

تم تحميل هذا الملف من موقع المناهج الإماراتية



مراجعة نهائية وفق الهيكل الوزاري منهج انسابير

[موقع المناهج](#) ← [المناهج الإماراتية](#) ← [الصف العاشر المتقدم](#) ← [كيمياء](#) ← [الفصل الثالث](#) ← [الملف](#)

تاريخ إضافة الملف على موقع المناهج: 09:48:33 2024-06-13

إعداد: طارق محمد

التواصل الاجتماعي بحسب الصف العاشر المتقدم



اضغط هنا للحصول على جميع روابط "الصف العاشر المتقدم"

روابط مواد الصف العاشر المتقدم على تلغرام

[الرياضيات](#)

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[اللغة العربية](#)

[التربية الاسلامية](#)

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

[تجميع أسئلة واختبارات سابقة وفق الهيكل الوزاري](#)

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هيكل 10ADV (حكومي)



EOT Term 3
2023/2024

المادة: الكيمياء

المدرس: طارق محمد



State the properties of metallic bond

1

Textbook + Figure 10

83

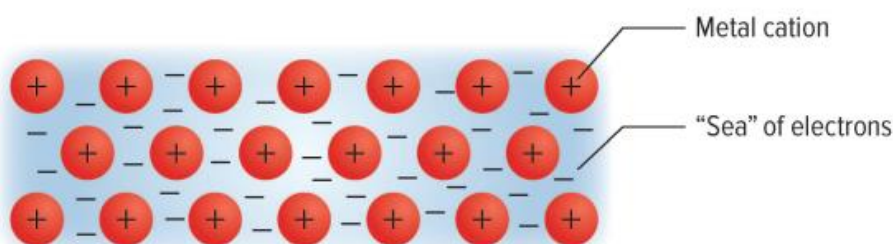


Figure 10 The valence electrons in metals (shown as a **blue cloud** of minus signs) are evenly distributed among the metallic cations (shown in red). Attractions between positive cations and the negative "sea" hold the metal atoms together in a lattice.

All the metal atoms contribute their valence electrons to form a "sea" of electrons.

The valence electrons of the bonding metallic atoms are not held by any specific atoms, and they are free to move, they are often referred to as **delocalized electrons**.

The attraction of a metallic cation for delocalized electrons is called **metallic bond**.

Which is the best description of the valence electrons in the metallic bond?

ما الوصف الأفضل لإلكترونات التكافؤ في الرابطة الفلزية؟



A. Have a fixed position in the lattice

A. لديها مواقع ثابتة في الشبكة

B. It is a sea of free-moving electrons

B. هي بحر من الإلكترونات الحرة الحركة

C. The electron density is concentrated around specific atoms

C. تتركز كثافة الإلكترون حول ذرات معينة

D. The positive charges repulse with negative charges in it

D. تتنافر فيها الشحنات الموجبة مع الشحنات السالبة

Your Guide to Success

What is the correct statement about the bonding model shown in the figure below?

A - The valence electrons move freely between the metallic nuclei

B - Form a brittle material

C - The Cations convey electricity along the metal

D - The metallic atoms form a "sea" of negatively charged ions

ما العبارة الصحيحة بالنسبة لنموذج الترابط الموضح في الشكل أدناه؟

A - تتحرك إلكترونات التكافؤ بحرية بين النوى الفلزية

B - ينتج عنه مادة هشة

C - تنقل الكاتيونات الكهرباء على امتداد الفلز

D - تكون الذرات الفلزية "بحر" من الأيونات المشحونة بشحنات سالبة



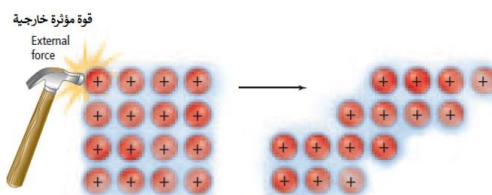


2	CHM.5.1.02.023.03 Explain some physical properties of metals (Melting and boiling points, Thermal and electrical conductivity, Malleability, ductility, durability, Hardness and strength)	Textbook	84
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Property	Explanation
Melting points vary	Mercury is a liquid at room temperature (low melting point), but tungsten has a melting point of 3422°C. The cations and electrons are mobile, so it does not take much energy to move past each other.
High boiling points	It requires much more energy to separate atoms completely from the lattice.
Good conductors	The movement of mobile electrons around positive metallic cations freely.
Luster (shiny)	Delocalized electrons interact with light, absorbing and releasing photons.
Malleability-Ductility-Durability	Metal ions can move through delocalized electrons. Metallic cations are strongly attracted to the electrons and are not easily removed.
Hardness - strength	Transition metals are strong and hard while alkali metals are soft. Transition metals have more delocalized electrons (s and d electrons), but alkali metals have only one delocalized electron

What explain malleability of metals?

ما الذي يُفسر قابلية الفلزات للطرق؟



The movement of the free (delocalized) electrons more easily

حركة الإلكترونات الحرة (غير المتموضعة) بسهولة كبيرة

The reaction of free (delocalized) electrons with light

تفاعل الإلكترونات الحرة (غير المتموضعة) مع الضوء

The movement of metallic cations through free (delocalized) electrons

حركة أيونات الفلزات عبر الإلكترونات الحرة (غير المتموضعة)

The movement of fixed electrons around the metallic cation

حركة الإلكترونات المثبتة حول الكاتيون الفلزي

Your Guide to Success

What explain the luster of metals?

ما الذي يُفسر لمعان الفلزات؟



The movement of the free (delocalized) electrons more easily

حركة الإلكترونات الحرة (غير المتموضعة) بسهولة كبيرة

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تفاعل الإلكترونات الحرة (غير المتموضعة) مع الضوء

The movement of metallic cations through free (delocalized) electrons

حركة أيونات الفلزات عبر الإلكترونات الحرة (غير المتموضعة)

The movement of electrons is fixed around the metallic cation

حركة الإلكترونات المثبتة حول الكاتيون الفلزي



An **alloy** is a mixture of elements that has metallic properties.

Substitutional alloys	Interstitial alloys
Some atoms in the original metallic solid are replaced by other metals of similar atomic size.	When the small holes in a metallic crystal are filled with smaller atoms.
Sterling silver is an example where copper atoms replace some of the silver atoms in the crystal.	Carbon steel is an example where holes in the iron crystal are filled with carbon atoms.

Which of the following is **correct** regarding the alloys in the table below?

أي مما يأتي **صحيح** فيما يتعلق بالسبائك الواردة في الجدول أدناه؟

3	2	1	رقم السبيكة Alloy number
الفضة الإسترلينية Sterling silver	الفولاذ الكربوني Carbon steel	سبيكة من التيتانيوم والفانديوم Titanium and vanadium alloy	السبيكة Alloy

Both **2** and **3** alloys are examples of Interstitial alloys

كلًا من السبيكة **2** و **3** تُعتبر مثالًا على السبائك الفراغية

Alloy **3** is an example of an interstitial alloy

السبيكة **3** تُعتبر مثالًا على السبائك الفراغية

Alloy **1** is used to make bicycle frames

تُستخدم السبيكة **1** في صناعة أجزاء الدراجات

Alloy **2** is an example of a substitutional alloy

السبيكة **2** تُعتبر مثالًا على السبائك الاستبدالية

Steel is an example of Interstitial alloys. What element is added to the iron crystal to obtain steel?

