ملخص وأوراق عمل وحدة equilibrium chemical الإتزان الكيميائي منهج انسباير

تم تحميل هذا الملف من موقع المناهج الإماراتية
موقع المناهج ⇦ المناهج الإماراتية ⇦ الصف الحادي عشر المتقدم ⇦ كيمياء ⇦ الفصل الثاني ⇦ ملفات متنوعة ⇦ الملف
تاريخ إضافة الملف على موقع المناهج: 12-01-2026 10:08:59

المزيد من مادة كيمياء:	ملفات ا كتب للمعلم ا كتب للطالب ا اختبارات الكترونية ا اختبارات ا حلول ا عروض بوربوينت ا أوراق عمل منهج انجليزي ا ملخصات وتقارير ا مذكرات وبنوك ا الامتحان النهائي ا للمدرس

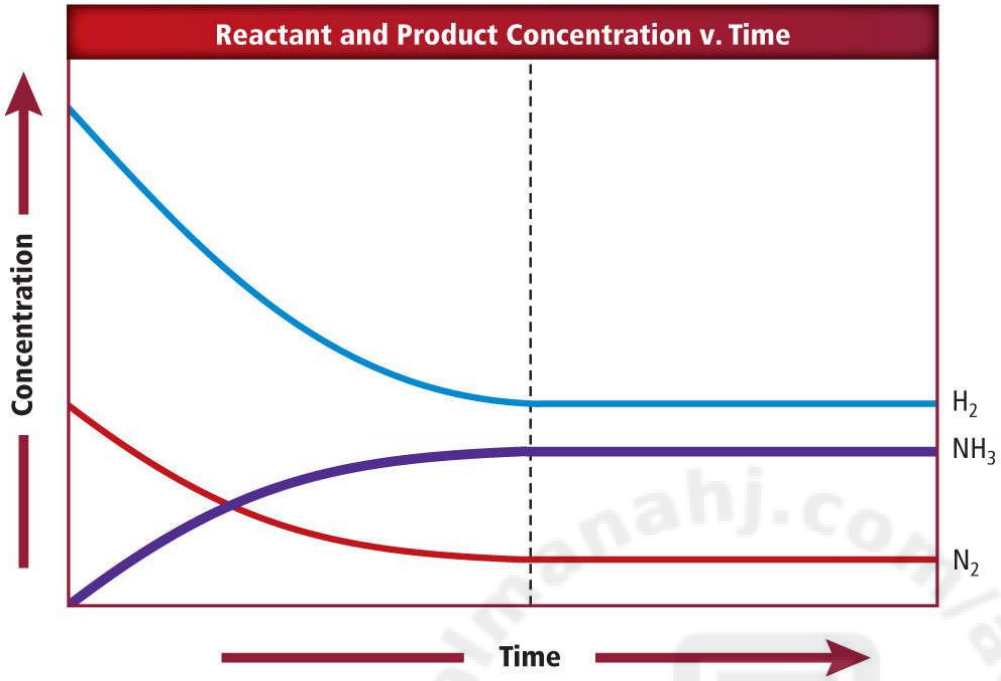
التواصل الاجتماعي بحسب الصف الحادي عشر المتقدم					
صفحة المناهج الإماراتية على فيسبوك					
المواد على تلغرام	التربية الاسلامية	اللغة العربية	اللغة الانجليزية	الرياضيات	

المزيد من الملفات بحسب الصف الحادي عشر المتقدم والمادة كيمياء في الفصل الثاني	
1	حل تجميعة صفحات الكتاب وفق الهيكل الوزاري منهج بريدج
2	شرح درس الخلايا الفولتية من قسم الكيمياء الكهربائية
3	خطوات وزن معادلة الأكسدة والاختزال
4	تجميعة أسئلة وزارية وفق الهيكل الوزاري الخطة C باللغتين العربية والانجليزية
5	مراجعة عامة وفق الهيكل الوزاري منهج بريدج الخطة C

Chemical Equilibrium Grade 11

Section 1:

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



The concentration of the product, NH_3, is zero at the start and gradually increases with time.

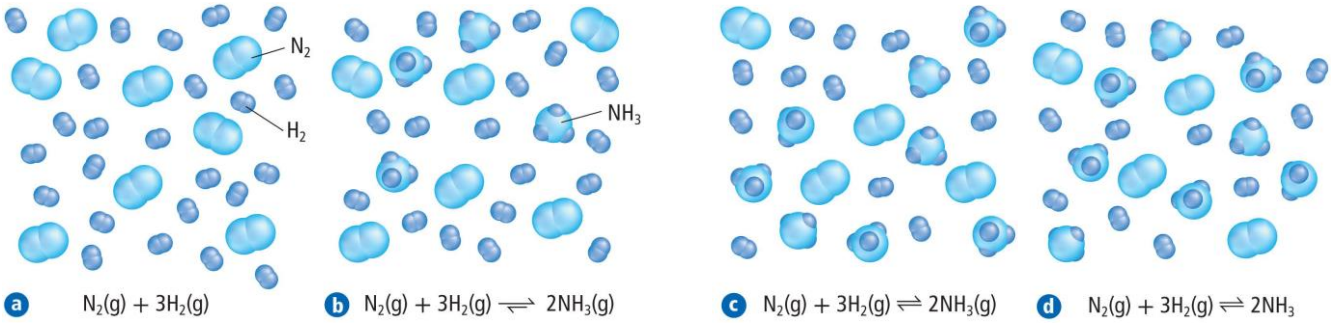
The reactants, H_2 and N_2, are consumed in the reaction, so their concentrations gradually decrease.

