



Adrenaline
Platform

منصة ادرينالين التعليمية

جامعة سيناء

Analytical

Lec 3

كورسات جامعية - كورسات عامة - استضافت كورسات - ابحاث علمية

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What does the Equilibrium Constant tell us?

A) Predict the direction of action.



Suppose 0.243 mole of H_2 , 0.146 mole of I_2 and 1.98 moles of HI in 2 Liter
will there be net reaction to form more H_2 or HI ?

Solution

① Find Q_c

① Find Conc of each substance

$$[\text{H}_2] = \frac{0.243}{1} = 0.243 \text{ M}$$

$$[\text{I}_2] = \frac{0.146}{1} = 0.146 \text{ M}$$

$$[\text{HI}] = \frac{1.98}{1} = 1.98$$

② Find Q_c

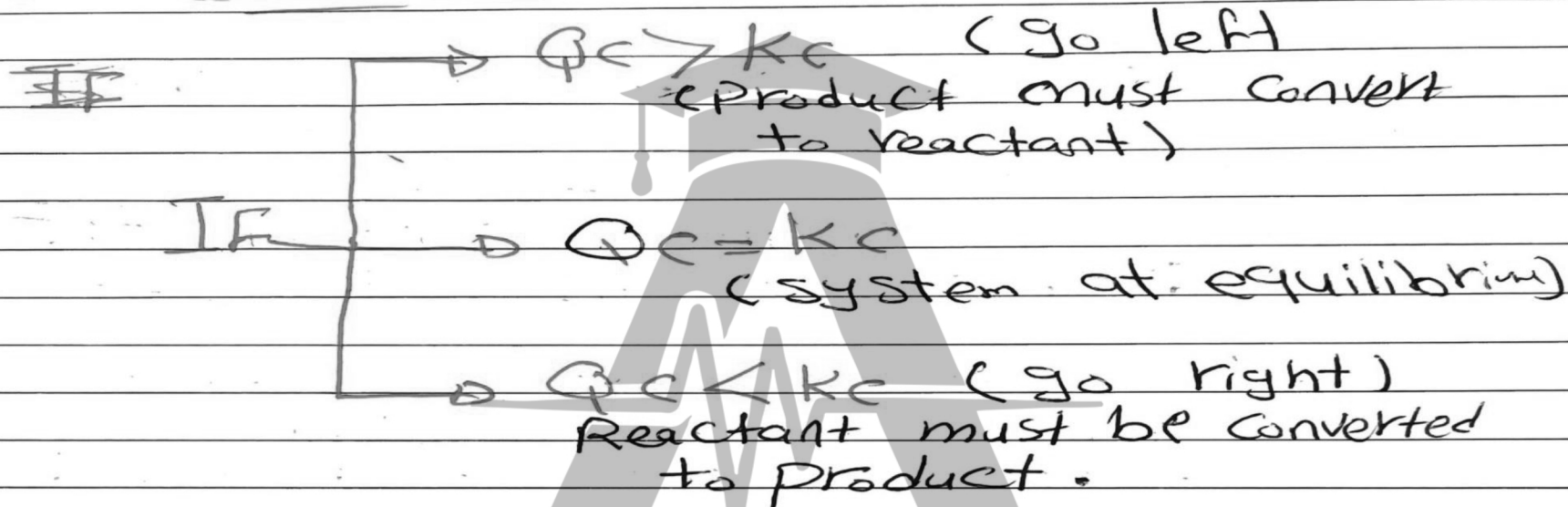
$$Q_c = \frac{[\text{HI}]^2}{[\text{H}_2][\text{I}_2]} = \frac{(1.98)^2}{(0.243)(0.146)} = 112$$

③ Compare Q_c with K_c

$$\therefore Q_c > K_c$$

So Reaction will move to the left to decrease Q_c to equal K_c

Very Important



(B) Calculating equilibrium conc

By knowing K_c value, we can calculate conc in equilibrium mixture.

Subject :

Date :

Ex/ Mix of 0.5 mole H_2 and 0.5 mole I_2 was placed in 1 Liter. The equilibrium constant K_c for this reaction $H_2 + I_2 \rightleftharpoons 2HI$ is 54.3. Calculate conc of H_2 , I_2 and HI at equilibrium.