- A – Carbon (C)
- B – Silver (Ag)
- C – Tin (Sn)
- D – Lead (Pb)

يُعتبر الفولاذ من أمثلة السبائك الفراغية. ما العنصر الذي يتم إضافته إلى بلورة الحديد للحصول على الفولاذ؟

- A – الكربون (C)
- B – الفضة (Ag)
- C – القصدير (Sn)
- D – الرصاص (Pb)



Electronegativity Values for Selected Elements

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1 H 2.20												5 B 2.04	6 C 2.55	7 N 3.04	8 O 3.44	9 F 3.98
3 Li 0.98	4 Be 1.57											13 Al 1.61	14 Si 1.90	15 P 2.19	16 S 2.58	17 Cl 3.16
11 Na 0.93	12 Mg 1.31											31 Ga 1.81	32 Ge 2.01	33 As 2.18	34 Se 2.55	35 Br 2.96
19 K 0.82	20 Ca 1.00	21 Sc 1.36	22 Ti 1.54	23 V 1.63	24 Cr 1.66	25 Mn 1.55	26 Fe 1.83	27 Co 1.88	28 Ni 1.91	29 Cu 1.90	30 Zn 1.65	49 In 1.78	50 Sn 1.96	51 Sb 2.05	52 Te 2.1	53 I 2.66
37 Rb 0.82	38 Sr 0.95	39 Y 1.22	40 Zr 1.33	41 Nb 1.6	42 Mo 2.16	43 Tc 2.10	44 Ru 2.2	45 Rh 2.28	46 Pd 2.20	47 Ag 1.93	48 Cd 1.69	81 Tl 1.8	82 Pb 1.8	83 Bi 1.9	84 Po 2.0	85 At 2.2
55 Cs 0.79	56 Ba 0.89	57 La 1.10	72 Hf 1.3	73 Ta 1.5	74 W 1.7	75 Re 1.9	76 Os 2.2	77 Ir 2.2	78 Pt 2.2	79 Au 2.4	80 Hg 1.9					
87 Fr 0.7	88 Ra 0.9	89 Ac 1.1														

Figure 20 Electronegativity values are derived by comparing an atom's attraction for shared electrons to that of a fluorine atom's attraction for shared electrons. Note, the electronegativity values for the lanthanide and actinide series, which are not shown, range from 1.12 to 1.7.

Table 7 EN Difference Between Atoms within a Compound and Bond Character

Electronegativity Difference	Bond Character
> 1.7	mostly ionic
0.4 – 1.7	polar covalent
< 0.4	mostly covalent
0	nonpolar covalent

Electronegativity and Bond Character

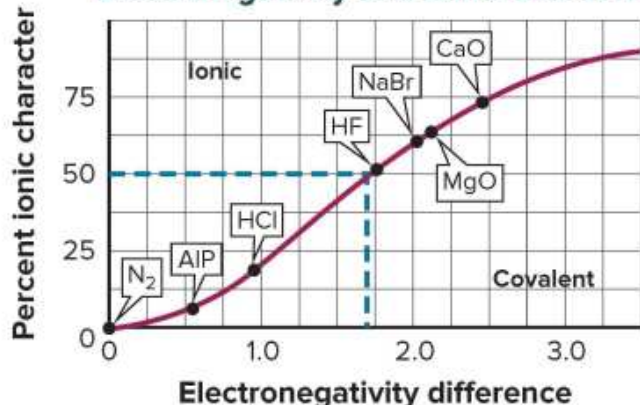


Figure 21 This graph shows that the difference in electronegativity between bonding atoms determines the percent ionic character of the bond. Above 50% ionic character, bonds are mostly ionic.

Figure 21 summarizes the range of chemical bonding between two atoms. What percent ionic character is a bond between two atoms that have an electronegativity difference of 2.00? Where would LiBr be plotted on the graph?



What is the bond type in H_2O molecule?

ما نوع الرابطة في الجزيء H_2O ؟

H	O	العنصر Element
2.20	3.44	السالبية الكهربائية Electronegativity

Mostly ionic

أيونية غالبًا

Nonpolar covalent

تساهمية غير قطبية

Polar covalent

تساهمية قطبية

Mostly covalent

تساهمية غالبًا

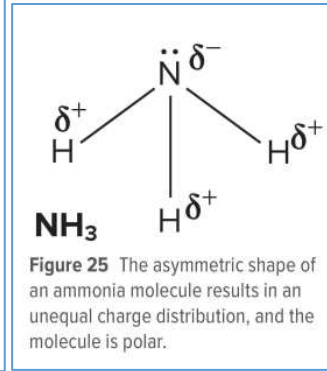
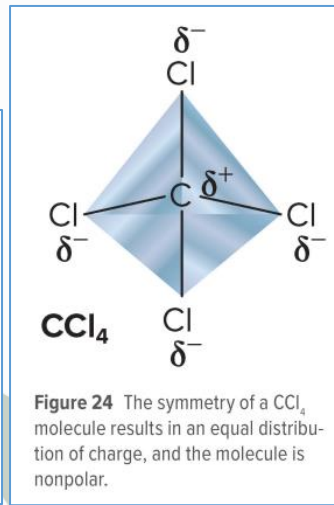
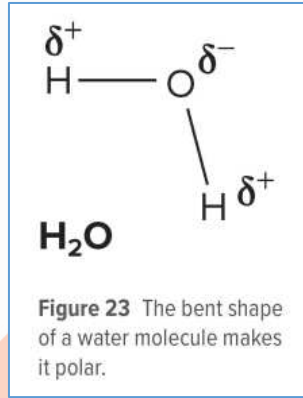
12. Look at the electronegativity difference in the table.

Which kind of bond is present in the compound OF_2 ?

element	electronegativity
oxygen	3.44
fluorine	3.98

- a. ionic b. metallic
c. polar covalent d. nonpolar covalent

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Polar	nonpolar
Molecule is asymmetric. It has lone pairs of electrons on the central atom	Molecule is symmetric. No lone pairs of electrons on the central atom

Which of the following is correct regarding the two molecules in the table below?

أي مما يأتي صحيح فيما يتعلق بالجزيئين في الجدول أدناه؟

		شكل الجزيء Molecule's shape
2	1	رقم الجزيء Molecule's number

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Molecule **1** is nonpolar due to the symmetry of the molecule

الجزيء **1** غير قطبي بسبب تناظر الجزيء

Both molecules are polar

كلا الجزيئين قطبي

Both molecules are nonpolar

كلا الجزيئين غير قطبي

Molecule **2** is nonpolar due to the symmetry of the molecule

الجزيء **2** غير قطبي بسبب تناظر الجزيء



Figure 2 Kinetic energy can be transferred between gas particles during an elastic collision. Between collisions, the particles move in straight lines.

Explain the influence that gas particles have on each other, both in terms of collisions and what happens to particles between collisions.

