

UNIT

1

Chemical Substances

Lesson One

Metals and Nonmetals

Lesson Two

Acids and Alkalis

Lesson Three

Chemical indicators and Salts



Learning Outcomes : By the end of this unit, the student should be able to :

1. Explain the metallic bond.
2. Differentiate between metals and nonmetals.
3. Describe bronze alloy.
4. Differentiate between the properties of each of the acids and the alkalis.
5. Recognize pH and its relation with acidity and basicity.
6. Describe the properties of the salts.
7. Distinguish between acids, alkalis and salt solutions by using chemical indicators.
8. Recognize a profile of the scientist Soren Sorensen.

Lesson **ONE**

Metals and Nonmetals



Lesson Terminology :

- Metal.
- Nonmetal.
- Metallic bond.
- Alloys.



Included Skills, Values and Issues :

- **Skills** : Discovery – Conclusion – Deduction.
- **Value** : Collaboration.
- **Issue** : The environmental effects of mining.



Lesson Objectives :

By the end of the lesson, the student should be able to :

1. Differentiate between the properties of each of the metals and the nonmetals.
2. Identify the metallic bond.
3. Describe the formation of the alloys.
4. Identify the importance of metals recycling.



Lesson Preparation :

The figure shows a lion statue found at the entrance of Qasr El-Nile bridge.

This lesson explores ideas that will help you answer these questions :

- What is the relation between bronze and copper ?
- Is copper a metal or a nonmetal ?
- Why are the statues not made of nonmetals ?



Metals and Nonmetals

Properties of Metals

- The last energy level in their atoms ends with **1, 2 or 3** electrons.



Sodium atom
 $_{11}\text{Na}$

- All of them are solids, except mercury element, "the only liquid metal."



Mercury

- They have metallic luster (shiny).



Sodium

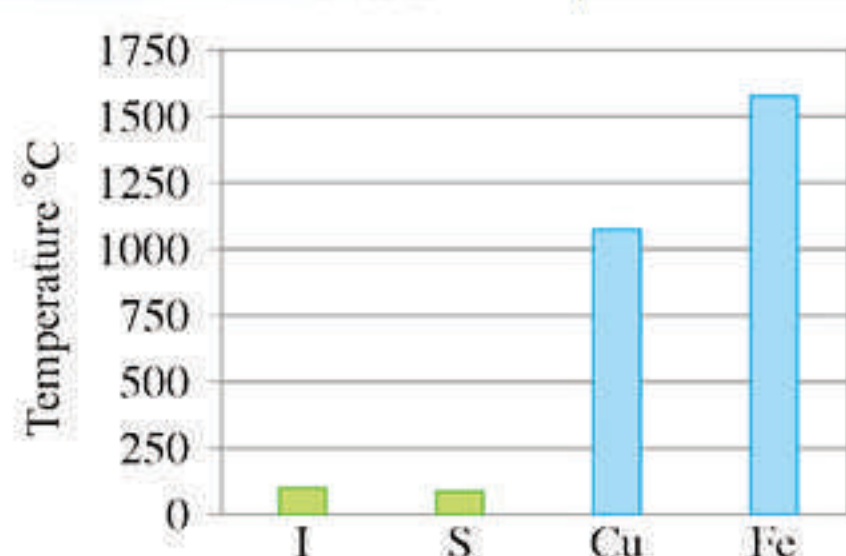
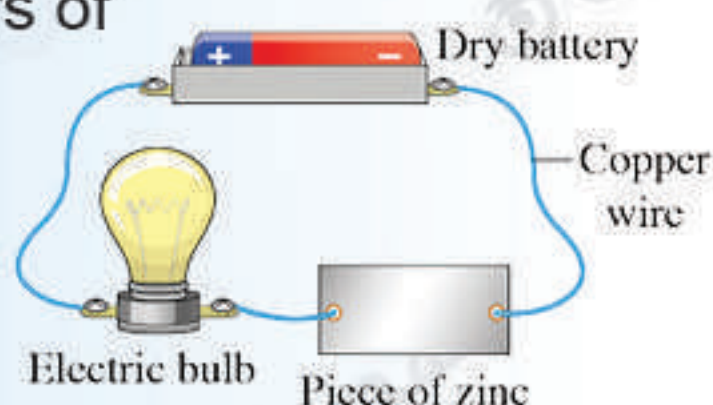
- Malleable, ductile and formable.



Copper

- Good conductors of heat (thermal conductors).

- Good conductors of electricity (electrical conductors).



Melting points of some metals and nonmetals

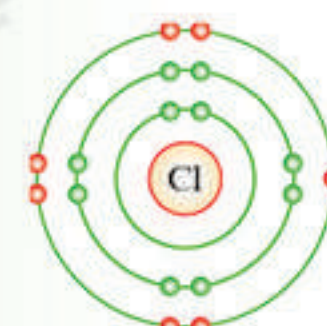
- Their melting points are high.

Examples :

- Sodium.
- Copper.
- Zinc.
- Silver.
- Iron.

Properties of Nonmetals

- The last energy level in their atoms ends with **5, 6 or 7** electrons, with the exception of hydrogen (1 electron) and carbon (4 electrons).



Chlorine atom
 $_{17}\text{Cl}$

- They are either solids or gases, except bromine element, "the only liquid nonmetal."



Bromine

- They do not have luster (opaque).



Carbon (graphite)

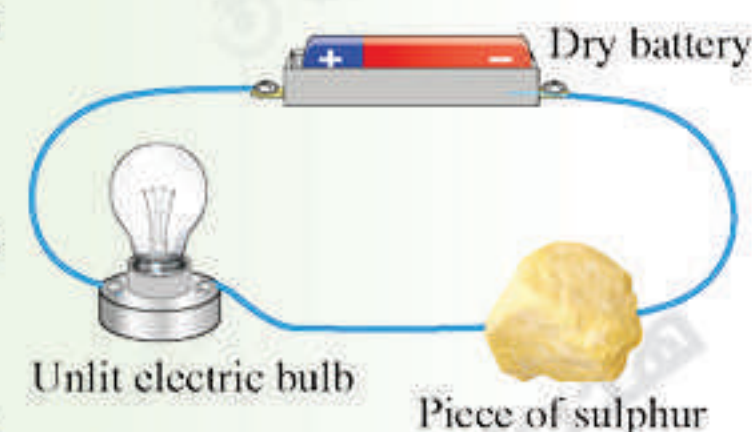
- Not malleable or ductile (brittle).



Sulphur

- Bad conductors of heat.

- Bad conductors of electricity, except graphite which is used in dry cells.



- Their melting points are low.

Examples :

- Carbon.
- Sulphur.
- Phosphorus.
- Bromine.
- Iodine.

What happens when ? With explanation

Hammering a piece of sulphur.

The piece of sulphur crumbles easily, **because** sulphur is a brittle nonmetal (not malleable).



G.R. ?

1

A piece of copper can be easily shaped into various forms.

Because

Copper is a metal and is malleable, ductile and formable.

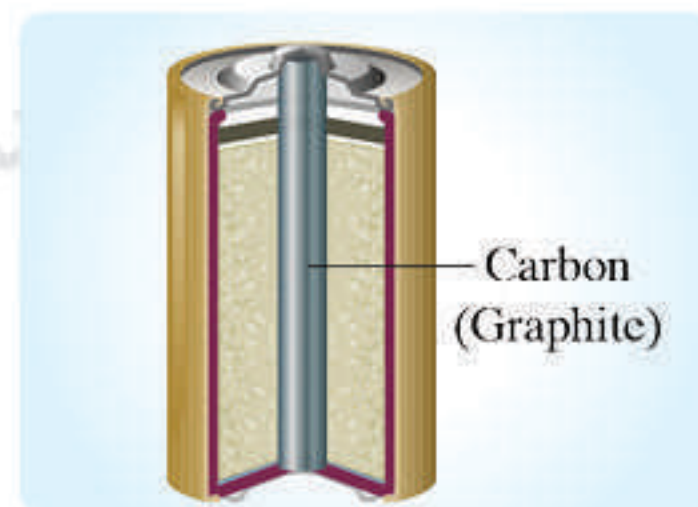


2

Graphite is used in manufacture of the dry cells despite being a nonmetal.

Because

Graphite is the only good electrical conductor nonmetal.