Solution

	H_2	I_2	$2HI$	
Initial conc	0.5	0.5	0	المولات
Change	$-x$	$-x$	$+2x$	
equilibrium conc	$0.5-x$	$0.5-x$	$2x$	

$$K_c = \frac{[HI]^2}{[H_2][I_2]} \Rightarrow 54.3 = \frac{[2x]^2}{[0.5-x][0.5-x]}$$

$$\Rightarrow 54.3 = \frac{[2x]^2}{[0.5-x]^2}$$

$$\therefore 7.37 = \frac{2x}{0.5-x} \Rightarrow x = 0.393 \text{ M}$$

$$\therefore H_2 = 0.5 - 0.393 = 0.107 \text{ M} \quad HI = 2x = 2 \times 0.393 = 0.786 \text{ M}$$

Subject :

Date :

Factors affecting Equilibrium

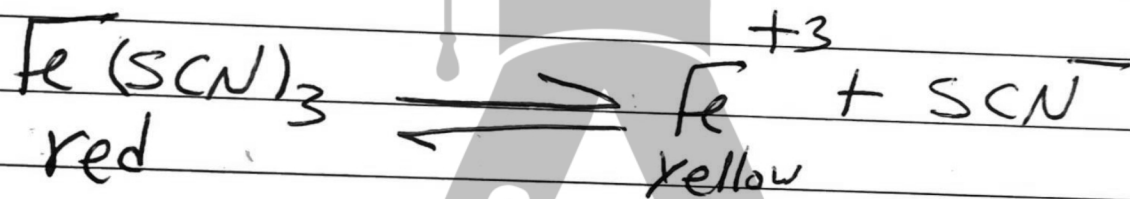
* Chemical equilibrium represents balance between forward and backward reactions.

Le Chastelier's Principle

IF an external stress is applied to system at chemical equilibrium, the system will adjust partially offset the stress.

— $\&$ The stress means change in Conc-Temp-P]

A) Change in Concentration



upon adding $\text{Fe(SCN)}_3 \rightarrow$ The equilibrium shift to right (yellow)

upon adding NaSCN The equilibrium shift to left (red)

upon adding $\text{H}_2\text{C}_2\text{O}_4$ Form FeC_2O_4 so equilibrium shift to right (yellow)

B) Change in Volume and Pressure

Change in pressure not affected on solid or liquid but highly affected gases.

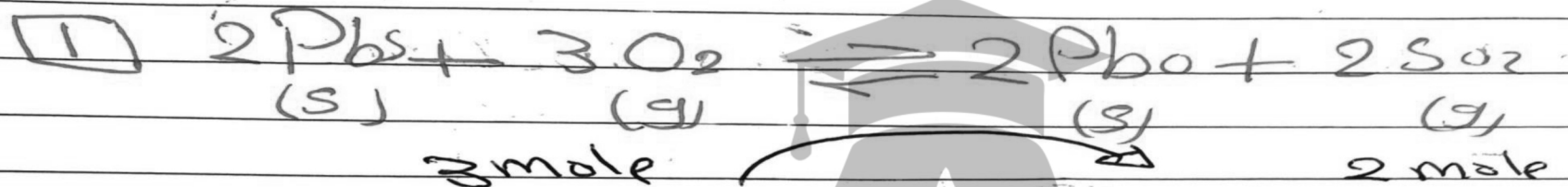
Rule

a) Increase in pressure - decrease volume
↳ Favor the net reaction that decrease total mole of gases
(lower moles of gas)

b) decrease in pressure - (Increase volume)
↳ Favor the net reaction that increase total mole of gases.
[to higher moles of gas.]

c) In case of no change in mole of gases pressure not affected.