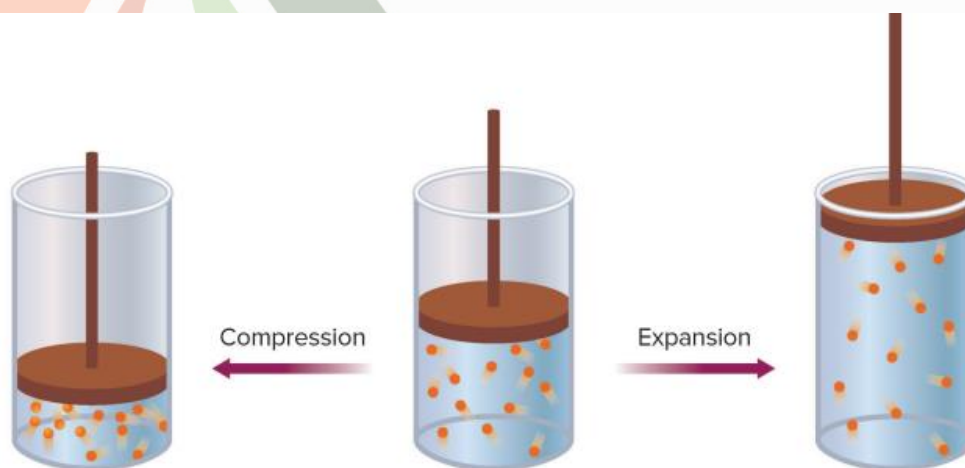


Figure 3 In a closed container, compression and expansion change the volume occupied by a constant mass of particles.

Relate the change in volume to the density of the gas particles in each cylinder.

The Kinetic-Molecular Theory

- Gases consist of **small particles** that are separated from one another by **empty space**.
- The particles have **no attractive or repulsive forces**.
- Gas particles are in **constant, random motion**.
- Particles move in a **straight line**.
- Collisions between gas particles are **elastic** (no kinetic energy is lost).
- The **total kinetic energy** of the two particles **does not change**.
- All particles **do not have the same kinetic energy** (different velocity).
- **Temperature** is a measure of the **average kinetic energy** of the particles.
- The constant motion of gas particles allows a gas to **expand** until it **fills its container**.
- Gases have **low density**. much space exists between gas particles.
- Gases can be **compressed** as there is an empty space between the particles.

$$KE = \frac{1}{2} mv^2$$

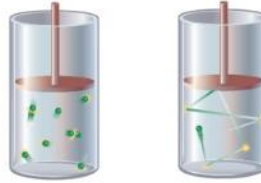


What definitely explain the decrease in density of gases in comparison to the density of liquids?

- The strong attractive forces between the gas particles.
- The far distance between the gas particles.
- The slow motion of gas particles.
- The inelastic collision between gas particles.

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

أي العبارات التالية **ليست** افتراضاً لنظرية الحركة الجزيئية؟



All the gas particles in a sample have the same velocity.

لكل جسيمات الغاز في عينة ما نفس السرعة.

A gas particle is not significantly attracted or repelled by other gas particles.

لا تتجاذب أو تتنافر جسيمات الغاز مع بعض.

Collisions between gas particles are elastic.

يكون التصادم بين جسيمات الغاز مرناً.

All gases at a given temperature have the same average kinetic energy.

لكل الغازات في درجة حرارة معينة نفس متوسط الطاقة الحركية.

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?

في نظرية الحركة الجزيئية أي من المصطلحات التالية هي مقياس لمتوسط الطاقة الحركية للجسيمات لعينة من المادة؟

Volume

الحجم

Temperature

درجة الحرارة

Mass

الكتلة

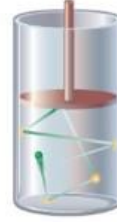
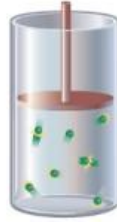
Density

الكثافة



Which of the following statements is **True**?

أي العبارات التالية **صحيحة**؟



Particles of a gas collide with each other and with the walls of their container, these collisions are inelastic.

جسيمات الغاز تتصادم مع بعضها البعض ومع جدران الوعاء وهذه التصادمات غير مرنة

Particles of a gas collide with their container only

جسيمات الغاز تتصادم بجدار الوعاء فقط

Particles of a gas never collide

جسيمات الغاز لا تتصادم

Particles of a gas collide with each other and with the walls of their container, these collisions are elastic.

جسيمات الغاز تتصادم مع بعضها البعض ومع جدران الوعاء وهذه التصادمات مرنة

Which of the following is **correct** about gases?

أي مما يأتي **صحيح** فيما يتعلق بالغازات؟

The volume of the particles is big compared with the volume of the empty space

حجم الجسيمات كبير مقارنة بحجم الفضاء الفارغ

Gas particles experience significant attractive and repulsive forces

تخضع جسيمات الغاز لقوى تجاذب وتنافر

During collision of gas particles kinetic energy is lost

أثناء تصادم جسيمات الغاز يحدث فقد في الطاقة الحركية

Gas particles are in constant, random motion

حركة جسيمات الغاز دائمة وعشوائية

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

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



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

What is the ratio of diffusion rates for carbon monoxide and carbon dioxide?

(Molar masses: CO = 28.01 g/mol , CO₂ = 44.01 g/mol)

- a. 1.25
- b. 1.15
- c. 1.47
- d. 1.95

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?

غاز النيون له كتلة مولية 20.0 g/mol، وغاز كلوريد الهيدروجين له
كتلة مولية 36.5 g/mol.
ما هي نسبة معدلات انتشارها؟

0.54

0.77

1.35

1.83

What is the ratio of diffusion rates for sulfur
trioxide(SO₃) and sulfur dioxide(SO₂)?

ما نسبة معدلات انتشار ثالث أكسيد الكبريت (SO₃) وثاني أكسيد
الكبريت (SO₂)؟

Molar mass of sulfur trioxide = 80 g/mol

الكتلة المولية لثالث أكسيد الكبريت = 80 g/mol

Molar mass of sulfur dioxide = 64 g/mol

الكتلة المولية لثاني أكسيد الكبريت = 64 g/mol

1.12

2.50

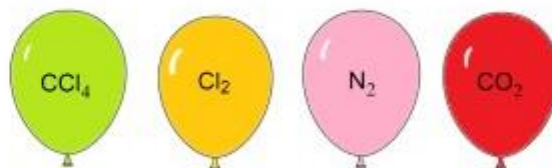
0.894

0.768



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

أربع بالونات متطابقة تم ملؤها بنفس الحجم من غازات مختلفة.
أي البالونات سيتدفق الغاز منه بشكل أسرع؟



CCl ₄	Cl ₂	N ₂	CO ₂	الكتلة المولية
154	71	28	44	Molar Mass (g/mol)

CO₂CCl₄N₂Cl₂

An unknown gas diffuses 1.25 times faster than
N₂O₄ gas. What is the molar mass of unknown gas?
(molar mass of carbon dioxide gas N₂O₄= 92.0 g/mol)

غاز مجهول يتدفق أسرع بـ 1.25 مرات من غاز N₂O₄
ما الكتلة المولية للغاز المجهول؟
(الكتلة المولية لغاز ثاني أكسيد الكربون N₂O₄ = 92.0 g/mol)

36.2 g/mol 58.9 g/mol 7.7 g/mol 18.6 g/mol

3. CHALLENGE What is the rate of effusion for a gas that has a molar mass twice that of a gas that effuses at a rate of 3.6 mol/min?



Dalton's Law of Partial Pressures

Dalton's law of partial pressures can be summarized by the following equation.

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

P_{total} represents total pressure. P_1 , P_2 , and P_3 represent the partial pressures of each gas up to the final gas, P_n .

To calculate the total pressure of a mixture of gases, add the partial pressures of each of the gases in the mixture.

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?

ما الضغط الكلي لخليط يحتوي على ثلاث غازات ضغوطها الجزئية كالتالي 5.22 kPa ، 3.81 kPa ، 1.35 kPa ؟



7.68 kPa

10.38 kPa

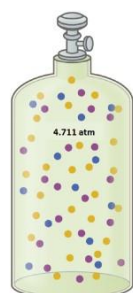
12.76 kPa

6.57 kPa

A sealed flask contains oxygen, helium, and nitrogen.