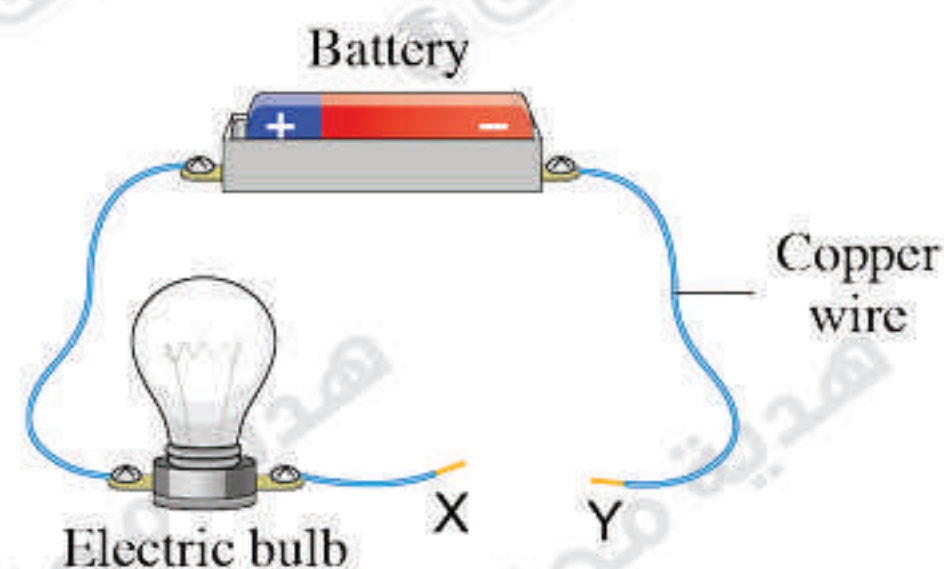


Dry cell

Question ? Answer

Q1 In the shown electrical circuit :
The electric bulb lights up when the ends (X) and (Y) are connected with each of the following substances, except

- (a) zinc.
- (b) graphite.
- (c) phosphorus.
- (d) silver.



Idea of answering :

- ∴ Zinc and silver are metals and are good electrical conductors.
- ∴ The choices (a) and (d) are excluded.
- ∴ Graphite is the only good electrical conductor nonmetal.
- ∴ The choice (b) is excluded.

A The correct choice is : (c)

Q2 The table below shows the properties of 4 elements:

Element	Physical state	Electrical conductivity	Colour
(W)	Solid	Bad conductor	Coloured
(X)	Solid	Good conductor	Black
(Y)	Gas	Bad conductor	Colourless
(Z)	Liquid	Good conductor	Coloured

Which of the following represents some of these elements?

- Ⓐ (W): Sulphur, (Y) : Hydrogen , (Z): Bromine.
- Ⓑ (W): Carbon , (Y) : Hydrogen , (Z): Mercury.
- Ⓒ (X): Carbon , (Y) : Oxygen , (Z): Mercury.
- Ⓓ (X): Sulphur , (Y) : Oxygen , (Z): Bromine.

Idea of answering:

- ∴ Mercury is the only liquid metal, and bromine is the only liquid nonmetal, and the metals are good electrical conductors.
- ∴ (Z) represents mercury not bromine.
- ∴ The choices Ⓐ and Ⓓ are excluded.
- ∴ Carbon is a solid nonmetal that is a good conductor of electricity and is black in colour.
- ∴ (X) represents carbon.
- ∴ The choice Ⓑ is excluded.

A The correct choice is : Ⓒ

Revise

- Important terms ...
- Important comparisons ...
- Important explanations ...
- Important diagrams ...
- Important conclusions ...

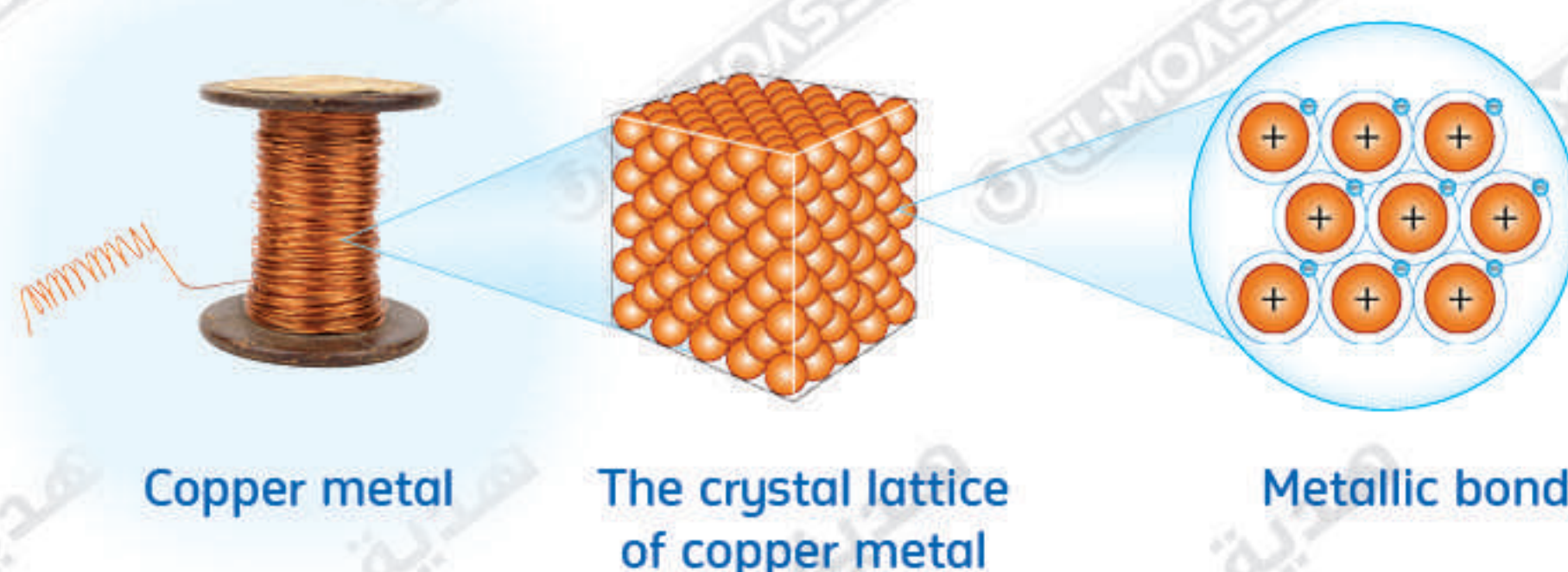
Comprehensively in the Note book



Metallic Bond

The atoms of solid metals are gathered in an arrangement known as **metallic crystal lattice**, where they exist in the lattice as cations (positive ions) surrounded by a cloud of free-moving valence electrons.

The attraction force between these positive metal ions (cations) and the surrounding negative valence electron cloud is known as **the metallic bond**.



Metallic Bond

The attraction force between the positive metal ions and the negative valence electron cloud which surrounds them.

Some physical properties of metals are attributed to (due to) the fact that their atoms bind together through **metallic bonds**. **The metallic bond** is responsible for the metals hardness and their high melting points. As the number of valence electrons in the metal atom **increases**, the strength of its metallic bond also **increases**, consequently, the metal is **harder** and its melting point is **higher**, as illustrated in the following table:

Metal	Sodium • Na	Magnesium • Mg •	Aluminum • Al
Metallic bond			
Melting point	98°C	650°C	660°C
The strength of the metallic bond increases with increasing the number of the valence electrons of the metal			

Alloys

- Pure metals are soft, almost unfit for the industrial uses, therefore, one metal melt or more is added to another metal melt to form what is known as **an alloy**, whose properties are different from the properties of the original elements forming it.
- Alloys are mixtures not compounds, thus most of them are not expressed in molecular formulas.

Alloy

A mixture composed of the melts of two or more metals.

Bronze alloy :



A statue made of bronze

Components

It is composed of copper (95%) and tin (5%)

Properties

It is characterized by being harder than copper and resistant to rusting (does not rust).

Uses

It is one of the well known alloys used in jewellery, medals and statues.

Life Application : Metal Recycling

Recycling

The process of the conversion of the wastes into new usable substances.

Some metals, such as copper, aluminum and iron, are recycled for the following reasons :

1
Decreasing of their abundance (percentage) in the Earth's crust.

2
Difficulty of extracting them from their ores.

3
The lower cost of recycling them compared to extracting them from their ores.



Metal recycling

Test ? Your Understanding

Answered

1 Choose the correct answer :

(1) What is the similarity between metals and nonmetals ?

- (a) They do not have metallic luster.
- (b) They are good conductors of heat.
- (c) They are malleable, ductile and formable.
- (d) The last energy level in their atoms is not filled with electrons.

(2) All the following are properties of graphite, except that it

- (a) is brittle.
- (b) is a bad electrical conductor nonmetal.
- (c) is black in colour.
- (d) does not have metallic luster.

(3) The liquid element that has metallic luster is

- (a) mercury.
- (b) bromine.
- (c) lithium.
- (d) chlorine.

(4) If the hardness of sodium $_{11}\text{Na}$ on the hardness scale is 0.5, then the hardness of aluminum $_{13}\text{Al}$ is

- (a) 0.1
- (b) 0.25
- (c) 0.5
- (d) 2.75

(5) The bronze alloy is formed by adding a small percentage of metal (X) to metal (Y).

