

CHEMISTRY 10 ADVANCED

REVIEW TRIMESTER 2
2022-2023

Done by : Mr. Tarek Mohamed
ABU DHBI SECONDARY School



■ **Figure 9.2** Each of these photos illustrates evidence of a chemical reaction.

Describe the evidence in each photo that tells you a chemical reaction has occurred.

Which figures illustrates evidence of a chemical reaction?

أي مما يأتي يُمثّل دليلاً على حدوث تفاعل كيميائي؟



1

A banana changing from green to yellow

تغيّر لون الموزة
من الأخضر إلى الأصفر



2

Fireworks

اللعاب نارية



3

Water boiling

غليان الماء



4

Chocolate melting

انصهار الشوكولاتة

2 and 3 only

2 و 3 فقط

☐

1 and 3 only

1 و 3 فقط

☐

1 and 2 only

1 و 2 فقط

☐

3 and 4 only

3 و 4 فقط

☐

In the figure below, what is the evidence that indicates a chemical reaction has occurred?

في الصورة أدناه، ما الدليل على حدوث تفاعل كيميائي؟



Temperature change

تغير في درجة الحرارة



Formation of a solid

تكوّن مادة صلبة



Gas bubbles

تصاعد غاز



Color Change

تغير اللون



What is the name of the solid substance formed from a chemical reaction as shown in the figure below?

☒ Liquid

☒ Precipitate

☒ Gas

☒ Aqueous





+



→



One aluminum
atom

Two bromine
atoms

One aluminum atom
Three bromine atoms

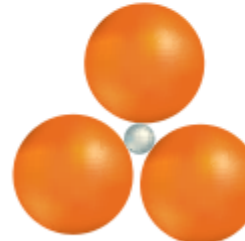
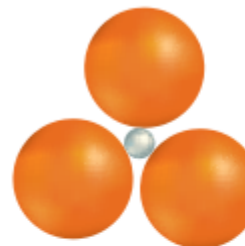
■ **Figure 9.4** The information conveyed by skeleton equations is limited. In this case, the skeleton equation is correct, but it does not show the exact number of atoms that interact. Refer to **Table R-1** on page 968 for a key to atom color conventions.



+



→



Two aluminum
atoms

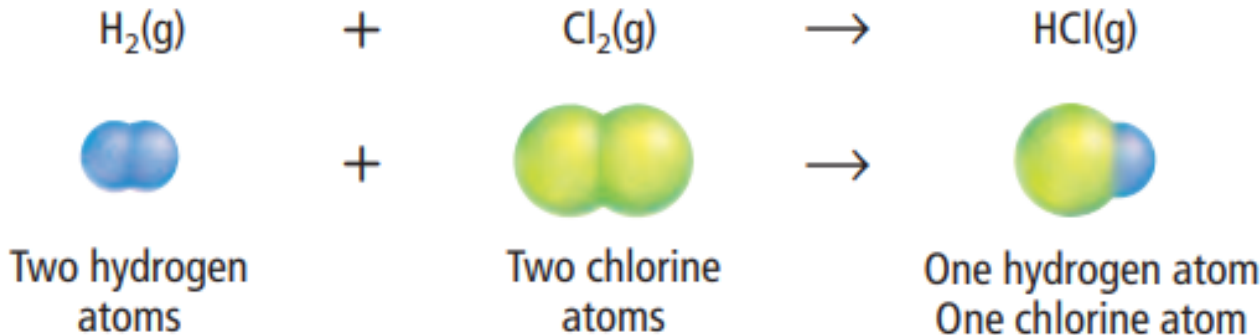
Six bromine
atoms



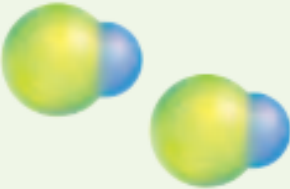
Two aluminum atoms
Six bromine atoms

■ **Figure 9.5** In a balanced chemical equation, the number of particles on the reactant side of the equation equals the number of particles on the product side of the equation. In this case, two aluminum atoms and six bromine atoms are needed on both sides of the equation.

Table 9.2**Steps for Balancing Equations**

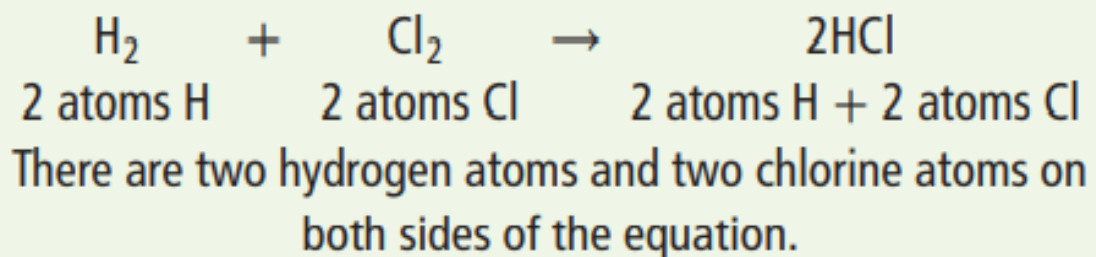
Interactive Table Explore balancing chemical equations at glencoe.com.

Step	Process	Example
1	<i>Write the skeleton equation for the reaction.</i> Make sure that the chemical formulas correctly represent the substances. An arrow separates the reactants from the products, and a plus sign separates multiple reactants and products. Show the physical states of all reactants and products.	$\text{H}_2(\text{g}) + \text{Cl}_2(\text{g}) \rightarrow \text{HCl}(\text{g})$ 
2	<i>Count the atoms of the elements in the reactants.</i> If a reaction involves identical polyatomic ions in the reactants and products, count each polyatomic ion as a single element. This reaction does not involve any polyatomic ions. Two atoms of hydrogen and two atoms of chlorine are reacting.	$\begin{array}{ccccc} \text{H}_2 & + & \text{Cl}_2 & \rightarrow & \\ 2 \text{ atoms H} & & 2 \text{ atoms Cl} & & \end{array}$

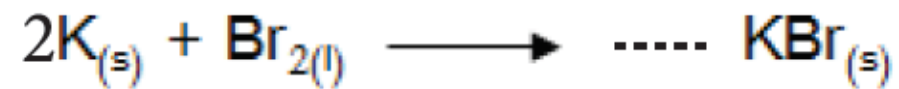
3	Count the atoms of the elements in the products. One atom of hydrogen and one atom of chlorine are produced.	HCl <p>1 atom H + 1 atom Cl</p>
4	Change the coefficients to make the number of atoms of each element equal on both sides of the equation. Never change a subscript in a chemical formula to balance an equation because doing so changes the identity of the substance.	<div> <div> H_2 2 atoms H  Two hydrogen atoms </div> <div>+</div> <div> Cl_2 2 atoms Cl  Two chlorine atoms </div> <div>→</div> <div> 2HCl 2 atoms H + 2 atoms Cl  Two hydrogen atoms Two chlorine atoms </div> </div>
5	Write the coefficients in their lowest possible ratio. The coefficients should be the smallest possible whole numbers. The ratio 1 hydrogen to 1 chlorine to 2 hydrogen chloride (1:1:2) is the lowest-possible ratio because the coefficients cannot be reduced further and still remain whole numbers.	$\text{H}_2(\text{g}) + \text{Cl}_2(\text{g}) \rightarrow 2\text{HCl}(\text{g})$ <p>1:1:2 1 H_2 to 1 Cl_2 to 2 HCl</p>

6

Check your work. Make sure that the chemical formulas are written correctly. Then, check that the number of atoms of each element is equal on both sides of the equation.



2– What is the **correct** coefficient to balance the following equation?