After a period of time, however, the concentrations of H_2, N_2 , and NH_3 no longer change. All concentrations become constant.

The concentrations of H_2 and N_2 are not zero, so not all of the reactants were converted to product

How does reversibility affect the production of ammonia?

Decreases in the concentrations of N_2 and H_2 cause the reaction to slow.



The reaction reaches equilibrium in figure ……

A **reversible reaction** is a chemical reaction that can occur in both the forward and reverse directions, such as the formation of ammonia.

Forward: $N_2\,(g) + 3H_2\,(g) \rightarrow 2NH_3\,(g)$

Reverse: $N_2\,(g) + 3H_2\,(g) \leftarrow 2NH_3\,(g)$

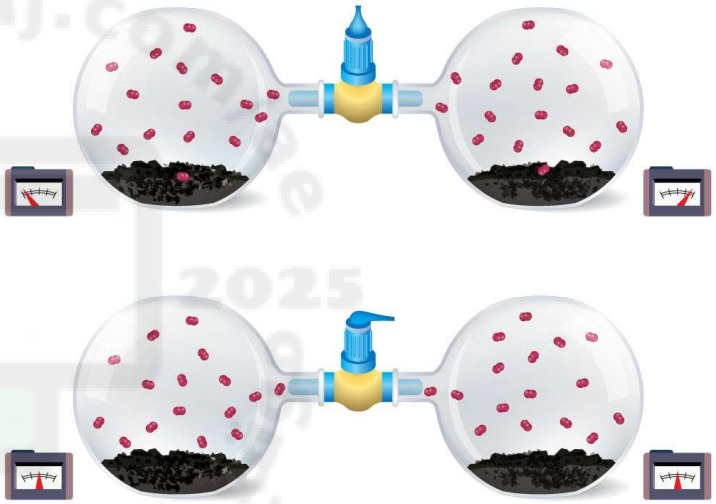
Reversible reaction $N2\,(g) + 3H\,2\,(g) \rightleftharpoons 2NH3\,(g)$

What is equilibrium?

· **Chemical equilibrium** is a state in which the forward and reverse reactions balance each other because they take place at equal rates.

· Equilibrium is a state of action, not inaction.

Example:



The dynamic nature of equilibrium: The reaction doesn't stop but continue in equilibrium state

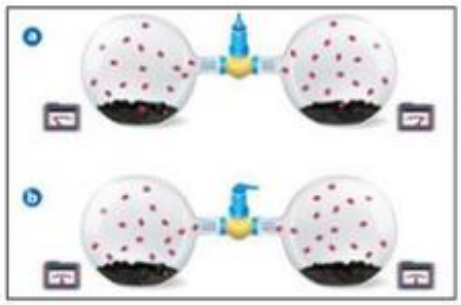
At chemical equilibrium, system must be

A) Opened

B) Static

C) dynamic

D) Nothing true



عند الأتزان لابد للنظام أن يكون

A) مفتوح

B) غير حركي

C) حركي

D) لا يوجد اجابة صحيحة

Which describes a system that has reached chemical equilibrium?

A. No new product is formed by the forward reaction.

B. The reverse reaction no longer occurs in the system.

C. The concentration of reactants in the system is equal to the concentration of products.

D. The rate at which the forward reaction occurs equals the rate of the reverse reaction.

A reaction is in equilibrium when:

A. there are more products than reactants

B. the amount of products equals the reactants

C. the rate of the forward reaction is greater than the reverse reaction

D. the rates of the forward and reverse reactions are equal

Which of the following is NOT a characteristic of chemical reactions that reach equilibrium?