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

وعاء مغلق يحتوي خليط من غازات الأوكسجين والهيليوم والنيتروجين. إذا كان الضغط الكلي في الوعاء 4.711 atm ، والضغط الجزئي لـ O_2 هو 2.592 atm ، والضغط الجزئي لـ He هو 0.836 atm ، ما هو الضغط الجزئي لـ N_2 ؟



2.955 atm

8.139 atm

0.467 atm

1.283 atm



What is the partial pressure of carbon dioxide in a gas mixture with a total pressure of 40.8 kPa ,if the partial pressures of the other two gases in the mixture are 18.4 kPa and 7.50 kPa.

a. **8.50**b. **10.2**c. **5.20**d. **14.9**

What is the partial pressure of water vapor in an air sample when the total pressure is **1.00 atm**, the partial pressure of nitrogen is **0.79 atm**, the partial pressure of oxygen is **0.20 atm**, and the partial pressure of all other gases in air is **0.0044 atm**?

ما الضغط الجزئي لبخار الماء في عينة من الهواء عندما يكون الضغط الكلي **1.00 atm** والضغط الجزئي للنيتروجين **0.79 atm** والضغط الجزئي للأكسجين **0.20 atm** والضغط الجزئي لجميع الغازات الأخرى **0.0044 atm**؟

0.0056 atm

0.2100 atm

0.80 atm

0.9956 atm

CHALLENGE Air is a mixture of gases. By percentage, it is roughly 78 percent nitrogen, 21 percent oxygen, and 1 percent argon. (There are trace amounts of many other gases in air.) If the atmospheric pressure is 760 mmHg, what are the partial pressures of nitrogen, oxygen, and argon in the atmosphere?

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9	<p>CH.M.5.1.02.007 Explain how the physical and chemical properties of a solid or liquid depend on the present particles, the type of bonds, and the intermolecular and intramolecular forces</p>	Textbook + Figures 9,10 , 11	251 , 252 , 253
10	<p>CH.M.5.1.02.007.15 Compare and contrast the intermolecular forces (dispersion forces, dipole-dipole forces, and hydrogen bond) with respect to type of molecules involved and strength</p>	Textbook + table 3	254

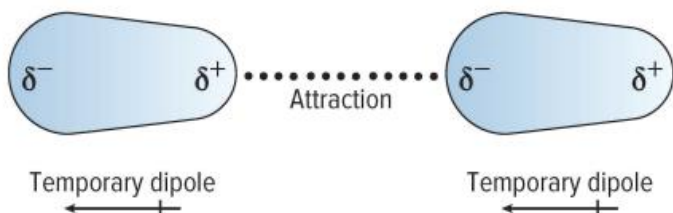


Figure 9 When two molecules are close together, the electron clouds repel each other, creating temporary dipoles. The δ sign represents an area of partial charge on the molecule.

Explain what the $\delta+$ and $\delta-$ signs on a temporary dipole represent.

In which halogen the dispersion forces are the most strong?

Fluorine-9

Iodine-53

Bromine-35

Chlorine-17

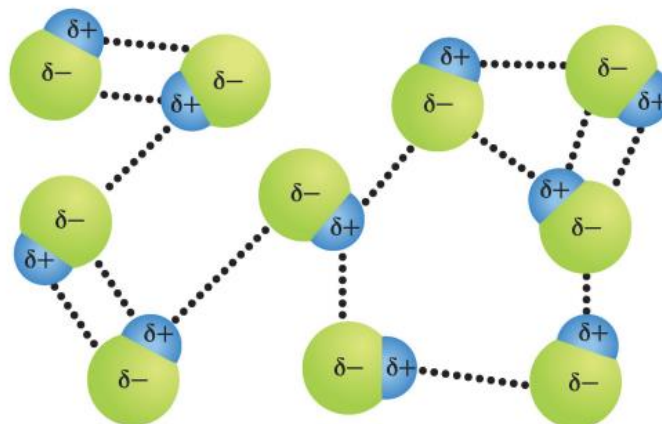


Figure 10 Neighboring polar molecules orient themselves so that oppositely charged regions align.

Identify the types of forces that are represented in this figure.

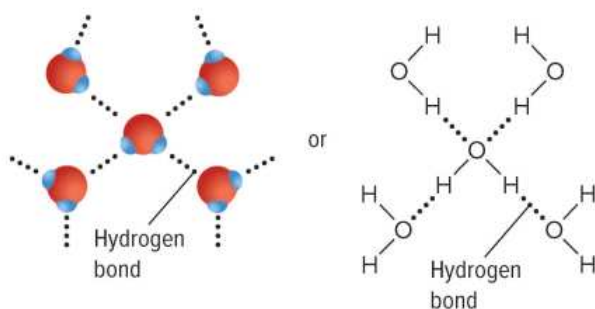


Figure 11 The hydrogen bonds between water molecules are stronger than typical dipole-dipole attractions because the bond between hydrogen and oxygen is highly polar.



Table 3 Properties of Three Molecular Compounds

Compound	Molecular Structure	Molar Mass (g)	Boiling Point (°C)
Water (H ₂ O)		18.0	100
Methane (CH ₄)		16.0	-161.5
Ammonia (NH ₃)		17.0	-33.3

What is the reason for the high boiling point of ammonia (NH₃) compared with the boiling point of methane(CH₄)?

Compound	Molecular structure	Molar mass (g/mol)	Boiling point (°C)
Water (H ₂ O)		18.0	100
Methane (CH ₄)		16.0	-161.5
Ammonia (NH ₃)		17.0	-33.3

- The molar mass of ammonia is greater than the molar mass of methane.
- The presence of hydrogen bonds between the methane molecules.
- The presence of hydrogen bonds between the ammonia molecules.
- Polarity of methane molecules.

Your Guide to Success

Which of the following is an intermolecular force?

أي من التالية تُعتبر من قوى الترابط بين الجزيئية؟

Hydrogen bond	الرابطه الهيدروجينية	<input type="radio"/>
Metallic bond	الرابطه الفلزية	<input type="radio"/>
Ionic bond	الرابطه الأيونية	<input type="radio"/>
Covalent bond	الرابطه التساهمية	<input type="radio"/>



Which of the following molecules can form Hydrogen bonds?

أي من الجزيئات التالية يمكن ان تشكل روابط هيدروجينية؟

HF

HCl

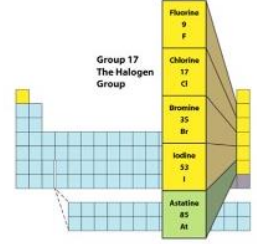
H₂S

CH₄

The element Astatine is the heaviest known halogen, what would its physical state be at room temperature?

عنصر الأستاتين هو أثقل عنصر معروف في مجموعة الهالوجينات، ما حالته الفيزيائية المتوقعة في درجة حرارة الغرفة؟

	5	6	7	8	9	10	
	B	C	N	O	F	Ne	
	13	14	15	16	17	18	
	Al	Si	P	S	Cl	Ar	
30	31	32	33	34	35	36	
Zn	Ga	Ge	As	Se	Br	Kr	
48	49	50	51	52	53	54	
Cd	In	Sn	Sb	Te	I	Xe	
80	81	82	83	84	85	86	
Hg	Tl	Pb	Bi	Po	At	Rn	



Solid

الصلبة

Plasma

البلازما

Liquid

السائلة

Gas

الغازية

Why is the boiling point of ammonia much lower than the boiling point of water, as shown in the table below?