☒ 1

☒ 2

☒ 3

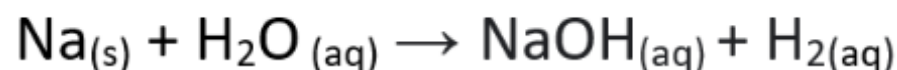
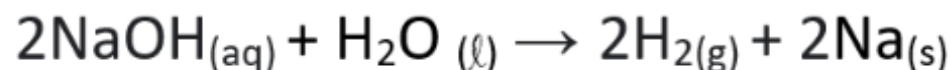
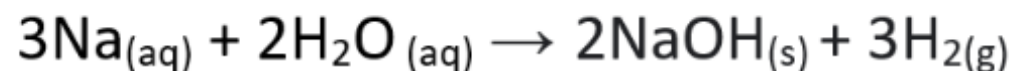
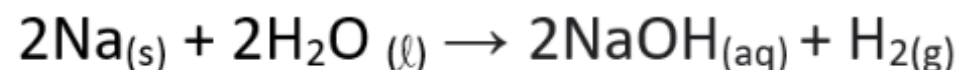
☒ 7

What is the **correct** balanced skeleton equation that represents the chemical reaction below?

ما المعادلة الموزونة بالصيغ **الصحيحة** التي تمثل التفاعل الكيميائي أدناه؟

Solid sodium (Na) reacts vigorously with water (H₂O) to yield gaseous hydrogen (H₂) and a solution of sodium hydroxide (NaOH).

يتفاعل الصوديوم الصلب (Na) بشدة مع الماء (H₂O) لينتج غاز الهيدروجين (H₂) محلول هيدروكسيد الصوديوم (NaOH).

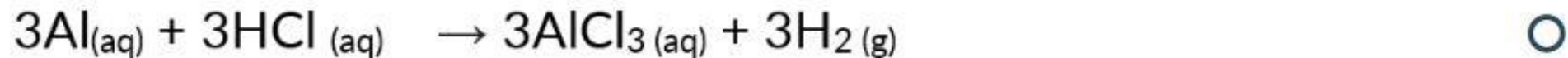
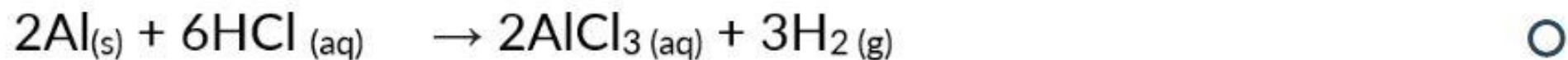
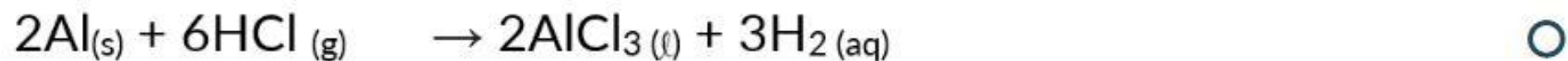
☐☐☐☐

What is the **correct** balanced skeleton equation that represents the chemical reaction below?

Hydrochloric acid (HCl) reacts with solid Aluminum (Al) metal to yield aqueous Aluminum chloride (AlCl₃) and Hydrogen gas (H₂)

ما المعادلة الموزونة بالصيغ **الصحيحة** التي تمثل التفاعل الكيميائي أدناه؟

يتفاعل حمض الهيدروكلوريك (HCl) مع فلز الألمنيوم الصلب (Al) ليعطي محلول كلوريد الألمنيوم (AlCl₃) وغاز الهيدروجين (H₂)



2. What are the correct coefficients when this equation is balanced ?



A. 1, 2, 10

B. 4, 6, 1

C. 4, 3, 1

D. 10, 5, 1

3	يُصنف التفاعلات الكيميائية Classify of chemical reactions	نص الكتاب - مثال 2 - تطبيقات Text book, Example 2, Applications	من صفحة 157 إلى صفحة 166 From page 157 to 166
---	--	--	--

Table 9.4

Predicting Products of Chemical Reactions

Interactive Table Explore types of chemical reactions at [glencoe.com](https://www.glencoe.com).

Type of Reaction	Reactants	Probable Products	Generic Equation
Synthesis	<ul style="list-style-type: none"> two or more substances 	<ul style="list-style-type: none"> one compound 	$A + B \rightarrow AB$
Combustion	<ul style="list-style-type: none"> a metal and oxygen a nonmetal and oxygen a compound and oxygen 	<ul style="list-style-type: none"> the oxide of the metal the oxide of the nonmetal two or more oxides 	$A + O_2 \rightarrow AO$
Decomposition	<ul style="list-style-type: none"> one compound 	<ul style="list-style-type: none"> two or more elements and/or compounds 	$AB \rightarrow A + B$
Single-replacement	<ul style="list-style-type: none"> a metal and a compound a nonmetal and a compound 	<ul style="list-style-type: none"> a new compound and the replaced metal a new compound and the replaced nonmetal 	$A + BX \rightarrow AX + B$
Double-replacement	<ul style="list-style-type: none"> two compounds 	<ul style="list-style-type: none"> two different compounds, one of which is a solid, water, or a gas 	$AX + BY \rightarrow AY + BX$

Single-Replacement Reactions Predict the products that will result when these reactants combine, and write a balanced chemical equation for each reaction.



■ **Figure 9.13** An activity series, similar to the series shown here for various metals and halogens, is a useful tool for determining whether a chemical reaction will occur and for determining the result of a single-replacement reaction.

Most
active

METALS

Lithium
Rubidium
Potassium
Calcium
Sodium
Magnesium
Aluminum
Manganese
Zinc
Iron
Nickel
Tin
Lead
Copper
Silver
Platinum
Gold

Least
active

Most
active

HALOGENS



Fluorine
Chlorine
Bromine
Iodine

Least
active

Predict whether the following single-replacement reactions will occur. If a reaction occurs, write a balanced equation for the reaction.

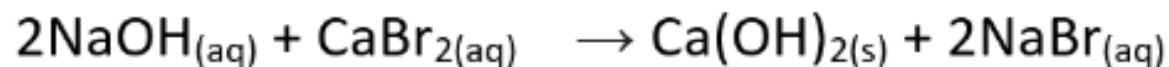
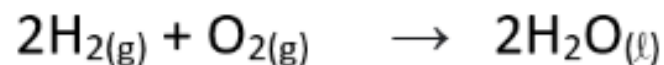
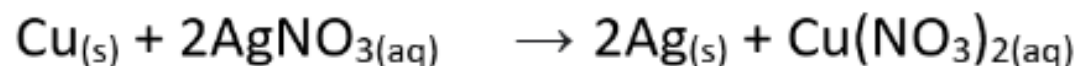


■ **Figure 9.13** An activity series, similar to the series shown here for various metals and halogens, is a useful tool for determining whether a chemical reaction will occur and for determining the result of a single-replacement reaction.

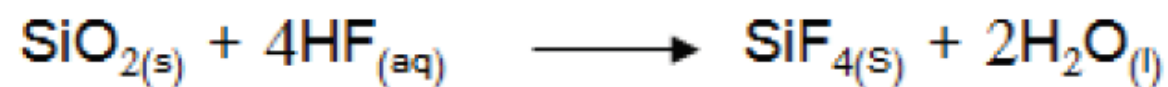
Most active		METALS
		Lithium
		Rubidium
		Potassium
		Calcium
		Sodium
		Magnesium
		Aluminum
		Manganese
		Zinc
		Iron
		Nickel
		Tin
		Lead
		Copper
		Silver
		Platinum
		Gold
Least active		
Most active		HALOGENS
		Fluorine
		Chlorine
		Bromine
		Iodine
Least active		

Which of the following is a single displacement reaction?

أي من التفاعلات التالية تفاعل استبدال احادي؟



· What is the type of the following chemical reaction?



☒ Synthesis

☒ Single replacement

☒ Dissociation

☒ Double replacement

What is a reaction of a substance with oxygen and releases energy in the form of heat and light?