أي مما يلي ليس من خصائص التفاعلات الكيميائية التي تصل إلى حالة اتزان؟

a. The reaction must take place in a closed system — يجب أن يحدث التفاعل في نظام مغلق

b. The temperature must remain constant — يجب أن تبقى درجة الحرارة ثابتة

c. All reactants and products are present, and they are in constant dynamic motion — يجب أن تبقى المواد المتفاعلة والمواد الناتجة معًا في حركة ديناميكية دائمة

d. The reactants and products must be in similar physical state — يجب أن تكون المواد المتفاعلة والمواد الناتجة في حالة فيزيائية متشابهة

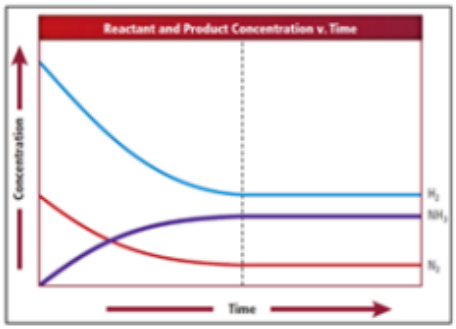
What happen to the concentration Of N2 at the chemical equilibrium?

A Decrease

B) Increase

C) Constant

D) Nothing true



ماذا يحدث لتركيز الهيدروجين عند الوصول للأتزان الكيميائي؟

A) يقل

B) يزيد

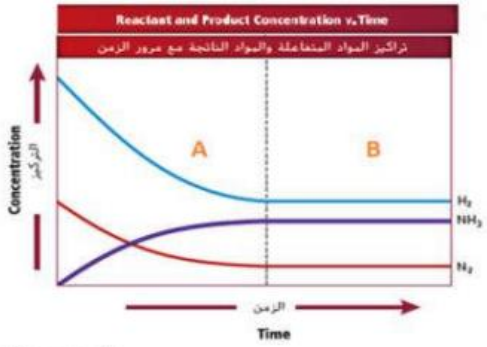
C) ثابت

D) لا يوجد اجابة صحيحة

What happens in the region B in the graph below for the reaction?

ماذا يحدث في المنطقة B في الرسم البياني أدناه للتفاعل؟

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



a. The concentrations of the reactants equal the concentrations of the products

تراكيز المواد المتفاعلة تُساوي تراكيز المواد الناتجة

b. The concentrations of the reactants and products become constant

تصبح تراكيز المواد المتفاعلة والمواد الناتجة ثابتة

c. The concentrations of the reactants decrease, and the concentrations of the products increase

تتناقص تراكيز المواد المتفاعلة وتزداد تراكيز المواد الناتجة

d. The concentrations of the reactants increase, and the concentrations of the products decrease

تزداد تراكيز المواد المتفاعلة وتتناقص تراكيز المواد الناتجة

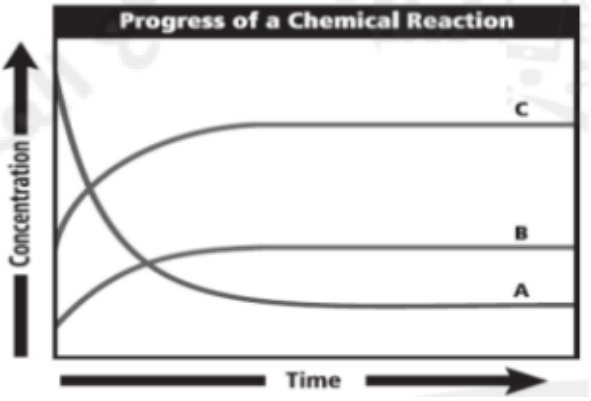
Depending on the corresponding drawing, which of the following options represent the correct order of concentrations of substances A, B, C when reaching the state of equilibrium?

a. [C] > [B] > [A]

b. [A] > [B] > [C]

c. [C] > [A] > [B]

d. [C] = [B] = [A] = 0



Equilibrium Expressions: Some chemical systems have little tendency to react, others go to completion.

The **law of chemical equilibrium:** at a given temperature, a chemical system might reach a state in which a particular ratio of reactant and product concentrations has a constant value.

$$aA + bB \rightleftharpoons cC + dD \qquad K_{eq} = \frac{[C]^c[D]^d}{[A]^a[B]^b}$$

The **equilibrium constant**, K_{eq}, is the numerical value of the ratio of product concentrations to reactant concentrations, with each concentration raised to the power equal to its coefficient in the balanced equation.

$K_{eq} > 1$: Products are favored at equilibrium

$K_{eq} < 1$: Reactants are favored at equilibrium

- The value of Keq is constant only at a specified temperature.

- Which of the following equilibrium constant values shows that raction has larger amount of products at equilibrium ?

A. 0.100 **C** .0.025

B. 0.500 **D** . 4.50

The state in which the forward and reverse chemical reactions take place at the same rate is called ____.

A. Le Ch atelier's Principle
B. Henry's Law
C. Charles's Law
D. chemical equilibrium

1. Any change in ____ results in a change in K_{eq}.

A. temperature
B. pressure
C. volume
D. concentration

Homogeneous equilibrium

All the reactants and products are in the same physical state.