Which of the following identifies the metals (X) and (Y)?

- (a) (X): Copper , (Y): Tin.
- (b) (X): Copper , (Y): Sulphur.
- (c) (X): Sulphur, (Y): Copper.
- (d) (X): Tin , (Y): Copper.

2 Give reason:

The melting point of magnesium is higher than that of sodium.

Questions ?

UNIT 1

Lesson 1

First

School Book Questions

Answered

1 Choose the correct answer for the questions from (1) : (5).

(1) All the following are properties of sodium element, except

- (a) a metal.
- (b) has metallic luster.
- (c) bad electrical conductor.
- (d) formable.

(2) Which of the following is the correct arrangement of the hardness of sodium $_{11}\text{Na}$, magnesium $_{12}\text{Mg}$ and aluminum $_{13}\text{Al}$?

- (a) $\text{Na} > \text{Mg} > \text{Al}$
- (b) $\text{Al} > \text{Mg} > \text{Na}$
- (c) $\text{Mg} > \text{Na} > \text{Al}$
- (d) $\text{Al} > \text{Na} > \text{Mg}$

(3) Element (X) its boiling point is 2807°C and its melting point is 1064°C

Which of the following is a property of element (X)?

- (a) Bad electrical conductor.
- (b) Brittle.
- (c) Ductile.
- (d) Opaque.

(4) Which of the following questions helps in the classification of some elements to metals and nonmetals ?

- (a) Is it solid ?
- (b) Is it liquid ?
- (c) Is it coloured ?
- (d) Is it brittle ?

(5) What is the common property of both sodium and copper ?

- (a) Colour.
- (b) Density.
- (c) Melting point.
- (d) Physical state.

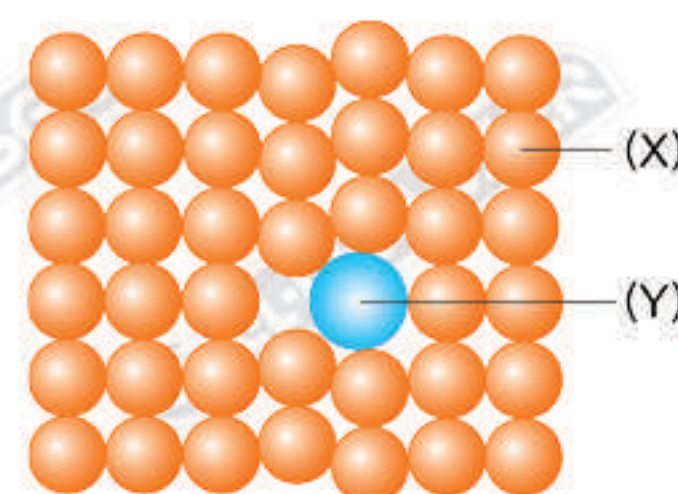
2 Compare between metals and nonmetals, in terms of:

- Electrical conductivity.
- Malleability, ductility and formability.
- Metallic luster.

3 The opposite figure illustrates the composition of the bronze alloy:

(1) What are the elements (X) and (Y) ?

(2) Why are alloys preferred to be used more than the pure metals ?



- 4 The table below shows the properties of 3 elements (a metal, a nonmetal and a metalloid) without order :

Element	Properties
(X)	• Solid at room temperature. • Shiny. • Brittle. • Heat conductor.
(Y)	• Solid at room temperature. • Shiny. • Soft. • Electrical conductor.
(Z)	• Solid at room temperature. • Opaque. • Brittle. • Bad electrical conductor.

Identify the metal and the nonmetal of these elements, with explanation.

Second Questions Bank of EL-MOASSER

Answered

- 1 Write the scientific term for each of the following statements :

- (1) Elements that have metallic luster and are good conductors of heat and electricity.
- (2) Brittle elements that are not malleable or ductile or formable.
- (3) A nonmetallic element that is a good conductor of electricity.
- (4) The attraction force between positive metal ions and the negative valence electron cloud which surrounds them.
- (5) A mixture composed of the melts of two metals or more.
- (6) The process of the conversion of the wastes into new usable substances.

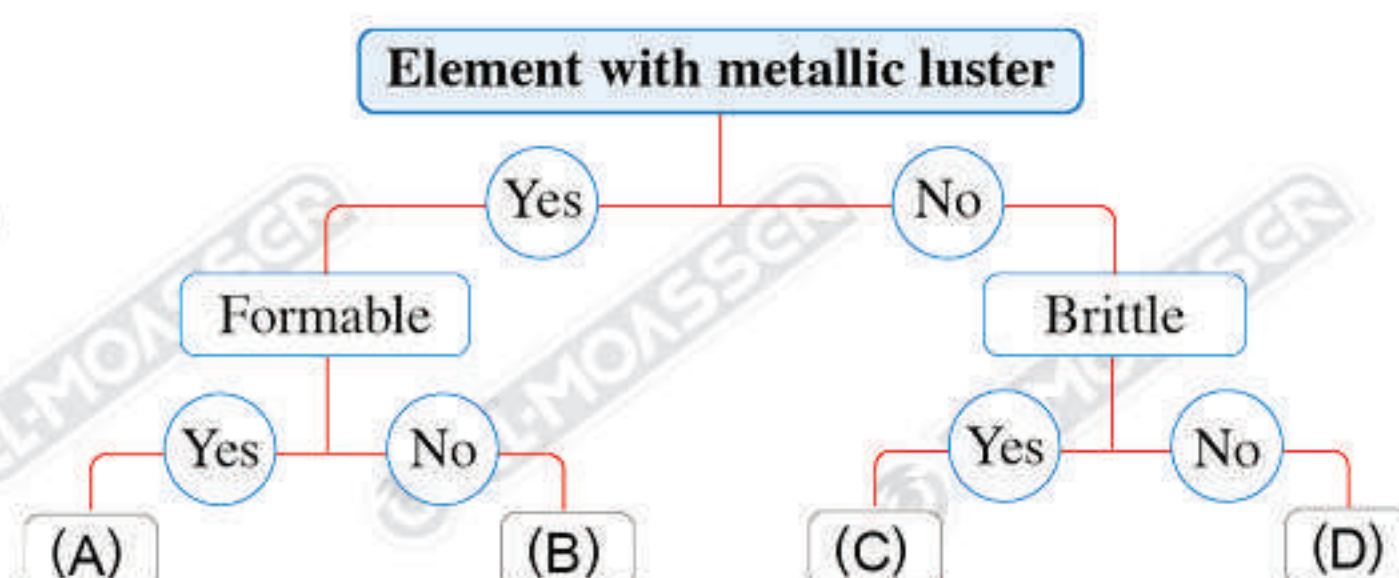
- 2 Choose the correct answer :

- (1) The last energy level of metal atoms contains
 - (a) 1: 3 electrons.
 - (b) 3: 5 electrons.
 - (c) 5: 7 electrons.
 - (d) 8 electrons.
- (2) Which of the following represents pure silver element ?
 - (a) Soft, conducts heat, opaque.
 - (b) Conducts heat, has metallic luster, brittle.
 - (c) Soft, conducts heat, has metallic luster.
 - (d) Conducts electricity, opaque, brittle.

- (3) Based on the opposite diagram :

Which of the following represents magnesium element $_{12}\text{Mg}$?

- (a) (A).
- (b) (B).
- (c) (C).
- (d) (D).



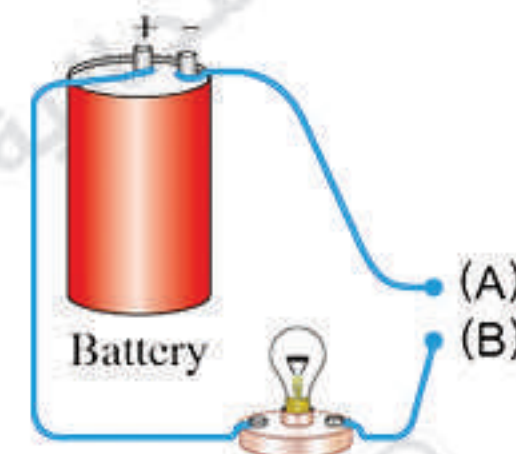
(4) The liquid element which is bad conductor of heat and electricity is

- (a) bromine. (b) chlorine. (c) mercury. (d) lithium.

(5) In the opposite electrical circuit :

Which of the following substances, when connected to the points (A) and (B), will light the bulb ?

- (a) Graphite and sulphur. (b) Sulphur and copper.
(c) Graphite and aluminum. (d) Graphite and bromine.



(6) The metallic bond exists between

- (a) atoms of different metals. (b) atoms of the same metal.
(c) positive ions and negative ions. (d) atoms of metals and hydrogen.