ماذا يُسمى تفاعل مادة مع الأكسجين مطلقاً طاقة في صورة حرارة وضوء؟

Decomposition reaction

☐ تفاعل تفكك

Combustion reaction

☐ تفاعل احتراق

Single Replacement reaction

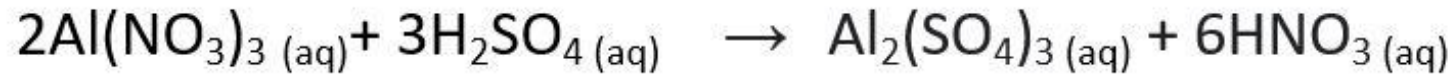
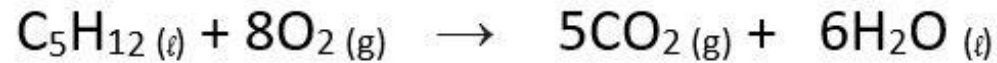
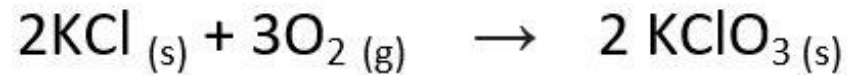
☐ تفاعل استبدال أحادي

Double Replacement reaction

☐ تفاعل استبدال مزدوج

Which one of the following chemical reaction equations represents a **synthesis reaction**?

أي من معادلات التفاعلات الكيميائية التالية تُمثل **تفاعل تكوين**؟



What is the type of chemical reaction represented in the equation below?

ما نوع التفاعل الكيميائي الذي تُمثله المعادلة أدناه؟



Combustion reaction

تفاعل احتراق



Double Replacement reaction

تفاعل استبدال مزدوج



Single Replacement reaction

تفاعل استبدال أحادي



Decomposition reaction

تفاعل تفكك



4. Which type of reaction is $4\text{Al} + 3\text{O}_2 \longrightarrow 2\text{Al}_2\text{O}_3$?

A. synthesis

B. decomposition

C. single replacement

D. combustion

7	يُحول عدد المولات إلى عدد من الجسيمات المُمثلة والعكس	نص الكتاب وتطبيقات	190 , 191
	Convert of moles to number of representative particles and vice versa	Text book, Applications	

1. Zinc (Zn) is used to form a corrosion-inhibiting surface on galvanized steel. Determine the number of Zn atoms in 2.50 mol of Zn.

2. Calculate the number of molecules in 11.5 mol of water (H₂O).

3. Silver nitrate (AgNO_3) is used to make several different silver halides used in photographic films. How many formula units of AgNO_3 are there in 3.25 mol of AgNO_3 ?

4. **Challenge** Calculate the number of oxygen atoms in 5.0 mol of oxygen molecules. Oxygen is a diatomic molecule, O_2 .

What is the number of atoms in a 0.645 mol sample of argon gas (Ar)?

كم عدد الذرات الموجودة في 0.645 mol من عينة من غاز الأرجون (Ar)؟

Avogadro's number = 6.02×10^{23}

عدد أفوجادرو = 6.02×10^{23}

9.33×10^{23} atom

9.33×10^{23} ذرة

☐

3.88×10^{23} atom

3.88×10^{23} ذرة

☐

1.07×10^{23} atom

1.07×10^{23} ذرة

☐

4.62×10^{23} atom

4.62×10^{23} ذرة

☐

11. Calculate the number of molecules in 4.0 mol H₂O?

A. 0.62×10^{23} molecules

B. 2.4×10^{24} molecules

C. 2.4×10^{-23} molecules

D. 2.4×10^{23} molecules

How many moles contained in 2.50×10^{24} molecules
of ammonia NH_3 ?

Avogadro's number = 6.02×10^{23}

كم عدد المولات الموجودة في 2.50×10^{24} جزيء
من الأمونيا NH_3 ؟

عدد أفوجادرو = 6.02×10^{23}

0.42 mol

☐

2.40 mol

☐

4.15 mol

☐

0.24 mol

☐

12	يحول عدد المولات إلى كتلة مركب ما والعكس	مثال 7 و 8 وتطبيقات	204 ,205
	Convert the number of moles to the mass of a compound and vice versa	Example 6,7 , Applications	

Mole-to-Mass Conversion for Compounds The characteristic odor of garlic is due to allyl sulfide $[(C_3H_5)_2S]$. What is the mass of 2.50 mol of $(C_3H_5)_2S$?

37. The United States chemical industry produces more sulfuric acid (H_2SO_4) , in terms of mass, than any other chemical. What is the mass of 3.25 mol of H_2SO_4 ?

38. What is the mass of 4.35×10^{-2} mol of zinc chloride (ZnCl_2)?

39. Challenge Write the chemical formula for potassium permanganate, and then calculate the mass in grams of 2.55 mol of the compound.

Mass-to-Mole Conversion for Compounds Calcium hydroxide $[\text{Ca}(\text{OH})_2]$ is used to remove sulfur dioxide from the exhaust gases emitted by power plants and for softening water by the elimination of Ca^{2+} and Mg^{2+} ions. Calculate the number of moles of calcium hydroxide in 325 g of the compound.

40. Determine the number of moles present in each compound.

a. 22.6 g AgNO_3

b. 6.50 g ZnSO_4

c. 35.0 g HCl

41. Challenge Identify each as an ionic or molecular compound and convert the given mass to moles. Express your answers in scientific notation.

a. 2.50 kg Fe_2O_3

b. 25.4 mg PbCl_4

Baking soda is the common name for sodium hydrogen carbonate (NaHCO_3). What is the mass in grams of 2.75 moles of sodium hydrogen carbonate?

A 63.2 g

B 84 g

C 210 g

D 231 g

How many moles are in 22.0 g of CO₂?

Molar mass CO₂ = 44 g/mol

كم مولاً موجود في 22.0 g من CO₂؟

الكتلة المولية CO₂ = 44 g/mol

1.25 mol



0.50 mol



0.60 mol



2.00 mol



How many moles are in 82.0 g of HCN?

Molar mass HCN = 27.0 g/mol

كم مولاً موجوداً في 82.0 g من HCN؟

الكتلة المولية HCN = 27.0 g/mol

3.04 mol



2.53 mol



1.25 mol



0.33 mol



6	يتوقع إذا كانت التفاعلات في المحاليل المائية ستنتج راسبًا أم ماءً أم غازًا	نص الكتاب ومثال 3 و 4 و 5 وتطبيقات	170 ,171 , 172 ,173
	Predict whether reactions in aqueous solutions will produce precipitate, water, or a gas	Text book,Example 4, Applications	

Reactions That Form a Precipitate Write the chemical, complete ionic, and net ionic equations for the reaction between aqueous solutions of barium nitrate and sodium carbonate that forms the precipitate barium carbonate.

Reactions That Form Water Write the chemical, complete ionic, and net ionic equations for the reaction between hydrochloric acid and aqueous lithium hydroxide. This reaction produces water and aqueous lithium chloride.

Reactions That Form Gases Write the chemical, complete ionic, and net ionic equations for the reaction between hydrochloric acid and aqueous sodium sulfide, which produces hydrogen sulfide gas. ■

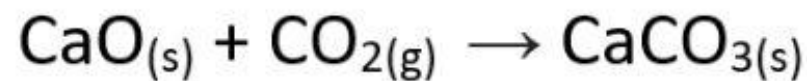
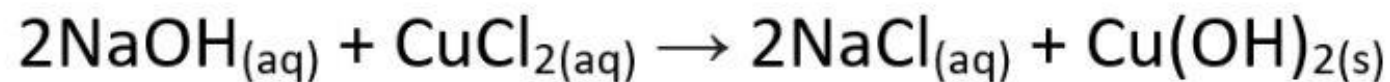
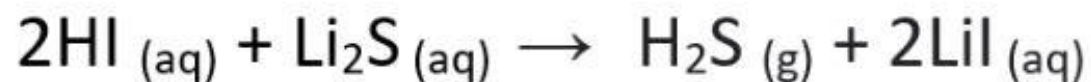
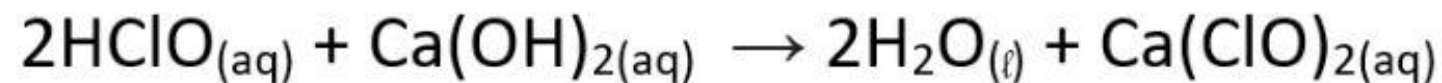
10. What happens when $\text{AgClO}_3(\text{aq})$ and $\text{NaNO}_3(\text{aq})$ are mixed?