$H_2(g) + I_2(g) \leftrightarrow 2HI(g)$

$$K_{eq} = \frac{[HI]^2}{[H_2][I_2]}$$

Write equilibrium constant expressions for these equilibria.

a. $N_2O_4\,(g) \rightleftharpoons 2NO_2\,(g)$	**b.** $2H_2S(g) \rightleftharpoons 2H_2\,(g) + S_2\,(g)$
c. $CO(g) + 3H_2\,(g) \rightleftharpoons CH_4\,(g) + H_2O(g)$	**d.** $4NH_3\,(g) + 5O_2\,(g) \rightleftharpoons 4NO(g) + 6H_2O(g)$
e. $CH_4\,(g) + 2H_2S(g) \rightleftharpoons CS_2\,(g) + 4H_2\,(g)$	

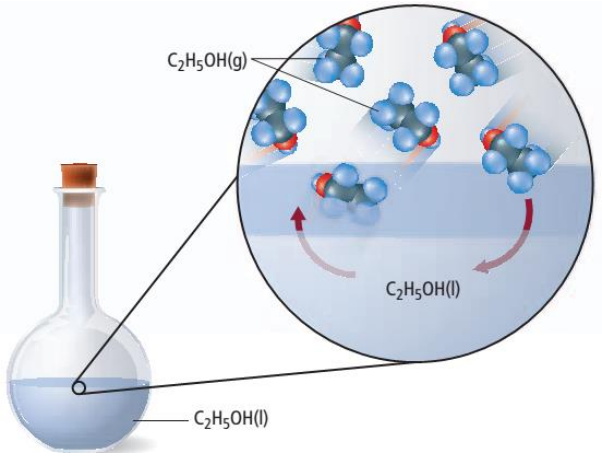
2. Challenge Write the chemical equation that has the equilibrium constant expression

$$K_{eq} = \frac{[CO]^2\,[O_2]}{[CO_2]^2}$$

What happens to *K*eq for an equilibrium system if the equation for the reaction is rewritten in the reverse?

Heterogeneous equilibrium

The reactants and products are present in more than one physical state.



· Ethanol in a closed flask is represented by $C_2H_5OH_{(l)} \rightleftharpoons C_2H_5OH_{(g)}$.

Why solids and liquids are not mentioned in K_{eq} expression?

Solids and liquids are pure substances with unchanging concentrations

Write equilibrium constant expressions for these heterogeneous equilibria.

$C_{10}H_8(s) \rightleftharpoons C_{10}H_8(g)$	$C(s) + H_2O(g) \rightleftharpoons CO(g) + H_2(g)$
$H_2O(l) \rightleftharpoons H_2O(g)$	$FeO(s) + CO(g) \rightleftharpoons Fe(s) + CO_2(g)$
$CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$	$2NaHCO_3(s) \rightleftharpoons Na_2CO_3(s) + CO_2(g) + H_2O(g)$

Which of the following reactions represents a homogeneous equilibrium?

أي التفاعلات التالية تُمثل اتزان متجانس؟

a. $C_2H_5OH_{(l)} \rightleftharpoons C_2H_5OH_{(g)}$

b. $H_2O_{(s)} \rightleftharpoons H_2O_{(l)}$

c. $H_{2(g)} + I_{2(g)} \rightleftharpoons 2HI_{(g)}$

d. $I_{2(s)} \rightleftharpoons I_{2(g)}$

What is the equilibrium constant expression for the following reaction?

ما تعبير ثابت الاتزان للتفاعل التالي؟

$$FeO_{(s)} + CO_{(g)} \rightleftharpoons Fe_{(s)} + CO_{2(g)}$$

$$K_{eq} = \frac{[CO_2]}{[CO]}$$

$$K_{eq} = \frac{[Fe][CO_2]}{[FeO][CO]}$$

$$K_{eq} = \frac{[Fe]}{[FeO]}$$

$$K_{eq} = \frac{[CO]}{[CO_2]}$$

Which is NOT an example of a homogeneous equilibria?

A. $H_2(g) + I_2(g) \leftrightarrow 2HI(g)$

B. $2H_2(g) + O_2(g) \leftrightarrow 2H_2O(g)$

C. $HCl(aq) + NaOH(aq) \leftrightarrow NaCl(aq) + H_2O$

D. $C_2H_5OH(l) \leftrightarrow C_2H_5OH(g)$

What is the expression for the equilibrium constant for the reaction?

$$CO_{(g)} + 3H_{2(g)} \rightleftarrows CH_{4(g)} + H_2O_{(g)}$$

a. $K_{eq} = \frac{[CO]\,[H_2]}{[CH_4]\,[H_2O]}$

b. $K_{eq} = \frac{[CO]\,[H_2]^3}{[CH_4]\,[H_2O]}$

c. $K_{eq} = \frac{[CH_4]\,[H_2O]}{[CO]\,[H_2]}$

d. $K_{eq} = \frac{[CH_4]\,[H_2O]}{[CO]\,[H_2]^3}$

In the following table, what is the correct equilibrium constant expression for the corresponding reaction?