(7) The strength of the metallic bond increases with the increasing the number of the

- (a) protons in the nucleus. (b) valence electrons.
(c) energy levels. (d) neutrons in the nucleus.

(8) The hardest element of the following is

- (a) $_{13}\text{Al}$ (b) $_{17}\text{Cl}$ (c) $_{12}\text{Mg}$ (d) $_{11}\text{Na}$

(9) Copper is a component of the bronze alloy, its percentage is

- (a) 5% (b) 15% (c) 65% (d) 95%

(10) Which of the following describes the metal that is not preferred to be recycled ?

Choices	Its percentage in the Earth's crust	Ease of extraction from its ores	Cost of recycling
(a)	High	Easy	Medium
(b)	Low	Difficult	High
(c)	Low	Difficult	Low
(d)	Medium	Difficult	High

3 Choose from column (B) what suits it in column (A) :

(A)	(B)
(1) Carbon	(1) It inters in the composition of the bronze alloy with a small percentage.
(2) Mercury	(2) A liquid element that is a bad conductor of heat.
(3) Tin	(3) A brittle nonmetal that is a bad conductor of electricity.
(4) Sulphur	(4) A brittle nonmetal that is a good conductor of electricity.
	(5) A liquid element with metallic luster.

4 Complete the following statements :

- (1) The outermost energy level of most nonmetallic elements contains more than electrons and less than electrons.
- (2) The elements are bad conductors of heat and electricity, except which is a good conductor of electricity.
- (3) are characterized by being ductile, malleable and formable, while are characterized by being brittle (not ductile or malleable or formable).
- (4) As the number of valence electrons of the metal atom, the strength of its metallic bond
- (5) The bronze alloy is formed by adding metal to metal.

5 Mark (✓) or (x) for each statement, with correction :

- (1) Lithium and sulphur can be differentiated by electrical conductivity. ()
- (2) Sodium is a soft metal with a melting point lower than that of nonmetals. ()
- (3) Sulphur is used in dry cells. ()
- (4) Bromine is a liquid element with metallic luster. ()
- (5) Magnesium is harder than sodium because the number of valence electrons in magnesium is less than that in sodium. ()
- (6) The hardness of a metal and its high melting point are due to the bonding of its atoms with each other by ionic bonds. ()
- (7) Pure gold metal is harder than gold alloys. ()

6 Give reasons for each of the following :

- (1) Magnesium $_{12}\text{Mg}$ is a metallic element, while sulphur $_{16}\text{S}$ is a nonmetallic element.
- (2) Graphite is used in dry cells despite being a nonmetal.
- (3) A piece of sulphur easily crumbles when hammered, while it is difficult to fragment a piece of iron.
- (4) Aluminum $_{13}\text{Al}$ is harder and has a higher melting point than sodium $_{11}\text{Na}$
- (5) Alloys are preferred to use in industry instead of pure metals.
- (6) The bronze alloy is used in jewellery and statues instead of copper metal.
- (7) Recycling some metals.

7 What is meant by each of the following :

- | | | |
|-------------|----------------------|--------------------|
| (1) Metals. | (2) Nonmetals. | (3) Metallic bond. |
| (4) Alloys. | (5) Metal recycling. | |

8 What happens when :

- (1) A piece of sulphur is hammered.
- (2) The number of valence electrons in metal atoms increases
"In order to: Their melting points".
- (3) A metal melt is added to another metal melt.

9 Choose the odd word out, then state the relation between the rest:

- (1) Magnesium / Copper / Mercury / Silver.
- (2) Lithium / Sodium / Calcium / Carbon.
- (3) Aluminum / Nitrogen / Hydrogen / Iodine.
- (4) Graphite / Sulphur / Chlorine / Oxygen.

10 State one difference between each of the following:

- (1) Sulphur **and** copper. (2) Sodium **and** graphite. (3) Zinc **and** phosphorus.

11 Compare between each of the following :

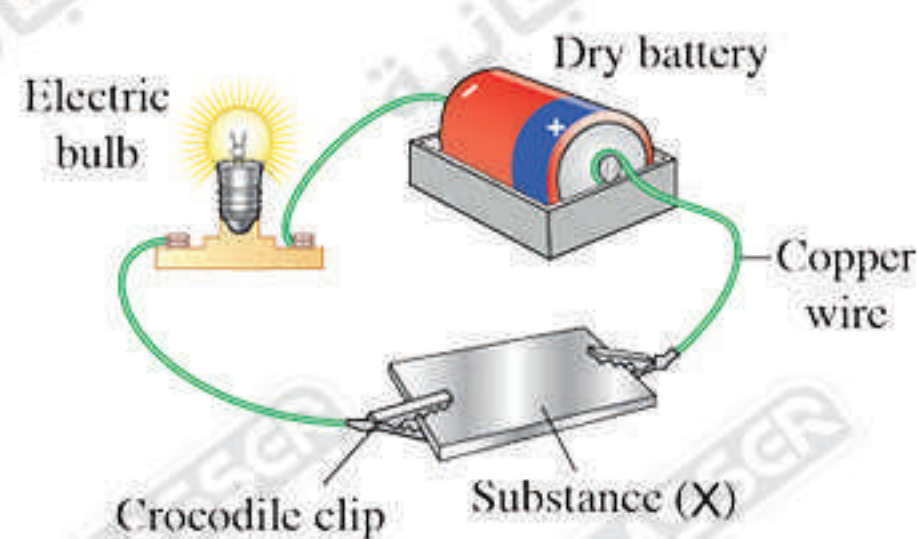
- (1) Metals **and** nonmetals "In terms of: Number of electrons in the outermost energy level - Physical state - Metallic luster - Thermal and electrical conductivity - Formability - Melting point."
- (2) Mercury **and** bromine "In terms of: Type of element - Physical state - Metallic luster."
- (3) Carbon **and** copper "In terms of: Type of element - Thermal conductivity - Electrical conductivity."

12 Study the following figures, then answer the questions:

1 In the opposite figure :

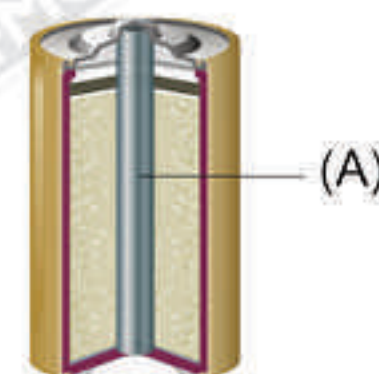
What happens to illuminate the bulb,
with explanation when the substance (X)
is replaced with each of the following :

- (1) A piece of graphite.
- (2) A piece of sulphur.



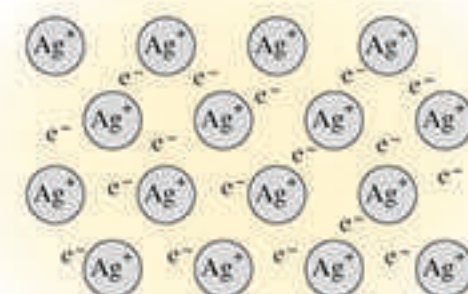
2 From the opposite figure:

- (1) What does the figure represent ?
- (2) What is the name of the element from which part (A) is made? What is its important property?



3 From the opposite figure:

What does the figure represent ?
And what is its effect on silver metal?



13 Variant questions :

- (1) State the properties of each of the following: (1) Metals. (2) Nonmetals.
- (2) State the importance of each of the following: (1) Graphite. (2) Bronze alloy.
- (3) The metallic bond is responsible for the hardness of metals,
State the relation between the number of valence electrons in the metal atom
and both the hardness **and** the melting point of this metal.



Higher-order Questions

Answered

14 Choose the correct answer:

(1) Sulphur $_{16}\text{S}$ element differs from calcium $_{20}\text{Ca}$ element in all the following, except

- (a) physical state. (b) ductility and malleability.
(c) thermal conductivity. (d) metallic luster.

(2) The properties of some different substances are recorded in the following table:

	Substance (1)	Substance (2)	Substance (3)	Substance (4)
Physical state	Solid	Solid	Liquid	Brittle solid
Colour	Shiny gray	White	Silver	Black
Electrical conductivity	Good conductor	Bad conductor	Good conductor	Good conductor

Which of the following are metals ?

- (a) Substances (1), (2). (b) Substances (2), (4).
(c) Substances (1), (3). (d) Substances (3), (4).

(3) The element (X) is shiny and can be hammered into sheets.

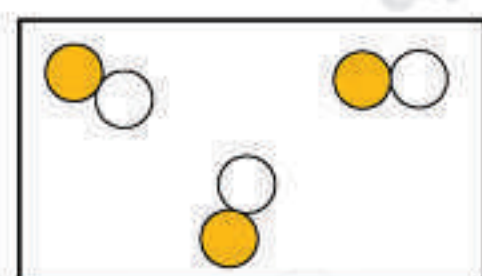
Which of the following describes the properties of element (X)?