- A. No visible reaction occurs
- B. Solid NaClO_3 precipitates out of the solution.
- C. NO_2 gas is released during the reaction.
- D. Solid Ag metal is produced.

Physical Properties of Select Ionic Compounds				
Compound	Name	State at 25°C	Soluble in Water?	Melting Point (°C)
NaClO_3	sodium chlorate	solid	yes	248
Na_2SO_4	sodium sulfate	solid	yes	884
NiCl_2	nickel(II) chloride	solid	yes	1031
Ni(OH)_2	nickel(II) hydroxide	solid	no	230
AgNO_3	silver nitrate	solid	yes	210

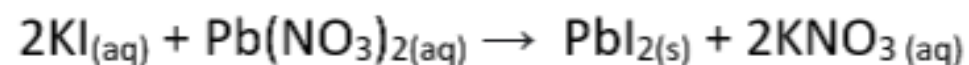
Which one of the following reactions in aqueous solution produce gases?

أي التفاعلات التالية في المحاليل المائية من التفاعلات التي تتكوّن الغازات؟



What is the type of chemical reaction shown in the following chemical equation?

ما نوع التفاعل الكيميائي المُبين في المعادلة الكيميائية التالية؟



Reactions that form only ions

التفاعلات التي تتكوّن أيونات فقط

Reactions that form gas

التفاعلات التي تتكوّن الغازات

Reactions that form water

التفاعلات التي تتكوّن الماء

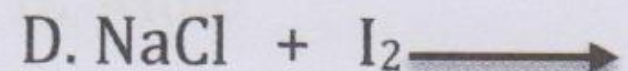
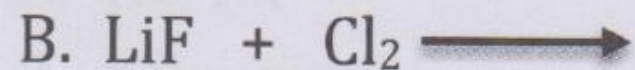
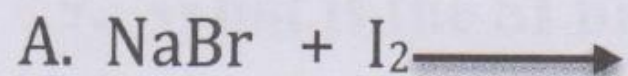
Reactions that form precipitates

التفاعلات التي تتكوّن رواسب

List the characteristics of the different types of chemical reactions

text book, Example 2, Applications , Figure

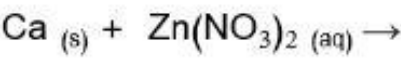
5. Use the activity series shown to predict which reaction will occur.



Activity Series for Halogens	
Fluorine	Most Active
Chlorine	
Bromine	
Iodine	Least Active

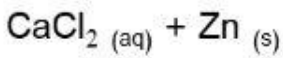
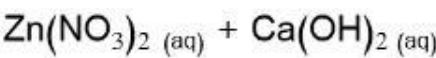
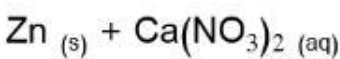
Using the reactivity series of metals, what would yield the single replacement reaction of calcium (Ca) with zinc nitrate $\text{Zn}(\text{NO}_3)_2$?

مستخدماً سلسلة النشاط الكيميائي، ما الناتج المتوقع لتفاعل الاستبدال الأحادي بين الكالسيوم (Ca) مع نترات الخارصين $\text{Zn}(\text{NO}_3)_2$ ؟



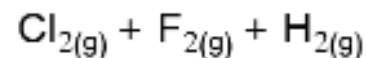
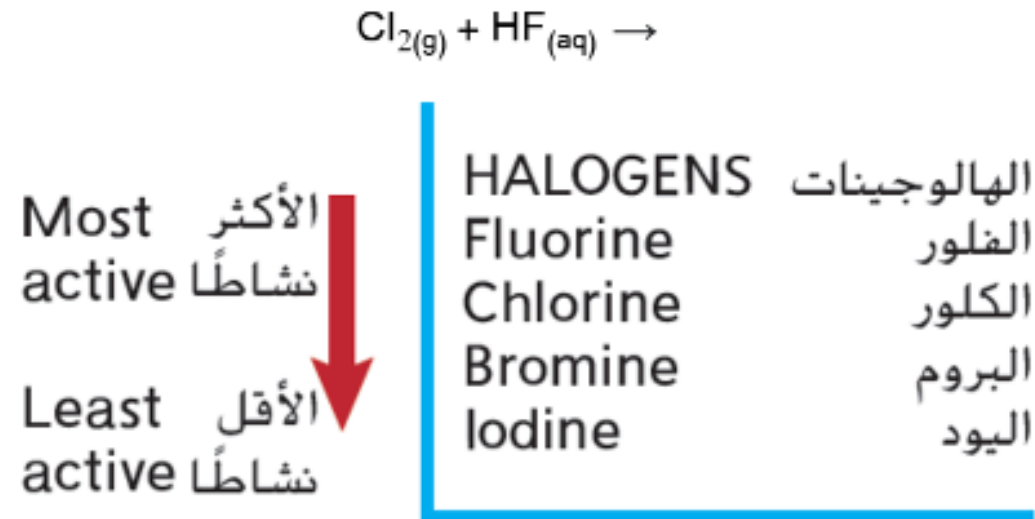
Most active		METALS	الفلزات
		Lithium	ليثيوم
		Rubidium	الروبيديوم
		Potassium	البوتاسيوم
		Calcium	الكالسيوم
		Sodium	الصوديوم
		Magnesium	المغنسيوم
		Aluminum	ألومنيوم
		Manganese	منغنيز
		Zinc	الغارصين
		Iron	الحديد
		Nickel	النيكل
		Tin	القصدير
		Lead	رصاص
		Copper	النحاس
		Silver	الفضة
		Platinum	البلاتين
		Gold	ذهب
Least active			

NR, No Reaction / لن يحدث تفاعل

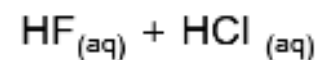
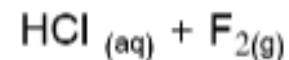


Using the halogens reactivity series, what would yield the reaction of chlorine gas (Cl_2) with aqueous hydrogen fluoride solution (HF)?

مستخدمًا سلسلة النشاط الكيميائي للهالوجينات، ما الناتج المتوقع للتفاعل بين غاز الكلور (Cl_2) مع محلول فلوريد الهيدروجين (HF)؟



NR, No Reaction / لا يحدث تفاعل



4– Which halogen of the following replaces **chlorine** in its solutions?

- ☒ Bromine only
- ☒ Fluorine only
- ☒ Both Fluorine and Iodine
- ☒ Both Bromine and Iodine

Most
active

Least
active



HALOGENS
Fluorine
Chlorine
Bromine
Iodine

8	يحول عدد المولات إلى عدد من الجسيمات المُمثلة والعكس	مثال 1 وتطبيقات	192
	Convert of moles to number of representative particles and vice versa	Example1 , Applications	

Converting Particles to Moles Zinc (Zn) is used as a corrosion-resistant coating on iron and steel. It is also an essential trace element in your diet. Calculate the number of moles of zinc that contain 4.50×10^{24} atoms.

5. How many moles contain each of the following?

- a.** 5.75×10^{24} atoms Al **b.** 2.50×10^{20} atoms Fe

6. Challenge Identify the representative particle for each formula, and convert the given number of representative particles to moles.



9	يُحول عدد المولات إلى كتلة عنصر ما والعكس	نص الكتاب - مثال 2 وتطبيقات	195 , 196
	Convert of the number of moles to the mass of an element and vice versa	Text book,Example 2, Applications	

Mole-to-Mass Conversion Chromium (Cr), a transition element, is a component of chrome plating. Chrome plating is used on metals and in steel alloys to control corrosion. Calculate the mass in grams of 0.0450 mol Cr.

