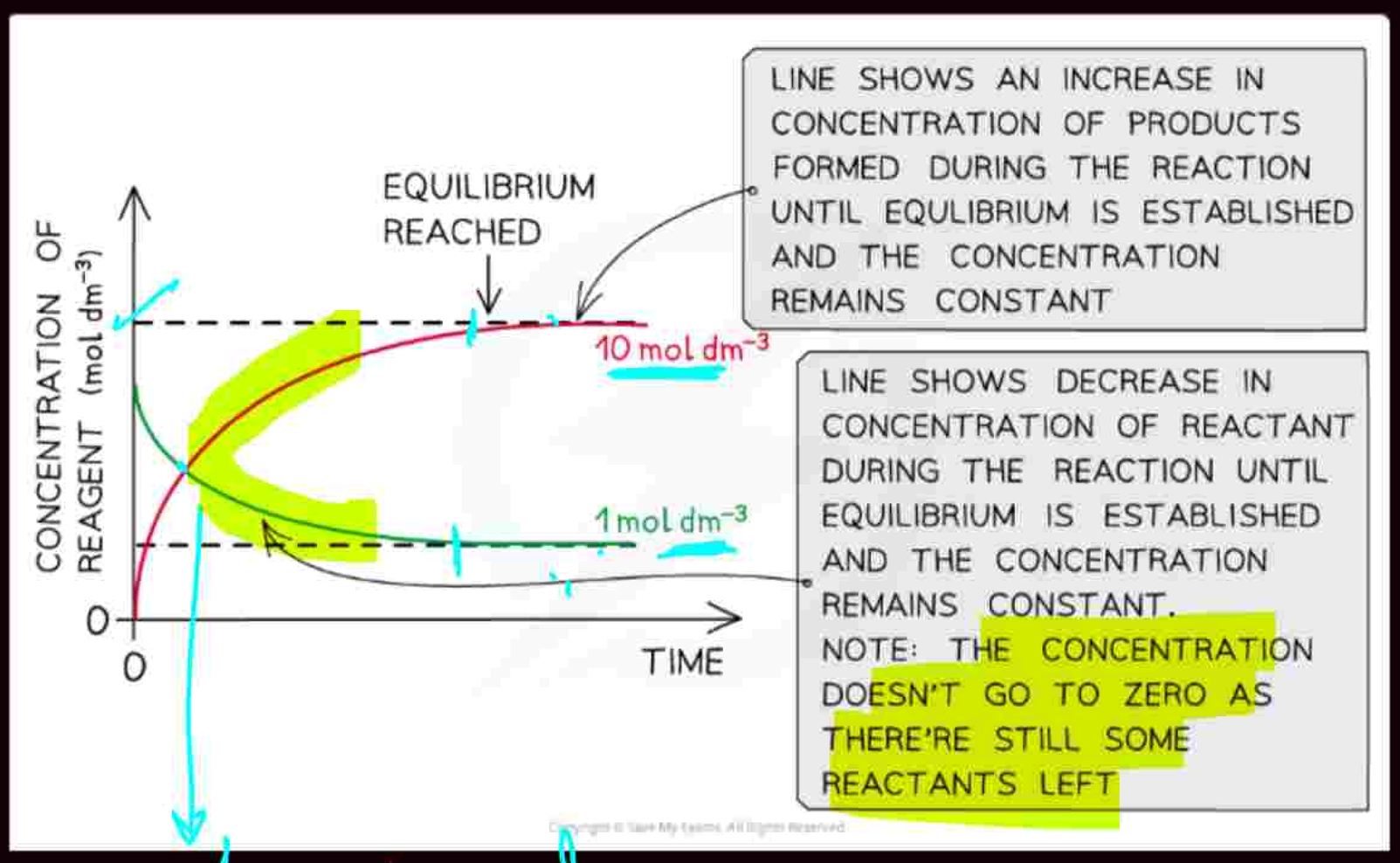
$A + B \rightleftharpoons C + D$

$A + B \longrightarrow C + D$ [Forward Rnc] product side
[Right]

$C + D \longrightarrow A + B$ [Backward Rnc] Reactant side
[Left]

Dynamic Equilibrium : rate of forward Rnc = rate of backward Rnc.