Choices	Good electrical conductor	Melts at a temperature below 25°C
(a)	✓	✓
(b)	✓	✗
(c)	✗	✓
(d)	✗	✗

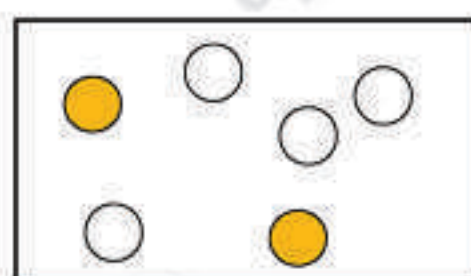
(4) Which of the following elements contains a metallic bond ?

- (a) Carbon. (b) Oxygen. (c) Iron. (d) Nitrogen.

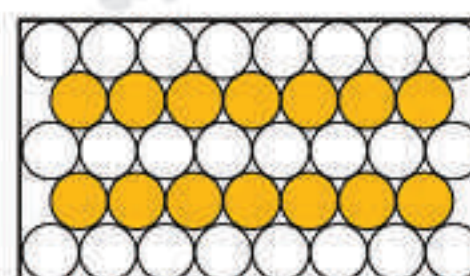
(5) Which of the following represents the composition of a solid alloy ?



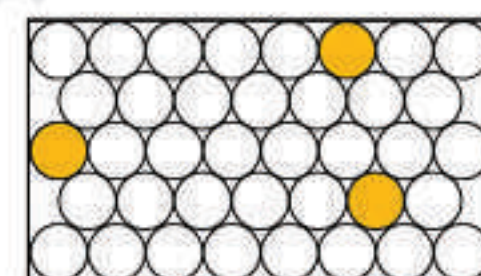
(a)



(b)



(c)



(d)

15 Give reasons : (1) Some metals are used in making cooking utensils.

(2) Some electrical wires are made of aluminum.

(3) Jewellery is made of some metallic elements.

Lesson **Two**

Acids and Alkalis



Lesson Terminology :

- Atomic group (Polyatomic).
- Acid.
- Alkali.
- Oxyacid.
- Acidic oxide.
- Base.
- Acid rain.



Included Skills, Values and Issues :

- **Skills** : Discovery - Prediction - Process.
- **Values** : Appreciation of scientists - Collaboration.
- **Issue** : Economic effect of acid rain.



Cross-Cutting Concept :

- Cause and Effect.



Lesson Objectives :

By the end of the lesson, the student should be able to :

1. Identify Atomic (polyatomic) groups.
2. Conclude the molecular formulas of acids and alkalis.
3. Name the molecular formulas of the acids by knowing the names of their anions.
4. Distinguish between acids and alkalis by using two litmus strips.
5. Recognize the difference between acids and alkalis.
6. Recognize the relation between metal and nonmetal oxides and each of acids and alkalis.
7. Compare between the electrical conductivity of each of strong acids and weak acids.
8. Recognize the harmful impacts of the acid rain.



Lesson Preparation :

This figure shows some household cleaners.

This lesson explores the ideas that will help you answer the following questions :

- Are these cleaners acidic substances or basic substances ?
- What is the relation between metals and alkalis, and between nonmetals and acids ?
- Can the rain be acidic ?



You knew in the first term that :

An ion can be $\rightarrow$ Cation (from a metal) or Anion (from a nonmetal).

► The following are examples of some cations and anions :

Cations (positive ions) (Metallic element ions)	
Lithium.....	Li^+
Sodium.....	Na^+
Potassium.....	K^+
Silver.....	Ag^+
Magnesium.....	Mg^{2+}
Calcium.....	Ca^{2+}
Zinc.....	Zn^{2+}
Barium.....	Ba^{2+}
Aluminum.....	Al^{3+}

Anions (negative ions) (Nonmetallic element ions)	
Fluoride.....	F^-
Chloride.....	Cl^-
Bromide.....	Br^-
Iodide.....	I^-
Oxide.....	O^{2-}
Sulphide.....	S^{2-}



Take care:

- All nonmetallic element ions end with the suffix (-ide).
- The hydrogen cation H^+ is the only positive ion derived from a nonmetallic element.

Atomic Group

- * An ion that composed of more than one atom of more than one element is referred to as **a polyatomic ion or an atomic group**.

Atomic group

An ion composed of more than one atom of more than one element.



- * **The atomic group** carries a number of positive or negative charges.

Examples of some atomic groups and their molecular formulas

Atomic group	Molecular formula	Atomic group	Molecular formula
Hydroxide	OH^-	Carbonate	CO_3^{2-}
Nitrate	NO_3^-	Sulphate	SO_4^{2-}
Nitrite	NO_2^-	Sulphite	SO_3^{2-}
Bicarbonate	HCO_3^-		
Chlorite	ClO_2^-	Phosphate	PO_4^{3-}
Ammonium	NH_4^+		

A simple method to remember the charges of the atomic groups to be studied

Phosphate
group

-3

3 specific atomic groups
(Carbonate, Sulphate, Sulphite)

-2

Other
atomic groups

-1

Except ammonium
group (+1)



Take care:

Ammonium group is the only positively charged atomic group that you should know this year.

Acids and Alkalis

The scientist Arrhenius clarified that :

Acids

Substances that dissolve in water and give positive hydrogen ions H^+



Alkalis

Substances that dissolve in water and give negative hydroxide ions OH^-

Acids



Names of acids :

- ▶ The name of the acid is related to the name of → **The anion** which composes it,
whether it is :

- * An anion of one of the nonmetallic elements (excluding oxygen).
- * An anion of one of the negatively charged atomic groups, (excluding hydroxide group).

- The acids which are composed of atomic groups containing oxygen are called oxyacids.

As illustrated below :

Acids that **do not contain** oxygen

The name begins with a word composed of the prefix "**hydro**", then **the name of the anion**, followed by the word "**acid**"

Acids that **contain** oxygen (Oxyacids)

The name begins with **the name of the anion** (The negatively charged atomic group), followed by the word "**acid**"

With

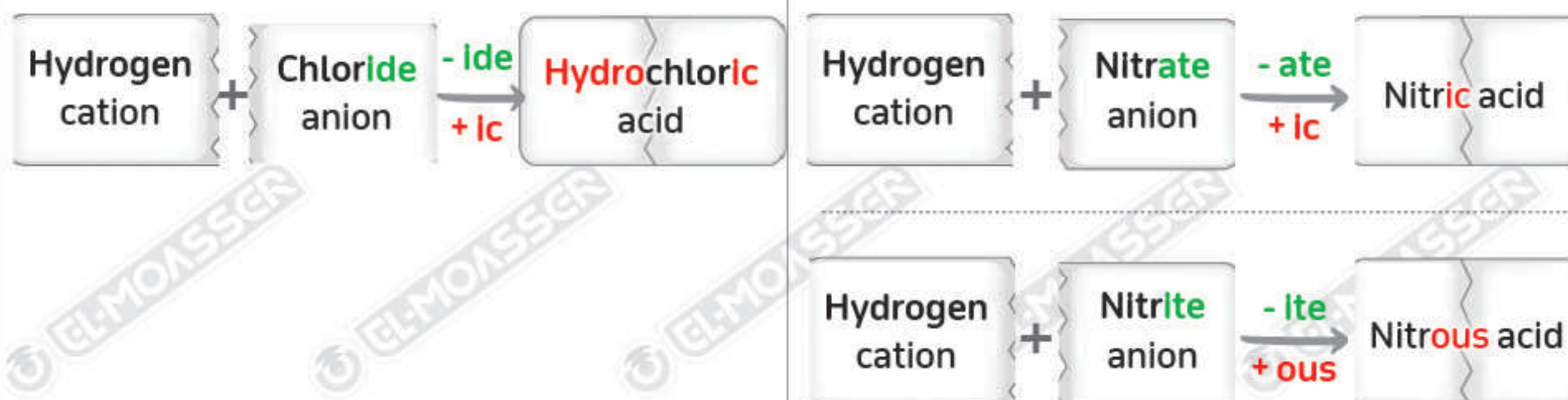
- * Replacing the suffix **(-ide)** of the anion with the suffix **(-ic)** in the acid.

- * Replacing the suffix **(-ate)** of the anion with the suffix **(-ic)** in the acid
- * Replacing the suffix **(-ite)** of the anion with the suffix **(-ous)** in the acid.

- **Prefix** : Letters added at the beginning of a word.

- **Suffix** : Letters added at the end of a word.