لماذا تكون درجة غليان الأمونيا أقل بكثير من درجة غليان الماء، كما هو مبين في الجدول أدناه؟

المركب Compound	التركيب الجزيئي Molecular Structure	الكتلة المولية Molar Mass (g/mol)	درجة الغليان Boiling point (°C)
الماء Water (H ₂ O)		18.0	100
الأمونيا Ammonia (NH ₃)		17.0	- 33.3

Because nitrogen atoms are more electronegative than oxygen atoms

لأن ذرات النيتروجين أكثر سالبية كهربائية من ذرات الأكسجين

Because N-H bonds in ammonia are less polar than O-H bonds in water

لأن الروابط N-H في الأمونيا أقل قطبية من الروابط O-H في الماء

Because ammonia is a liquid at room temperature

لأن الأمونيا سائل في درجة حرارة الغرفة

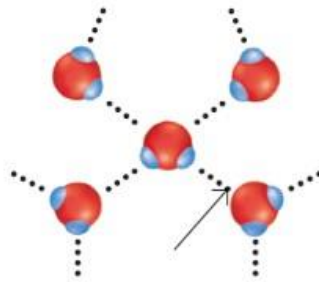
Because the molar mass of ammonia is less than water

لأن الكتلة المولية للأمونيا أقل منها للماء



What is the type of attraction forces shown in the figure below?

ما نوع قوى التجاذب المشار لها في الشكل أدناه؟



Covalent bonds

الروابط التساهمية

Hydrogen bonds

الروابط الهيدروجينية

Dispersion forces

قوى التشتت

Ionic bonds

الروابط الأيونية

What explains the low boiling point of ammonia

ما الذي يُسر انخفاض درجة غليان الأمونيا مقارنة

compared to with the boiling point of water?

مع درجة غليان الماء؟

درجة الغليان (°C) Boiling Point (°C)	الكتلة المولية (g/mol) Molar Mass(g/mol)	تركيب الجزيء Molecular Structure	المركب Compound
100	18.0		ماء (H ₂ O) Water
-33.3	17.0		الأمونيا (NH ₃) Ammonia

Ammonia molecules do not form hydrogen bonds

لا تكون جزيئات الأمونيا روابط هيدروجينية

Ammonia molecules are nonpolar

جزيئات الأمونيا غير قطبية

The attractive forces between ammonia molecules are weaker than it in water molecules

قوى الجذب بين جزيئات الأمونيا أضعف من قوى الجذب بين جزيئات الماء

The attractive forces between ammonia molecules are weaker than it in water molecules

قوى الجذب بين جزيئات الأمونيا أضعف من قوى الجذب بين جزيئات الماء

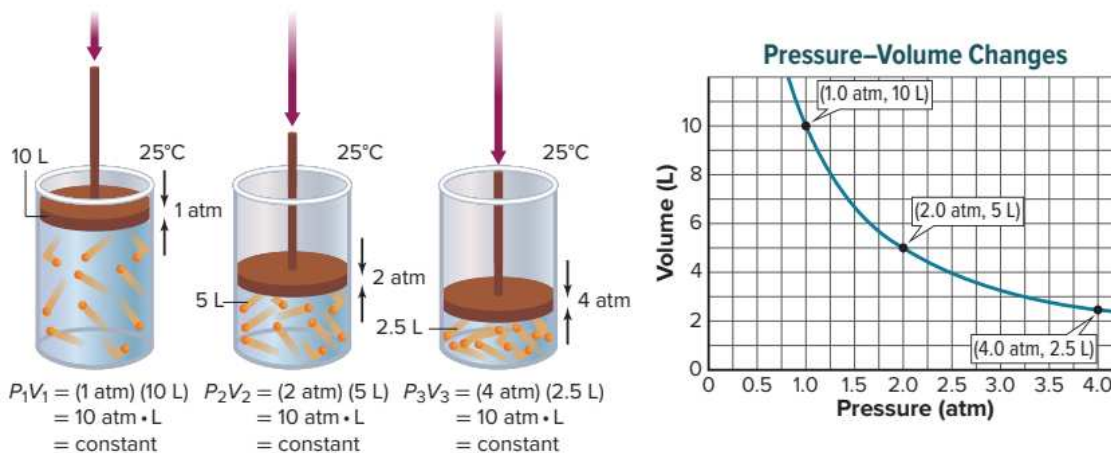


Figure 1 As the external pressure on the cylinder's piston increases, the volume inside the cylinder decreases. The graph shows the inverse relationship between pressure and volume.

Boyle's Law

$$P_1V_1 = P_2V_2 \quad P \text{ represents pressure. } V \text{ represents volume.}$$

For a given amount of gas held at constant temperature, the product of pressure and volume is constant.

The pressure of a sample of helium in a container of 1.00L volume is 3.95 atm, if the temperature remains constant. What is the new pressure in (atm) if the same sample is placed in a 2.00L container?

- A – 1.98
- B – 7.90
- C – 0.494
- D - 0.247

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

حجم غاز 400.0 ml وعند ضغط 1.00 atm
إذا أصبح حجم الغاز 2.0 L ، ما ضغط الغاز عند نفس درجة الحرارة؟

0.20 atm

0.5 atm

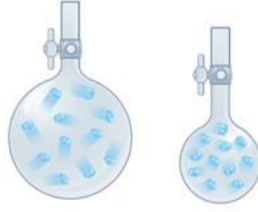
5.0 atm

0.80 atm



The pressure of a sample of helium in a 1.0 L container is 0.857 atm. What is the pressure if the same sample is placed in a 0.50 L container?
(Assume that the temperature is constant.)

ضغط عينة من الهيليوم في حاوية سعة 1.0 L هو 0.857 atm. ما الضغط إذا تم وضع نفس العينة في حاوية سعة 0.50L؟ (افتراض أن درجة الحرارة ثابتة)



0.44 atm

1.4 atm

1.7 atm

0.14 atm

Increasing the pressure on the balloon's gas shown in the figure below, how that would affect the balloon's volume at constant temperature?

عند ازدياد الضغط على الغاز في البالون الموضح بالشكل أدناه، ما تأثير ذلك على حجم البالون عند ثبات درجة الحرارة؟



It will increase

سوف يزداد

It will decrease

سوف يقل

It will stay the same

سيبقى كما هو

It will increase triple times

يزداد ثلاثة أضعاف

Air trapped in a cylinder fitted with a piston occupies **365.5 mL** at **0.985 atm** pressure. What is the new volume (mL) when the piston is depressed, increasing the pressure by **50%**?