15. Determine the mass in grams of each of the following.

a. 3.57 mol Al

b. 42.6 mol Si

16. Challenge Convert each given quantity in scientific notation to mass in grams expressed in scientific notation.

a. 3.45×10^2 mol Co

b. 2.45×10^{-2} mol Zn

Atoms-to-Mass Conversion Helium (He) is an unreactive noble gas often found in underground deposits mixed with methane. The mixture is separated by cooling the gaseous mixture until all but the helium has liquefied. A party balloon contains 5.50×10^{22} atoms of helium gas. What is the mass, in grams, of the helium?

19. How many atoms are in each of the following samples?

a. 55.2 g Li

b. 0.230 g Pb

c. 11.5 g Hg

20. What is the mass in grams of each of the following?

- a. 6.02×10^{24} atoms Bi
- b. 1.00×10^{24} atoms Mn
- c. 3.40×10^{22} atoms He
- d. 1.50×10^{15} atoms N
- e. 1.50×10^{15} atoms U

21. Challenge Convert each given mass to number of representative particles. Identify the type of representative particle, and express the number in scientific notation.

- a. 4.56×10^3 g Si
- b. 0.120 kg Ti

Mole Relationships from a Chemical Formula Aluminum oxide (Al_2O_3), often called alumina, is the principal raw material for the production of aluminum (Al). Alumina occurs in the minerals corundum and bauxite. Determine the moles of aluminum ions (Al^{3+}) in 1.25 mol of Al_2O_3 .

How many moles of nitrogen atoms are contained in one mole of $\text{Ba}(\text{NO}_3)_2$?

A 1

B 2

C 6

D 9

29. Zinc chloride (ZnCl_2) is used in soldering flux, an alloy used to join two metals together. Determine the moles of Cl^- ions in 2.50 mol ZnCl_2 .

- 30.** Plants and animals depend on glucose ($\text{C}_6\text{H}_{12}\text{O}_6$) as an energy source. Calculate the number of moles of each element in 1.25 mol $\text{C}_6\text{H}_{12}\text{O}_6$.

31. Iron(III) sulfate[Fe₂(SO₄)₃] is sometimes used in the water purification process. Determine the number of moles of sulfate ions present in 3.00 mol of Fe₂(SO₄)₃.

32. How many moles of oxygen atoms are present in 5.00 mol of diphosphorus pentoxide (P_2O_5)?

33. Challenge Calculate the number of moles of hydrogen atoms in 1.15×10^1 mol of water. Express the answer in scientific notation.

Write chemical, complete ionic, and net ionic equations for each of the following reactions that might produce a precipitate. Use *NR* to indicate that no reaction occurs.

- 35.** Aqueous solutions of potassium iodide and silver nitrate are mixed, forming the precipitate silver iodide.

Write chemical, complete ionic, and net ionic equations for each of the following reactions that might produce a precipitate. Use *NR* to indicate that no reaction occurs.

- 36.** Aqueous solutions of ammonium phosphate and sodium sulfate are mixed. No precipitate forms and no gas is produced.

Write chemical, complete ionic, and net ionic equations for each of the following reactions that might produce a precipitate. Use *NR* to indicate that no reaction occurs.

- 37.** Aqueous solutions of aluminum chloride and sodium hydroxide are mixed, forming the precipitate aluminum hydroxide.

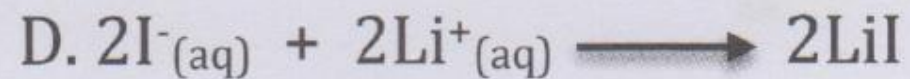
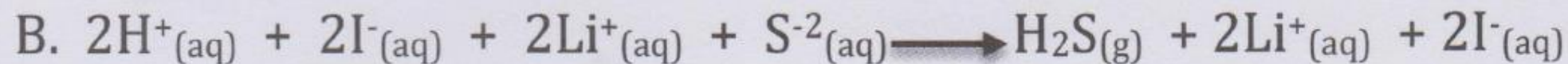
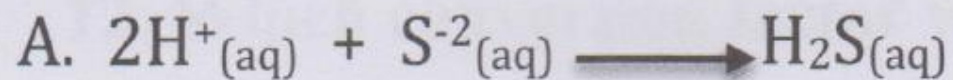
Write chemical, complete ionic, and net ionic equations for each of the following reactions that might produce a precipitate. Use *NR* to indicate that no reaction occurs.

- 38.** Aqueous solutions of lithium sulfate and calcium nitrate are mixed, forming the precipitate calcium sulfate.

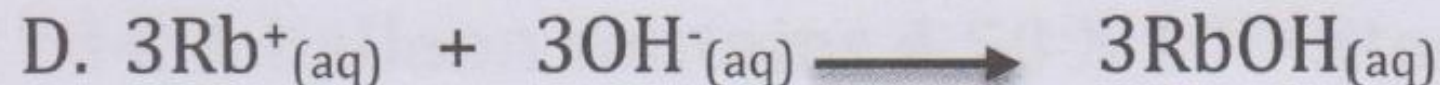
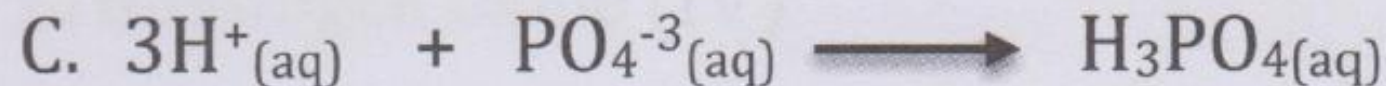
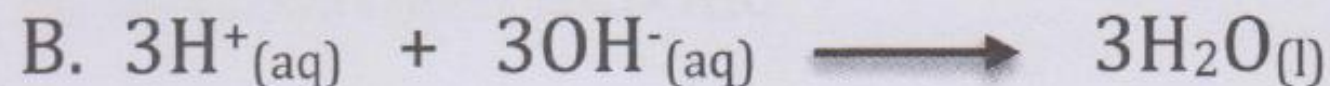
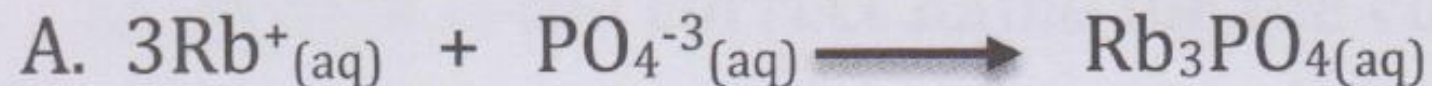
Write chemical, complete ionic, and net ionic equations for each of the following reactions that might produce a precipitate. Use *NR* to indicate that no reaction occurs.

- 39. Challenge** When aqueous solutions of sodium carbonate and manganese(V) chloride are mixed, a precipitate forms. The precipitate is a compound containing manganese.

7. Which of the following is the complete ionic equation of the reaction between hydroiodic acid and aqueous lithium sulfide?

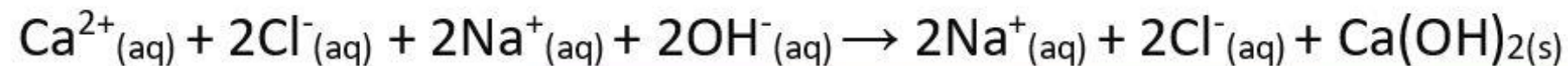
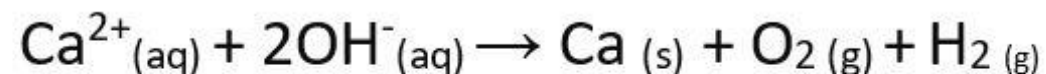
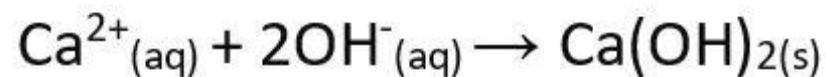
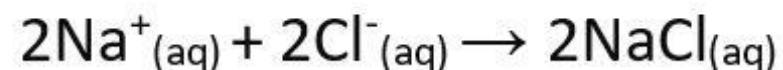


8. Which of the following is the net ionic equation of this reaction?



What is the **net ionic equation** for the following reaction?

