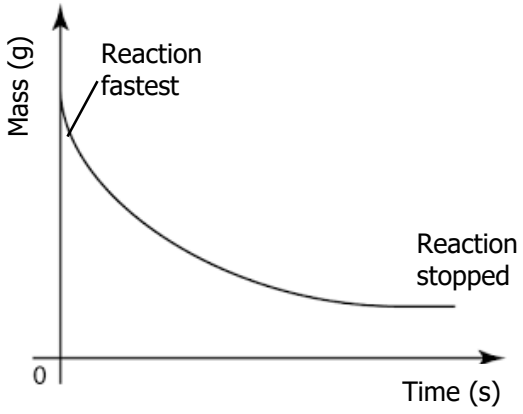
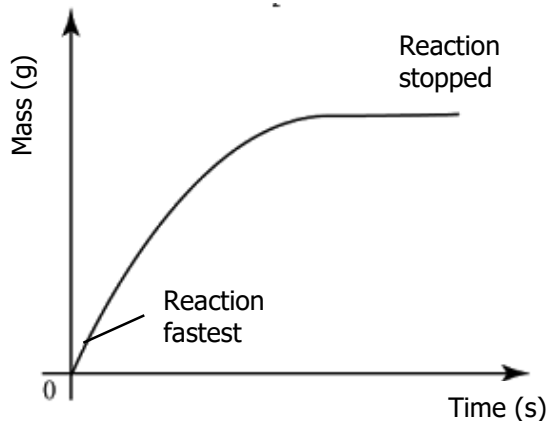
Chemistry 6: Rate and Extent of Chemical Change

1 **Calculating rate of reaction**:

Mean rate = $\frac{\text{amount of reactant used}}{\text{time taken}}$ *or* Mean rate = $\frac{\text{amount of product formed}}{\text{time taken}}$



2 Typical graph when measuring **reactants used**



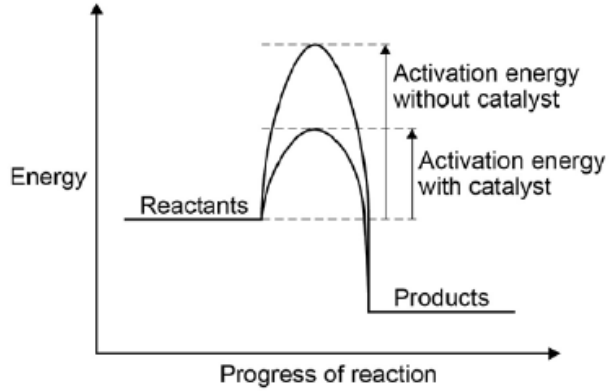
3 Typical graph when measuring **products formed**

Section 1: Key terms	
4 Collision theory	**Reactions occur** only when **particles collide with enough energy**.
5 Activation energy	The amount of **energy particles** need in order **to react**.
6 Catalyst	A chemical (or **enzyme**) that **increases the rate of reaction without being used itself** (therefore they are not included in an equation). They **provide an alternative pathway** for the reaction with a **lower activation energy**.
7 Concentration	The **number of particles** in a certain **volume.**

Section 2: Factors Affecting Rate		
Factor	**Effect on Rate**	**Explanation**
9 Concentration of reactants	Increasing the concentration **increases** the rate of reaction.	**Increases the chance of a collision** as there are more particles.
10 Pressure of gases	Increasing the pressure **increases** the rate of reaction.	**Increases the chance of a collision** as there are more particles.
11 Surface area of solid reactants	Increasing the surface area **increases** the rate of reaction.	**Exposes more of the solid** so that there is a **greater chance of collisions** occurring.
12 Temperature	Increasing the temperature **increases** the rate of reaction.	**Increases speed** at which particles move and makes **collisions more energetic**.
13 Catalyst	Catalysts **increase** the rate of reaction.	**Lowers** the **activation energy**.

Section 3: Reversible Reactions	
14 Reversible reaction	A reaction in which the **products can also form the reactants**. Shown as: A + B ⇌ C + D
15 Exothermic	A reaction that **releases heat to the environment**.
16 Endothermic	A reaction that **takes in heat from the environment**.
17 Equilibrium (HT)	Equilibrium is reached when the **forward and reverse reactions occur at exactly the same rate**. Needs a **sealed container**.
18 Le Chatelier's Principle (HT)	If a system is at equilibrium and a change is made to any of the conditions, then the **system responds to counteract the change**.

Section 4: Changing conditions at equilibrium	
19 Changing temperature (HT)	If the temperature of a system at equilibrium is increased: • the amount of products at equilibrium increases for an endothermic reaction • the amount of products at equilibrium decreases for an exothermic reaction. If the temperature of a system at equilibrium is decreased: • the amount of products at equilibrium decreases for an endothermic reaction • the amount of products at equilibrium increases for an exothermic reaction.
20 Changing concentration (HT)	• If the concentration of a reactant is increased, more products will be formed. • If the concentration of a product is decreased, more products will be formed.
21 Changing pressure (HT)	For reactions of gases: • an increase in pressure causes the reaction to favour the side with the smaller number of molecules (as shown by the symbol equation for that reaction). • A decrease in pressure causes the reaction to favour the side with the larger number of molecules (as shown by the symbol equation for that reaction).



8 Energy profile diagram for a reaction with/ without a catalyst.