Application





Writing the Molecular Formulas of Acids :

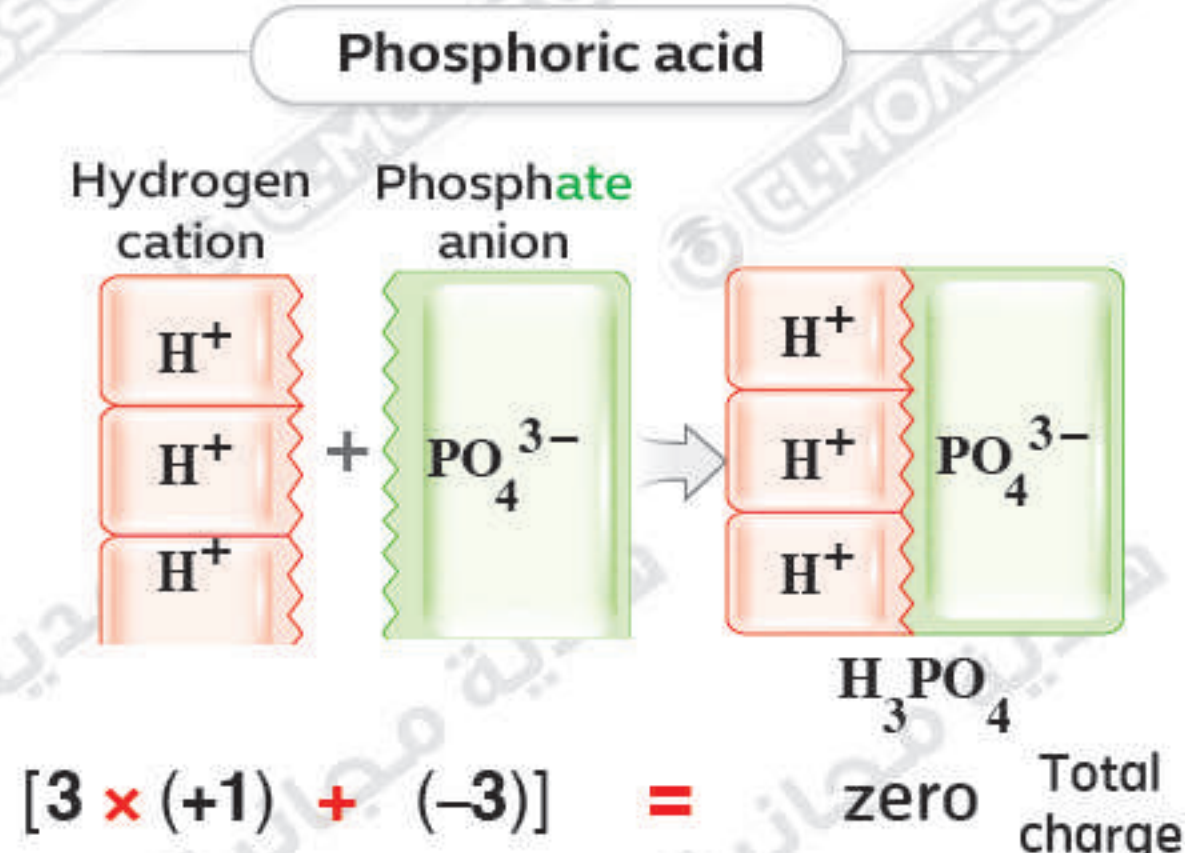
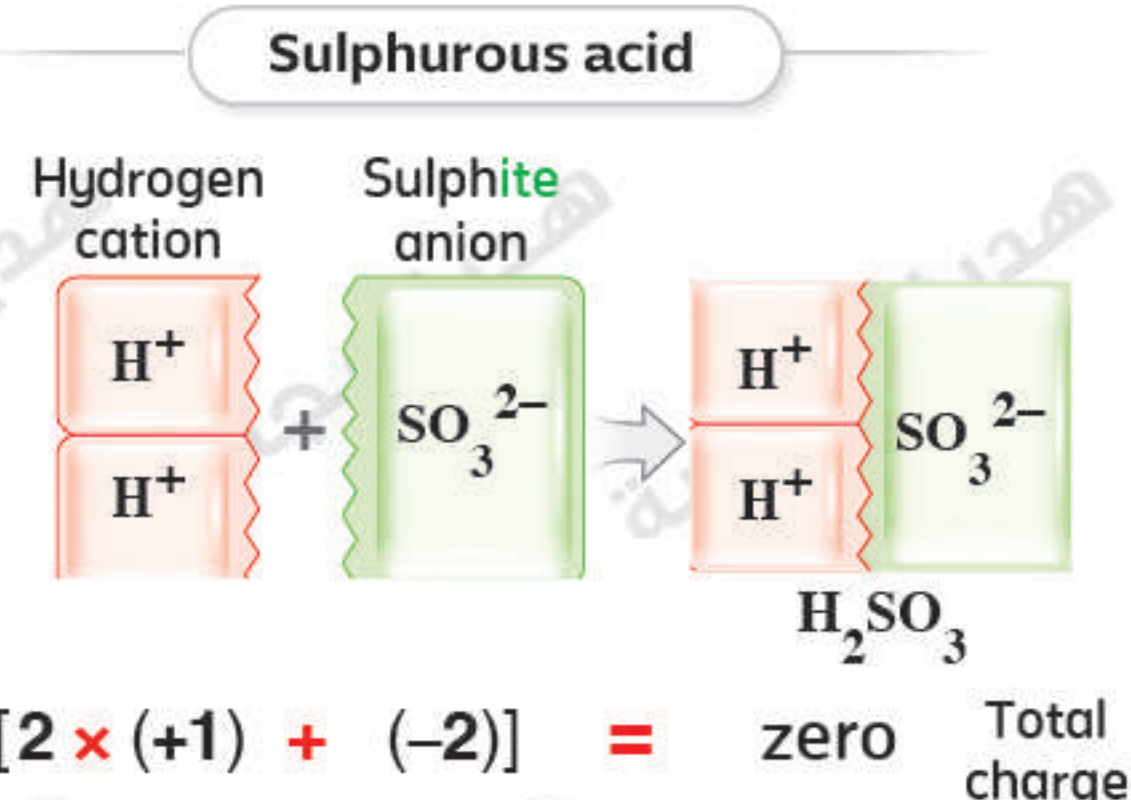
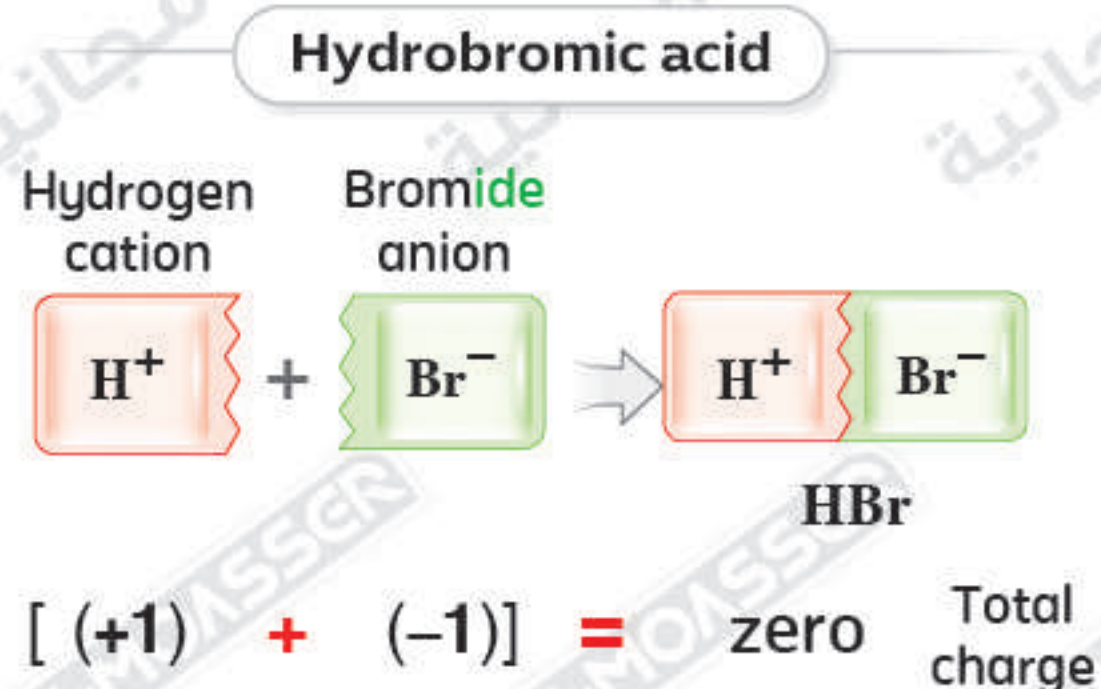
- ▶ The molecular formula of an acid begins with the symbol of → **Hydrogen cation H^+**
- ▶ Followed by → the symbol of the anion of the element, or the formula of the anion of the atomic group.