هواء محصور في أسطوانة مغلقة بمكبس يشغل **365.5 mL** عند ضغط **0.985 atm** ، ما الحجم الجديد (mL) إذا تم ضغط المكبس بحيث يزيد الضغط بمقدار **50%**؟

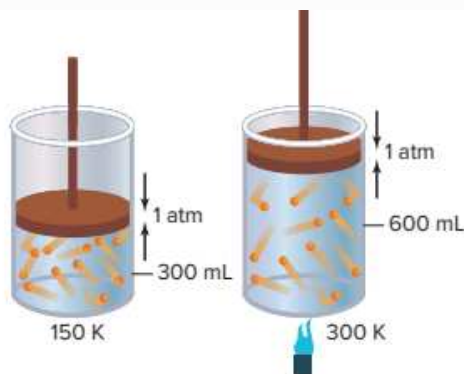
244

354

198

455

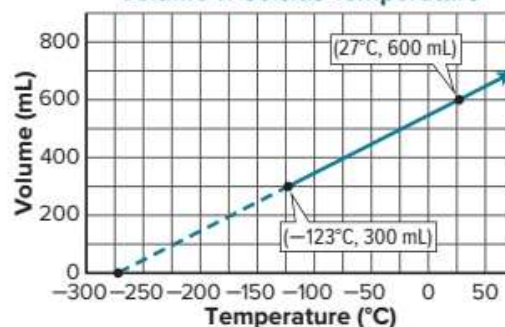
CHALLENGE Air trapped in a cylinder fitted with a piston occupies 145.7 mL at 1.08 atm pressure. What is the new volume when the piston is depressed, increasing the pressure by 25%?



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

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

Volume v. Celsius Temperature



Volume v. Kelvin Temperature

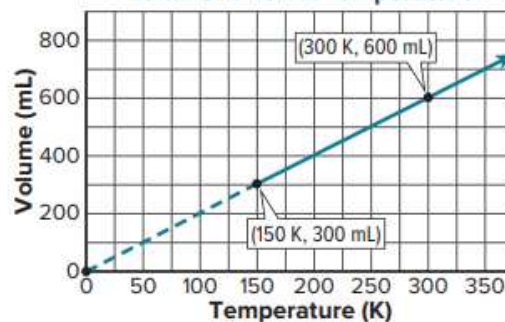


Figure 2 When the cylinder is heated, the kinetic energy of the gas particles increases, causing them to push the piston outward. The graphs show the relationship of volume to Celsius and Kelvin temperatures.

Charles's law

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

V represents volume.
T represents Temperature.

For a given amount of gas at constant pressure, the quotient of the volume and Kelvin temperature is a constant.

The Celsius temperature of a 6.8L of gas sample is lowered from 27°C to 0.0°C, at constant pressure. What will be the resulting volume (L) of this gas?

- A - 7.47
- B - 6.19
- C - 4.64
- D - 3.10

What volume will the gas in the balloon at the right occupy at 250 K?
(Assume that the pressure and the amount of gas remain constant)

- a. 20.3 L
- b. 3.07 L
- c. 1.4 L
- d. 6.02 L





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

ما حجم الغاز الموجود في البالون أدناه عندما تتغير درجة الحرارة إلى 348 K ؟



4.01 L

3.84 L

2.73 L

2.31 L

A sample of gas occupies a volume of **6.50 L** at **95.0 °C** .What is the Celsius temperature (**°C**) at which the volume of the gas sample will become **1.63 L**?

تشغل عينة من غاز حجمًا **6.50 L** عند درجة حرارة **95.0 °C** فما درجة الحرارة (**°C**) التي يُصبح عندها حجم عينة الغاز **1.63 L** ؟

-181

-92

365

418

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

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13	CHM5.2.01.304.19 Use the mathematical formula of Gay-Lussac's law to calculate pressure-temperature changes for a gas sample at constant volume	Textbook + figure3 + example problem 3 + practice problems	283, 284
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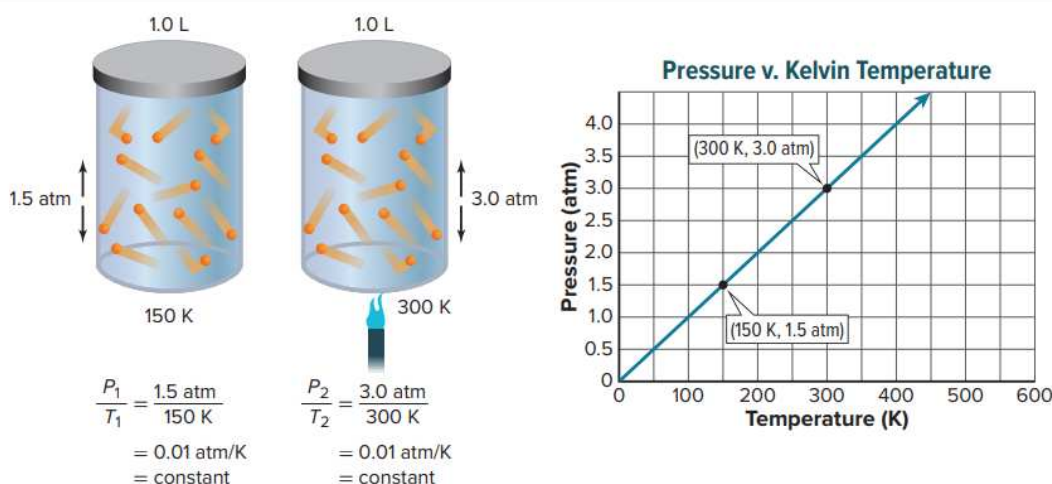


Figure 3 When the cylinder is heated, the kinetic energy of the particles increases, increasing both the frequency and energy of the collisions with the container wall. The volume of the cylinder is fixed, so the pressure exerted by the gas increases.

Gay-Lussac's Law

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}$$

P represents pressure.
T represents temperature.

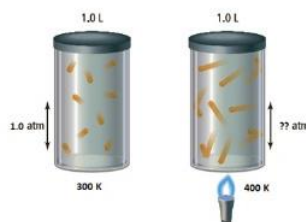
For a given amount of gas held at constant volume, the quotient of the pressure and the Kelvin temperature is a constant.

The pressure in an automobile tire is 2.50 atm at 40.0°C . What will be the pressure if the temperature decreases to 32.0°C? (the volume remains constant)

- A – 2.57
- B – 1.52
- C – 2.44
- D – 1.28

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

الضغط لغاز في أسطوانة 1.00 atm عند 300 K. كم سيصبح الضغط إذا زادت درجة الحرارة إلى 400 K؟



- 0.75 atm
- 2.67 atm
- 2.44 atm
- 1.30 atm



GAY-LUSSAC'S LAW The pressure of the oxygen gas inside a canister is 5.00 atm at 25.0°C. The canister is located at a camp high on Mount Everest. If the temperature there falls to -10.0°C , what is the new pressure inside the canister?

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

Helium gas in a 2.00-L cylinder is under 1.12 atm pressure. At 36.5°C, that same gas sample has a pressure of 2.56 atm. What was the initial temperature in degrees Celsius of the gas in the cylinder?

CHALLENGE If a gas sample has a pressure of 30.7 kPa at 0.00°C, by how many degrees Celsius does the temperature have to increase to cause the pressure to double?



The Combined Gas Law

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

P represents pressure. V represents volume.
 T represents temperature.

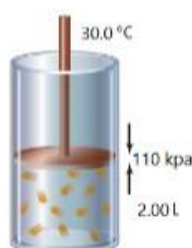
For a given amount of gas, the product of pressure and volume, divided by the Kelvin temperature, is a constant.

A sample of gas starts at 110.0 kPa, 30.0° C, and 2.00 L.

What is the volume in mL if the temperature increases to 80.0° C and the pressure increases to 440.0 kPa?

عينة من الغاز بدأت عند 110.0 kPa ، 30.0° C ، 2.00 L.

ما الحجم إذا زادت درجة الحرارة إلى 80.0° C وزاد الضغط إلى 440.0 kPa ؟



0.64 L

0.58 L

1.3 L

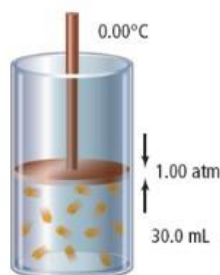
8.1 L

A sample of gas starts at 1.00 atm, 0.00° C, and 30.0 mL.

