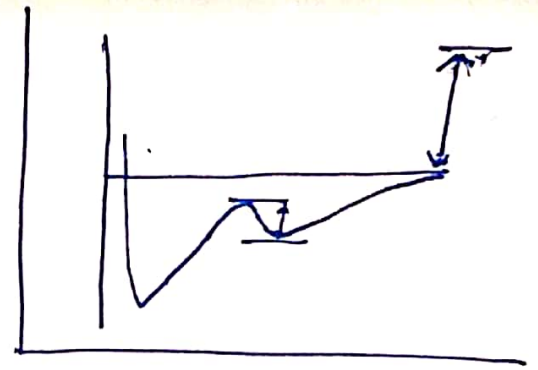
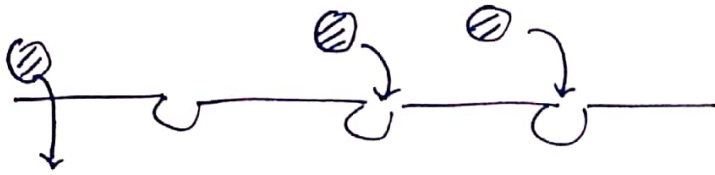
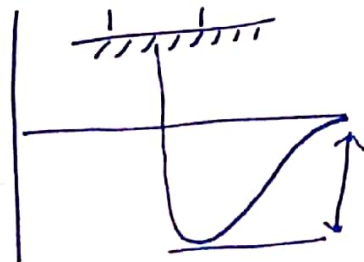