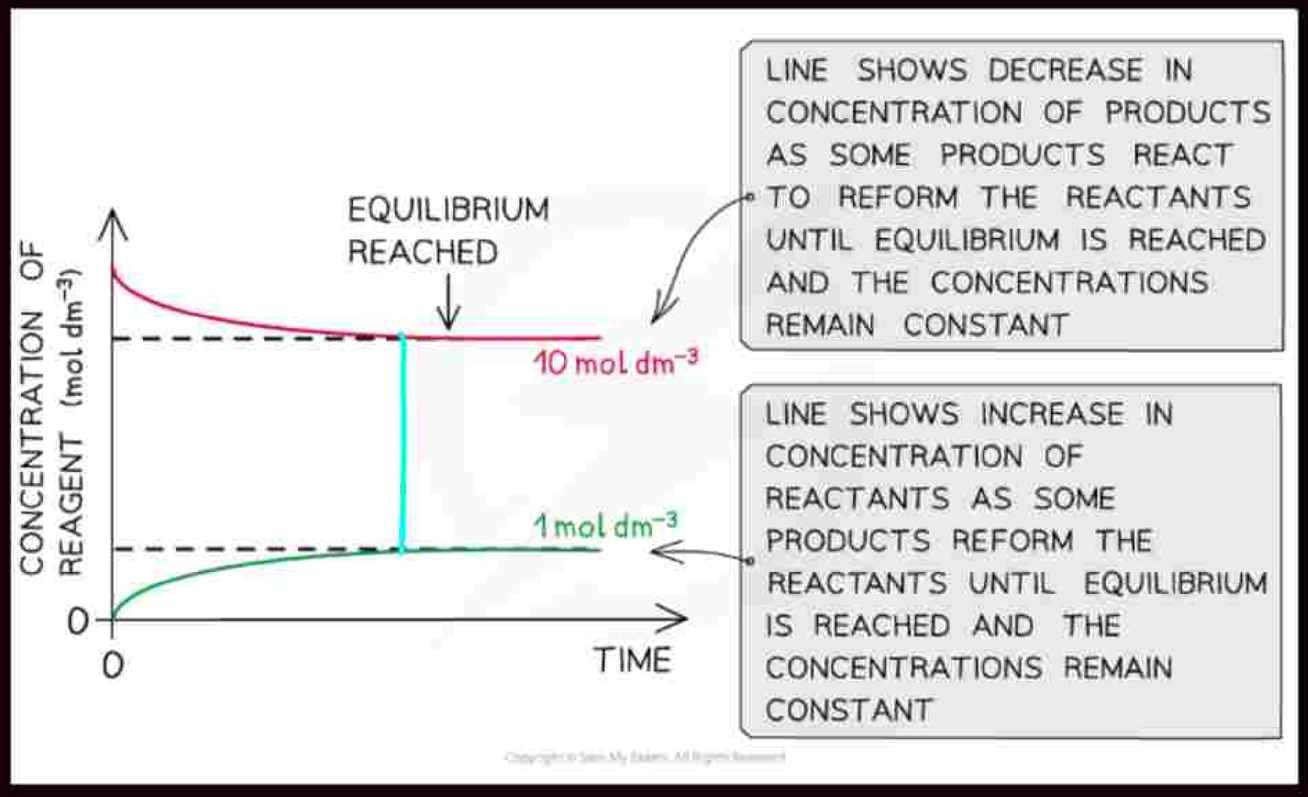


conc. of product and Rnc are equal.

$\frac{10}{t} = \frac{1}{t}$

rate equal.

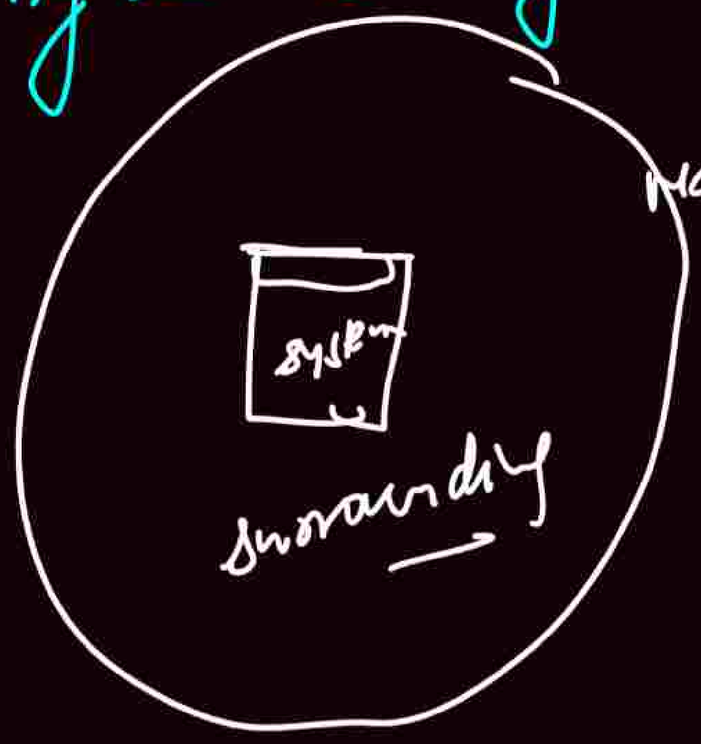
Con V/S time gradient is rate of Rnc.



→ Conc. of Product and Reactant are were never equal.

