

ملزمة الهيكل EOT مراجعة نهائية



تم تحميل هذا الملف من موقع المناهج الإماراتية

موقع المناهج ← المناهج الإماراتية ← الصف العاشر المتقدم ← كيمياء ← الفصل الثالث ← ملفات متنوعة ← الملف

تاريخ إضافة الملف على موقع المناهج: 15:25:54 2026-06-17

ملفات اكتب للمعلم اكتب للطالب | اختبارات الكترونية | اختبارات | حلول | عروض بوربوينت | أوراق عمل
منهج انجليزي | ملخصات وتقارير | مذكرات وبنوك | الامتحان النهائي | للمدرس

المزيد من مادة
كيمياء:

إعداد: Waswas Issa

التواصل الاجتماعي بحسب الصف العاشر المتقدم



صفحة المناهج
الإماراتية على
فيسبوك

الرياضيات

اللغة الانجليزية

اللغة العربية

التربية الاسلامية

المواد على تلغرام

المزيد من الملفات بحسب الصف العاشر المتقدم والمادة كيمياء في الفصل الثالث

مراجعة هيكل الامتحان كراسة تدريبية

1

ملخص حالات المادة

2

مقررات الكيمياء: الدروس المحذوفة 2026

3

مراجعة نهاية الفصل EoT3 انسباير

4

العوامل المؤثرة في الذوبان وذائبية الغازات

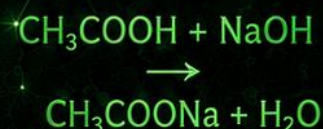
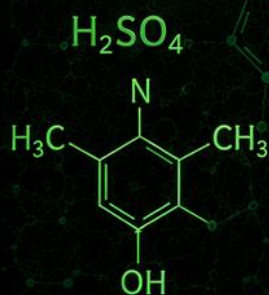
5

طريقك نحو التفوق

ملزمة الهيكل

EOT

مراجعة نهائية



Grade 10 ADV
CHEMISTRY
TERM 3

2025 - 2026



CHEMISTRY
MOLECULES
EQUATIONS



FOCUSED
REVISION



SIMPLIFIED
EXPLANATION



COMPREHENSIVE
QUESTIONS



HIGHER
LEVEL

Mr. Issa Waswas

1	Define stoichiometry	Textbook	209
2	Interpret a balanced chemical equation in terms of moles, mass, and representative particles (atoms, molecules, and formula units)	Textbook + Example problem 1+ Table 1+ Practice Problems	210 211 212

Stoichiometry

is the study of the **quantitative relationships** between the **amounts of reactants and products** in a chemical reaction.

helps determine **how much reactant is needed** or **how much product will be formed**.

depends on the **law of conservation of mass**.

Law of Conservation of Mass

States that matter is **neither created nor destroyed** in a chemical reaction.

The total **mass of reactants** = total **mass of products**.

The number of each atom before and after the reaction **stays the same**.

Table 1 Relationships Derived from a Balanced Chemical Equation

4Fe(s)	+	3O ₂ (g)	→	2Fe ₂ O ₃ (s)
Iron	+	oxygen	→	iron (III) oxide
4 atoms of Fe	+	3 molecules O ₂	→	2 formula units of Fe ₂ O ₃
4 mol Fe	+	3 mol O ₂	→	2 mol Fe ₂ O ₃
223.4 g Fe	+	96.00 g O ₂	→	319.4 g Fe ₂ O ₃
319.4 g reactants			→	319.4 g products

Type of substance	Representative particle	Examples
Element (Single atom)	Atoms	Fe and He
Molecular elements & covalent compounds (NM+NM)	Molecules	O ₂ , H ₂ O, and CO ₂
Ionic compounds (usually M+NM)	Formula units	NaCl and Fe ₂ O ₃

The study of the quantitative relationships between the amounts of reactants used and the amounts of products formed in a chemical reaction is called:

- A) Thermochemistry
- B) Stoichiometry
- C) Electrochemistry
- D) Atomic theory

Stoichiometry is based on the law of conservation of _____.

- A) Charge
- B) Volume
- C) Reactants
- D) Mass

In a balanced chemical equation, the numbers of individual particles and the numbers of moles of particles are represented by the _____.

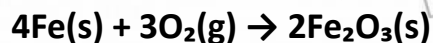
- A) Chemical symbols
- B) Coefficients
- C) Subscripts
- D) Molar masses



What is the first step you must take to solve a stoichiometric problem?

- A) Write a balanced chemical equation
- B) Find the limiting reactant
- C) Find the excess reactant
- D) Convert given amounts of each substance to moles

What is the total mass of the products in the following balanced chemical equation?



Element	Molar mass
Fe	55.85 g/mol
O	16 g/mol

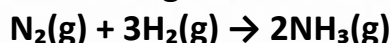
A) 415.6 g

B) 271.4 g

C) 319.4 g

D) 291.5 g

In the reaction below, which of the following statements is correct?



Element	Molar mass
N	14.007 g/mol
H	1.008 g/mol

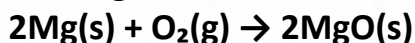
A) The sum of the masses of reactants equals 34.062 g

B) The sum of the masses of products equals 28.014 g

C) The sum of the masses of reactants is smaller than the sum of the masses of products

D) A decrease in mass takes place during the reaction

What do the coefficients in the following balanced chemical equation represent?



Statement	Meaning
I	Number of moles
II	Number of representative particles
III	Ratio between reactants and products

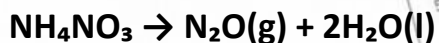
A) I only

B) II only

C) I and II

D) I, II, and III

What is the total mass of the products in the following balanced chemical equation?



Element	Molar mass
N	14 g/mol
O	16 g/mol
H	1 g/mol

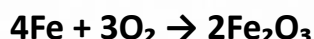
A) 45 g

B) 114 g

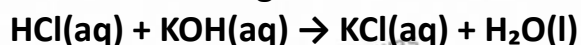
C) 80 g

D) 58 g

Which statement correctly describes the relationship represented by the following balanced chemical equation?

A) 4 iron atoms + 3 oxygen atoms $\rightarrow$ 2 formula units of Fe_2O_3 B) 4 iron atoms + 2 oxygen molecules $\rightarrow$ 3 formula units of Fe_2O_3 C) 4 iron atoms + 3 oxygen molecules $\rightarrow$ 2 formula units of Fe_2O_3 D) 2 iron atoms + 3 oxygen molecules $\rightarrow$ 2 formula units of Fe_2O_3

In the reaction below, which of the following statements is correct?



Element	Molar mass
H	1.008 g/mol
K	39.00 g/mol
Cl	35.45 g/mol
O	16 g/mol

A) The sum of the masses of reactants equals 92.466 g

B) The sum of the masses of products equals 74.589 g

C) The sum of the masses of reactants is smaller than the sum of the masses of products

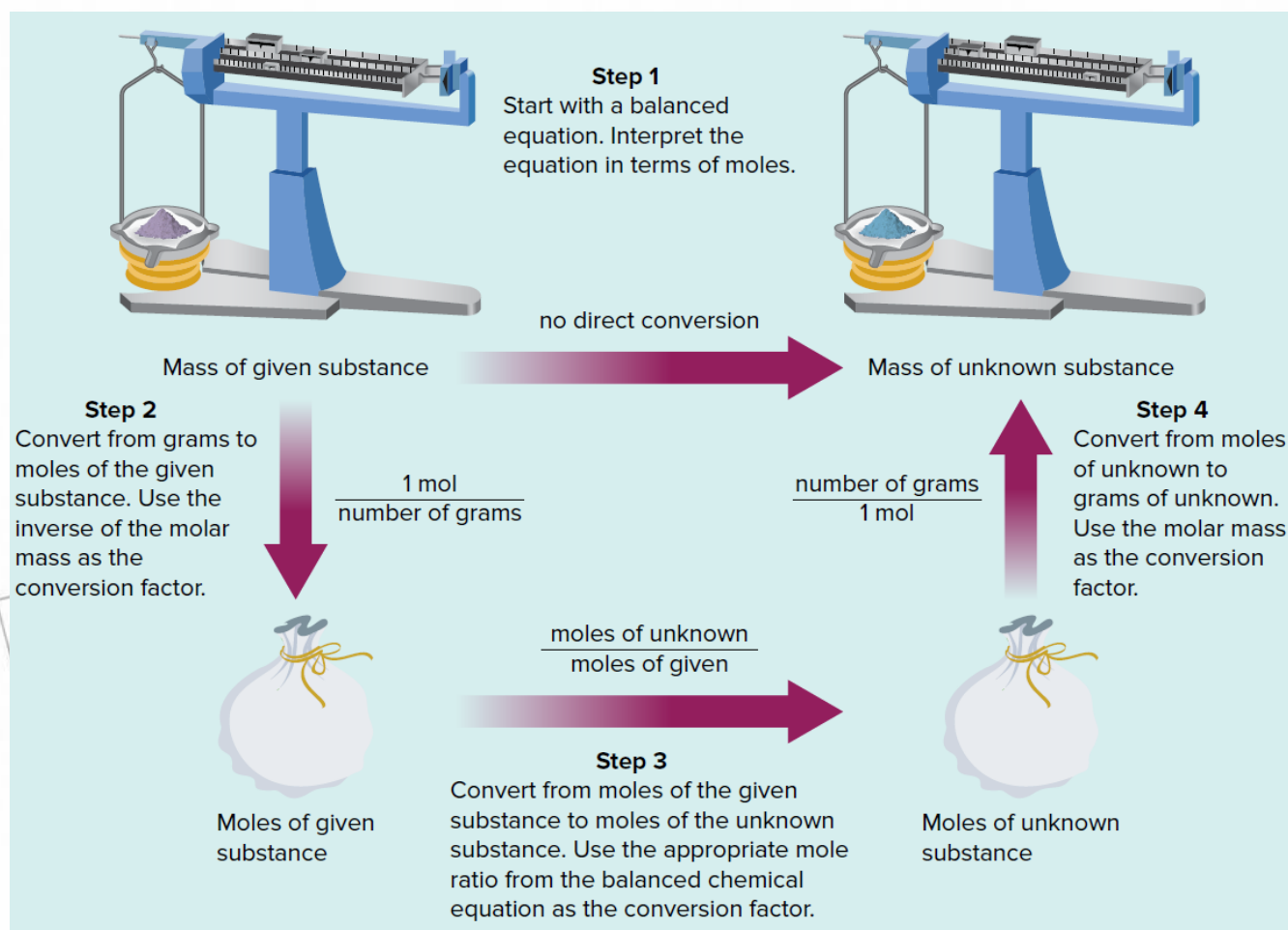
D) A decrease in mass takes place during the reaction

4

List the steps included in stoichiometric calculations

Textbook + Problem-Solving Strategy

216



Conversion	From → To	Conversion factor
Moles → Moles	Moles of given → Moles of unknown	$\frac{\text{moles of unknown}}{\text{moles of given}}$
Moles → Mass	Moles of unknown → Mass of unknown	$\frac{\text{number of grams}}{1 \text{ mol}}$
Mass → Moles	Mass of given → Moles of given	$\frac{1 \text{ mol}}{\text{number of grams}}$
Mass → Mass	Mass of given → Mass of unknown	No direct conversion: Mass → Moles → Moles → Mass

What is the correct conversion factor for converting moles of a given substance to moles of an unknown substance?



Moles of a known substance



Moles of an unknown substance

- A) $\frac{1 \text{ mol}}{\text{number of grams}}$ B) $\frac{\text{number of grams}}{1 \text{ mol}}$ C) $\frac{\text{moles of unknown}}{\text{moles of given}}$ D) No direct conversion

What is the correct conversion factor for converting moles of a substance to mass (grams)?