ما المعادلة الأيونية الصّرفة للتفاعل التالي؟



An ionic equation that shows all of the particles in a solution as they exist is called

إنّ المعادلة الأيونية التي تُظهر كل الجسيمات في المحلول كما هي تُسمّى

General chemical equation

المعادلة الكيميائية العامة

Complete ionic equation

المعادلة الأيونية كاملة

Spectator ions equation

معادلة الأيونات المتفرجة

Net ionic equation

المعادلة الأيونية الصّرفة

What is the meaning of spectator ions?

بماذا تُعرف الأيونات المُتفرجة؟

Ions that produce gas released from the reaction

الأيونات المكونة للغاز المتصاعد من التفاعل ☐

Ions that produce solid precipitate from the reaction

الأيونات المكونة للمادة الصلبة الراسبة من التفاعل ☐

The total ions in the solution of a reaction

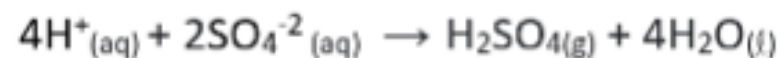
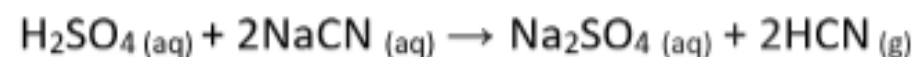
الأيونات الكلية الموجودة في محلول التفاعل ☐

Ions that do not participate in a reaction

الأيونات التي لم تشارك في التفاعل ☐

What is the net ionic equation for the following reaction?

ما المعادلة الأيونية الصّرفة للتفاعل التالي؟



13	يُوضح المقصود بالنسبة المئوية لتركيب المركب	نص الكتاب - مثال 10 وتطبيقات	209 ,210 ,211, 212
	Explain what is meant by the percentage composition of the compound	Text book,Example 10, Applications	

Calculating Percent Composition Sodium hydrogen carbonate (NaHCO_3), also called baking soda, is an active ingredient in some antacids used for the relief of indigestion. Determine the percent composition of NaHCO_3 .

54. What is the percent composition of phosphoric acid (H_3PO_4)?

55. Which has the larger percent by mass of sulfur, H_2SO_3 or $\text{H}_2\text{S}_2\text{O}_8$? _____

56. Calcium chloride (CaCl_2) is sometimes used as a de-icer. Calculate the percent by mass of each element in CaCl_2 .

57. Challenge Sodium sulfate is used in the manufacture of detergents.

- a. Identify each of the component elements of sodium sulfate, and write the compound's chemical formula.
- b. Identify the compound as ionic or covalent.
- c. Calculate the percent by mass of each element in sodium sulfate.

17. Which is the percent composition of bromine in the compound NaBr?
(molar mass of Br= 80.0 g/mol , Na= 23.0 g/mol)

A. 81.6%

B. 79.9%

C. 84.1%

D. 77.7%

What is the percent by mass of sodium (Na) in sodium sulfate (Na_2SO_4)?

ما النسبة المئوية بحسب كتلة عنصر الصوديوم في كبريتات الصوديوم (Na_2SO_4)؟

Molar mass:
 $\text{Na} = 23 \text{ g/mol}$
 $\text{Na}_2\text{SO}_4 = 119 \text{ g/mol}$

الكتلة المولية:
 $23 \text{ g/mol} = \text{Na}$
 $119 \text{ g/mol} = \text{Na}_2\text{SO}_4$

- | | |
|-------|-----------------------|
| 19.3% | <input type="radio"/> |
| 77.3% | <input type="radio"/> |
| 38.7% | <input type="radio"/> |
| 23.1% | <input type="radio"/> |

In the caffeine molecule ($C_8H_{10}N_4O_2$), what is the percent by mass of carbon (C)?

Molar mass:

$C = 12 \text{ g/mol}$

$C_8H_{10}N_4O_2 = 194 \text{ g/mol}$

في جزيء الكافيين ($C_8H_{10}N_4O_2$)، ما النسبة المئوية بحسب كتلة عنصر الكربون (C)؟

الكتلة المولية:

$12 \text{ g/mol} = C$

$194 \text{ g/mol} = C_8H_{10}N_4O_2$

24.74%



49.48%



12.37%



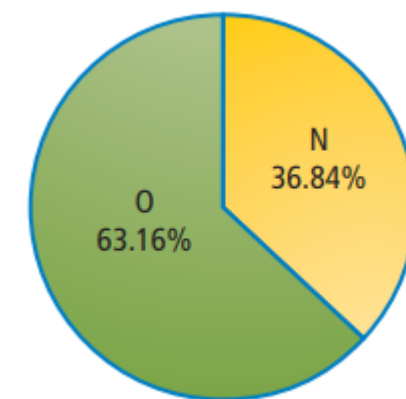
6.19%



14	يُحدد الصيغ الأولية والجزيئية لمركب ما من النسبة المئوية للكتلة وبيانات الكتلة الفعلية	نص الكتاب - مثال 11 وتطبيقات	212 ,213 ,214
	Determin of the empirical and molecular formulas for a compound from mass percent and	Text book,Example 11, Applications	

Empirical Formula from Percent Composition Methyl acetate is a solvent commonly used in some paints, inks, and adhesives. Determine the empirical formula for methyl acetate, which has the following chemical analysis: 48.64% carbon, 8.16% hydrogen, and 43.20% oxygen.

58. The circle graph at the right gives the percent composition for a blue solid. What is the empirical formula for this solid?



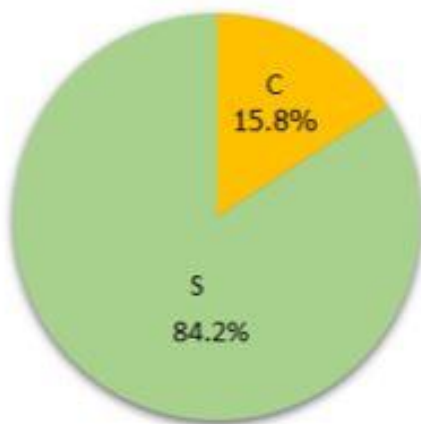
59. Determine the empirical formula for a compound that contains 35.98% aluminum and 64.02% sulfur.

60. Propane is a hydrocarbon, a compound composed only of carbon and hydrogen. It is 81.82% carbon and 18.18% hydrogen. What is the empirical formula?

61. Challenge Aspirin is the world's most-often used medication. The chemical analysis of aspirin indicates that the molecule is 60.00% carbon, 4.44% hydrogen, and 35.56% oxygen. Determine the empirical formula for aspirin.

What is the empirical formula for a compound with the following percent compositions shown in the pie chart below?

ما الصيغة الأولية لمركب يحتوي على النسب الواردة في التمثيل البياني الدائري أدناه؟



Molar Mass:
C = 12 g/mol
S = 32 g/mol

الكتلة المولية:
12 g/mol = C
32 g/mol = S

CS

☐

C₂S

☐

CS₃

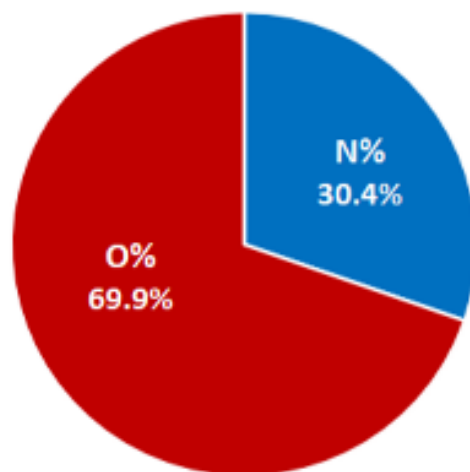
☐

CS₂

☐

What is the empirical formula for a compound with the following percent compositions shown in the pie chart below?