في الجدول التالي، ما تعبير ثابت الاتزان الصحيح للتفاعل الذي يُقابله؟

تعبير ثابت الاتزان	التفاعل	
$\frac{[H_2][I_2]}{[HI]^2}$	$H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$	A
$\frac{[Na_2CO_3][CO_2][H_2O]}{[NaHCO_3]^2}$	$2NaHCO_3(s) \rightleftharpoons Na_2CO_3(s) + CO_2(g) + H_2O(g)$	B
$\frac{[CH_4][H_2O]}{[CO][H_2]^3}$	$CO(g) + 3H_2(g) \rightleftharpoons CH_4(g) + H_2O(g)$	C
$\frac{[CaCO_3]}{[CaO]}$	$CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$	D

Equilibrium Constants

For a given reaction at a given temperature, K_{eq} will always be the same regardless of the initial concentrations of reactants and products.

$$H_2\,(g) + I_2\,(g) \rightleftharpoons 2HI(g)$$

Table 17.1 Experimental Data for HI Reaction Equilibrium

	Initial Concentrations			Equilibrium Concentrations			K_{eq}
Trial	$[H_2]_0$ (*M*)	$[I_2]_0$ (*M*)	$[HI]_0$ (*M*)	$[H_2]_{eq}$ (*M*)	$[I_2]_{eq}$ (*M*)	$[HI]_{eq}$ (*M*)	$\frac{[HI]^2}{[H_2][I_2]} = K_{eq}$
1	1.0000	2.0000	0	0.06587	1.0659	1.8682	$\frac{[1.8682]^2}{[0.06587][1.0659]} = 49.70$
2	0	0	5.0000	0.5525	0.5525	3.8950	$\frac{[3.8950]^2}{[0.5525][0.5525]} = 49.70$
3	1.0000	1.0000	1.0000	0.2485	0.2485	1.7515	$\frac{[1.7515]^2}{[0.2485][0.2485]} = 49.70$

What is the value of K_{eq} for the equilibrium: $CO_{(g)} + 3H_{2(g)} \rightleftarrows CH_{4(g)} + H_2O_{(g)}$

if you know that: $[CO] = 0.0613$ mol/L, $[H_2] = 0.1839$ mol/L, $[CH_4] = 0.0387$ mol/L, $[H_2O] = 0.0387$ mol/L

a. 7.526

b. 3.928

c. 1.384

d. 0.133

Determine the value of *K*eq at 400K for this equation: $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$ if $[PCl_5] = 0.135$ mol/L, $[PCl_3] = 0.550$ mol/L, and $[Cl_2] = 0.550$ mol/L.

What is the value of K_{eq} of the following reaction?

ما قيمة K_{eq} للتفاعل التالي؟

$$N_2O_{4(g)} \rightleftharpoons 2NO_{2(g)}$$

The equilibrium concentrations are:

$[N_2O_4] = 0.0185\ mol/L$

$[NO_2] = 0.0627\ mol/L$

علمًا بأن التراكيز عند الاتزان هي:

$[N_2O_4] = 0.0185\ mol/L$

$[NO_2] = 0.0627\ mol/L$

0.213

0.00545

3.39

1.70

The table below shows the value of the equilibrium constant for a reaction at three different temperatures. At which temperature is the concentration of the products the greatest? Explain your answer.

K_{eq} and Temperature		
263 K	273 K	373 K
0.0250	0.500	4.500

Section: 2 Factors Affecting Chemical Equilibrium (Le Chatelier's Principle)

Le Chatelier's Principle: If stress is applied to a system at equilibrium, the system shifts in the direction that relieves the stress.

Stress is any kind of change in a system that upsets the equilibrium.

If a stress is applied to a system at equilibrium, the system shifts in the direction that relieves the stress. this is called .....

إذا تم بذل جهد على نظام في حالة اتزان تتم إزاحة النظام في الاتجاه الذي يخفف عنه هذا الجهد. هذا يُسمى .....

a. law of chemical equilibrium — قانون الاتزان الكيميائي

b. Le Chatelier's principle — مبدأ لوشاتيلييه

c. Aufbau principle — مبدأ أوفباو

d Pauli exclusion principle — مبدأ باولي للاستبعاد

1. Concentration:

Adjusting the concentrations of either the reactants or the products puts stress on a system in equilibrium.

Table 17.2 At Equilibrium: $CO(g) + 3H_2(g) \rightleftharpoons CH_4(g) + H_2O(g)$

Equilibrium position	$[CO]_{eq}$ (*M*)	$[H_2]_{eq}$ (*M*)	$[CH4]_{eq}$ (*M*)	$[H_2O]_{eq}$ (*M*)	K_{eq}
1	0.30000	0.10000	0.05900	0.02000	3.933
2	0.99254	0.07762	0.06648	0.02746	3.933

- **Adding reactants** increases the number of effective collisions between molecules and upsets the equilibrium.