What is the volume if the temperature increases to 27.0° C and the pressure increases to 2.00 atm?

عينة من الغاز بدأت عند 1.00 atm ، 0.00° C ، 30.0mL.

ما الحجم إذا زادت درجة الحرارة إلى 27.0° C وزاد الضغط إلى 2.00 atm ؟



65.9 mL

16.5 mL

54.6 mL

13.7 mL



The volume of a sample of gas measured at 25.0°C and 1.00 atm is 5.00 L. If the gas was pressed to 3.00 atm and the volume became 2.00 L what is the final temperature?

حجم عينة من الغاز على درجة حرارة 25.0°C وضغط 1.00 atm هو 5.00 L. إذا تم ضغط الغاز لـ 3.00 atm وأصبح الحجم 2.00 L فما درجة الحرارة النهائية للغاز؟



$$\begin{aligned} V_1 &= 5.00 \text{ L} \\ P_1 &= 1.00 \text{ atm} \\ T_1 &= 25.0^\circ\text{C} \end{aligned}$$



$$\begin{aligned} V_2 &= 2.00 \text{ L} \\ P_2 &= 3.00 \text{ atm} \end{aligned}$$

98.2°C

30.0°C

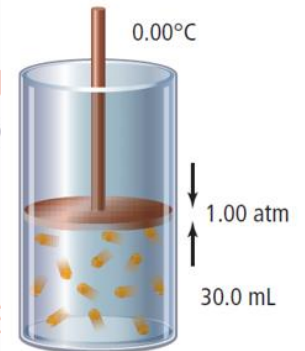
84.6°C

20.3°C

CHALLENGE If the temperature in the gas cylinder at right increases to 30.0°C and the pressure increases to 1.20 atm, will the cylinder's piston move up or down?

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

"الأحجام المتساوية من الغازات تحتوي عند نفس الضغط ودرجة الحرارة على أعداد متساوية من الجسيمات" هو نص



Combined gas law

القانون العام للغازات

Le Châtelier's principle

مبدأ لوشاتيليه

Ideal gas law

القانون الغاز المثالي

Avogadro's principle

مبدأ أفوجادرو

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

22.4 L

3.72 L

1.00 L

6.02 L

What is the volume of 7.85 mol sample of gas at (STP)? (the molar volume is 22.4 L at STP)

A – 1.43 L

B – 2.90 L

C – 88.0 L

D – 176 L

What size container do you need to hold 0.0459 mol of N_2 gas at STP?

How much carbon dioxide gas, in grams, is in a 1.0-L balloon at STP?

Molar mass $CO_2 = 44 \text{ g/mol}$



What volume in milliliters will 0.00922 g of H_2 gas occupy at STP?

Molar mass $H_2 = 2 \text{ g/mol}$

What volume will 0.416 g of krypton gas occupy at STP?

Molar mass Kr = 83.8 g/mol

Calculate the volume that 4.5 kg of ethylene gas (C_2H_4) will occupy at STP.

Molar mass $C_2H_4 = 28 \text{ g/mol}$

CHALLENGE 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 Helium = 4 g/mol

How many neon atoms are there in 1.86 L sample

ما عدد ذرات النيون في 1.86 L منه عند الضغط ودرجة الحرارة

at standard temperature and pressure (STP)?

القياسيين (STP)؟

$$6.02 \times 10^{23}$$

ثابت (عدد) أفوجادرو

Avogadro's constant(number)

$$R = 0.0821 \text{ L.atm/mol.K}$$

$$5.00 \times 10^{22}$$

$$2.70 \times 10^{23}$$

$$3.50 \times 10^{24}$$

$$1.40 \times 10^{25}$$



The Ideal Gas Law

$$PV = nRT$$

P represents pressure. V represents volume.

n represents number of moles. R is the ideal gas constant.

T represents temperature.

For a given amount of gas held at constant temperature, the product of pressure and volume is a constant.

$$\frac{P_1V_1}{n_1T_1} = \frac{P_2V_2}{n_2T_2}$$

Value of R	Units of R
0.0821	$\frac{\text{L}\cdot\text{atm}}{\text{mol}\cdot\text{K}}$
8.314	$\frac{\text{L}\cdot\text{kPa}}{\text{mol}\cdot\text{K}}$
62.4	$\frac{\text{L}\cdot\text{mm Hg}}{\text{mol}\cdot\text{K}}$

What is the volume of a 0.323 mol sample of a gas at 12°C and 0.900 atm?

ما حجم عينة من غاز عدد مولاتها 0.323 mol عند 12°C و 0.900 atm؟

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

7.26 L

8.40 L

3.53 L

6.52 L

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

ما حجم (L) عينة من غاز الهيليوم مقدارها 0.216 mol عند درجة حرارة 30.0 °C وضغط 7.16 atm؟

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

0.750 L

1.40 L

0.375 L

2.85 L

An ideal gas has a volume of 9.40 L. If the number of moles of gas and the temperature (K) are doubled, while the pressure remains constant, what is the new volume of the gas (L)?

A – 4.70

B – 2.35

C – 37.6

D - 18.8



Determine the Celsius temperature of 2.49 mol of a gas contained in a 1.00-L vessel at a pressure of 143 kPa.

Calculate the volume of a 0.323-mol sample of a gas at 265 K and 0.900 atm.

What is the pressure, in atmospheres, of a 0.108-mol sample of helium gas at a temperature of 20.0°C if its volume is 0.505 L?

If the pressure exerted by a gas at 25°C in a volume of 0.044 L is 3.81 atm, how many moles of gas are present?

CHALLENGE An ideal gas has a volume of 3.0 L. If the number of moles of gas and the temperature are doubled, while the pressure remains constant, what is the new volume?



$$MPV = mRT$$

$$MP = DRT$$

M is molar mass, m is the mass, D is the density

What is the molar mass of unknown gas at STP,
if its density was 1.70 g/L?

ما الكتلة المولية لغاز مجهول عند درجة الحرارة والضغط القياسيين STP،
إذا كانت كثافة الغاز 1.70 g/L ؟

$$R = 0.0821 \text{ L.atm/mol.K}$$

87.3 g/mol

25.6 g/mol

38.1 g/mol

5.11 g/mol

A **4.25 L** flask is filled with butane gas (C_4H_{10})
at a pressure of **1.5atm** and a temperature of
-20 °C. What is the mass of butane in the flask?

دورق حجمه **4.25 L** مملوء بغاز البيوتان (C_4H_{10}) عند ضغط
1.5atm ودرجة حرارة **-20 °C** فما كتلة البيوتان في الدورق؟

R	الكتلة المولية للبيوتان C_4H_{10} Molar mass of butane C_4H_{10}
0.0821 L.atm/mol.K	58.1 g/mol

17.8 g

8.9 g

26.7 g

13.5 g

A 4.50 L flask is filled with butane gas (C_4H_{10})
under a pressure of 1.20 atm and a temperature
of (-10.0°C). What is the mass of the butane in
the flask?

