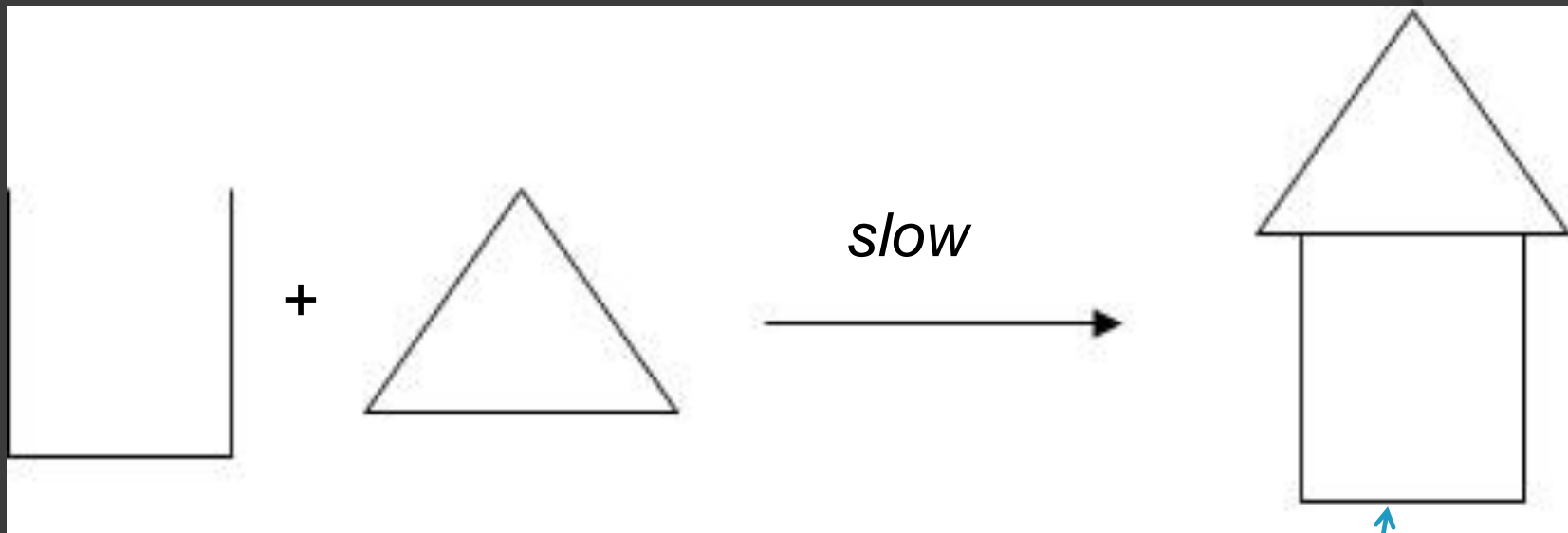
Reactants

Products

The reactants might not all combine at once, but in fact, take a sequence of steps to reach the product. Each step can also proceed at its own rate!