It should be noted that :

- * The number of hydrogen atoms in the molecule of the acid **equals** the magnitude of the charge of the anion (or atomic group) that forms it.
- * The total charge of the acid **equals** zero.

Application



- * The following table shows examples of some acids that do not contain oxygen and the anions which compose them :

Nonmetal anion	Name of the compound in the gaseous state	Name of the compound in solution form (Name of the acid)
Chloride Cl^-	Hydrogen chloride HCl	Hydrochloric acid HCl
Bromide Br^-	Hydrogen bromide HBr	Hydrobromic acid HBr
Sulphide S^{2-}	Hydrogen sulphide H_2S	Hydrosulphuric acid H_2S

- The following tables show examples of some anions and their oxyacids :

Anions ending with the suffix (ate)		Acids of these anions have the suffix (ic)	
Nitrate	NO_3^-	Nitric acid	HNO_3
Sulphate	SO_4^{2-}	Sulphuric acid	H_2SO_4
Phosphate	PO_4^{3-}	Phosphoric acid	H_3PO_4

Anions ending with the suffix (ite)		Acids of these anions have the suffix (ous)	
Nitrite	NO_2^-	Nitrous acid	HNO_2
Sulphite	SO_3^{2-}	Sulphurous acid	H_2SO_3

Question ? Answer

Q Write the formula and name of the acid that contains each of the following anions :

(1) Iodide I^-

(2) Carbonate CO_3^{2-}

(3) Chlorite ClO_2^-

A

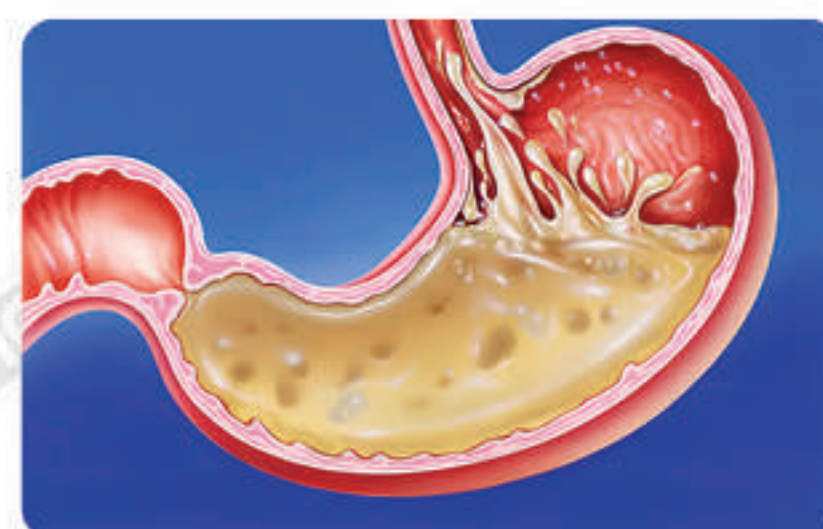
Anion	Acid formula	Acid name
(1) Iodide I^-	HI	Hydroiodic acid
(2) Carbonate CO_3^{2-}	H_2CO_3	Carbonic acid
(3) Chlorite ClO_2^-	HClO_2	Chlorous acid

The importance of acids in our lives

Acids play an important role in the human body, including :

1 Hydrochloric acid

It is secreted by the stomach, which participates in food digestion.



2 Lactic acid

It provides the muscles with the necessary energy during their lack of oxygen however, its accumulation in the muscles causes muscle cramps.



Alkalis



Names of Alkalis :

- ▶ The name of the alkali is related to the name of → **The cation** which composes it (excluding hydrogen cation),

As illustrated below :

- ▶ The name begins with the name of the cation, followed by the word hydroxide.



Application : Sodium hydroxide.

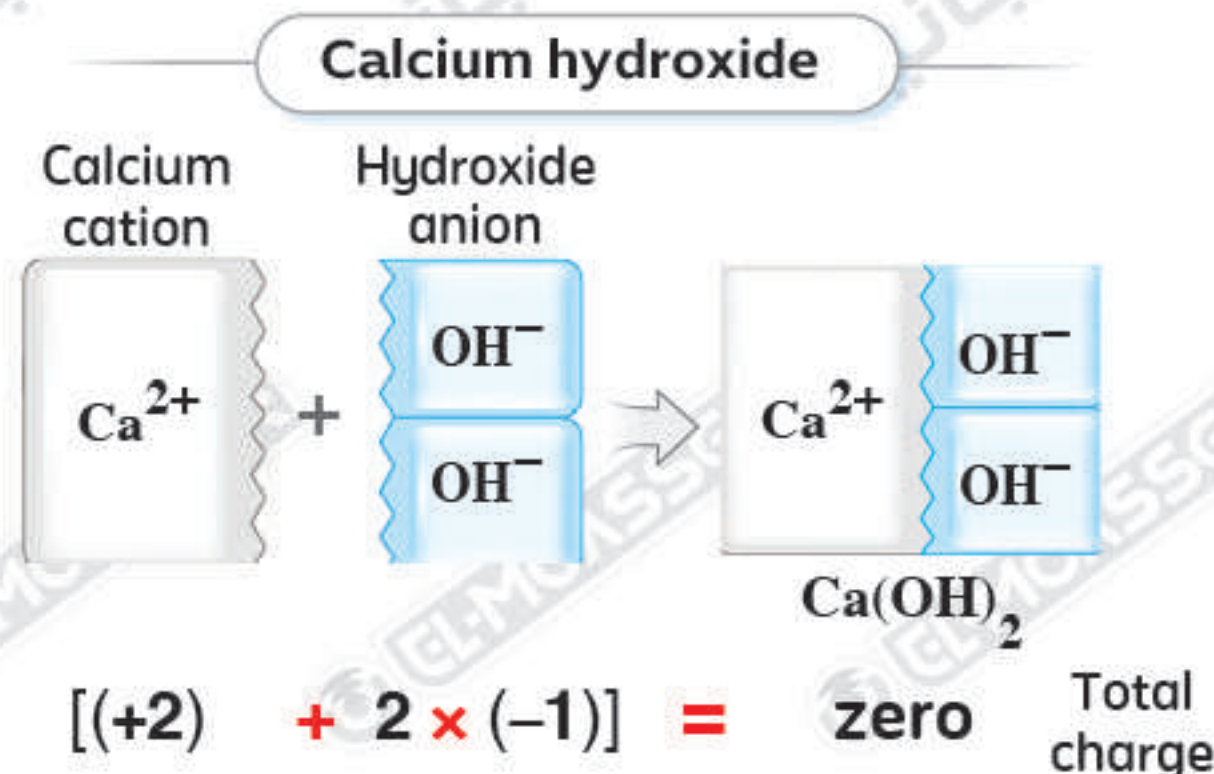


Writing the molecular formulas of alkalis :

- ▶ The molecular formula of the alkali ends with the formula of → **The hydroxide anion OH^-**
- ▶ **It should be noted that :**
 - * The number of hydroxide groups in the alkali molecule **equals** the magnitude of the charge of the cation (or the atomic group) that composes it.
 - * The total charge of the alkali equals zero.



Application



- The following table shows examples of some alkalis and the cations which compose them:

Cation	Alkali molecular formula	Alkali name
Sodium Na^+	NaOH	Sodium hydroxide
Magnesium Mg^{2+}	$\text{Mg}(\text{OH})_2$	Magnesium hydroxide
Ammonium NH_4^+	NH_4OH	Ammonium hydroxide



Take care:

When the hydroxide anion is repeated in the molecular formula of the alkali, the ion is written in brackets and below it is the number indicating the number of repetitions.

Test ? Your Understanding 1

Answered

1 Choose the correct answer :

- Which of the following atomic groups carries the same charge as hydroxide group ?
 (a) Ammonium. (b) Nitrate. (c) Sulphate. (d) Phosphate.
- The combination of hydrogen with each of the following nonmetals produces acids, except
 (a) chlorine. (b) bromine. (c) oxygen. (d) iodine.
- The compound HBr in its gaseous state is known as
 (a) hydrogen bromide. (b) bromide hydride.
 (c) hydrobromic acid. (d) hydrobromide acid.
- Each of the following is a correct name of acids, except
 (a) HNO_3 nitric acid. (b) H_2CO_3 carbonic acid.
 (c) HI hydroiodic acid. (d) H_3PO_4 phosphoric acid.
- What is the molecular formula of the acid secreted by the stomach and participates in food digestion ?
 (a) HBr (b) HCl (c) H_2SO_4 (d) H_2S
- Each of the following is a molecular formula of an alkalis, except
 (a) NaOH (b) HOH (c) $\text{Mg}(\text{OH})_2$ (d) NH_4OH

2 What are the consequences of the accumulation of lactic acid in the muscles ?

Properties of Acids and Alkalis

There are many acids and alkalis in your home

Acids

Examples of acidic substances :

- Lemon.
- Ketchup.
- Grapes.



