

Rate of Reaction

telegram : @chemistry
instagram : @anisa-frina

meaning; changes in the quantity of reactant per unit time.

By Formula;

ROR = $\frac{\text{change in the quantity of reactant or product}}{\text{Time taken for the change to occur}}$

During reaction

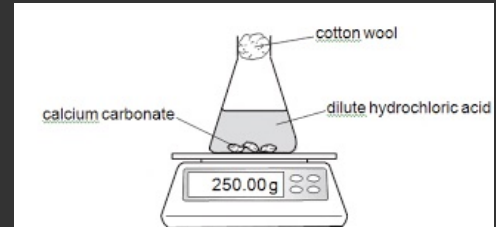
- Quantity of reactant ↓
- Quantity of product ↑

Changes that occurs during Reactions

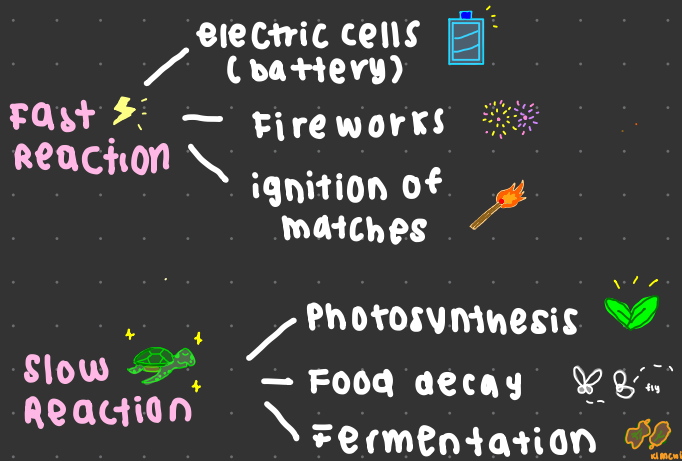
① **Decrease in mass of reactant**

→ Reaction that produce gases.

example ; $\text{HNO}_3 + \text{CaCO}_3$
; produce $\text{Ca(NO}_3)_2 + \text{CO}_2 + \text{H}_2\text{O}$
→ lime stone CaCO_3 experience loss in mass.



Rate of Reaction
Fast Reaction
Slow Reactions

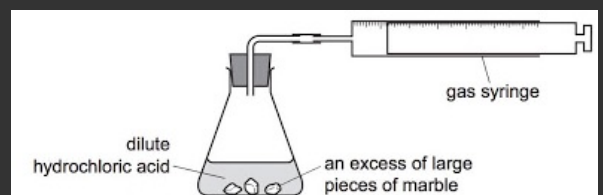


② **increase in volume of gas**

→ Reaction that produces gas

example ; $\text{HCl} + \text{Mg}$
; produce $\text{MgCl}_2 + \text{H}_2$

→ Hydrogen gas, H_2 is collected
→ volume are measured using gas syringe

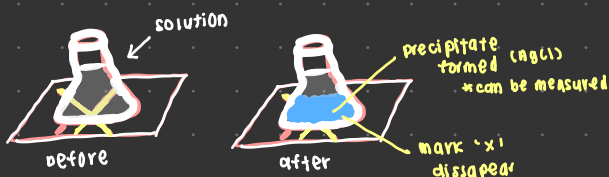


Changes that occurs during Reactions

③ **Formation of precipitate**

→ production of insoluble salt

example ; reaction between $\text{AgNO}_3 + \text{NaCl}$
; produce precipitate AgCl



Rate of Reaction

Types of Rate of Reaction

- average ROR
- instantaneous rate

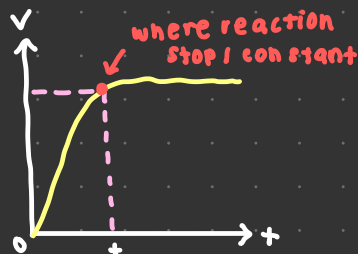
① Average Rate of Reaction
→ average value of ROR that occurs in a particular time interval.

Formula (s);

→ overall average ROR

$$= \frac{\text{Total volume of gas collected}}{\text{time taken}}$$

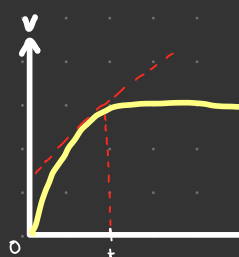
$$= \frac{V}{t} \text{ cm}^3 \text{ s}^{-1}$$



② instantaneous rate
→ ROR at particular point of time.