ما الصيغة الأولية لمركب يحتوي على النسب الواردة في التمثيل البياني الدائري أدناه؟



Molar mass:

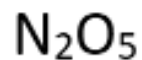
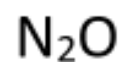
N = 14 g/mol

O = 16 g/mol

الكتلة المولية:

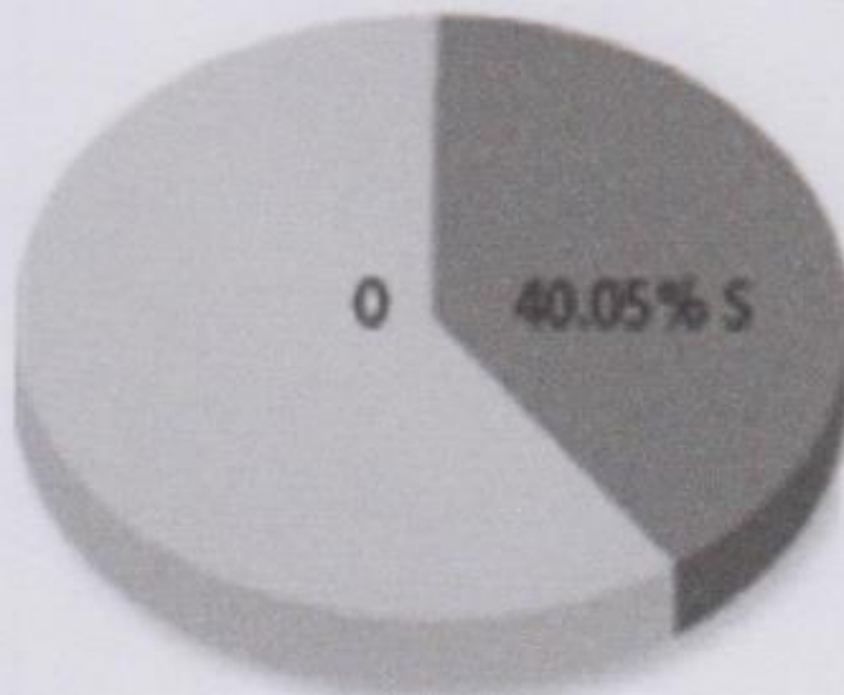
14 g/mol = N

16 g/mol = O



20. What is the empirical formula for the substance whose percent composition is shown? (molar mass of S= 32.07 g/mol , O= 16.00 g/mol)

- A. SO_3
- B. SO
- C. S_2O_6
- D. S_3O



15	يتعرف العلاقات التي يمكن اشتقاقها من معادلة كيميائية متوازنة	مثال 1 وتطبيقات	238 ,239
	Identy the relationships can be derived from a balanced chemical equation	Example1 , Applications	

Interpreting Chemical Equations The combustion of propane (C_3H_8) provides energy for heating homes, cooking food, and soldering metal parts. Interpret the equation for the combustion of propane in terms of representative particles, moles, and mass. Show that the law of conservation of mass is observed.

1. Interpret the following balanced chemical equations in terms of particles, moles, and mass. Show that the law of conservation of mass is observed.



2. Challenge For each of the following, balance the chemical equation; interpret the equation in terms of particles, moles, and mass; and show that the law of conservation of mass is observed.



3. Determine all possible mole ratios for the following balanced chemical equations.



4. Challenge Balance the following equations, and determine the possible mole ratios.



في المعادلة أدناه،

أي النسب المولية التالية **ليست** صحيحة؟

In the equation below,

Which of the following mole ratio is **NOT** correct?



$$\frac{3 \text{ mol } C}{2 \text{ mol } B}$$

☐

$$\frac{2 \text{ mol } C}{3 \text{ mol } B}$$

☐

$$\frac{4 \text{ mol } A}{2 \text{ mol } C}$$

☐

$$\frac{4 \text{ mol } A}{3 \text{ mol } B}$$

☐

17	يُطبق خطوات الحسابات الكيميائية	نص الكتاب ومثال 2 و 3 والتطبيقات	241 ,242 ,243 ,244
	Apply the steps to solve stoichiometric problems	Text book,Example 2,3 , Applications	

Mole-to-Mole Stoichiometry One disadvantage of burning propane (C_3H_8) is that carbon dioxide (CO_2) is one of the products. The released carbon dioxide increases the concentration of CO_2 in the atmosphere. How many moles of CO_2 is produced when 10.0 mol of C_3H_8 is burned in excess oxygen in a gas grill?

- 11.** Methane and sulfur react to produce carbon disulfide (CS_2), a liquid often used in the production of cellophane.



- a.** Balance the equation.
- b.** Calculate the moles of CS_2 produced when 1.50 mol S_8 is used.
- c.** How many moles of H_2S is produced?

12. Challenge Sulfuric acid (H_2SO_4) is formed when sulfur dioxide (SO_2) reacts with oxygen and water.

- a. Write the balanced chemical equation for the reaction.
- b. How many moles of H_2SO_4 is produced from 12.5 moles of SO_2 ?
- c. How many moles of O_2 are needed?

Mole-to-Mass Stoichiometry Determine the mass of sodium chloride (NaCl), commonly called table salt, produced when 1.25 mol of chlorine gas (Cl_2) reacts vigorously with excess sodium.

14. Challenge Titanium is a transition metal used in many alloys because it is extremely strong and lightweight. Titanium tetrachloride (TiCl_4) is extracted from titanium oxide (TiO_2) using chlorine and coke (carbon).

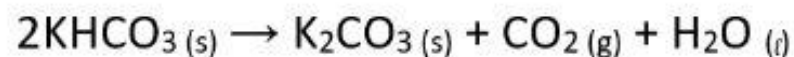


- a. What mass of Cl_2 gas is needed to react with 1.25 mol of TiO_2 ?
- b. What mass of C is needed to react with 1.25 mol of TiO_2 ?
- c. What is the mass of all of the products formed by reaction with 1.25 mol of TiO_2 ?

كم مولاً ينتج من ثاني أكسيد الكربون CO_2 إذا تفكك

100.0 g من كربونات البوتاسيوم الهيدروجينية KHCO_3 ؟

How many moles of carbon dioxide CO_2 will be produced if 100.0 g of potassium hydrogen carbonate KHCO_3 have decomposed?



(الكتلة المولية $\text{KHCO}_3 = 100 \text{ g/mol}$)

(Molar Mass of $\text{KHCO}_3 = 100 \text{ g/mol}$)

0.5 mol

☐

1 mol

☐

0.25 mol

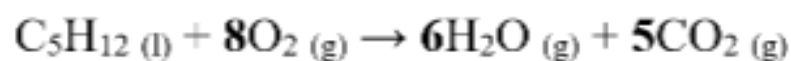
☐

2 mol

☐

In the following equation, which mole ratio to be used to convert from moles of O_2 to moles of CO_2 ?

في المعادلة التالية، ما المُعامل المُستخدم للتحويل من عدد مولات O_2 إلى عدد مولات CO_2 ؟



$$\frac{5 \text{ mol O}_2}{1 \text{ mol CO}_2}$$

$$\frac{5 \text{ mol CO}_2}{8 \text{ mol O}_2}$$

$$\frac{8 \text{ mol O}_2}{6 \text{ mol CO}_2}$$

$$\frac{5 \text{ mol CO}_2}{6 \text{ mol O}_2}$$

18	يُطبق خطوات الحسابات الكيميائية	مثال 4 وتطبيقات	245
	Apply the steps to solve stoichiometric problems	Example 4 , Applications	

Mass-to-Mass Stoichiometry Ammonium nitrate (NH_4NO_3), an important fertilizer, produces dinitrogen oxide (N_2O) gas and H_2O when it decomposes. Determine the mass of H_2O produced from the decomposition of 25.0 g of solid NH_4NO_3 .