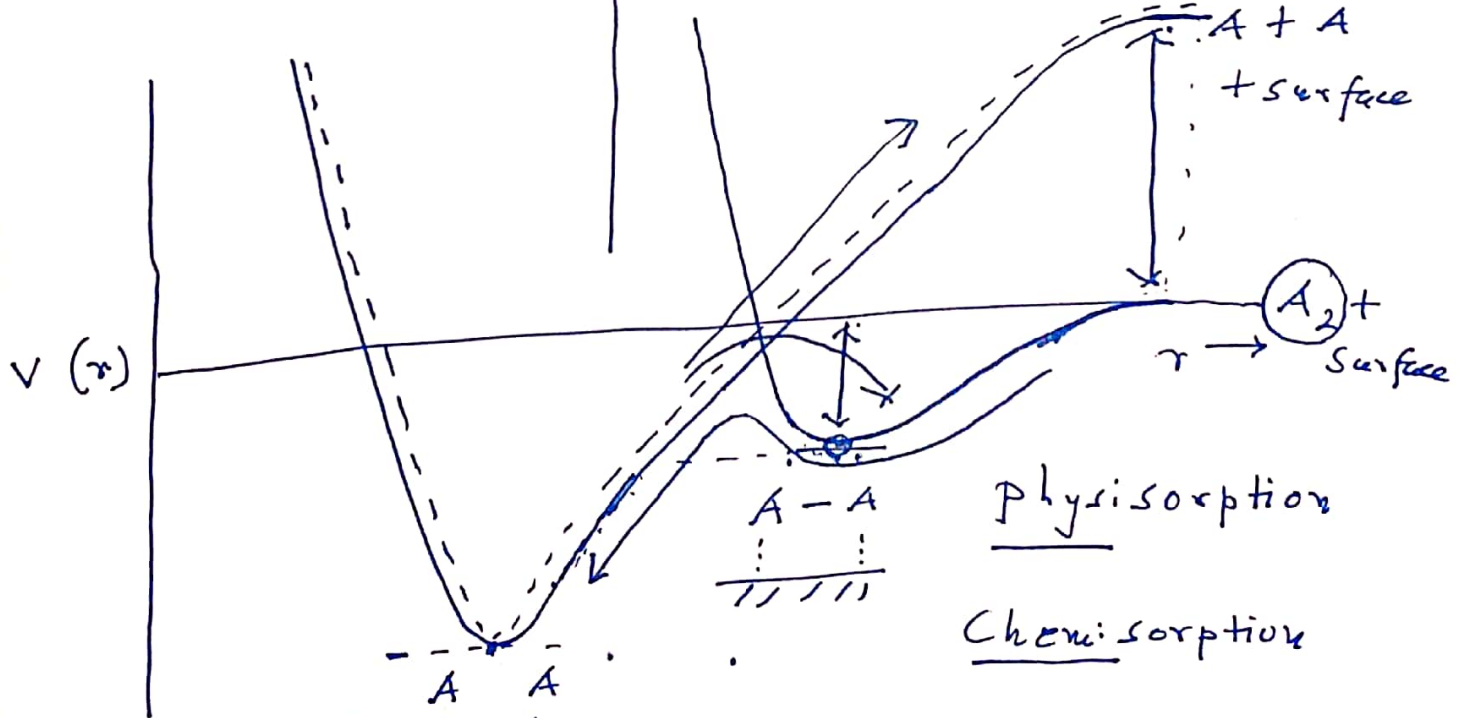
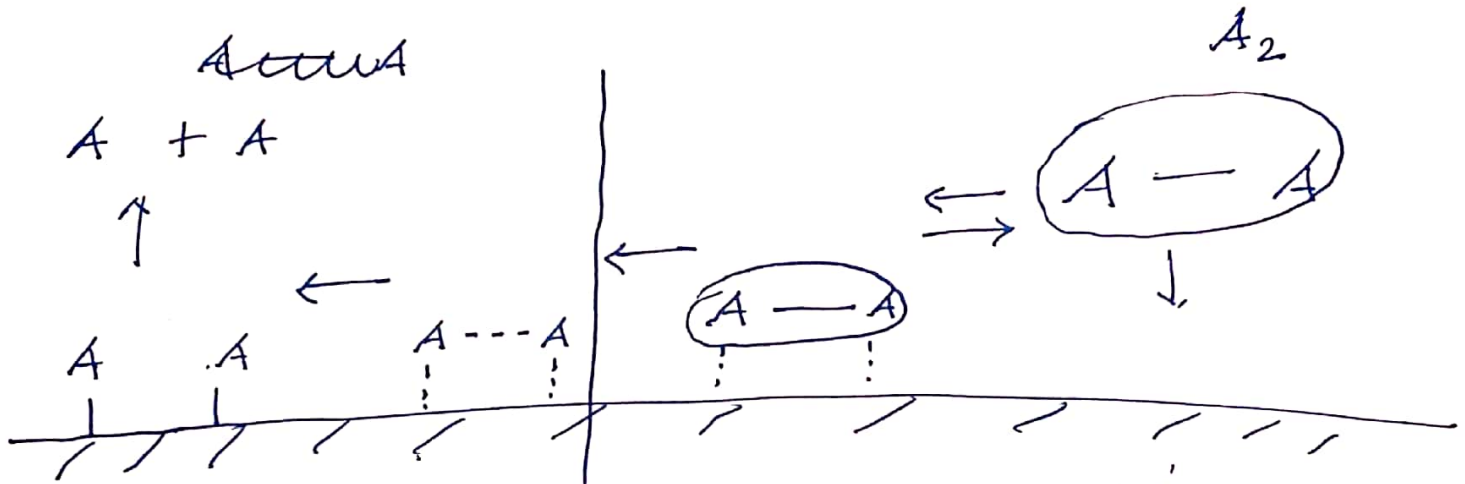