How to determine?

method ①



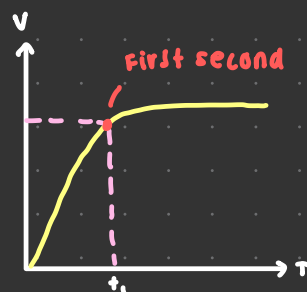
- draw tangent to the curve at time t.

② Average ROR for first t₁ seconds

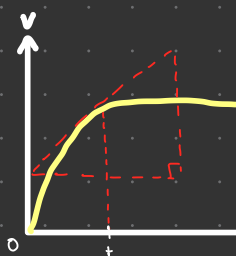
$$= \frac{\text{total volume of gas collected in first } t_1 \text{ (s)}}{\text{time taken}}$$

$$= \frac{V_1 - 0}{t_1 - 0} \text{ cm}^3 \text{ s}^{-1}$$

$$= \frac{V_1}{t_1} \text{ cm}^3 \text{ s}^{-1}$$



method ②



- use tangent to complete the vertically-angled triangle

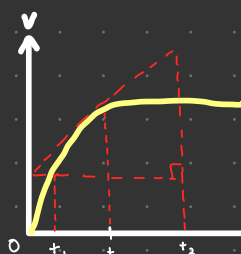
✦ The bigger the triangle, the more accurate it can be to determine the tangent gradient.

③ Average rate from t₁ to t₂

$$= \frac{\text{total volume of gas collected from } t_1 \text{ to } t_2}{\text{time taken}}$$

$$= \frac{V_2 - V_1}{t_2 - t_1} \text{ cm}^3 \text{ s}^{-1}$$

method ③

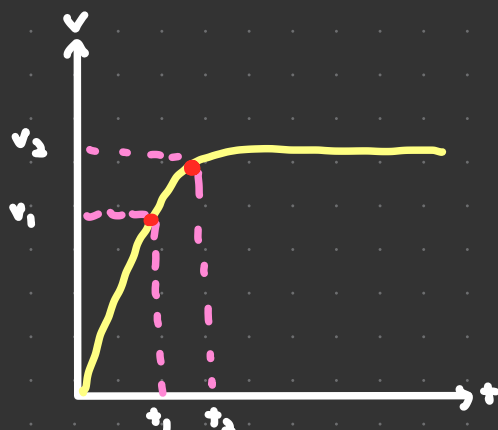


- Rate of Reaction at time t

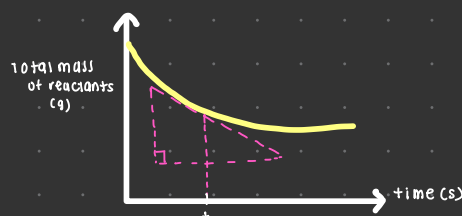
$$= \text{gradient of the tangent at time } t$$

$$= \frac{\Delta V}{\Delta t}$$

$$= \frac{V_2 - V_1}{t_2 - t_1} \text{ cm}^3 \text{ s}^{-1}$$



✦ for reaction that involves decrease in total mass of reactants, graph below is obtained;



RATE OF REACTION

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Factors affecting
Rate of Reaction
(CCT si Cantik)

- Size of Reactant concentration
- Temperature
- Catalyst

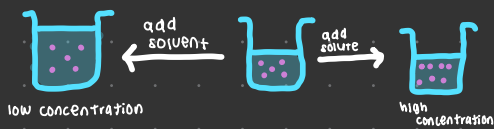
① Size of Reactant

total surface area of
smaller pieces >
total surface area of
big pieces



② concentration

- can be changed by adding
solvent (liquid) or
solute (solid)



③ Temperature

↑ temperature
↑ Rate of reaction

④ presence of catalyst

→ catalyst alter the rate of
chemical reaction without
undergoing any changes at
the end of reaction

changes in ;

- ✗ chemical properties
- ✓ physical properties

example change in shape :

- ✓ from lump → powder

✦ extra factor ✦

① Pressure

→ only involving gases

- when gas is compressed at
constant temperature, the gas
particles will be pushed into smaller
volume of space.

→ Ⓢ pressure

Ⓢ concentration
of gas

Ⓢ rate of reaction