1.9 Reaction Mechanisms

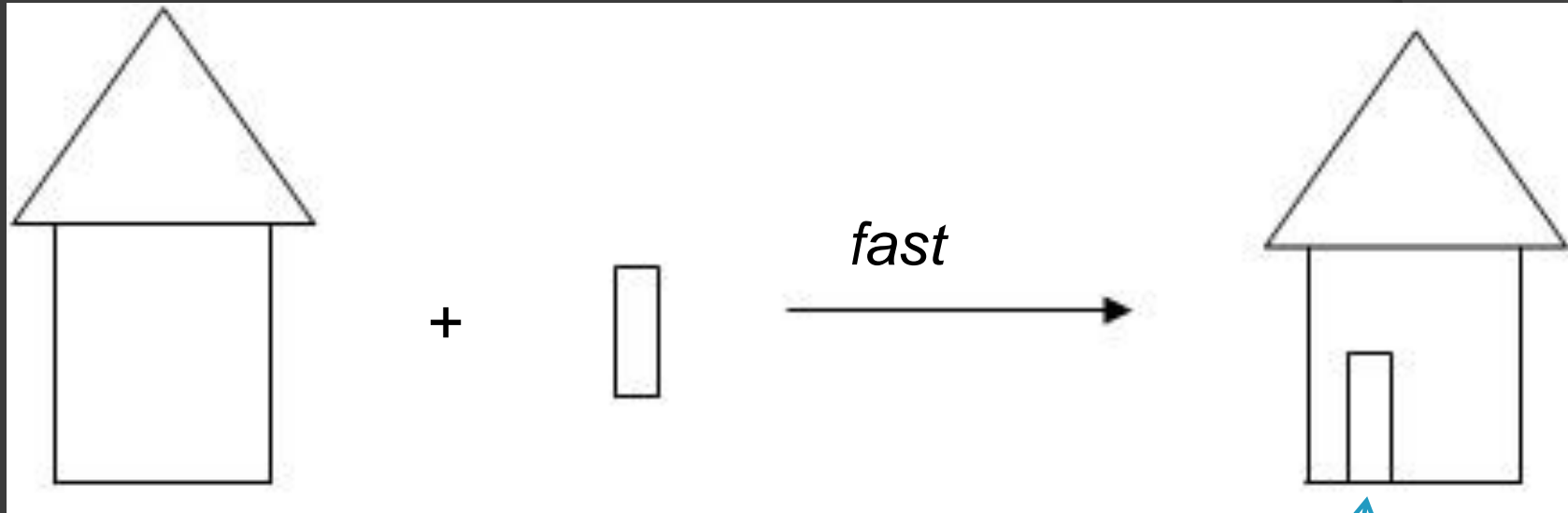
Step 1



intermediate

1.9 Reaction Mechanisms

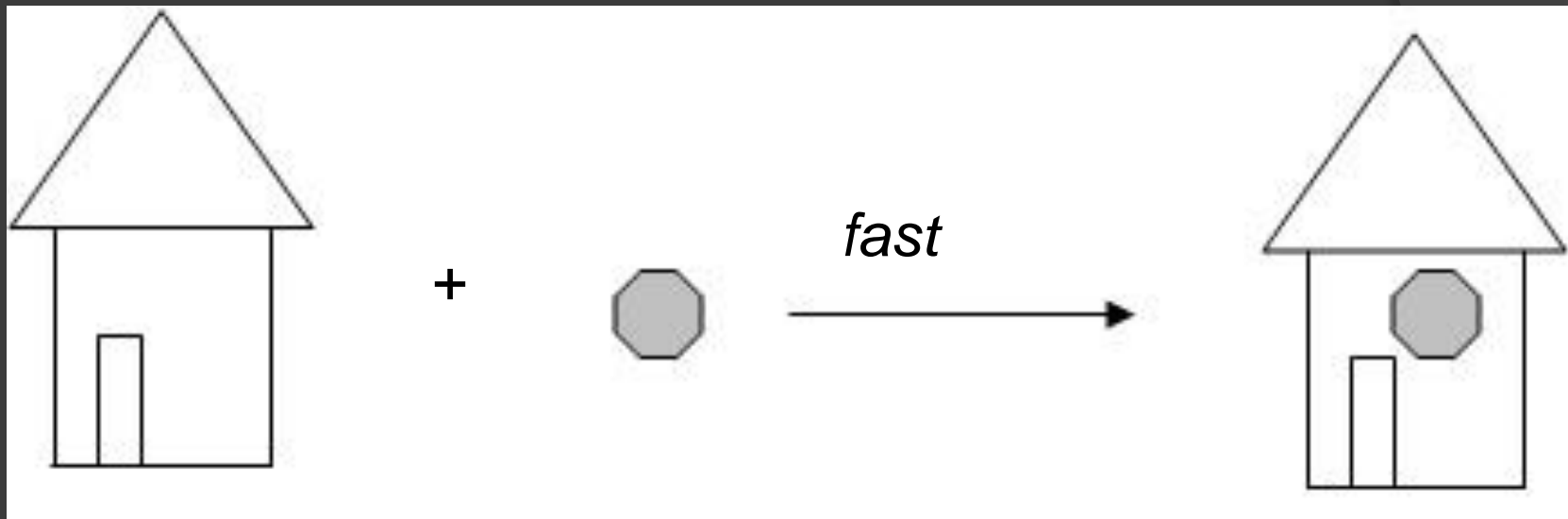
Step 2



intermediate

1.9 Reaction Mechanisms

Step 3



1.9 Reaction Mechanisms

- ⦿ i) Each individual step is called an “elementary process”
- ⦿ ii) The rate of the overall reaction is only as fast as its slowest step!
- ⦿ iii) The slowest step in a reaction = *Rate Determining Step* (eg. Step 1 for above)

1.9 Reaction Mechanisms

- ⦿ The reaction intermediates **CANNOT** build up since they are made and used up in the reaction
- ⦿ The overall rate is **UNAFFECTED** by increasing the concentration of intermediates
- ⦿ **To determine the overall rate:** *add up all the steps and cancel any species that occur on both sides of the equation*

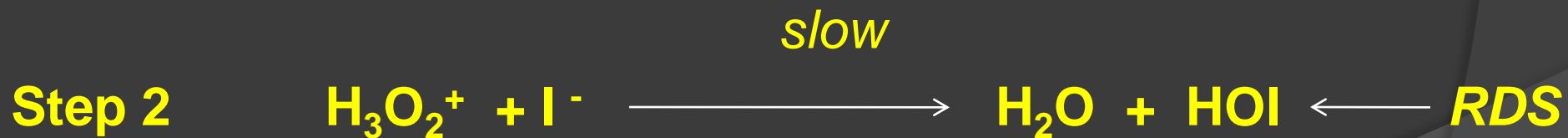
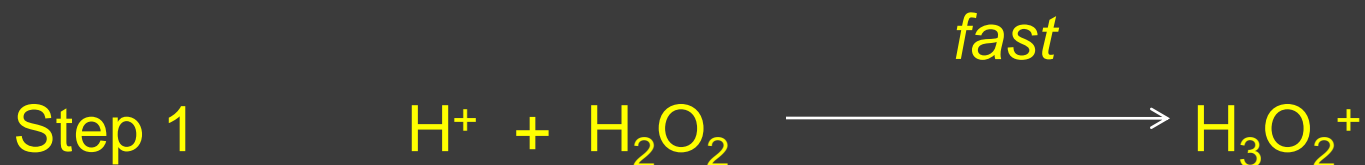
1.9 Reaction Mechanisms

Example:



Reactants

Products



1.9 Reaction Mechanisms

Example:



Reactants

Products



1.9 Reaction Mechanisms

Other concepts you should know:

i) Can you find the formula of the activated complex at any step?

- add elements of reactants together.
- e.g. for first example, activated complex for first step = H_3O_2 , second step = $\text{H}_3\text{O}_2\text{I}$
- e.g. for second example, activated complex for first step = HBrO_2 , second step = $\text{H}_2\text{Br}_2\text{O}_2$, third step = $\text{H}_4\text{Br}_4\text{O}_2$

ii) Can you see that the overall reaction is a result of adding the reaction steps together?

- cross out the intermediates that appear on both sides of the reaction

1.9 Reaction Mechanisms

iii) Can you determine if the concentration of an intermediate will be low or high?

- Eg/ conc. of HOObR intermediate at end of first step of second example will be very low. As soon as it is produced, it is used up! Produced slowly, but used fast.
- Eg/ conc. of H_3O_2^+ intermediate from first example will be high. It is produced very rapidly, but it is used up slowly...build up a excess at that step!

iv) Do you understand the difference between an intermediate and an activated complex?

- intermediate has low energy (compared to activated complex) and is stable
- activated complex has high energy and is unstable.

1.9 Reaction Mechanisms

- Do Questions: #46-52 page 28