Moles of an unknown substance



Mass of an unknown substance

- A) $\frac{1 \text{ mol}}{\text{number of grams}}$ B) $\frac{\text{number of grams}}{1 \text{ mol}}$ C) $\frac{\text{moles of unknown}}{\text{moles of given}}$ D) No direct conversion

What is the correct conversion factor for converting mass (grams) of a substance to moles?



Mass of a known substance



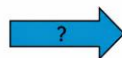
Moles of same substance

- A) $\frac{1 \text{ mol}}{\text{number of grams}}$ B) $\frac{\text{number of grams}}{1 \text{ mol}}$ C) $\frac{\text{moles of unknown}}{\text{moles of given}}$ D) No direct conversion

What is the correct conversion factor for converting mass (grams) of a substance to mass?



Mass of a known substance



Mass of an unknown substance

- A) $\frac{1 \text{ mol}}{\text{number of grams}}$ B) $\frac{\text{number of grams}}{1 \text{ mol}}$ C) $\frac{\text{moles of unknown}}{\text{moles of given}}$ D) No direct conversion

3	Calculate the number of moles of a reactant or a product given the number of moles of another reactant or product	Textbook +	215
5	Calculate the mass of a reactant or a product given the number of moles of another reactant or product and vice versa	Example	216
		problems 2,3,	217
		and 4 +	218
6	Calculate the mass of a reactant or a product given the mass of another reactant or product	Practice	219
		Problems	220

المطلوب

Example 1: Mole → Mole

المعروف

Question: How many moles of CS_2 are produced when 1.50 mol S_8 reacts?

Balanced equation: $2\text{CH}_4(\text{g}) + \text{S}_8(\text{s}) \rightarrow 2\text{CS}_2(\text{l}) + 4\text{H}_2\text{S}(\text{g})$ نتأكد إنه المعادلة موزونة

نبدأ دائماً بالرقم المعطى بالسؤال ضرب المطلوب فوق والمعروف تحت (الأرقام من المعادلة الموزونة)

Answer: $1.5 \text{ mole } \text{S}_8 \times \frac{2 \text{ mol } \text{CS}_2}{1 \text{ mol } \text{S}_8} = 3 \text{ mol } \text{CS}_2$

المطلوب (كتلة)

Example 2: Mole → Mass

المعروف

Question: How many grams of Cl_2 are produced from 2.50 mol NaCl ?

Balanced equation: $2\text{NaCl} \rightarrow 2\text{Na} + \text{Cl}_2$ نتأكد إنه المعادلة موزونة

نبدأ دائماً بالرقم المعطى بالسؤال ضرب المطلوب فوق والمعروف تحت ونستعين بالكتلة المولية

Answer: $2.5 \text{ mole } \text{NaCl} \times \frac{1 \text{ mol } \text{Cl}_2}{2 \text{ mol } \text{NaCl}} \times \frac{70.9 \text{ g } \text{Cl}_2}{1 \text{ mol } \text{Cl}_2} = 88.6 \text{ g } \text{Cl}_2$

Element	Molar mass
Cl_2	70.9 g/mol

المطلوب (كتلة)

Example 3: Mass → Mass

المعروف (كتلة)

Question: What mass of N_2 is produced from 100.0 g NaN_3 ?

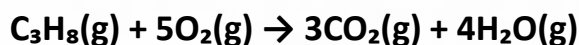
Balanced equation: $2\text{NaN}_3 \rightarrow 2\text{Na} + 3\text{N}_2$ نتأكد إنه المعادلة موزونة

نبدأ دائماً بالرقم المعطى بالسؤال ضرب المطلوب فوق والمعروف تحت ونستعين بالكتلة المولية

Answer: $100 \text{ g } \text{NaN}_3 \times \frac{1 \text{ mol } \text{NaN}_3}{65 \text{ g } \text{NaN}_3} \times \frac{3 \text{ mol } \text{N}_2}{2 \text{ mol } \text{NaN}_3} \times \frac{28 \text{ g } \text{N}_2}{1 \text{ mol } \text{N}_2} = 64.6 \text{ g } \text{N}_2$

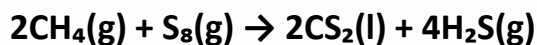
Element	Molar mass
N_2	28 g/mol
NaN_3	65 g/mol

How many moles of CO_2 are produced when 5 mol of C_3H_8 reacts?



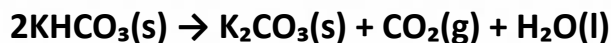
- A) 15 mol
- B) 3 mol
- C) 30 mol
- D) 5 mol

How many moles of H_2S are produced when 1.50 mol S_8 reacts?



- A) 8 mol
- B) 4 mol
- C) 2 mol
- D) 6 mol

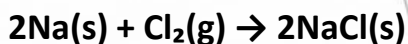
How many moles of CO_2 are produced when 100.0 g of KHCO_3 decomposes?



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

- A) 0.5 mol
- B) 1 mol
- C) 0.25 mol
- D) 2 mol

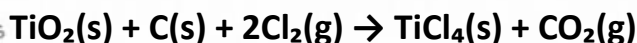
How many moles of NaCl are produced when 146 g of Cl₂ reacts?



(Molar mass of Cl₂ = 70.9 g/mol)

- A) 1.03 mol
- B) 2.06 mol
- C) 4.12 mol
- D) 8.24 mol

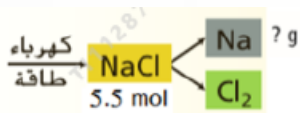
Titanium tetrachloride (TiCl₄) is extracted from titanium oxide (TiO₂) using chlorine and coke (carbon). What mass of Cl₂ gas is needed to react with 3.75 mol of TiO₂?



(Molar mass of Cl₂ = 70.9 g/mol)

- A) 532 g
- B) 473 g
- C) 358 g
- D) 266 g

Sodium chloride is decomposed into the elements sodium and chlorine by means of electrical energy. How much sodium, in grams, is obtained from the process diagrammed ?



Substance	Molar mass
Na	23.0 g/mol
NaCl	58.45 g/mol

- A) 127 g
- B) 390 g
- C) 321 g
- D) 254 g

What is the mass of carbon dioxide CO_2 produced from the reaction of 250 g of calcium carbonate CaCO_3 ?



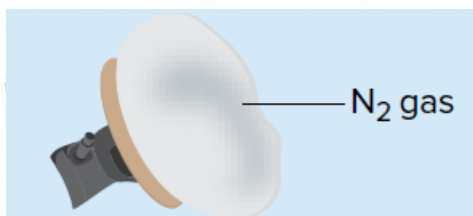
Substance	Molar mass
CaCO_3	100 g/mol
CO_2	44 g/mol

- A) 31.5 g
B) 388 g
C) 110 g
D) 77.0 g

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 ?



Substance	Molar mass
NaN_3	65 g/mol
N_2	28 g/mol



- A) 56.0 g
B) 112.0 g
C) 126.0 g
D) 25.0 g

7

Identify **limiting reactant** and **excess reactant** in a chemical reaction given the particulate **diagram** of reactants

Textbook +
Figure 5

221
222

Limiting reactant
(بيخلص أول)

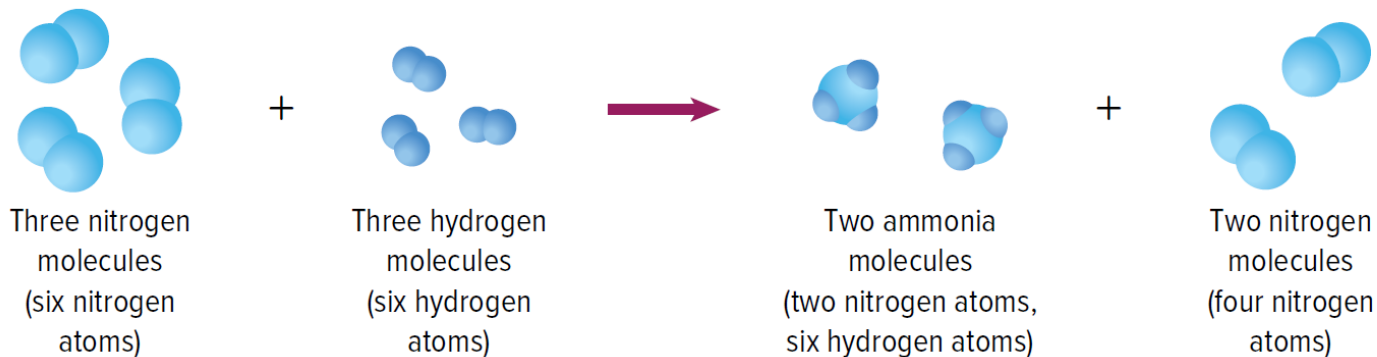
The reactant that is **completely used up first** in a chemical reaction. It **limits** the amount of product that can form.

Excess reactant
(فائض)

The reactant that **remains after the reaction stops** because it was not completely used up.

Before Reaction

After Reaction



Before reaction:

3 nitrogen molecules
(3N_2)

3 hydrogen molecules
(3H_2)

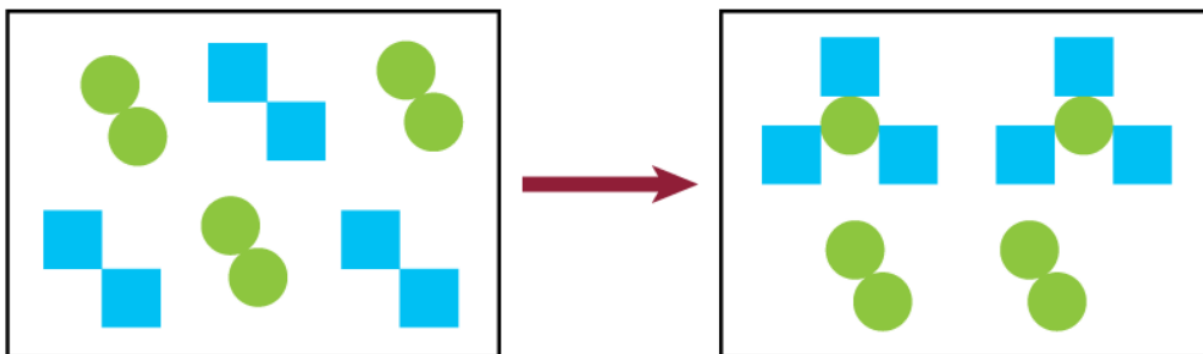
After reaction:

2 Ammonia molecules
(2NH_3)

2 Nitrogen molecules
(2N_2)

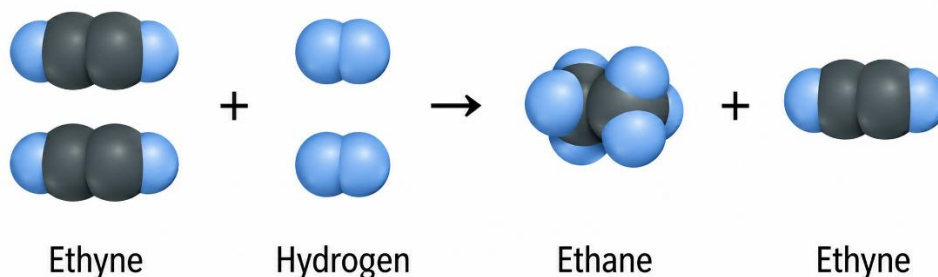
✓ Limiting reactant = H_2 ✓ Excess reactant = N_2

Blue squares represent element X. Green circles represent element Y. Which of the following is correct?