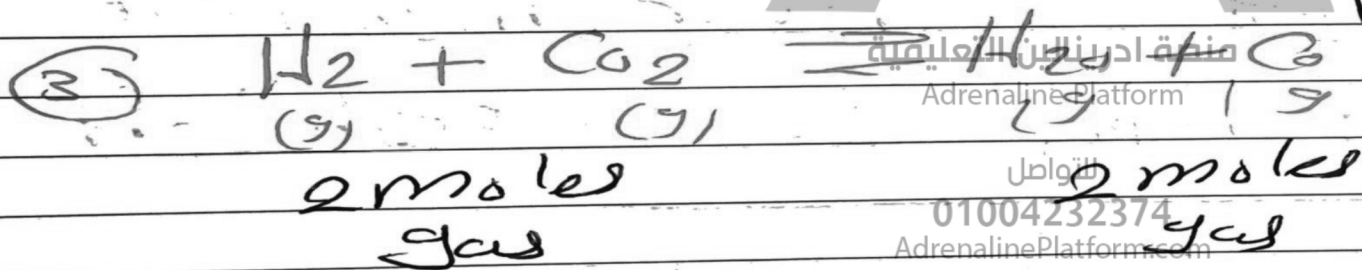
Examples Predict the net reaction when increasing pressure.



Reaction move to lower moles
[Forward]



Reaction move to lower moles
[backward]