Surface chemistry



Adsorption



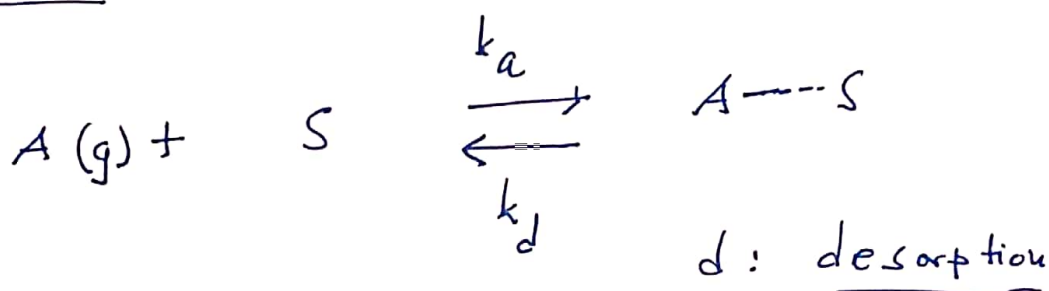
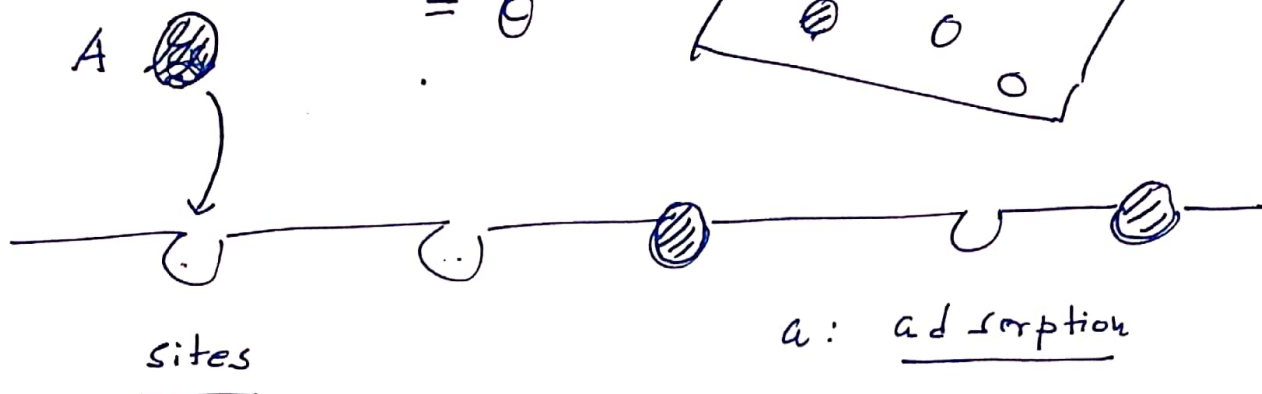
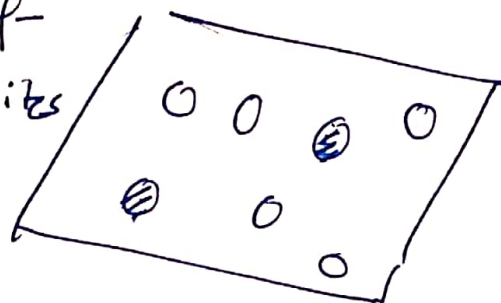
Reactant $A + A$

$A-A$

①

Physisorption

fraction of
occupied sites
 $= \theta$



forward $v_a = k_a \times [A] \times (1-\theta) \times \sigma_0$

↑ ↑

fraction of surface area

available/unoccupied

sites

reverse $v_d = k_d \times \theta \times \sigma_0$

$$k_a \times [A] \times (1-\theta) \cancel{\sigma_0} = k_d \times \theta \cancel{\sigma_0}$$

$$[A] \frac{1-\theta}{\theta} = \frac{k_d}{k_a} = \frac{1}{K_{eq}}$$

$$\left(\frac{1}{\theta} - 1\right) = \frac{1}{K_{eq} [A]}$$

$$\boxed{\frac{1}{\theta} = \frac{K_{eq} [A] + 1}{K_{eq} [A]}}$$

(2)