One of the reactions used to inflate automobile air bags involves sodium azide (NaN_3). What is the **mass** of N_2 produced from the decomposition of 195 g of NaN_3 ?

أحد التفاعلات المستخدمة لنفخ الأكياس الهوائية في السيارات يتضمن أزيد الصوديوم (NaN_3).

ماهي كتلة N_2 الناتجة عن تفكك 195 g من NaN_3 ؟



Molar mass:
 $\text{NaN}_3 = 65 \text{ g/mol}$
 $\text{N}_2 = 28 \text{ g/mol}$

كتلة مولية:
 $65 \text{ g/mol} = \text{NaN}_3$
 $28 \text{ g/mol} = \text{N}_2$

56.0 g

112.0 g

126.0 g

25.0 g

Determining the Limiting Reactant The reaction between solid white phosphorus (P_4) and oxygen produces solid tetraphosphorus decoxide (P_4O_{10}). This compound is often called diphosphorus pentoxide because its empirical formula is P_2O_5 .

- a. Determine the mass of P_4O_{10} formed if 25.0 g of P_4 and 50.0 g of oxygen are combined.
- b. How much of the excess reactant remains after the reaction stops?

23. The reaction between solid sodium and iron(III) oxide is one in a series of reactions that inflates an automobile airbag: $6\text{Na(s)} + \text{Fe}_2\text{O}_3\text{(s)} \rightarrow 3\text{Na}_2\text{O(s)} + 2\text{Fe(s)}$. If 100.0 g of Na and 100.0 g of Fe_2O_3 are used in this reaction, determine the following.

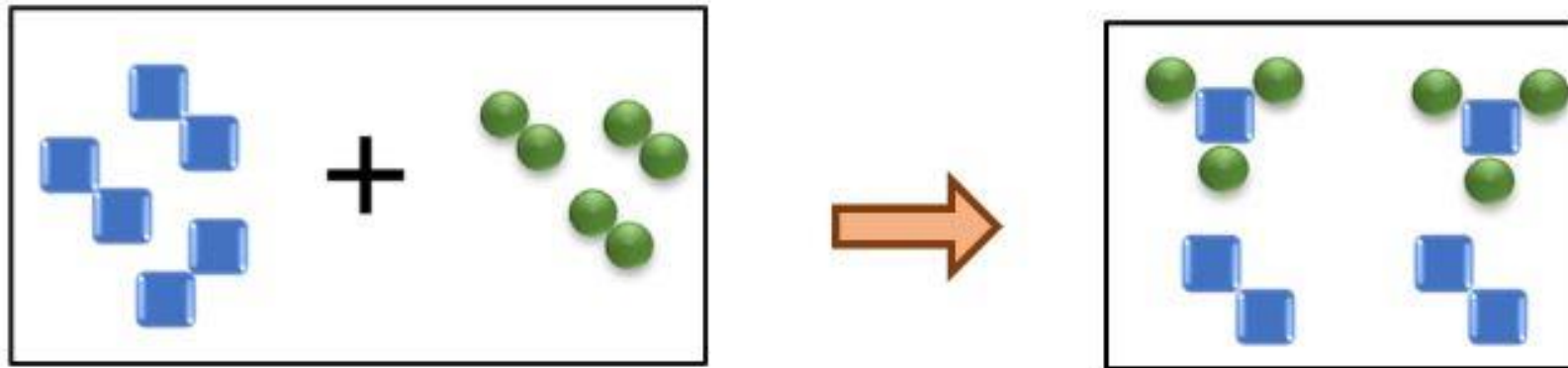
- a.** limiting reactant
- b.** reactant in excess
- c.** mass of solid iron produced
- d.** mass of excess reactant that remains after the reaction is complete

24. Challenge Photosynthesis reactions in green plants use carbon dioxide and water to produce glucose ($\text{C}_6\text{H}_{12}\text{O}_6$) and oxygen. A plant has 88.0 g of carbon dioxide and 64.0 g of water available for photosynthesis.

- a. Write the balanced chemical equation for the reaction.
- b. Determine the limiting reactant.
- c. Determine the excess reactant.
- d. Determine the mass in excess.
- e. Determine the mass of glucose produced.

blue squares represent element X,
green circles represent element Y.
Which of the following is correct?

المربعات الزرقاء تمثل العنصر X،
والدوائر الخضراء تمثل العنصر Y.
أي مما يلي صحيح؟



Limiting reactant is X_2

المتفاعل المحدد هو X_2



Limiting reactant is Y_2

المتفاعل المحدد هو Y_2



X_2 is consumed first in the reaction

يتم استهلاك X_2 أولاً في التفاعل



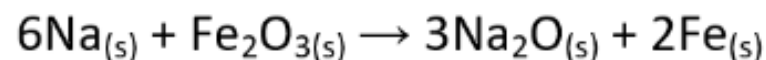
At the end of the reaction an amount
of Y_2 is leftover unreacted

في نهاية التفاعل تبقى كمية
من Y_2 غير متفاعلة



In the following reaction, if we use 100 g of sodium Na and 100 g of iron (III) oxide (Fe₂O₃), what is the limiting reactant?

في التفاعل التالي، إذا استخدمنا 100 g من الصوديوم Na و 100 g من أكسيد الحديد (III) Fe₂O₃، ما المتفاعل المحدد؟



Molar Mass:

Na = 23 g/mol

Fe₂O₃ = 160 g/mol

الكتلة المولية:

23 g/mol = Na

160 g/mol = Fe₂O₃

Na

☐

Fe

☐

Fe₂O₃

☐

Na₂O

☐

20	يحسب المردود النظري للتفاعل الكيميائي	نص الكتاب - ومثال 6 وتطبيقات	253,254,255
	Calculate of the theortical yield of a chemical reaction	Text book,Example 6, , Applications	

Percent Yield Solid silver chromate (Ag_2CrO_4) forms when potassium chromate (K_2CrO_4) is added to a solution containing 0.500 g of silver nitrate (AgNO_3). Determine the theoretical yield of Ag_2CrO_4 . Calculate the percent yield if the reaction yields 0.455 g of Ag_2CrO_4 .

- 28.** Aluminum hydroxide ($\text{Al}(\text{OH})_3$) is often present in antacids to neutralize stomach acid (HCl). The reaction occurs as follows:
 $\text{Al}(\text{OH})_3(\text{s}) + 3\text{HCl}(\text{aq}) \rightarrow \text{AlCl}_3(\text{aq}) + 3\text{H}_2\text{O}(\text{l})$. If 14.0 g of $\text{Al}(\text{OH})_3$ is present in an antacid tablet, determine the theoretical yield of AlCl_3 produced when the tablet reacts with HCl .

29. Zinc reacts with iodine in a synthesis reaction: $\text{Zn} + \text{I}_2 \rightarrow \text{ZnI}_2$.

a. Determine the theoretical yield if 1.912 mol of zinc is used.

b. Determine the percent yield if 515.6 g of product is recovered.

30. Challenge When copper wire is placed into a silver nitrate solution (AgNO_3), silver crystals and copper(II) nitrate ($\text{Cu}(\text{NO}_3)_2$) solution form.

- a.** Write the balanced chemical equation for the reaction.
- b.** If a 20.0-g sample of copper is used, determine the theoretical yield of silver.
- c.** If 60.0 g of silver is recovered from the reaction, determine the percent yield of the reaction.

- Red mercury(II) oxide decomposes at high temperatures to form mercury metal and oxygen gas.



If 3.55 mol of HgO decomposes to form 1.54 mol of O₂ and 618 g of Hg, what is the percent yield of this reaction?

- A. 13.2%
- B. 42.5%
- C. 56.6%
- D. 86.8%