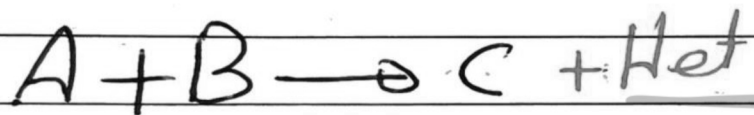


Pressure not affected

C Changes In Temp

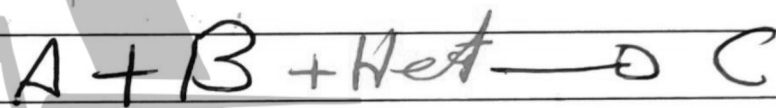
Exothermic

$$\Delta H = -$$



Endothermic

$$\Delta H = +$$



Rise Temp: go to left

go to ~~left~~ Right

Favor low Temp

Favor high Temp

decrease Temp: go to right

go to ~~high~~ Left

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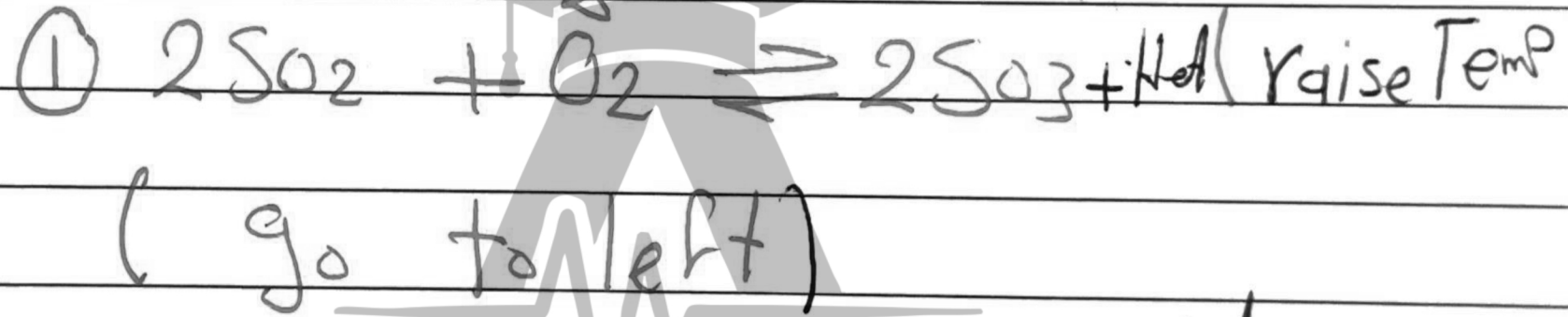
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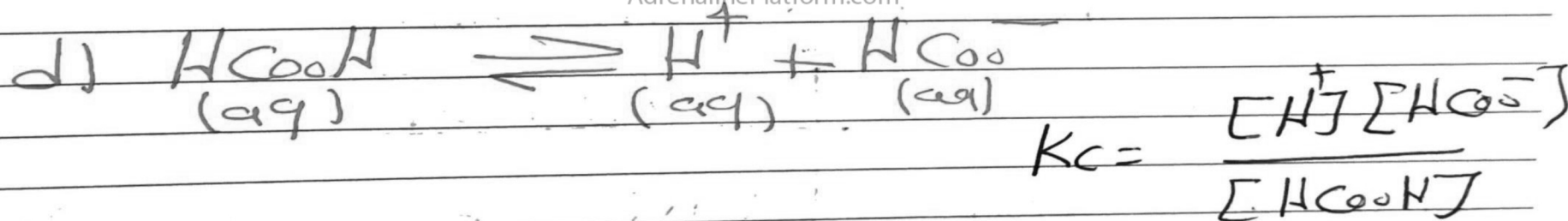
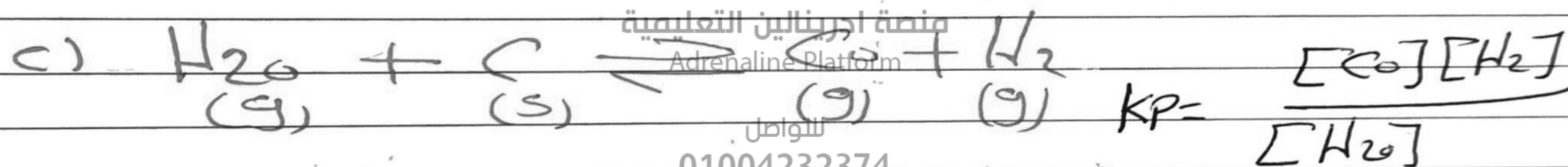
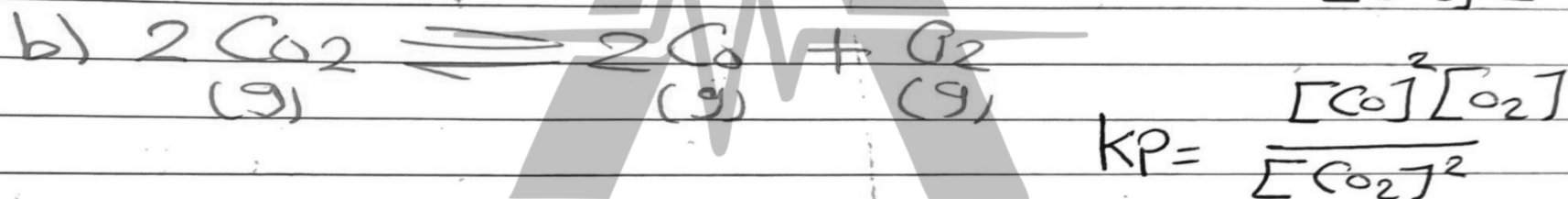
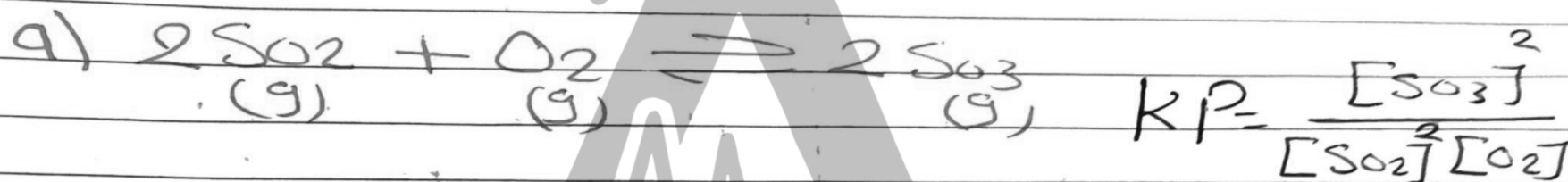
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Example: predict the direction when:



Questions

① write equilibrium Constant K_c or K_p For the following:



Compare between Homogenous and Heterogeneous equilibrium.

homogenous	Heterogeneous
Involve substances in the same phase	Involve substances in different phases
$\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$ (g) (g) (g)	$\text{CaCO}_3 \rightleftharpoons \text{CaO} + \text{CO}_2$ (s) (s) (g)

Compare between Physical and chemical equilibrium.

chemical	Physical
State in which rate of forward and backward are equal and conc are constant	Type of equilibrium between 2 phases of same substance
	$\text{H}_2 \rightleftharpoons \text{H}_2\text{O}$ (l) (v)