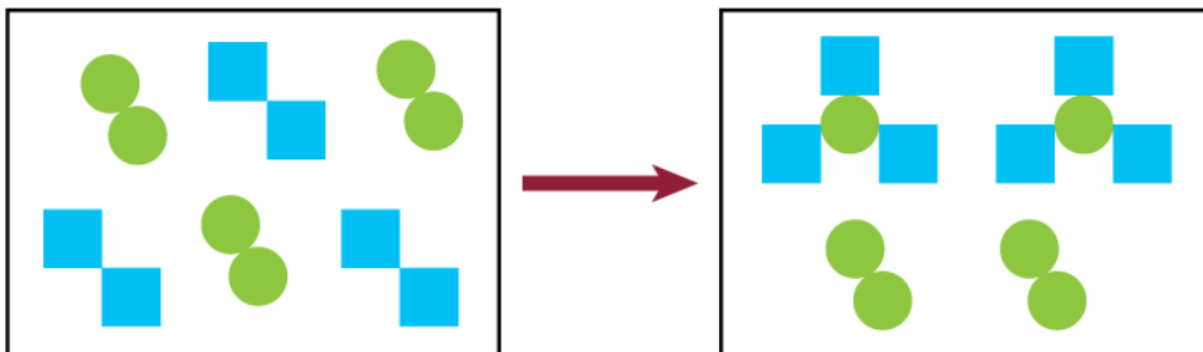
- A) Limiting reactant is X_2
 B) Limiting reactant is Y_2
 C) X_2 is consumed last in the reaction
 D) At the end of the reaction an amount of X_2 is leftover unreacted

What is the limiting reactant in the figure shown below?



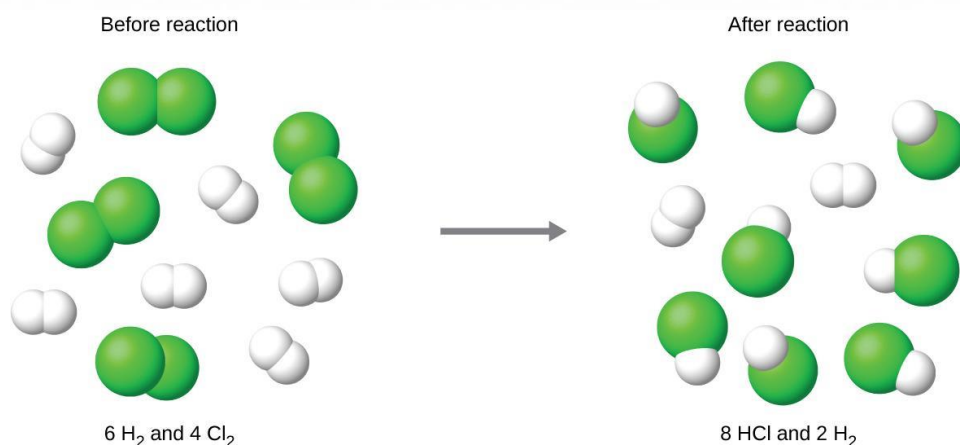
- A) Ethane molecules
 B) No limiting reactant
 C) Hydrogen molecules
 D) Ethyne molecules

Blue squares represent element X. Green circles represent element Y. Which of the following is wrong?



- A) Limiting reactant is X_2
- B) Excess reactant is Y_2
- C) X_2 is consumed last in the reaction
- D) At the end of the reaction an amount of Y_2 is leftover unreacted

The diagram represents the reaction between hydrogen gas (H_2) and chlorine gas (Cl_2). Which substance is the excess reactant?



- A) H_2
- B) Cl_2
- C) HCl
- D) No excess reactant

8	Identify limiting reactant and excess reactant in a chemical reaction given the number of moles of reactants	Textbook +	222
9	Identify limiting reactant and excess reactant in a chemical reaction given the mass of reactants	Example	223
		problem 5 +	224
10	Calculate the mass of product(s) produced in a chemical reaction given a particulate diagram, mass or mole of the reactants	Practice Problems	225

طريقة حل الأسئلة حسب المطلوب

1. نتأكد إنه المعادلة موزونة
2. نحسب عدد مولات كل متفاعل، ثم نقسم عدد المولات على المعامل الموجود يساره في المعادلة.
3. العامل المحدد هو الذي يعطي أقل قيمة.
4. إذا كان السؤال يطلب مولات أو كتلة أحد النواتج نستخدم العامل المحدد فقط ونتبع طريقة المطلوب والمعروف.
5. إذا كان السؤال يطلب كمية الفائض المتبقية، نستخدم العامل المحدد لحساب كمية الفائض التي تم استهلاكها، ثم نطرحها من كمية الفائض الموجودة قبل التفاعل.

1. Make sure that the **chemical equation is balanced**.
2. Calculate the **number of moles for each reactant**, then divide the moles by the **coefficient in the balanced equation**.
The reactant with the **smallest value is the limiting reactant**.
3. If the question asks for the **moles or mass of a product**, use the **limiting reactant** and follow the given → required method.
4. If the question asks for the **amount of excess reactant remaining**, use the limiting reactant to calculate the amount of excess reactant consumed, then subtract it from the original amount of excess reactant.

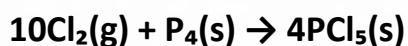
Sodium (Na) and iron(III) oxide (Fe_2O_3) react according to the following balanced chemical equation:



If **4.35 mol of Na** and **0.63 mol of Fe_2O_3** are used in the reaction, which of the following is the limiting reactant?

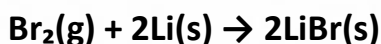
- A) Fe_2O_3
- B) Na
- C) Na_2O
- D) Fe

Chlorine gas (Cl_2) reacts with phosphorus (P_4) to form phosphorus pentachloride (PCl_5). When **0.226 mol of Cl_2** reacts with **0.185 mol of P_4** , which one is the excess reactant?



- A) Cl_2
- B) P_4
- C) PCl_5
- D) No excess reactant

If **25 g of lithium (Li)** reacts with **25 g of bromine (Br_2)** to produce lithium bromide (LiBr), which one is the limiting reactant?



(Molar mass of Br_2 = 159.8 g/mol, Li = 6.94 g/mol)

- A) Both are limiting
- B) LiBr
- C) Li
- D) Br_2

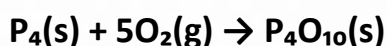
If 88.0 g of carbon dioxide (CO₂) reacts with 64 g of water (H₂O) in the photosynthesis process to produce glucose (C₆H₁₂O₆) and oxygen, which one is the limiting reactant?



(Molar mass of CO₂ = 44.01 g/mol, H₂O = 18.02 g/mol)

- A) CO₂ B) O₂
C) C₆H₁₂O₆ D) H₂O

If 25 g of phosphorus (P₄) reacts with 50 g of oxygen (O₂) to produce phosphorus pentoxide (P₄O₁₀), which one is the excess reactant?

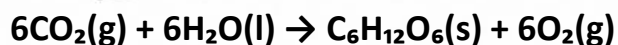


(Molar mass of P₄ = 123.9 g/mol, O₂ = 32 g/mol)

- A) both are excess

- B) O₂
C) P₄
D) P₄O₁₀

Carbon dioxide (CO₂) reacts with water (H₂O) in the photosynthesis reaction in green plants to produce glucose (C₆H₁₂O₆) and oxygen, as shown in the equation below. **A plant has 66 g of CO₂ and 72 g of H₂O. What is the mass of glucose produced?**

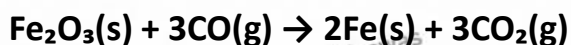


C ₆ H ₁₂ O ₆	180.18 g/mol
CO ₂	44.0 g/mol
H ₂ O	18.02 g/mol

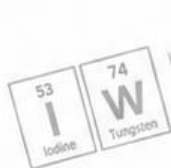
- A) 270.0 g
B) 135 g
C) 90.0 g
D) 45.0 g

Mr. Issa Waswas
@CHEMISTRYIWMr. Issa Waswas
@CHEMISTRYIW

Hematite (Fe_2O_3) and carbon monoxide (CO) react according to the following balanced chemical equation. If 25.0 mol of Fe_2O_3 and 30.0 mol of CO are used in the reaction, How many grams of iron (Fe) is produced?

(Molar mass of Fe = 55.85 g/mol)

- A) 513 g
B) 793 g
C) 1117 g
D) 931 g

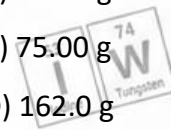
Mr. Issa Waswas
@CHEMISTRYIWMr. Issa Waswas
@CHEMISTRYIW

The reaction between solid sodium and iron(III) oxide is one in a series of reactions that inflates an automobile airbag. If 200.0 g of Na and 200 g of Fe_2O_3 are used in this reaction, what is the mass of solid iron produced?



Substance	Molar mass
Na	23.00 g/mol
Fe	56.00 g/mol
Fe_2O_3	160 g/mol

- A) 81.00 g
B) 140.0 g
C) 75.00 g
D) 162.0 g

Mr. Issa Waswas
@CHEMISTRYIWMr. Issa Waswas
@CHEMISTRYIW

Mr. Issa Waswas
@CHEMISTRYIWMr. Issa Waswas
@CHEMISTRYIW

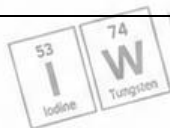
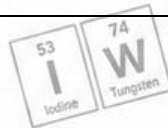
The reaction between solid sodium and iron(III) oxide is one in a series of reactions that inflates an automobile airbag. If **125.0 g of Na** and **125.0 g of Fe₂O₃** are present at the beginning of the reaction, what is the excess mass of the excess reactant?

Mr. Issa Waswas
@CHEMISTRYIW

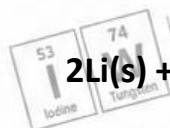
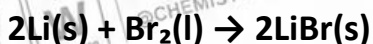
Molar mass of Na = 23.0 g/mol

Molar mass of Fe₂O₃ = 160.0 g/mol

- A) 34.7 g
- B) 25.4 g
- C) 45.3 g
- D) 17.2 g

Mr. Issa Waswas
@CHEMISTRYIWMr. Issa Waswas
@CHEMISTRYIW

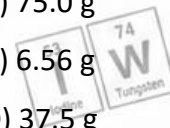
Lithium reacts spontaneously with bromine to produce lithium bromide, as the following balanced equation. If **75.0 g of lithium** and **75.0 g of Bromine** are present at the beginning of the reaction, what is the excess mass of the excess reactant?

Mr. Issa Waswas
@CHEMISTRYIW

Molar mass of Li = 7.00 g/mol

Molar mass of Br₂ = 160.0 g/mol

- A) 68.4 g
- B) 75.0 g
- C) 6.56 g
- D) 37.5 g

Mr. Issa Waswas
@CHEMISTRYIWMr. Issa Waswas
@CHEMISTRYIW

11	Define the percent yield of a chemical reaction	Textbook + Figure 8	
12	Distinguish between theoretical yield and actual yield in stoichiometric calculations	Textbook + Example problem 6 + Practice Problems	227 228 229
13	Calculate the percent yield and theoretical in a chemical reaction		

Theoretical yield
(نحسبها نظرياً)

The **maximum amount of product** that **can be produced** from a given amount of reactant. (Calculated by **Stoichiometry**)

Actual yield
(بالمختبر - عملياً)

The **amount of product produced** when the **experiment** is performed. (Found **in the question**)

Why is the actual yield usually less than the theoretical yield?

- Reactions may **not** go to **completion**.
- Products may **stick to the container**.
- Some product may be **lost during filtration or purification**.
- **Side reactions** may produce other products.
- Some substances may **evaporate**.



Percent yield

- The **ratio** of the **actual yield** to the **theoretical yield** expressed as a percent.
- It measures the **efficiency of the reaction**. Higher percent yield = more efficient reaction.

$$\text{Percent yield} = \frac{\text{Actual yield}}{\text{Theoretical yield}} \times 100$$

Which of the following is **NOT** a reason for the actual yield to be less than the theoretical yield?

- A) Some products may transform completely into energy.
- B) Some product may be lost during the purification process.
- C) Reactants and products might adhere to containers.
- D) Competing reactions might form other products.