System :- set-up under observation.

Surrounding :- everything other than system.



Mars - Surrounding

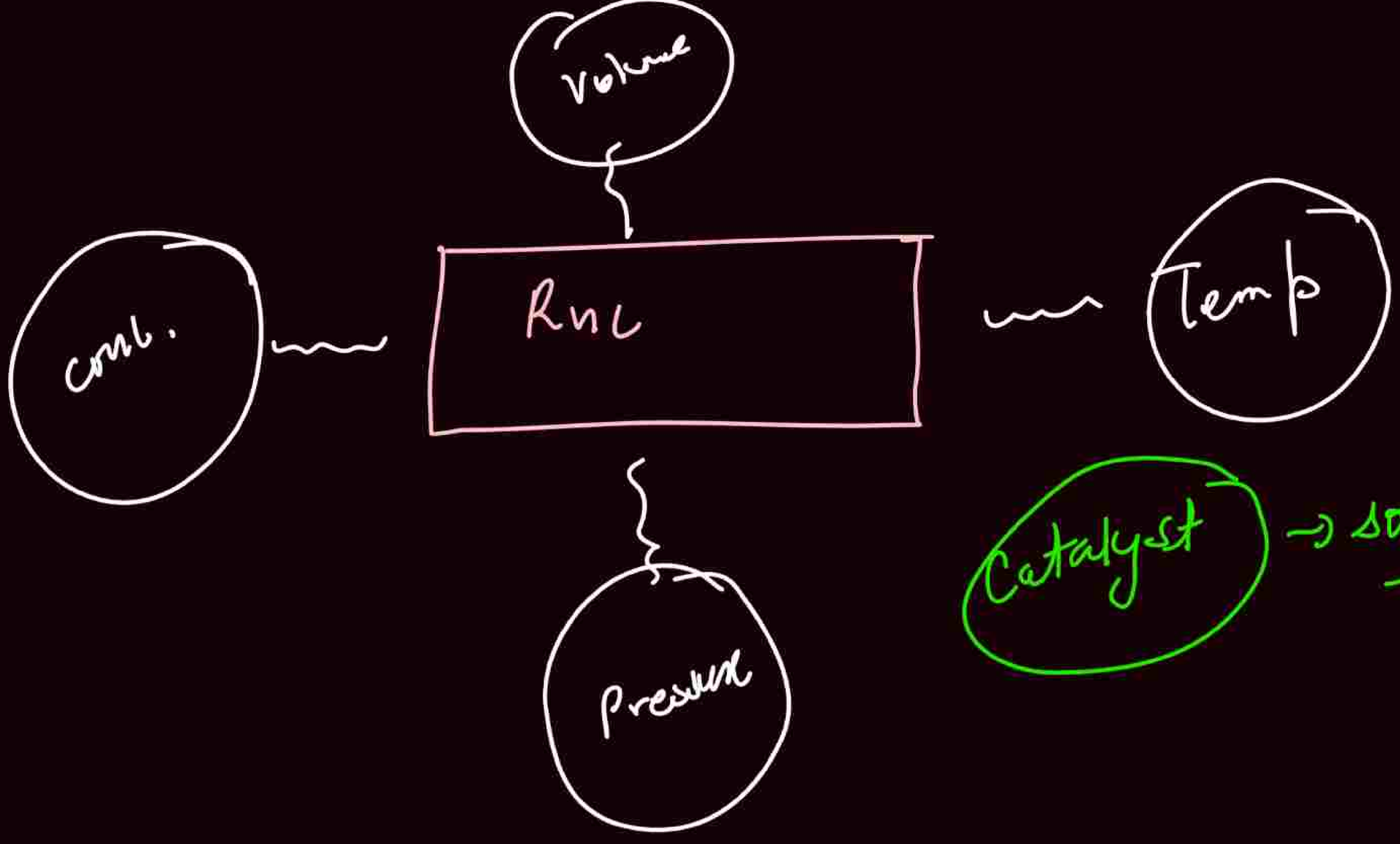
system + surroundings = universe.

solid / liquid / gas

(i) Closed System :- no matter can escape the system. energy can out.

(ii) Open System :- energy and matter both can escape.

(iii) Isolated System :- neither energy nor matter can be exchanged.



Catalyst → sometimes.

Boiling Point of H_2O :- 100°C at 100KPa [1atm]

Le Chatelier's principle

- **Le Chatelier's principle** says that if a change is made to a system in dynamic equilibrium, the position of the equilibrium moves to counteract this change
- The principle is used to predict changes to the position of equilibrium when there are changes in temperature, pressure or concentration

① Conc : R ↑ ⟶ equilibrium moves forward.
more product formed.

P ↓ ⟶ equilibrium moves forward
more product formed.

P ↑ ⟶ equilibrium moves backward
more reactant formed.