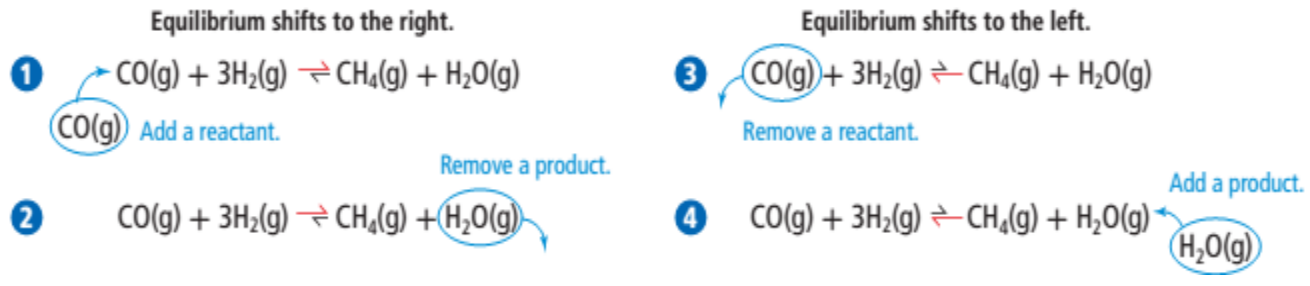
The equilibrium shifts to the right to produce more products.

- **Removing reactants** decreases the number of effective collisions between molecules and upsets the equilibrium

The equilibrium shifts to the left to produce more reactants.

Stress is relieved by shifting to the left, converting products to reactants.

$$CO(g) + 3H_2(g) \rightleftharpoons CH_4(g) + H_2O(g)$$



What is the effect of adding more CO on the chemical equilibrium?

$CO\ (g) + 3\ H_2\ (g) \rightleftarrows CH_4\ (g) + H_2O\ (g)$

ما تأثير اضافة كمية من CO على الأتزان الكيميائي ؟

$CO\ (g) + 3\ H_2\ (g) \rightleftarrows CH_4\ (g) + H_2O\ (g)$

A) Equilibrium shifts left

B) Equilibrium shifts right

C) No change

D) Equilibrium shifts REVERSE

Adding product to a chemical equilibrium:

A. does nothing

B. creates a stress and shifts the equilibrium to the right

C. creates a stress and shifts the equilibrium to the left

D. causes more product to form

2. Pressure: (volume)

Affects gasses only

It works **only** if the number of moles of **gaseous** reactants is **different** from the moles of gaseous products.

The reaction between CO and H_2 is at equilibrium.

Lowering the piston decreases the volume and increases the pressure.

As a result, more molecules of the products form. Their formation relieves the stress on the system.

$$CO(g) + 3H_2(g) \rightleftharpoons CH_4(g) + H_2O(g)$$

• **Increasing pressure** shifts the system to the left, and more products are formed.

· If the number of moles is the same on both sides of the balanced equation, changes in pressure and volume have no effect on the equilibrium.

Explain how decreasing the volume of the reaction vessel affects each equilibrium.

a. $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$

b. $H_2(g) + Cl_2(g) \rightleftharpoons 2HCl(g)$

c. $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$

What is the effect of decreasing pressure on the chemical equilibrium?

H2 +I₂ ⇌ 2HI

A) Equilibrium shifts left

B) Equilibrium shifts right

C) No change

D) Equilibrium shifts reverse

ما تأثير تخفيض الضغط على الاتزان الكيميائي ؟

H2 +I₂ ⇌ 2HI

What is the effect of decreasing the volume of the reaction vessel on the equilibrium systems below?

ما تأثير تقليل حجم وعاء التفاعل على أنظمة الاتزان أدناه؟

$CO(g) + 3H_2(g) \rightleftharpoons CH_4(g) + H_2O(g)$	1
$H_2(g) + Cl_2(g) \rightleftharpoons 2HCl(g)$	2

a. The equilibrium **1** shifts to the right and the total number of gas moles decreases

ينزاح الاتزان **1** جهة اليمين ويقل عدد مولات الغاز

b. The equilibrium **2** shifts to the left

ينزاح الاتزان **2** جهة اليسار

c. The equilibrium **1** shifts to the left and the total number of gas moles increases

ينزاح الاتزان **1** جهة اليسار ويزداد عدد مولات الغاز

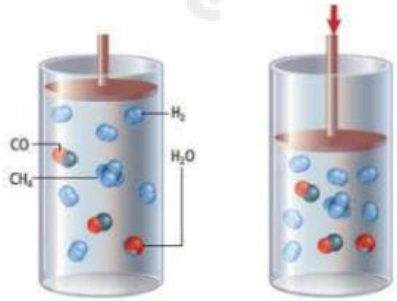
d. The equilibrium in both **1,2** shifts to the right

ينزاح الاتزان في كل من **1** و **2** جهة اليمين

What is the effect of decreasing the volume of the reaction vessel on the equilibrium system below?