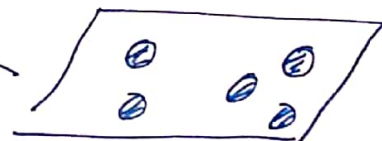
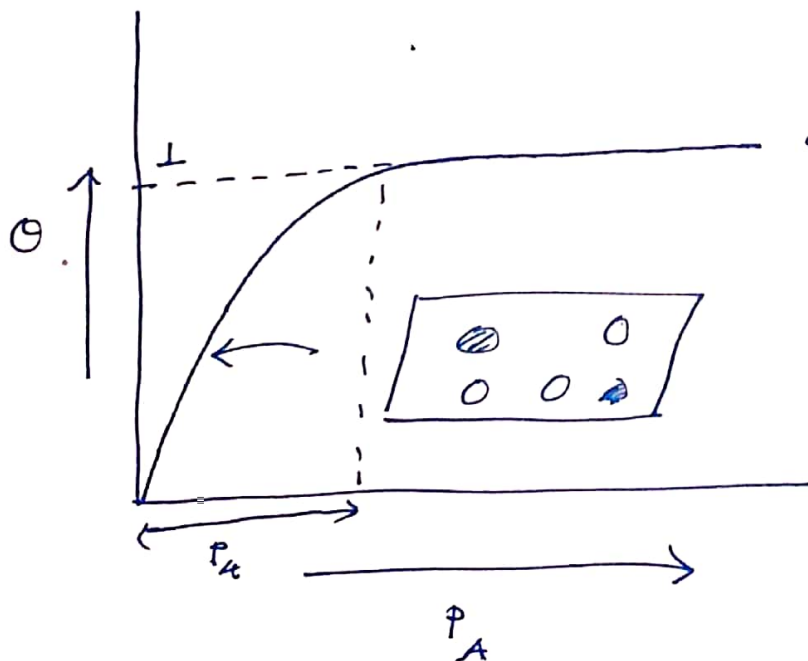
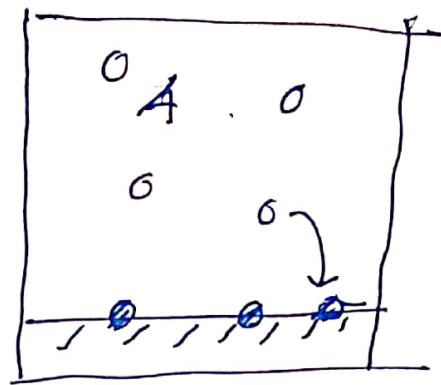
$$\frac{1}{\theta} = \frac{k_{eq} [A] + 1}{k_{eq} [A]}$$

$$[A] = \frac{P_A}{k_B T}$$

$$k_{eq} [A] = k_{eq} \times \frac{P_A}{k_B T} = b_A \times P_A$$

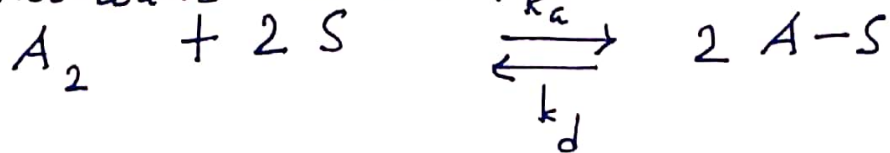
$$\frac{1}{\theta} = \frac{b P_A + 1}{b P_A}$$

$$\theta = \frac{b P_A}{1 + b P_A}$$



Langmuir adsorption isotherm

Dissociative chemisorption:



$$v_a = k_a \times [A_2] \times (1-\theta)^2 \sigma_0^2$$

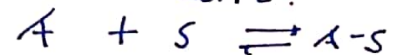
$$v_d = k_d \times \theta^2 \sigma_0^2$$

$$\left(\frac{1-\theta}{\theta}\right)^2 =$$

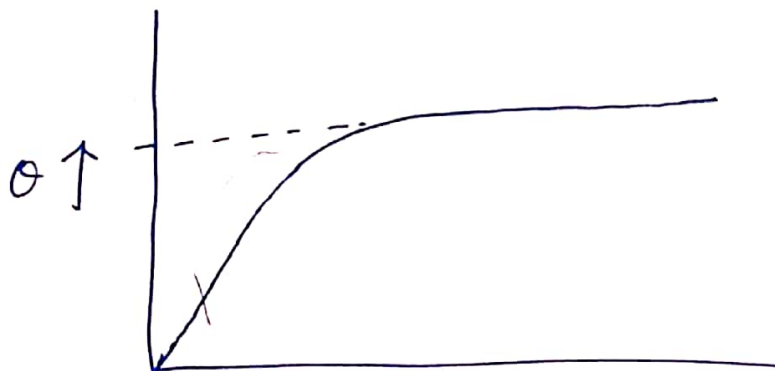
$$\boxed{\frac{1}{\theta} = 1 + \frac{1}{b_{A_2}^{1/2} P_{A_2}^{1/2}}}$$

$$\theta = \frac{b_{A_2}^{1/2} P_{A_2}^{1/2}}{1 + b_{A_2}^{1/2} P_{A_2}^{1/2}} \quad \text{--- (1)}$$

Non-dissociative:



$$\theta = \frac{b P}{1 + b P} \quad \text{--- (2)}$$



(HW)

Plot θ vs P_A for eqn (1) & (2)