Which of the following statements about percent yield is **NOT** correct?

- A) The theoretical yield is the maximum amount of product that can be produced.
- B) The actual yield is the amount of product produced when the experiment is performed.
- C) The actual yield is usually greater than the theoretical yield.
- D) The percent yield is used to measure the efficiency of a reaction.

Percent yield of a product is a measure of a reaction's ____.

- A) Heat production
- B) Spontaneity
- C) Rate
- D) Efficiency

The actual yield of a product is ____.

- A) Independent of the reactants
- B) The same as its theoretical yield
- C) A negative value
- D) Measured experimentally

Which of the following equations correctly represents percent yield?

- A) Percent yield = (Theoretical yield ÷ Actual yield) × 100
- B) Percent yield = (Actual yield ÷ Theoretical yield) × 100
- C) Percent yield = (Actual yield × Theoretical yield) ÷ 100
- D) Percent yield = Theoretical yield – Actual yield

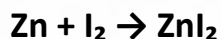
Calcium hydroxide decomposes when heated to calcium oxide and water vapor according to the following equation. If 59.2 g of Ca(OH)_2 is used and 40.32 g of CaO is produced, what is the percent yield?



Molar mass: $\text{Ca(OH)}_2 = 74 \text{ g/mol}$, $\text{CaO} = 56 \text{ g/mol}$

- A) 93.6%
- B) 86.5%
- C) 90.0%
- D) 75.0%

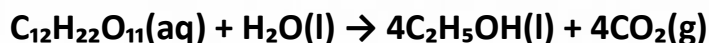
Zinc reacts with iodine according to the following equation. If 3.5 mol of Zn is used, what is the theoretical yield of ZnI_2 ?



(Molar mass of $\text{ZnI}_2 = 319 \text{ g/mol}$)

- A) 1117 g
- B) 2234 g
- C) 889 g
- D) 228 g

Ethanol (C_2H_5OH) is produced from the fermentation of sucrose ($C_{12}H_{22}O_{11}$) in the presence of enzymes. If 684 g of sucrose undergoes fermentation and 349 g of ethanol is obtained, what is the percent yield of ethanol?



A) 84.5%

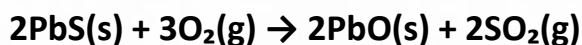
Molar mass: $C_{12}H_{22}O_{11} = 342 \text{ g/mol}$, $C_2H_5OH = 46 \text{ g/mol}$

B) 90.0%

C) 94.8%

D) 105%

Lead(II) oxide is obtained by roasting galena, lead(II) sulfide, in air. If 200.0 g of PbS is heated and 170.0 g of PbO is obtained, what is the percent yield?

Molar mass: $PbS = 239.3 \text{ g/mol}$, $PbO = 223.2 \text{ g/mol}$

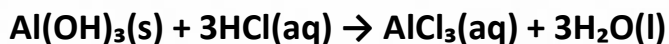
A) 85.0%

B) 91.1%

C) 93.6%

D) 110%

Aluminum hydroxide ($Al(OH)_3$) is often present in antacids to neutralize stomach acid (HCl). The reaction occurs as follows. If 14.0 g of $Al(OH)_3$ is present in an antacid tablet, what is the theoretical yield of $AlCl_3$ produced when the tablet reacts with HCl ?

Molar mass: $Al(OH)_3 = 78 \text{ g/mol}$, $AlCl_3 = 133.5 \text{ g/mol}$

A) 12.5 g

B) 18.7 g

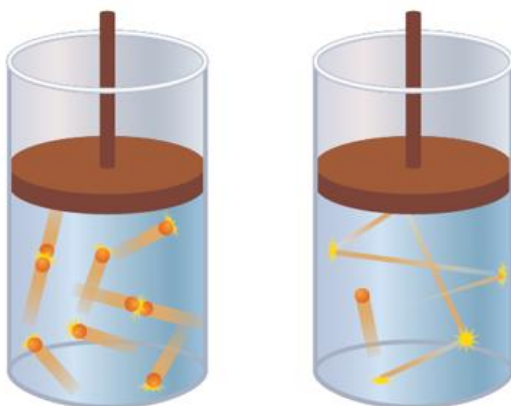
C) 23.9 g

D) 31.4 g

14 List the five assumptions of the Kinetic Molecular Theory

Textbook +
Figure 2237
238

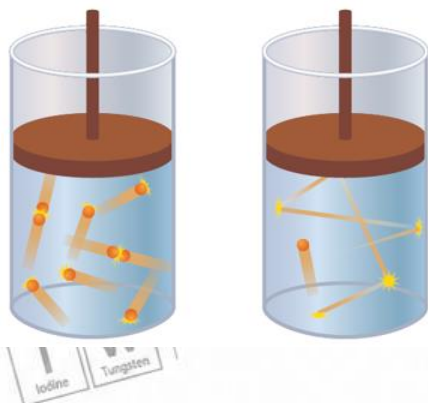
The **kinetic-molecular theory** explains the behavior of matter as **tiny** particles that are **always in motion**. It describes the **size, motion, and energy** of gas particles



Assumption of Kinetic Molecular Theory	Explanation
1. Particle size	Gas particles are very small and separated by a large empty space. (low density)
2. Particle motion	Gas particles are in constant, random motion and move in straight lines until they collide.
3. Particle collisions	Collisions between gas particles are elastic (no kinetic energy is lost) .
4. Particle attraction	Gas particles have no significant attractive or repulsive forces between them.
5. Particle energy $KE = \frac{1}{2}mv^2$	The average kinetic energy of gas particles depends on temperature . Higher temperature → higher kinetic energy.

At the same temperature, gases have the same average kinetic energy, but **individual particles can have different velocities**.

Which is **NOT** an assumption of the kinetic-molecular theory?



- A) All the gas particles in a sample have the same velocity.
- B) Gas particles are not significantly attracted or repelled by other gas particles.
- C) Collisions between gas particles are elastic.
- D) All gases at a given temperature have the same average kinetic energy.

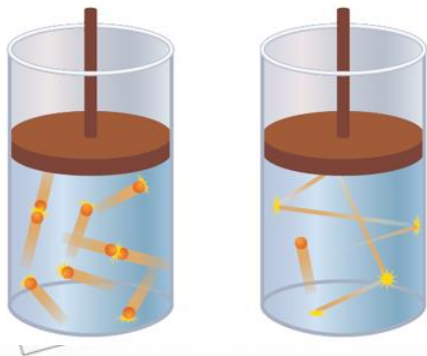
Which of the following is correct about gases according to the kinetic-molecular theory?

- A) The volume of the particles is big compared with the volume of the empty space.
- B) Gas particles experience significant attractive and repulsive forces.
- C) During collisions of gas particles, kinetic energy is lost.
- D) Gas particles are in constant, random motion.

Which of the following is **NOT** an assumption of the kinetic-molecular theory of gases?

- A) Kinetic energy can be transferred between gas particles during an elastic collision.
- B) Gas particles are far apart and experience no significant attractive or repulsive forces.
- C) Gas particles are in constant, random motion.
- D) The kinetic energy of a particle can be represented by $KE = mv^2$.

Which of the following statements is True?



- A) Particles of a gas collide with each other and with the walls of their container; these collisions are inelastic.
- B) Particles of a gas collide with their container only.
- C) Particles of a gas never collide.
- D) Particles of a gas collide with each other and with the walls of their container; these collisions are elastic.

In the kinetic-molecular theory, which of the following terms is a measure of the average kinetic energy of the particles in a sample of matter?

- A) Volume
- B) Temperature
- C) Mass
- D) Density

The theory that describes the behavior of gases in terms of the motion of gas particles is __.

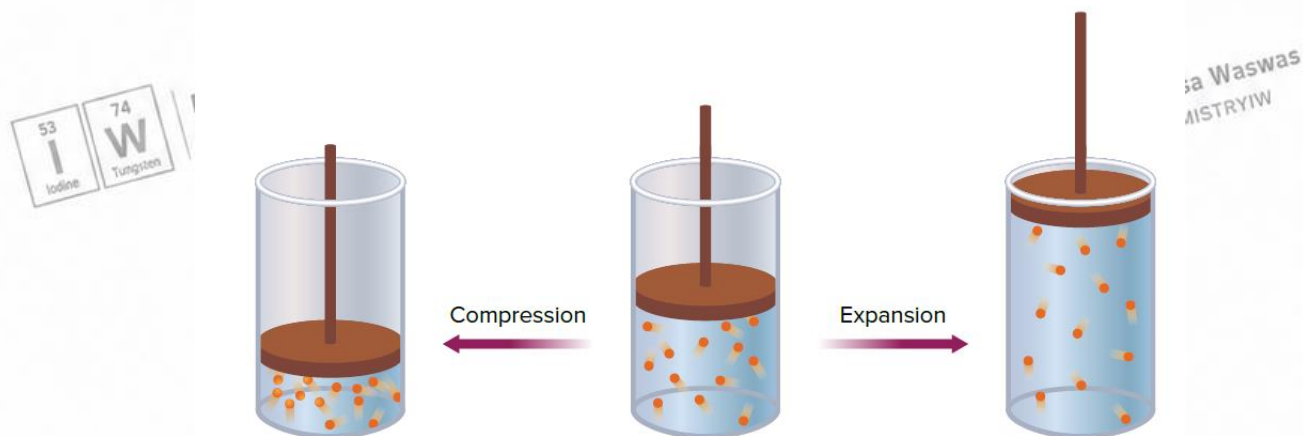
- A) Dalton's law of partial pressures
- B) Graham's law of effusion
- C) the kinetic-molecular theory
- D) the theory of intermolecular forces

- 15** Use the mathematical formula of **Graham's law** of effusion to calculate the relative rates of effusion of different gases and their molar masses

Textbook +
Figure 3 +
Example
problem 1 +
Practice
Problems

240
241

Compression	Reducing the volume of gas by squeezing it into a smaller space.
Expansion	Increasing the volume available to gas allows particles to spread out and fill the space.



Diffusion	Movement of particles from an area of high concentration to an area of low concentration until they are evenly distributed.
Effusion	The escape of gas particles through a tiny opening .

Graham's law states that the rate of **diffusion or effusion** is **inversely proportional** to the **square root of the molar mass**.

Lighter gases **diffuse and effuse faster** than heavier gases.

$$\text{Rate of effusion} \propto \frac{1}{\sqrt{\text{molar mass}}}$$

$$\frac{\text{Rate}_A}{\text{Rate}_B} = \sqrt{\frac{\text{molar mass}_B}{\text{molar mass}_A}}$$

Neon (Ne) has a molar mass of 20.0 g/mol, and hydrogen chloride (HCl) has a molar mass of 36.5 g/mol. What is the ratio of their diffusion rates?

- A) 0.54
- B) 0.77
- C) 1.35
- D) 1.83

An unknown gas diffuses 1.25 times faster than N_2O_4 gas. What is the molar mass of the unknown gas?

Molar mass of $\text{N}_2\text{O}_4 = 92.0$ g/mol

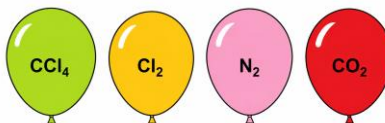
- A) 36.2 g/mol
- B) 58.9 g/mol
- C) 7.7 g/mol
- D) 18.6 g/mol

What is the ratio of diffusion rate for nitrogen (N_2) and sulfur trioxide (SO_3)?

Gas	Molecular mass
SO_3	80 g/mol
N_2	28 g/mol

- A) 1.7
- B) 0.60
- C) 2.4
- D) 0.30

Four identical balloons were filled with different gases to the same volume. Which balloon does the gas effuse the fastest from?