(molar mass of butane = 58.1 g / mol , R = 0.0821)

A – 46.5 g

B – 14.5 g

C – 26.6 g

D - 35.8 g



	Ideal gases(follow kinetic molecular theory)	Real gases(deviate from ideal)
Particles behaviour	Particles take up no space	Particles have volume
	No attraction or repulsion	There are intermolecular interactions
	Collisions between particles are elastic	Collisions are not elastic
Conditions	High temperature	Low temperature
	Low pressure	High pressure
	Nonpolar	Polar
	Small particles(low molar mass)	Large particles(high molar mass)

When does a real gas behave like an ideal gas?

- When the particles are far apart and attractive forces decreases
- When the particles are closer together and attractive forces increases
- At high pressure and low temperature
- When the gas is liquefied if enough pressure is applied

When real gases deviate most from ideal gas behavior?

- At high pressures and low temperatures
- At low pressures and high temperatures
- At high pressures and high temperatures
- At low pressures and low temperatures

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

أي مما يلي من خصائص الغاز المثالي؟

Its particles move at variable velocities and on winding (zigzag) lines

تتحرك جسيماته بسرعات متغيرة وبمسارات متعرجة

Its particles take up space and measured in volume units (L)

تشغل جسيماته حيزاً من الفراغ ويعبر عنها بوحدة الحجم (L)

Its particles collide with each other or with the wall surface in perfectly elastic way

تتصادم جسيماته ببعضها أو مع جدران الوعاء تصادمات مرنة بشكل مثالي

Its particles experience intermolecular attractive forces

تتعرض جسيماته لقوى تجاذب بينها

When does a real gas behave like an ideal gas?

متى يسلك الغاز الحقيقي مثل الغاز المثالي؟

At high pressure and low temperature

عند الضغط العالي ودرجة الحرارة المنخفضة

When high pressure is applied and the gas changes to the liquid phase

عندما تتحول حالة الغاز إلى سائل، عند التأثير عليه بضغط مرتفع

When the particles are close to each other, and attractive forces are high

عندما تقترب الجزيئات عن بعضها البعض وتزداد قوى التجاذب

When the particles are far apart, and the attractive forces are low

عندما تبتعد الجزيئات عن بعضها البعض وتقل قوى التجاذب



19	CHM.5.2.01.006.03 Identify what the coefficients in a balanced chemical equation specify	Textbook + example problem 7 + practice problems	296 , 297 , 298 , 299
20	calculate the amounts of gaseous reactants and products in a chemical reaction	Textbook + example problem 8 + practice problems	298 , 299

In the chemical reactions' equations, which physical state/s of matter that can use their coefficients to represent both molar amounts and relative volumes?

في معادلات التفاعلات الكيميائية، أي حالة/ حالات فيزيائية من حالات المادة يمكن استخدامها معاملات لتحديد كميات المولات ونسبها والنسب الحجمية لتلك المواد؟

i.	Gas	غاز	.i
ii.	Liquid	سائل	.ii
iii.	Solid	صلب	.iii

i and ii

ii و i

i, ii, and iii

iii ، ii ، i

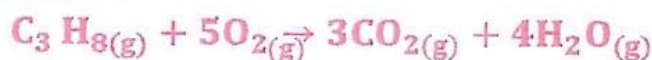
i only

i فقط

ii only

ii فقط

How many liters of propane gas (C₃H₈) will undergo complete combustion with 35.0 L of oxygen gas?



a. 5.00 L

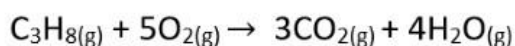
b. 7.00 L

c. 0.250 L

d. 0.200 L

How many liters of propane gas (C₃H₈) will undergo complete combustion with 30.0 L of oxygen gas? Assume that pressure and temperature remain constant

كم عدد لترات غاز البروبان (C₃H₈) التي سيتم احتراقها بالكامل بوجود 30.0 L من غاز الأوكسجين؟ افترض ثبات الضغط ودرجة الحرارة



2 L

1 L

6 L

5 L



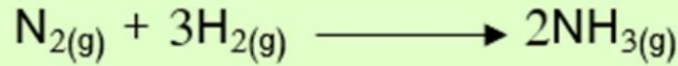
Nitrogen and hydrogen gases react to form ammonia gas (NH₃). What volume of ammonia is formed from the reaction of 8.75 L of hydrogen H₂?

يتفاعل غاز النيتروجين مع غاز الهيدروجين لتكوين غاز الأمونيا (NH₃). ما حجم الأمونيا التي تنتج من تفاعل 8.75 L من الهيدروجين H₂؟

Assume that temperature and pressure remain

افترض ثبات درجة الحرارة والضغط

constant



5.80 L

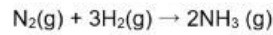
13.3 L

9.50 L

15.8 L

What is the mass of ammonia gas (NH₃) can be formed from 13.7 L of hydrogen gas H₂ at 93.0°C and a pressure of 0.396 atm according to the reaction in the chemical equation below? (molar mass of NH₃ = 17.04 g/mol) (R = 0.0821 L.atm/mol.K)

ما كتلة غاز الأمونيا (NH₃) التي يمكن أن تتشكل من 13.7 L من غاز الهيدروجين H₂ عند درجة حرارة 93°C وضغط 0.396 atm حسب التفاعل المبين في المعادلة الكيميائية أدناه؟ (الكتلة المولية لـ NH₃ = 17.04 g/mol) (R = 0.0821 L.atm/mol.K)



0.274 g

0.122 g

2.05 g

1.24 g

When iron rusts, it undergoes a reaction with oxygen to form iron(III) oxide.

عندما يصدأ الحديد، فإنه يتفاعل مع الأكسجين لتكوين أكسيد الحديد (III).

What is the volume of oxygen gas at STP that is required to completely react with 52.0 g of iron?

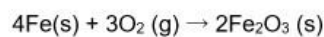
ما حجم غاز الأكسجين عند درجة الحرارة والضغط القياسيين STP اللازم ليتفاعل تمامًا مع 52.0 g من الحديد؟

(molar mass of Fe = 55.8 g/mol)

(الكتلة المولية لـ Fe = 55.8 g/mol)

R = 0.0821 L.atm/mol.K

R = 0.0821 L.atm/mol.K



1.24 L

27.8 L

15.7 L

0.711 L



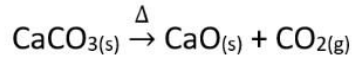
What is the volume of carbon dioxide gas produced from the complete decomposition of 25 g from calcium carbonate by heating, according to the below equation, and at STP conditions? (if the molar mass of $\text{CaCO}_3 = 100 \text{ g/mol}$)

$R = 0.0821 \text{ L.atm/mol.K}$

ما حجم غاز ثاني أكسيد الكربون الناتج من التفكك التام لـ 25 g من كربونات الكالسيوم بالتسخين، وفقاً للمعادلة أدناه، وعند درجة الحرارة والضغط القياسيين؟

(علماً بأن الكتلة المولية $\text{CaCO}_3 = 100 \text{ g/mol}$)

$0.0821 \text{ L.atm/mol.K} = R$



5.60 L



8.22 L



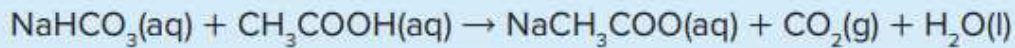
89.7 L



12.3 L



CHALLENGE An excess of acetic acid is added to 28 g of sodium bicarbonate at 25°C and 1 atm pressure. During the reaction, the gas cools to 20°C. What volume of carbon dioxide will be produced? The balanced equation for the reaction is shown below.



Molar mass $\text{NaHCO}_3 = 84 \text{ g/mol}$ – $R = 0.0821 \text{ L.atm/mol.K}$

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