⑥ Pressure :- valid for gases moles only.

CHANGE	HOW THE EQUILIBRIUM SHIFTS
INCREASE IN PRESSURE	EQUILIBRIUM SHIFTS IN THE DIRECTION THAT PRODUCES THE SMALLER NUMBER OF MOLECULES OF GAS TO DECREASE THE PRESSURE AGAIN
DECREASE IN PRESSURE	EQUILIBRIUM SHIFTS IN THE DIRECTION THAT PRODUCES THE LARGER NUMBER OF MOLECULES OF GAS TO INCREASE THE PRESSURE AGAIN

$$N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$$

moles in reactant = 4

moles in product = 2

$P \uparrow$ ⟶ equilibrium moves to right more NH_3 forward.

Predict the effect of increasing the pressure on the following reactions:

1. $N_2O_4(g) \rightleftharpoons 2NO_2(g)$
2. $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$

⟶ Reactant = 0 moles of gas
Product = 1 mole of gas

Predict the effect of decreasing the pressure on the following reaction:

3. $2NO_2(g) \rightleftharpoons 2NO(g) + O_2(g)$

Temperature :-

$$A + B \rightleftharpoons C \qquad \Delta H = -x \text{ kJ/mol}$$

ΔH = -ve means exothermic.

if Forward Rnc is exothermic backward will be endothermic.

$$C \rightleftharpoons A + B \qquad \Delta H = +x \text{ kJ/mol}$$

TRICK :-

If temperature ↑ equilibrium moves to endothermic side.

If temp ↓ equilibrium moves to the exothermic side.

Changes in temperature

Using the reaction below:

$H_2(g) + CO_2(g) \rightleftharpoons H_2O(g) + CO(g) \quad \Delta H = +41.2 \text{ kJ mol}^{-1}$

1. Predict the effect of increasing the temperature on this reaction

] Forward Rnc. Favoured.

Using the reaction below:

$Ag_2CO_3(s) \rightleftharpoons Ag_2O(s) + CO_2(g)$

2. Increasing the temperature increases the amount of $CO_2(g)$ at constant pressure. Is this reaction exothermic or endothermic?

Endothermic

Explain your answer

↳ equilibrium will shift to direction where excess energy is getting absorbed.

Volume :- Volume and pressure and inversely related.

If V ↑ P ↓.

$$N_2 + 3H_2 \rightleftharpoons 2NH_3$$

If $\frac{V \uparrow}{P \downarrow}$ → reactant side (backward side)

Catalyst : No effect on equilibrium

Homework

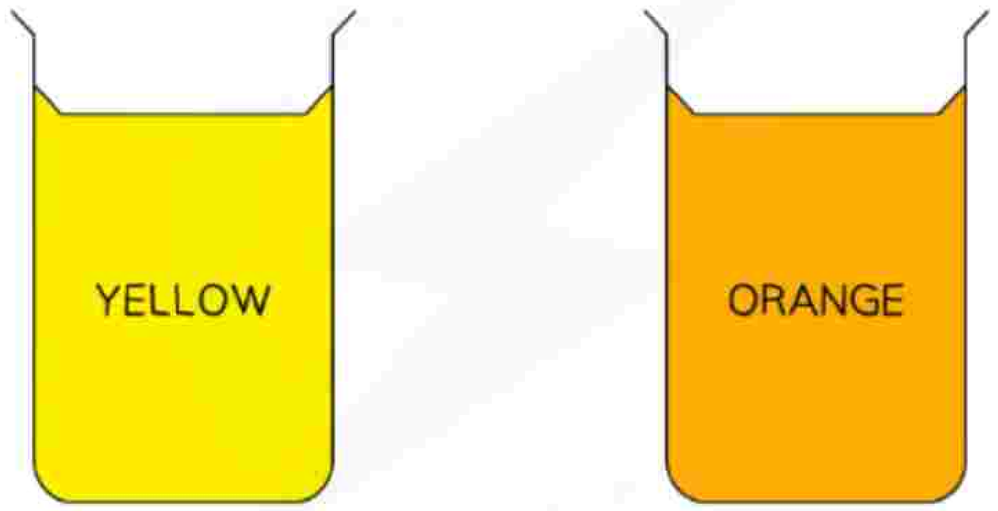
Condition for Haber's Process.

→ Why T & P chosen

→ Catalyst

→ which is exoth a which is endo

$2CrO_4^{2-}(aq) + 2H^+(aq) \rightleftharpoons Cr_2O_7^{2-}(aq) + 2H_2O(l)$



THE CHROMATE / DICHROMATE EQUILIBRIUM

If I add acid (H^+) to above Rnc

⇒ equilibrium shifts forward

soln turns more orangy.

If I add sodium hydroxide. (NaOH)

⇒ soln turns yellowish.