Gas	CCl_4	Cl_2	N_2	CO_2
Molar mass (g/mol)	154	71	28	44

- A) CO_2
- B) CCl_4
- C) N_2
- D) Cl_2

Carbon monoxide (CO) has a molar mass of 28.0 g/mol, and carbon dioxide (CO_2) has a molar mass of 44.0 g/mol. What is the ratio of their diffusion rates?

- A) 0.64
- B) 0.80
- C) 1.25
- D) 1.57

Gas A effuses at a rate of 3.6 mol/min. Gas B has a molar mass twice that of Gas A. What is the rate of effusion of Gas B?

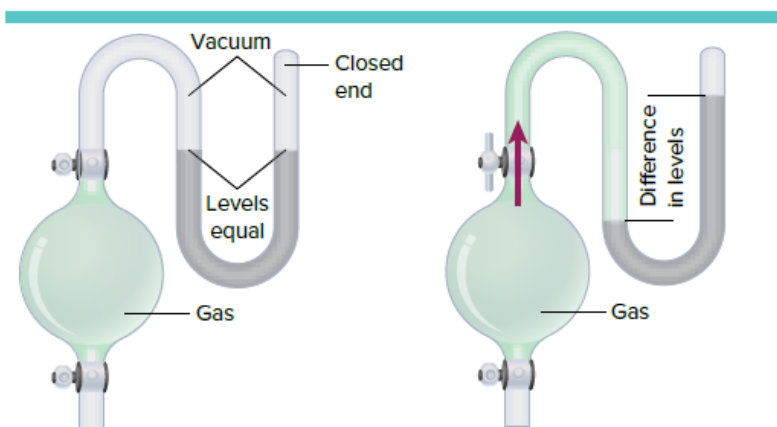
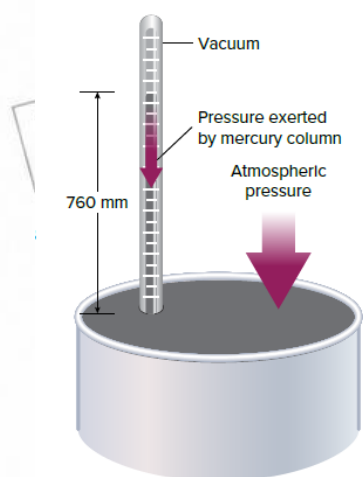
- A) 1.8 mol/min
- B) 2.5 mol/min
- C) 5.1 mol/min
- D) 7.2 mol/min

16

Identify the **most commonly used units** for pressure while **converting** among units of pressure

Textbook +	242
Table 1 +	243
Figures 5, 6	244

Device	Used to measure	Main idea
Barometer	Atmospheric pressure	Mercury level shows air pressure
Manometer	Gas pressure in a closed container	The difference in mercury levels shows the gas pressure



Before gas is released into the U-tube, the mercury is at the same height in each arm.

After gas is released into the U-tube, the heights in the two arms are no longer equal.

Comparison of Pressure Units		
Unit	Number Equivalent to 1 atm	Number Equivalent to 1 kPa
Kilopascal (kPa)	101.3 kPa	—
Atmosphere (atm)	—	0.009869 atm
Millimeters of mercury (mmHg)	760 mmHg	7.501 mmHg
Torr	760 torr	7.501 torr
Pounds per square inch (psi or lb/in ²)	14.7 psi	0.145 psi
Bar	1.01 bar	0.01 bar

$$1 \text{ atm} = 101.3 \text{ kPa} = 760 \text{ mmHg} = 760 \text{ torr} = 14.7 \text{ psi} = 1.01 \text{ bar}$$

The weather report includes an atmospheric pressure reading of 0.95 atm. Express this pressure in mmHg units.

- A) 722 mmHg
- B) 760 mmHg
- C) 101.3 mmHg
- D) 1 mmHg

The weather report includes an atmospheric pressure reading of 96.2 kPa. Express this pressure in atm units.

- A) 0.95 atm
- B) 760 atm
- C) 101.3 atm
- D) 1 atm

The weather news reports an atmospheric pressure of 1.07 atm. What is this atmospheric pressure in torr?

- A) 760 torr
- B) 813 torr
- C) 710 torr
- D) 101.3 torr

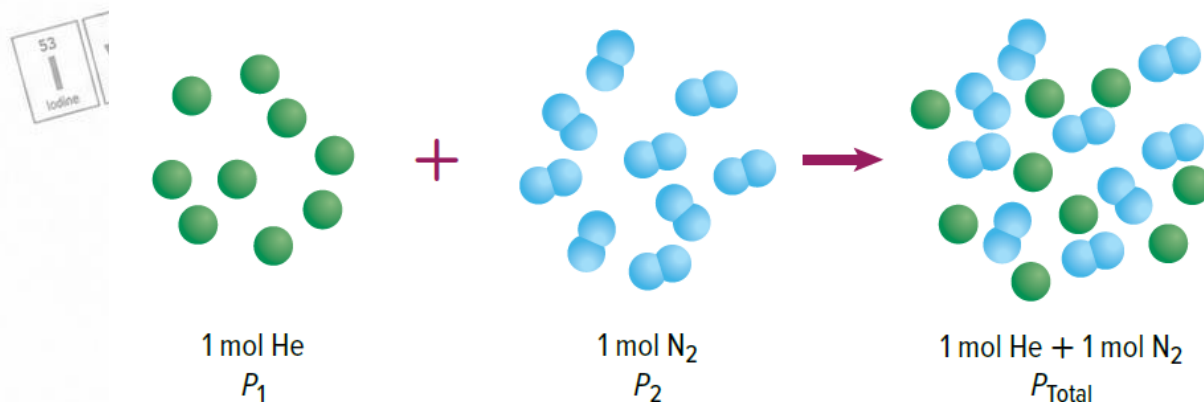
The weather news shows atmospheric pressure as 720 mmHg. What is this atmospheric pressure in kPa?

- A) 95.9 kPa
- B) 101.3 kPa
- C) 760 kPa
- D) 54.0 kPa

17	Use the mathematical formula of Dalton's law of partial pressures to calculate partial pressures and total pressure of a mixture of gases	Textbook + Figure 7 + Example problem 2 + Practice Problems	244 245
----	--	--	------------

Dalton's law of partial pressures

- Dalton's law** states that the **total pressure** of a gas mixture equals **the sum of the partial pressures of all gases**.



- Partial pressure** is the pressure contributed by a **single gas** in the mixture.
- Partial pressure** depends on the **number of moles, container volume, and temperature**.
- At the same temperature and pressure, 1 mole of any gas has the same pressure/ partial pressure.

$$P_{\text{total}} = P_1 + P_2 + P_3 + \dots + P_n$$

What is the partial pressure of oxygen in an air sample when the total pressure is 1.10 atm, the partial pressure of nitrogen is 0.75 atm, the partial pressure of water vapor is 0.0056 atm, and the partial pressure of all other gases is 0.0044 atm?

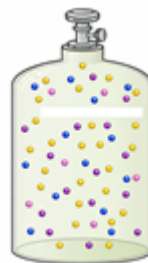
- A) 0.20 atm B) 0.21 atm C) 0.34 atm D) 0.36 atm

What is the total pressure for a mixture that contains three gases with partial pressures of 1.35 kPa, 3.81 kPa, and 5.22 kPa?

- A) 7.68 kPa
B) 10.38 kPa
C) 12.76 kPa
D) 6.57 kPa

If the total pressure in the flask is 4.711 atm, the partial pressure of O_2 is 2.592 atm, and the partial pressure of He is 0.836 atm, what is the partial pressure of N_2 ?

- A) 2.955 atm
B) 8.139 atm
C) 0.467 atm
D) 1.283 atm



Air is a mixture of gases. By percentage, it is roughly 78% nitrogen, 21% oxygen, and 1% argon. If the atmospheric pressure is 760 mmHg, what is the partial pressure of oxygen?

- A) 7.6 mmHg
B) 159.6 mmHg
C) 592.8 mmHg
D) 760 mmHg

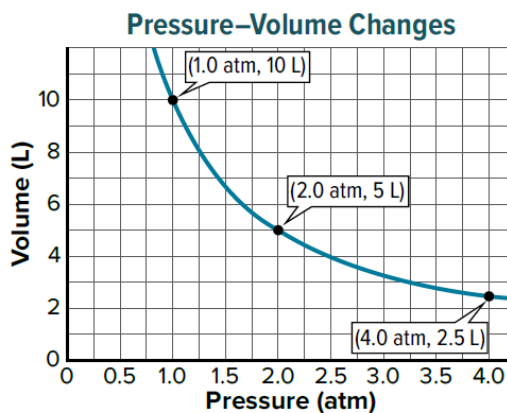
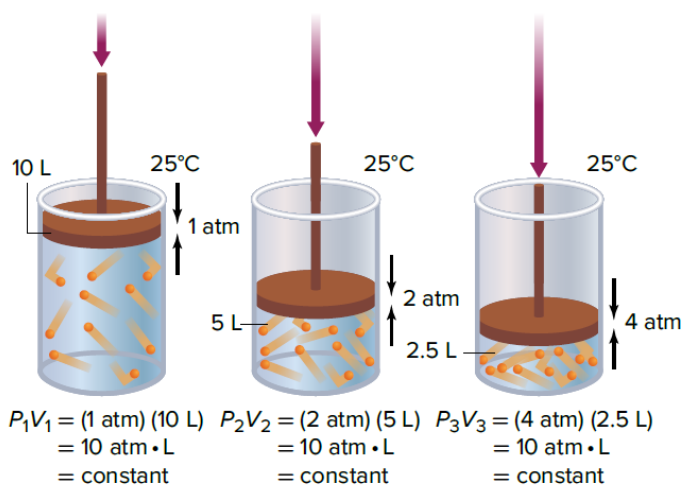
18	Use the pressure-volume graph to determine the volume when the pressure is given and vice versa	Textbook + Figures 1,2,3 + Example problems 1,2,3 + Practice Problems	275
19	Use the mathematical formula of Charles's law to calculate volume-temperature changes at constant pressure		276
20	Use the mathematical formula of Gay-Lussac's law to calculate pressure-temperature changes at constant volume		277
			278
			279
			280
			281

The Gas Laws

Boyle's Law $P_1V_1 = P_2V_2$

The **pressure** of a gas is **inversely** proportional to its **volume** at constant temperature.

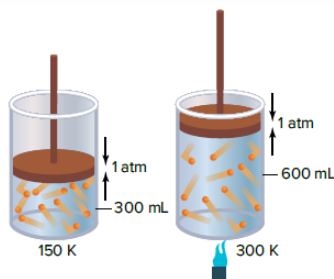
Pressure $\uparrow \rightarrow$ Volume $\downarrow$ (or vice versa)



Charles's Law $\frac{V_1}{T_1} = \frac{V_2}{T_2}$

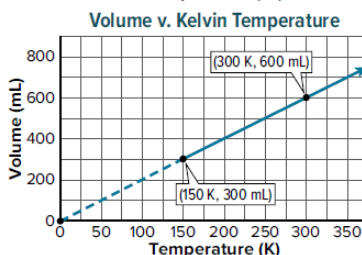
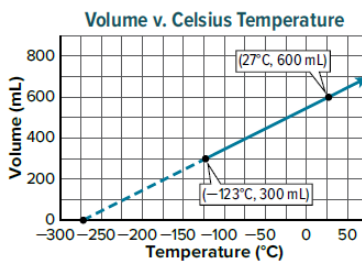
The **volume** of a gas is **directly** proportional to its **temperature** at constant pressure.