ما تأثير تقليل حجم وعاء التفاعل على نظام الاتزان أدناه؟

$$CO(g) + 3H_2(g) \rightleftharpoons CH_4(g) + H_2O(g)$$



The equilibrium shifts to the right

ينزاح الاتزان جهة اليمين

CO concentration increases

يزداد تركيز **CO**

CH_4 concentration decreases

يقل تركيز **CH_4**

The equilibrium shifts to the left

ينزاح الاتزان جهة اليسار

3. Temperature Affects Keq value

If heat is added to an equilibrium system, the equilibrium shifts in the direction in which the heat is used up.

Exothermic Reaction

Equilibrium shifts to the left. (heat — Raise the temperature.)

1. $CO(g) + 3H_2(g) \rightleftharpoons CH_4(g) + H_2O(g) + \text{heat}$

Equilibrium shifts to the right. (Lower the temperature.)

2. $CO(g) + 3H_2(g) \rightleftharpoons CH_4(g) + H_2O(g) + \text{heat}$

Endothermic Reaction

Equilibrium shifts to the right.

3. $\text{heat} + N_2O_4(g) \rightleftharpoons 2\,NO_2(g)$ (heat — Raise the temperature.)

Equilibrium shifts to the left.

4. $\text{heat} + N_2O_4(g) \rightleftharpoons 2\,NO_2(g)$ (Lower the temperature.)

Removing Heat (Cooling):

$N_2O_4(g) \rightleftharpoons 2NO_2(g) \quad \Delta H° = 55.3\ kJ$

Decide whether higher or lower temperatures will produce more CH_3CHO in the following equilibrium. $C_2H_2(g) + H_2O(g) \rightleftharpoons CH_3CHO(g) \quad \Delta H° = -151\ kJ$

What is the effect of decreasing temperature in the previous reaction?
N_2O_4 (g) ⇌ 2NO_2 (g) ΔH° = 55.3 kJ

ما تأثير خفض درجة الحرارة على الاتزان الكيميائي ؟
N_2O_4 (g) ⇌ 2NO_2 (g) ΔH° = 55.3 kJ

A) Equilibrium shifts forward

B) Equilibrium shifts right

C) No change

D) Equilibrium shifts reverse

The figure below shows the following endothermic reaction at equilibrium at room temperature.
What happens if the flask were placed in an ice bath?

يُوضح الشكل أدناه التفاعل الماص للحرارة التالي عند الاتزان في درجة حرارة الغرفة. ماذا يحدث إذا تم وضع الدورق في حوض به ثلج؟

$$Co(H_2O)_6^{2+}{}_{(aq)} + 4Cl^-{}_{(aq)} \rightleftharpoons CoCl_4^{2-}{}_{(aq)} + 6H_2O_{(l)}$$

وردي أزرق

a. The equilibrium shifts to the right and the blue color increases

ينزاح الاتزان نحو اليمين ويزداد اللون الأزرق

b. The equilibrium shifts to the left and the pink color increases

ينزاح الاتزان نحو اليسار ويزداد اللون الوردي

c. The equilibrium shifts to the right and the concentration of Cl^- ions increases

ينزاح الاتزان نحو اليمين ويزداد تركيز أيونات الكلوريد Cl^-

d. The equilibrium shifts to the left and the concentration of $CoCl_4^{2-}$ ions increases

ينزاح الاتزان نحو اليسار ويزداد تركيز أيونات $CoCl_4^{2-}$

What is the effect of lowering the temperature on the following equilibrium?

ما أثر خفض درجة الحرارة على الاتزان التالي؟

$$C_2H_{2(g)} + H_2O_{(g)} \rightleftharpoons CH_3CHO_{(g)} \qquad \Delta H^\circ = -151 kJ$$

a. Produces more **CH_3CHO**

يُنتج المزيد من **CH_3CHO**

b. Produces more **C_2H_2**

يُنتج المزيد من **C_2H_2**

c. The equilibrium shifts to the left

ينزاح الاتزان نحو اليسار

d. The value of K_{eq} does not change

لن تتغير قيمة K_{eq}

Adding Catalyst:

catalyzed reaction reaches equilibrium more quickly, but with no change in the amount of product formed.

Assessment:

1. How would each of the following changes affect the equilibrium position of the system used to produce methanol from carbon monoxide and hydrogen?

   $CO(g) + 2H_2(g) \rightleftharpoons CH_3OH(g) + heat$

   a. adding CO to the system

   b. cooling the system

   c. adding a catalyst to the system

   d. removing CH3OH from the system

   e. decreasing the volume of the system.