Temperature $\uparrow \rightarrow$ Volume $\uparrow$ (or vice versa)



$$\frac{V_1}{T_1} = \frac{300 \text{ mL}}{150 \text{ K}} = 2 \text{ mL/K} = \text{constant}$$

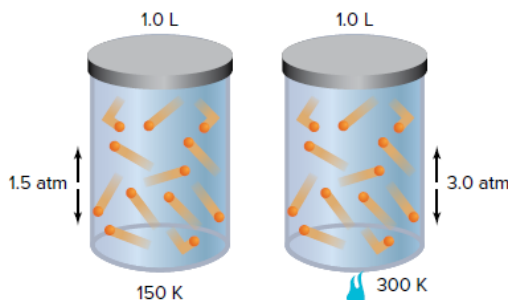
$$\frac{V_2}{T_2} = \frac{600 \text{ mL}}{300 \text{ K}} = 2 \text{ mL/K} = \text{constant}$$



Gay-Lussac's Law $\frac{P_1}{T_1} = \frac{P_2}{T_2}$

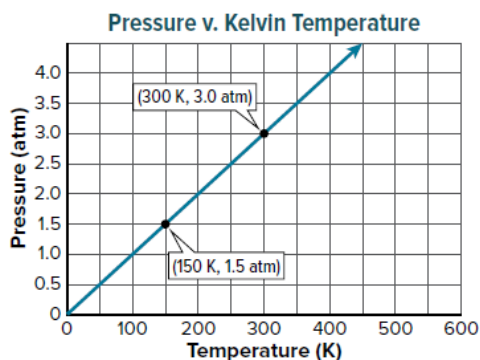
The **pressure** of a gas is **directly** proportional to its **temperature** at constant volume.

Temperature $\uparrow \rightarrow$ Pressure $\uparrow$ (or vice versa)

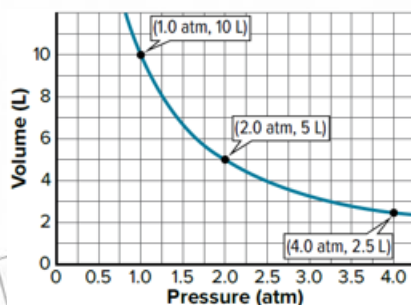


$$\frac{P_1}{T_1} = \frac{1.5 \text{ atm}}{150 \text{ K}} = 0.01 \text{ atm/K} = \text{constant}$$

$$\frac{P_2}{T_2} = \frac{3.0 \text{ atm}}{300 \text{ K}} = 0.01 \text{ atm/K} = \text{constant}$$

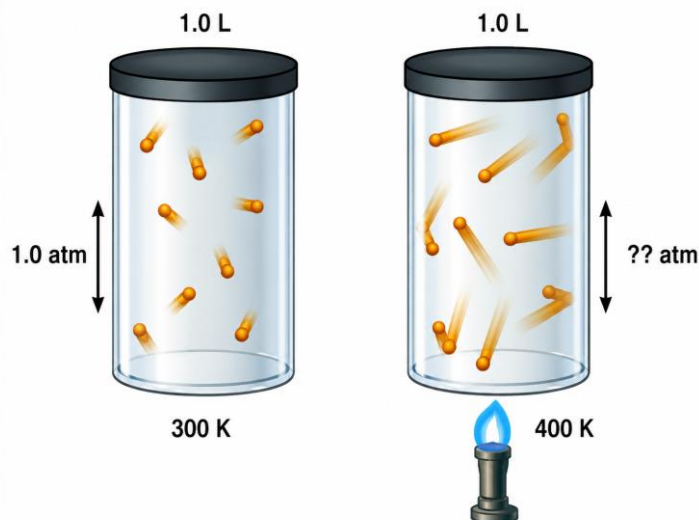


Which law is represented by the graph below?



- A) Gay-Lussac's law
- B) Boyle's Law
- C) Charles's law
- D) Henry's Law

The pressure of a gas in a cylinder is 1.00 atm at 300 K. What will be the pressure if the temperature increases to 400 K?



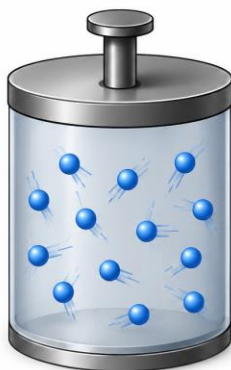
- A) 0.75 atm
- B) 2.67 atm
- C) 2.44 atm
- D) 1.33 atm

What is the volume of the gas in the balloon when the temperature changes to 348 K?



- A) 4.01 L
- B) 3.84 L
- C) 2.73 L
- D) 2.31 L

Helium gas in a 2.00 L cylinder has a pressure of 1.12 atm. What was the initial temperature of the gas if the pressure increases to 2.56 atm at 36.5°C?



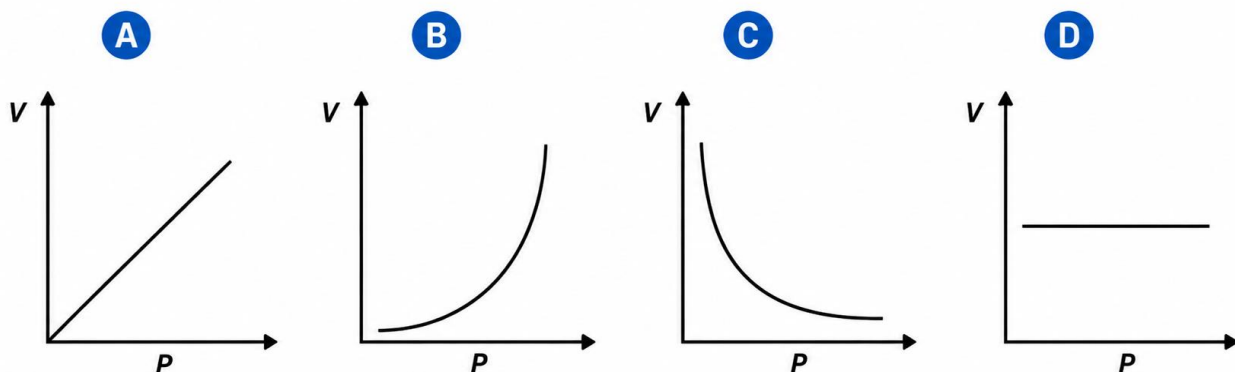
$$\begin{aligned}P_1 &= 1.12 \text{ atm} \\V &= 2.00 \text{ L} \\T_1 &= ?^\circ\text{C}\end{aligned}$$



$$\begin{aligned}P_2 &= 2.56 \text{ atm} \\V &= 2.00 \text{ L} \\T_2 &= 36.5^\circ\text{C}\end{aligned}$$

- A) -95°C
- B) -120°C
- C) -138°C
- D) -165°C

Which diagram shows the correct relationship between volume (V) and pressure (P) for a gas at constant temperature?



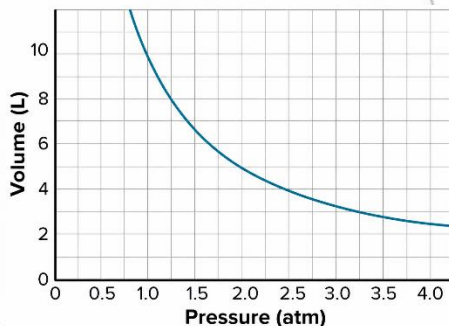
The pressure in an automobile tire is 1.88 atm at 25.0°C. What will the pressure be if the temperature increases to 37.0°C?

- A) 1.50 atm
- B) 1.96 atm
- C) 2.82 atm
- D) 3.10 atm

The Celsius temperature of a 3.00-L sample of gas is lowered from 80.0°C to 30.0°C. What will be the resulting volume of this gas?

- A) 2.00 L
- B) 2.30 L
- C) 2.58 L
- D) 3.50 L

From the diagram, what will the volume of the gas be at 2 atm?



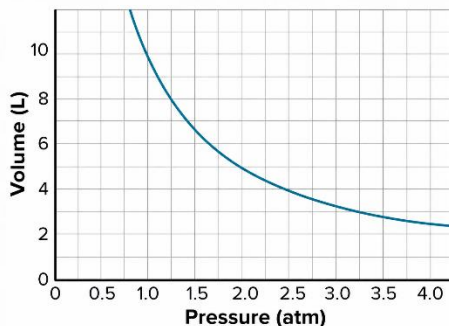
A) 2 L

B) 4 L

C) 5 L

D) 10 L

From the diagram, what will the gas pressure be at a volume of 10 L?



A) 1 atm

B) 2 atm

C) 3 atm

D) 5 atm

A gas occupies 0.67 L at 350 K. What temperature is required to reduce the volume by 45%?

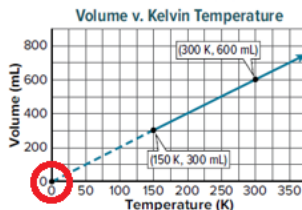
A) 193 K

B) 250 K

C) 405 K

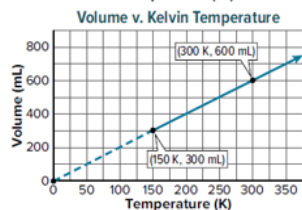
D) 636 K

What is the point marked in red on the following graph called?



- A) Absolute zero
- B) Boiling point
- C) Triple point
- D) Critical point

According to the graph below, which of the following statements is NOT correct?



- A) Doubling the temperature doubles the volume
- B) Doubling the temperature does not double the volume
- C) The graph shows a linear relationship
- D) The graph shows a directly proportional relationship

The volume of a gas is 400.0 mL, and the pressure is 1.00 atm. What is the pressure when the volume of the gas becomes 2.0 L if the temperature remains the same?

- A) 0.20 atm
- B) 0.50 atm
- C) 5.0 atm
- D) 0.80 atm

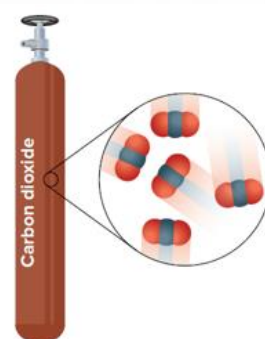
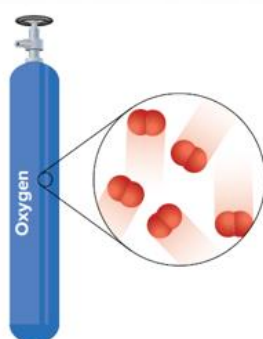
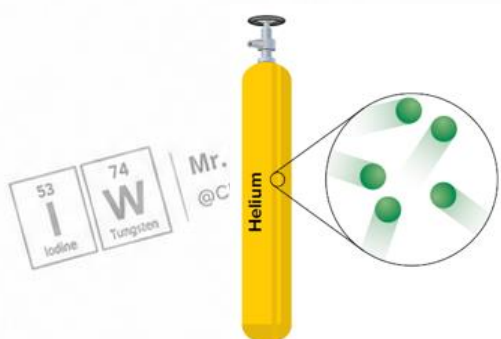
21 List the conditions of a gas at **STP and RTP**Textbook + Example problem 5 +
Practice Problems

285

286

287

STP	RTP
Standard Temperature and Pressure	Room Temperature and Pressure
T = 0°C (273 K)	T = 25°C (298 K)
P = 1 atm	P = 1 atm
1 mol gas = 22.4 L	1 mol gas ≈ 24 L

➤ **Equal volumes of gases at the same temperature and pressure**➤ contain **equal numbers of particles**.➤ **Gas particle size** has **little effect on gas volume** because **particles are far apart**, unlike particles in liquids and solids, which are close together.

STP



Standard Temperature and Pressure



0°C and 1.00 atm

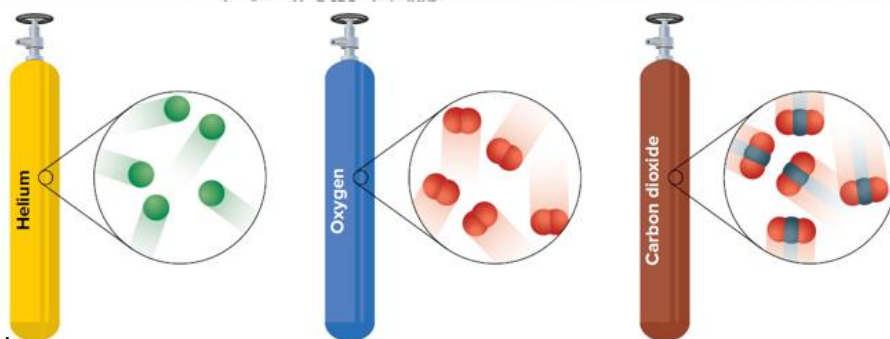
$$1 \text{ mol} = 6.02 \times 10^{23} \text{ particles}$$

$$1 \text{ mol gas} = 22.4 \text{ L at STP}$$

According to Avogadro's principle, 1 mol of any gas at STP occupies a volume of _____.

- A) 22.4 L B) 3.72 L
C) 1.00 L D) 6.02 L

"Equal volumes of gases at the same pressure and temperature contain equal numbers of particles." This is the statement of _____.



- A) Combined gas law
B) Le Chatelier's principle
C) Ideal gas law
D) Avogadro's principle

What volume of container is needed to hold 0.0459 mol of N_2 gas at STP?

- A) 0.514 L B) 1.03 L
C) 2.24 L D) 22.4 L

How much carbon dioxide gas, in grams, is in a 1.0-L balloon at STP? (Molar mass of CO_2 = 44.0 g/mol)

- A) 0.51 g
B) 1.96 g
C) 22.4 g
D) 44.0 g

What volume in milliliters will 0.00922 g of H_2 gas occupy at STP? (Molar mass of $\text{H}_2 = 2.0 \text{ g/mol}$)

- A) 10.2 mL
- B) 51.2 mL
- C) 103 mL
- D) 224 mL

What volume will 4.5 kg of ethylene gas (C_2H_4) occupy at STP? (Molar mass of $\text{C}_2\text{H}_4 = 28 \text{ g/mol}$)

- A) 360 L
- B) 1800 L
- C) 3600 L
- D) 4500 L

A flexible plastic container contains 0.860 g of helium gas in a volume of 19.2 L. If 0.205 g of helium is removed at constant pressure and temperature, what will be the new volume? (Molar mass of $\text{He} = 4.0 \text{ g/mol}$)

- A) 4.58 L
- B) 14.6 L
- C) 19.2 L
- D) 25.2 L

How many neon atoms are there in a 1.6 L sample at standard temperature and pressure (STP)? (Avogadro's number = 6.02×10^{23} particles/mol)

- A) 4.30×10^{22}
- B) 2.70×10^{23}
- C) 3.50×10^{24}
- D) 1.40×10^{25}

22	Use the ideal gas law to calculate pressure, volume, temperature, and mass of a gas when three quantities are given	Textbook + Table 2 +	287
		Example problem 6 +	288
		Practice Problems	289

Ideal Gas

A gas that behaves according to the **kinetic-molecular theory**.

Gas **particles** are very **far apart**.

Gas particles have **negligible volume**.

There are **no significant attractive or repulsive forces** between particles.

Gas particles **move randomly in straight lines** and **collide elastically** with each other and the container walls (no kinetic energy is lost).

Ideal gases behave **most ideally** under **Low pressure and High temperature**

The ideal gas law **describes gas behavior** using **P, V, T, and n**.

1) Ideal Gas Law

$$PV = nRT$$

2) Molar Mass Equation

$$M = \frac{mRT}{PV}$$

3) Density Equation

$$D = \frac{MP}{RT}$$

If the pressure exerted by a gas at 3°C in a volume of 0.044 L is 7.62 atm, how many moles of gas are present?

$$(R = 0.0821 \text{ L}\cdot\text{atm}/\text{mol}\cdot\text{K})$$

- A) 4.25 mol B) 0.068 mol
C) 2.45 mol D) 0.015 mol

What is the volume (L) of a 0.216 mol sample of helium gas at a temperature of 30.0°C and a pressure of 7.16 atm?

$$(R = 0.0821 \text{ L}\cdot\text{atm}/\text{mol}\cdot\text{K})$$

- A) 0.750 L B) 1.40 L
C) 0.375 L D) 2.85 L

Determine the Celsius temperature of 2.80 mol of a gas contained in a 1.20-L vessel at a pressure of 155 kPa.

$$(R = 8.31 \text{ L}\cdot\text{kPa}/\text{mol}\cdot\text{K})$$

- A) -120°C B) 70°C
C) -265°C D) 150°C

What is the pressure, in atmospheres, of a 0.150-mol sample of helium gas at a temperature of 25.0°C if its volume is 1.20 L?

$$(R = 0.0821 \text{ L}\cdot\text{atm}/\text{mol}\cdot\text{K})$$

- A) 2.05 atm B) 3.06 atm
C) 4.10 atm D) 5.22 atm

What is the density of a sample of nitrogen gas (N_2) that exerts a pressure of 5.30 atm at 125°C?

$$(\text{Molar mass of } \text{N}_2 = 28 \text{ g/mol}, R = 0.0821 \text{ L}\cdot\text{atm}/\text{mol}\cdot\text{K})$$

- A) 1.82 g/L B) 4.55 g/L
C) 0.92 g/L D) 3.14 g/L

23	Predict the conditions under which a real gas might deviate from ideal behavior while explaining its effect	Textbook + Figure 8	291
----	---	---------------------	-----

Real Gases vs Ideal Gases

No gas is truly ideal; gases only behave almost ideally under certain conditions.

Real gases deviate most from ideal gases at **High pressure and Low temperature**.

Polar gases deviate more because they have **stronger attractive forces**.

Large nonpolar gases deviate more because particles have a larger volume.

High pressure → particles are closer together → particle volume and attractive forces become important → **Deviate from Ideal**

Low temperature → particles move slowly → attractive forces have a greater effect → **Deviate from Ideal**

When does a real gas behave like an ideal gas?

- A) At high pressure and low temperature
- B) When the particles are close together, and the attractive forces are high
- C) When the gas is liquefied by applying enough pressure
- D) When the particles are far apart, and attractive forces are low

When do real gases deviate most from ideal gas behavior?

- A) At high pressure and low temperature
- B) At low pressure and high temperature
- C) At high pressure and high temperature
- D) At low pressure and low temperature

Which of the following is a characteristic of an ideal gas?

- A) Its particles move at variable velocities and curved lines
- B) Its particles take up space and have measurable volume
- C) Its particles collide with each other and the container walls in a perfectly elastic way
- D) Its particles have strong attractive forces

Which statement about gases is correct?

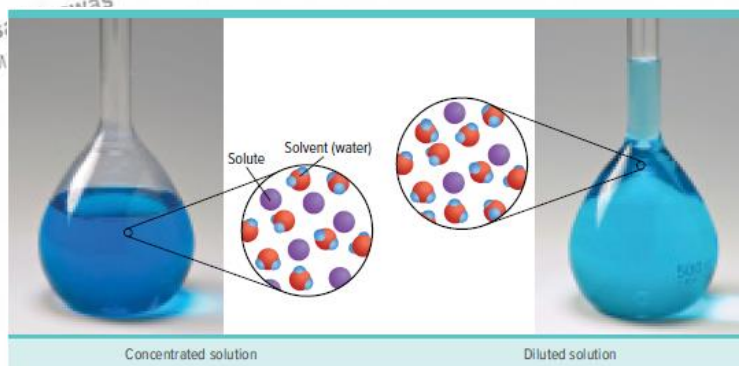
- A) Polar gases behave more like ideal gases than nonpolar gases
- B) Large molecules like butane (C_4H_{10}) behave more like ideal gases
- C) Real gases deviate significantly from ideal gas behavior at high pressures and low temperatures
- D) Ideal gases have strong attractive forces between particles

Which gas sample would behave most like an ideal gas?

- A) A polar gas at high pressure and low temperature
- B) A gas with large particles at low temperature
- C) A gas with particles far apart and weak attractive forces
- D) A gas with particles close together and strong attractive forces

24	Calculate the percent by mass of a solution		308
25	Calculate molarity when the moles or the mass of solute and volume of solution are given, and vice versa	Textbook +Table	309
26	Perform a calculation involving diluting a concentrated solution	3+Figure 9+	310
		Example	311
		problem 1,2,3,4	312
27	Calculate molality when the moles or the mass of solute and the mass of solvent are given, and vice versa	+ Practice	314
		Problems	315
			316

- **Concentration**: the **amount of solute dissolved** in a certain amount of **solvent or solution**.
- **Concentrated solution**: contains a **large amount of solute**.
- **Dilute solution**: contains a **small amount of solute**.



Common Ways to Express Concentration	
Concentration Type	Formula / Ratio
Percent by mass (% by mass)	$\frac{\text{mass of solute}}{\text{mass of solution}} \times 100$
Molarity (M)	$\frac{\text{moles of solute}}{\text{liter of solution}}$
Molality (m)	$\frac{\text{moles of solute}}{\text{kilogram of solvent}}$
Dilution	$M_1 V_1 = M_2 V_2$

What is the percent by mass of sodium chloride (NaCl) in a solution containing 4.0 g of NaCl dissolved in 100.0 g of water (H₂O)?

- A) 3.8%
- B) 4.0%
- C) 3.3%
- D) 4.8%

What is the molarity of an aqueous solution containing 1.19 g of KBr in 2.0 L of solution? (Molar mass of KBr = 119.0 g/mol)

- A) 2.50×10^{-3} M
- B) 7.50×10^{-3} M
- C) 5.00×10^{-3} M
- D) 1.30×10^{-3} M

What volume of 2.00 M calcium chloride (CaCl₂) stock solution would you need to prepare 0.5 L of 0.5 M CaCl₂ solution?

- A) 125 mL
- B) 172 mL
- C) 250 mL
- D) 200 mL

What is the molality of a solution containing 5.0 g of sodium chloride (NaCl) dissolved in 100.0 g of water (H₂O)? (Molar mass of NaCl = 58.44 g/mol)

- A) 0.86 m
- B) 0.18 m
- C) 0.25 m
- D) 0.77 m

What is the molarity of an aqueous solution containing 40.0 g of glucose ($C_6H_{12}O_6$) in 1.5 L of solution?

(Molar mass of glucose = 180.16 g/mol)

- A) 0.15 M
- B) 0.22 M
- C) 1.33 M
- D) 1.14 M

What is the percent by mass of $NaHCO_3$ in a solution containing 20.0 g of $NaHCO_3$ dissolved in 600.0 mL of H_2O ?

- A) 3.2%
- B) 4.5%
- C) 6.0%
- D) 10.0%

You have 1500.0 g of a bleach solution. The percent by mass of sodium hypochlorite ($NaOCl$) is 3.62%. How many grams of $NaOCl$ are in the solution?

- A) 36.2 g
- B) 54.3 g
- C) 75.0 g
- D) 150 g

What is the molality of a solution containing 10.0 g of Na_2SO_4 in 1000.0 g of water? (Molar mass of Na_2SO_4 = 142.0 g/mol)

- A) 0.035 m
- B) 0.070 m
- C) 0.142 m
- D) 1.42 m

How many milliliters of a 5.0 M H_2SO_4 stock solution would you need to prepare 100.0 mL of 0.25 M H_2SO_4 ?

- A) 2.5 mL
- B) 5.0 mL
- C) 10.0 mL
- D) 20.0 mL

Calculate the molarity of 1.60 L of a solution containing 0.013 mol of dissolved KBr.

- A) 0.0081 M
- B) 0.013 M
- C) 0.021 M
- D) 0.050 M

What is the molarity of a KI stock solution needed to prepare 0.300 L of a 1.25 M KI solution using 0.125 L of stock solution?