PCl5 (g) ⇌ PCl3 (g) + Cl2 (g) + heat (**DISCUSS** the effect on Keq value)

a. temperature increases.

b. some of the chlorine gas dissolves.

(effect of removing Cl_2 on $[PCl_3]$)

2. **EFFECT of cooling on**
   a. 2O3 (g) ⇌ 3O2 (g) + heat
   b. heat + H2 (g) + F2 (g) ⇌ 2HF(g)

3. Whether higher or lower temperatures will produce more CH_3CHO in the following equilibrium. $C_2H_2\ (g) + H_2O(g) \rightleftharpoons CH_3CHO(g)$ $\Delta H° = -151$ kJ

4. Use Le Châtelier's principle to explain how a shift in the equilibrium $H_2CO_3(aq) \rightleftharpoons H_2O(l) + CO_2\ (g)$ causes a soft drink to go flat when its container is left open.

5. The following endothermic reaction at equilibrium at room temperature.
   $Co(H_2O)_6^{2+}\ (aq) + 4Cl^-(aq) \rightleftharpoons CoCl_4^{2-}\ (aq) + 6H_2O(l)$
   Given that $Co(H_2O)_6^{2+}\ (aq)$ is pink and $CoCl_4^{2-}\ (aq)$ is blue, what visual change would you expect to see if:

   a. the flask were placed in an ice bath? Explain.

   b. 10 g of solid potassium chloride were added and dissolved? Explain

6. The table below shows the concentrations of Substances A and B in two reaction mixtures. A and B react according to the equation $2A \rightleftharpoons B$; *K*eq= 200.

   Are the two mixtures at different equilibrium positions?

Concentration Data in mol/L		
Reaction	[A]	[B]
1	0.0100	0.0200
2	0.0500	0.500

Which of the following factors will NOT lead to an increase in the amount of substance produced?

أي العوامل التالية لن تؤدي إلى زيادة كمية المادة الناتجة؟

$$CO_{(g)} + 2H_2 \rightleftharpoons CH_3OH_{(g)}$$

a. Adding **CO** to the system — إضافة **CO** للنظام

b. Removing **CH_3OH** from the system — إزالة **CH_3OH** من النظام

c. Adding **H_2** to the system — إضافة **H_2** للنظام

d. Adding a catalyst to the system — إضافة حفاز للنظام

How is the equilibrium shift affected when chlorine gas Cl_2 is added to the equilibrium system: $PCl_{5(g)} \rightleftarrows PCl_{3(g)} + Cl_{2(g)}$ .How is the value of K_{eq} affected?

a. the equilibrium shifts to the left, the value of K_{eq} does not change

b. the equilibrium shifts to the right, the value of K_{eq} does not change

c. the equilibrium shifts to the left, the value of K_{eq} decreases

d. the equilibrium shifts to the right, the value of K_{eq} decreases

) How is the equilibrium shift affected when PCl_3 gas is removed from the equilibrium system: $PCl_{5(g)} \rightleftarrows PCl_{3(g)} + Cl_{2(g)}$ .How is the value of K_{eq} affected?

a. the equilibrium shifts to the right, the value of K_{eq} decreases

b. the equilibrium shifts to the left, the value of K_{eq} decreases

c. the equilibrium shifts to the right, the value of K_{eq} does not change

d. the equilibrium shifts to the left, the value of K_{eq} does not change

How is the equilibrium shift affected by an increase in temperature in an equilibrium system? $2O_{3(g)} \rightleftarrows 3O_{2(g)}$ + heat, how is the value of K_{eq} affected?

a. the equilibrium shifts to the right, the value of K_{eq} decreases

b. the equilibrium shifts to the left, the value of K_{eq} decreases

c. the equilibrium shifts to the right, the value of K_{eq} does not change

d. the equilibrium shifts to the left, the value of K_{eq} does not change

How does an increase in pressure affect the equilibrium shift in an equilibrium system: $N_2O_{4(g)} \rightleftarrows 2NO_{2(g)}$, what effect does this have on the NO_2 concentration and K_{eq} value?

choice	equilibrium shift	$[NO_{2(g)}]$	K_{eq} value
a.	right	increase	decrease
b.	left	increase	no change
c.	left	decrease	no change
d.	right	decrease	increase

All the following changes cause the equilibrium to shift to the left in the reaction below except .....

جميع التغيرات التالية تُسبب انزياح الاتزان إلى جهة اليسار في التفاعل أدناه عدا.....

$$N_2O_4(g) \rightleftharpoons 2NO_2(g) \quad \Delta H^\circ = 57.2 \text{ kJ}$$

a. Lowering the system temperature — خفض حرارة النظام

b. Reducing the concentration of NO_2 — تقليل تركيز NO_2

c. Increasing the pressure — زيادة الضغط

d. Reducing the concentration of N_2O_4 — تقليل تركيز N_2O_4