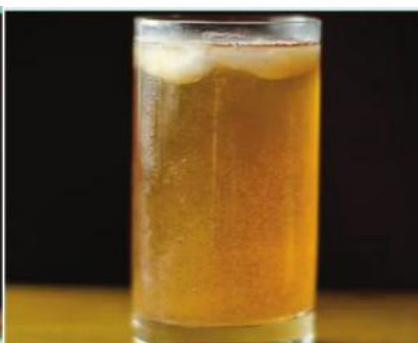
- A) 1.50 M
- B) 2.00 M
- C) 3.00 M
- D) 4.00 M

28	Explain three factors that affect the rate at which a solid solute dissolves in a liquid, while explaining their effect	Textbook + Figure 14,16,17 + Table 4	322
29	Interpret the temperature - solubility graph for solids		323
30	Explain three factors that affect the rate at which a solid solute dissolves in a liquid, while explaining their effect		324 325

Factor	Effect on solvation rate
Agitation (stirring/shaking)	Increases contact between solute and solvent particles → solute dissolves faster
Surface area	Smaller solute pieces have larger surface area → more collisions → faster dissolving
Temperature	Higher temperature increases particle motion → most solids dissolve faster • Solids: ↑ Temperature → ↑ solubility • Gases: ↑ Temperature → ↓ solubility (gas escapes from solution)



A sugar cube in iced tea will dissolve slowly, but stirring will make the sugar cube dissolve more quickly.



Granulated sugar dissolves faster in iced tea than a sugar cube. Stirring speeds the process.



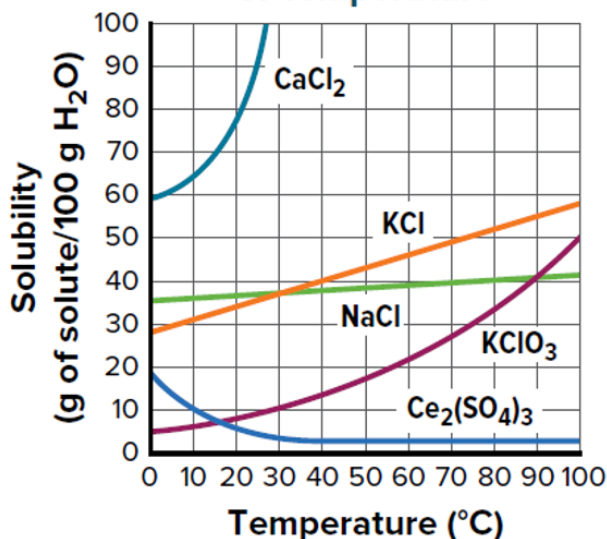
Granulated sugar dissolves very quickly in hot tea.

In General

Increasing agitation, surface area, and temperature increases the rate of solvation.

Solubility	The ability of a solute to dissolve in a solvent.
Solvation	It is the process in which solvent particles surround and separate solute particles to form a solution.
Crystallization	Dissolved solute particles return to the solid form.
Saturated solution	Contains the maximum amount of dissolved solute at a specific temperature and pressure.
Unsaturated solution	Contains less solute than the maximum amount , so more solute can dissolve.
Supersaturated solution	contains more dissolved solute than a saturated solution at the same temperature.
Dynamic equilibrium	The rate of solvation equals the rate of crystallization , so the amount of dissolved solute remains constant.

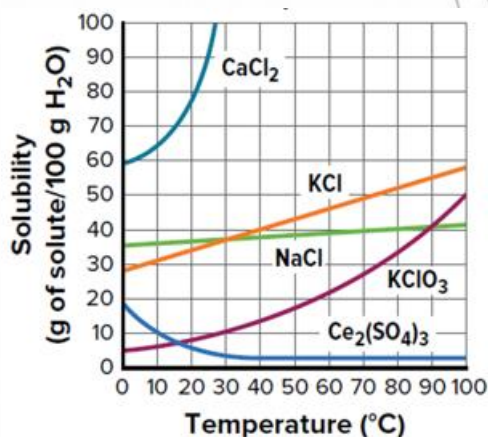
Solubilities as a Function of Temperature



Example 1 : Calcium chloride (CaCl₂): At 10°C → about 64 g CaCl₂ / 100 g H₂O At about 27°C → about 100 g CaCl₂ / 100 g H₂O (Increase ≈ 50%)

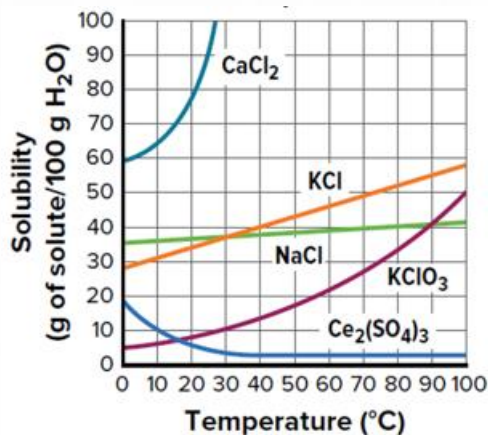
Example 2: Sucrose (C₁₂H₂₂O₁₁): At 20°C → 203.9 g / 100 g H₂O At 100°C → 487.2 g / 100 g H₂O (Increase ≈ 140%)

Which substance has the greatest change in solubility with increasing temperature?



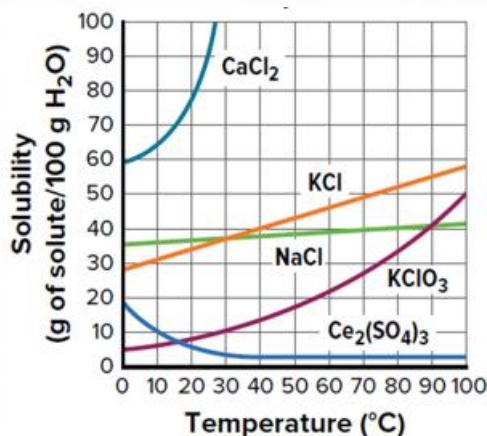
- A) $\text{Ce}_2(\text{SO}_4)_3$
- B) NaCl
- C) CaCl_2
- D) KCl

According to the solubility graph, which statement is correct?



- A) KClO_3 solubility decreases as temperature increases
- B) $\text{Ce}_2(\text{SO}_4)_3$ solubility increases rapidly as temperature increases
- C) NaCl has the highest increase in solubility with increasing temperature
- D) CaCl_2 has a solubility equal to 64 g per 100 g H_2O at 10°C

The graph below shows the solubility of several substances at different temperatures. Which substance has a solubility that initially decreases rapidly as temperature increases?

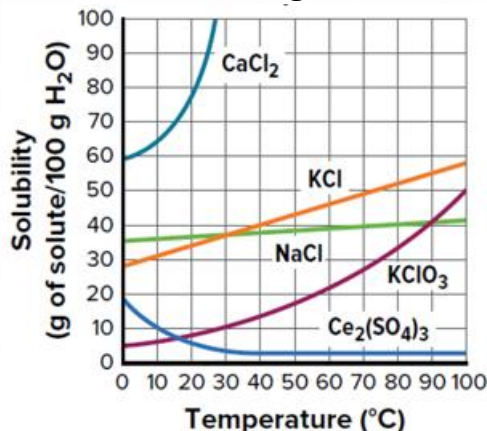
A) Ce₂(SO₄)₃

B) NaCl

C) CaCl₂

D) KCl

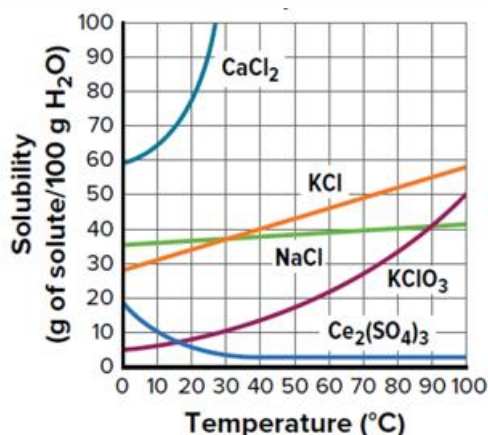
Using the solubility graph, which of the following statements is correct?

A) CaCl₂ solubility decreases as temperature increasesB) Ce₂(SO₄)₃ solubility increases rapidly as temperature increases

C) KCl solubility increases as temperature increases

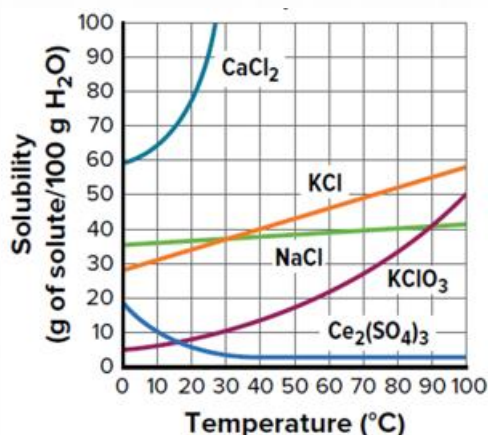
D) KClO₃ solubility is 17 g per 100 g H₂O at 20°C

Using the solubility graph, which of the following statements is NOT correct?



- A) KClO₃ solubility increases as temperature increases
- B) KCl has the highest increase in solubility with increasing temperature
- C) Ce₂(SO₄)₃ solubility decreases rapidly as temperature increases
- D) CaCl₂ solubility is about 64 g per 100 g H₂O at 10°C

According to the solubility graph, what is the solubility of KClO₃ at 75°C?



- A) 40 g / 100 g H₂O
- B) 30 g / 100 g H₂O
- C) 30 g / g H₂O
- D) 40 g / g H₂O

Which of the following solutions can dissolve more solute at a specific temperature and pressure?

- A) Saturated solution
- B) Unsaturated solution
- C) Supersaturated solution
- D) Concentrated solution

Which of the following happens in a saturated solution at a specific temperature and pressure?

- A) The rate of solvation is less than the rate of crystallization
- B) The rate of solvation equals the rate of crystallization
- C) The overall amount of dissolved solute in the solution increases
- D) The rate of solvation is greater than the rate of crystallization

Which condition will make sugar dissolve the fastest when using the same amount of tea and sugar?

- A) Granulated sugar in hot tea with stirring
- B) Sugar cube in iced tea without stirring
- C) Sugar cube in hot tea with stirring
- D) Granulated sugar in iced tea without stirring

Which of the following increases the rate of solvation?

- A. lower temperature and larger crystals
- B. no stirring and lower surface area
- C. agitation, increased surface area, and higher temperature
- D. freezing the solution

Which factors increase the rate of solvation?

- i. Increasing the pressure of the solution
- ii. Shaking or stirring the solution
- iii. Increasing the surface area of the solute
- iv. Increasing the temperature of the solvent

- A) i and ii only
- B) i, ii, and iii only
- C) ii and iii only
- D) ii, iii, and iv only

Which statements about the effect of temperature on solubility are NOT correct?

1. Most solid solutes are more soluble in cold solvents than in hot solvents.
2. A more solid solute can dissolve in hot solvents than in cold solvents.
3. Increasing temperature increases the solubility of gases.

- A) 1 only
- B) 3 only
- C) 1 and 2
- D) 1 and 3

53 I Iodine 74 W Tungsten
Mr. Issa Waswas
@CHEMISTRYIW

53 I Iodine 74 W Tungsten
Mr. Issa Waswas
@CHEMISTRYIW



@CHEMISTRYIW

53 I Iodine 74 W Tungsten
Mr. Issa Waswas
@CHEMISTRYIW

74 W Tungsten
Mr. Issa Waswas
@CHEMISTRYIW



53 I Iodine 74 W Tungsten
Mr. Issa W
@CHEMISTF

74 W Tungsten
Mr. Issa Waswas
@CHEMISTRYIW