An acid

Is a substance whose dissolution in water increases the percentage of **hydrogen cations H^+** in the solution.

Alkalis

Examples of alkaline substances :

- Detergents.
- Toothpaste.
- Baking soda.

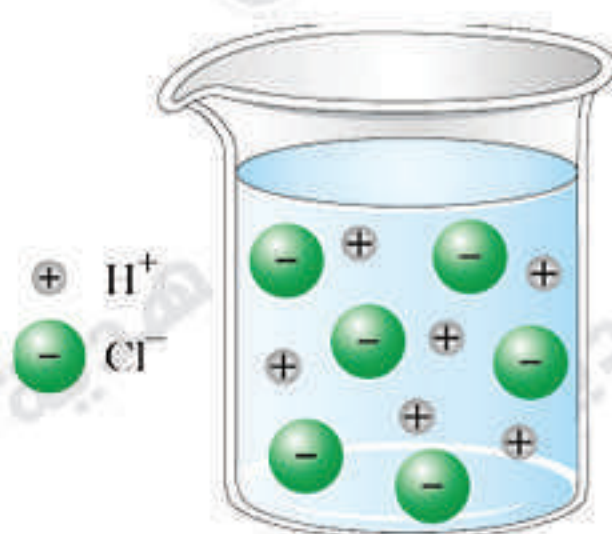


An alkali

Is a substance whose dissolution in water increases the percentage of **hydroxide anions OH^-** in the solution.

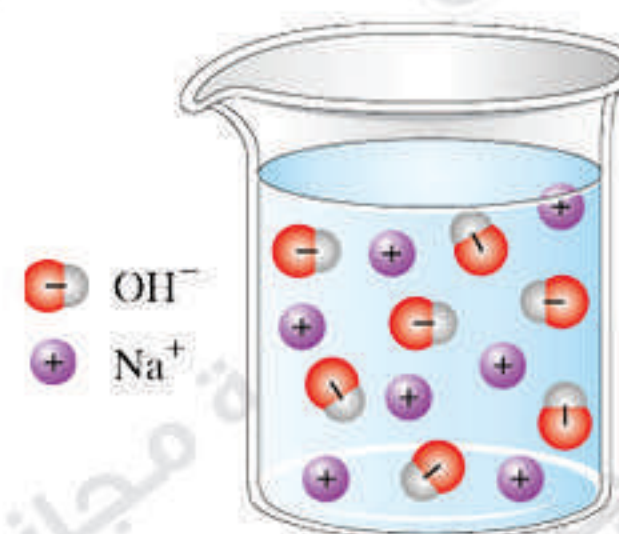
Applications

Dissolution of hydrogen chloride gas in water



- When hydrogen chloride gas HCl dissolves in water, **H^+ cations** and Cl^- anions are formed.
- When sulphuric acid H_2SO_4 dissolves in water, **H^+ cations** and SO_4^{2-} anions are formed.

Dissolution of solid sodium hydroxide in water



- When sodium hydroxide $NaOH$ dissolves in water, Na^+ cations and **OH^- anions** are formed.
- When magnesium hydroxide $Mg(OH)_2$ dissolves in water, Mg^{2+} cations and **OH^- anions** are formed.

It is clear from the previous that

The dissolution of all acids in water leads to an increase in the percentage of **H^+ cations** in the solution, which are responsible for all the properties of acids, such as the effect on blue litmus strip

The dissolution of all alkalis in water leads to an increase in the percentage of **OH^- anions** in the solution, which are responsible for all the properties of alkalis, such as the effect on red litmus strip

How can you differentiate between **An acid solution** and **an alkali solution** by using litmus strips.

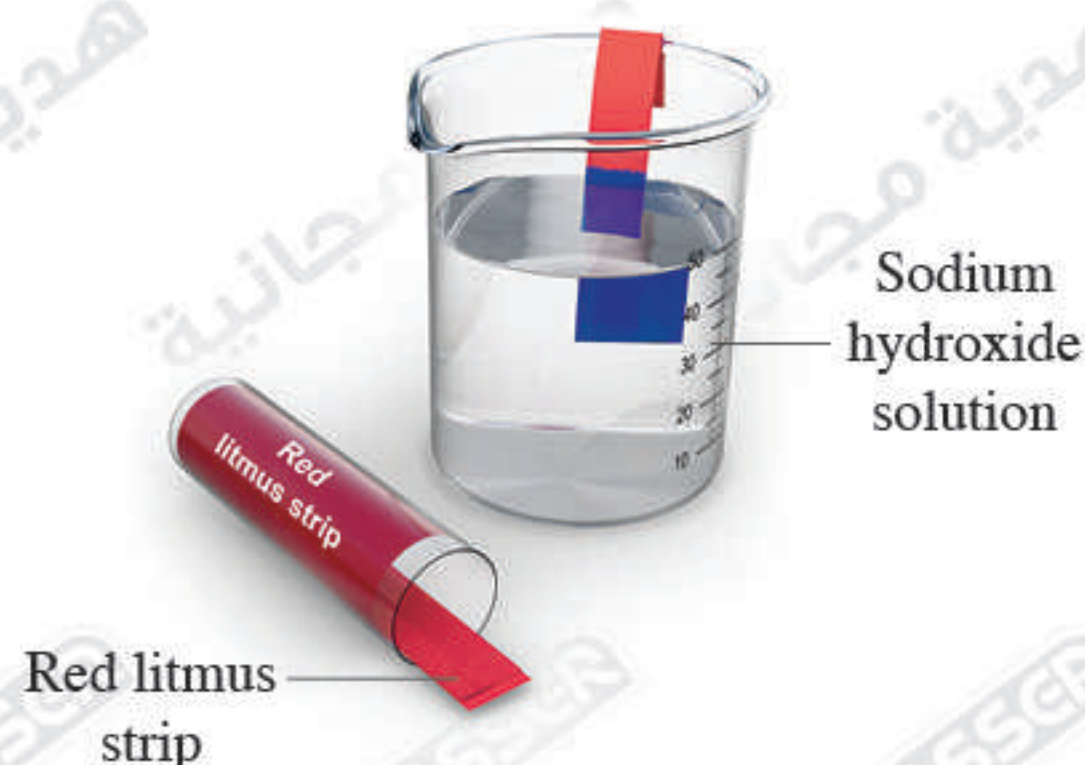
Acid solution

Turns **blue** litmus strip to **red**



Alkali solution

Turns **red** litmus strip to **blue**



Evaluate Your Understanding

Which of the following solutions :

NaOH

HCl

NaCl

HNO_3

$Ca(OH)_2$

(1) Turns blue litmus strip to red.

(2) Turns red litmus strip to blue.

- Acids and alkalis conduct electricity to variant degrees according to their strength , acids can be classified according to their ability to conduct electricity into :

Strong acids

Acids that are good electrical conductors.



- Hydrochloric acid.
- Sulphuric acid.
- Nitric acid.

Weak acids

Acids that are bad electrical conductors.



- Vinegar (dilute acetic acid).
- Nitrous acid.
- Sulphurous acid.

Examples

Question ? Answer

Q Compare between the electrical conductivity of sodium hydroxide and ammonium hydroxide, with an explanation.

A The electrical conductivity of sodium hydroxide is **stronger than** that of ammonium hydroxide, **because** sodium hydroxide is a strong alkali, while ammonium hydroxide is a weak alkali.

Reaction of acids with alkalis



Application

Hydrochloric acid HCl reacts with sodium hydroxide NaOH forming sodium chloride NaCl and water H_2O

! Take care :

Acids do not react with each other, and likewise, **alkalis** do not react with each other.

Medical Application

Milk of magnesia is used as a temporary treatment to neutralize gastric acidity, as it contains magnesium hydroxide $\text{Mg}(\text{OH})_2$



Metals and Nonmetals Oxides

When a metallic or nonmetallic element burns in the presence of oxygen, a compound is formed known as an **oxide**. There are several types of element oxides, including :

Metal oxides

Oxides produced from the burning of metals in the presence of oxygen are mostly known as **basic oxides** and what dissolves in water form **alkalis**

Basic oxides

Metal oxides, some of which dissolve in water forming alkalis.

Nonmetal oxides

Oxides produced from the burning of nonmetals in the presence of oxygen are mostly known as **acidic oxides**, which dissolve in water forming **acids**

Acidic oxides

Nonmetal oxides that dissolve in water forming acids.

Applications



Magnesium burning

Magnesium burning forms magnesium oxide MgO , which dissolves in water forming magnesium hydroxide solution $\text{Mg}(\text{OH})_2$ which turns red litmus strip to **blue**



Sulphur burning

Sulphur burning forms sulphur trioxide SO_3 , which dissolves in water forming sulphuric acid solution H_2SO_4 which turns blue litmus strip to **red**

Take care ⚠

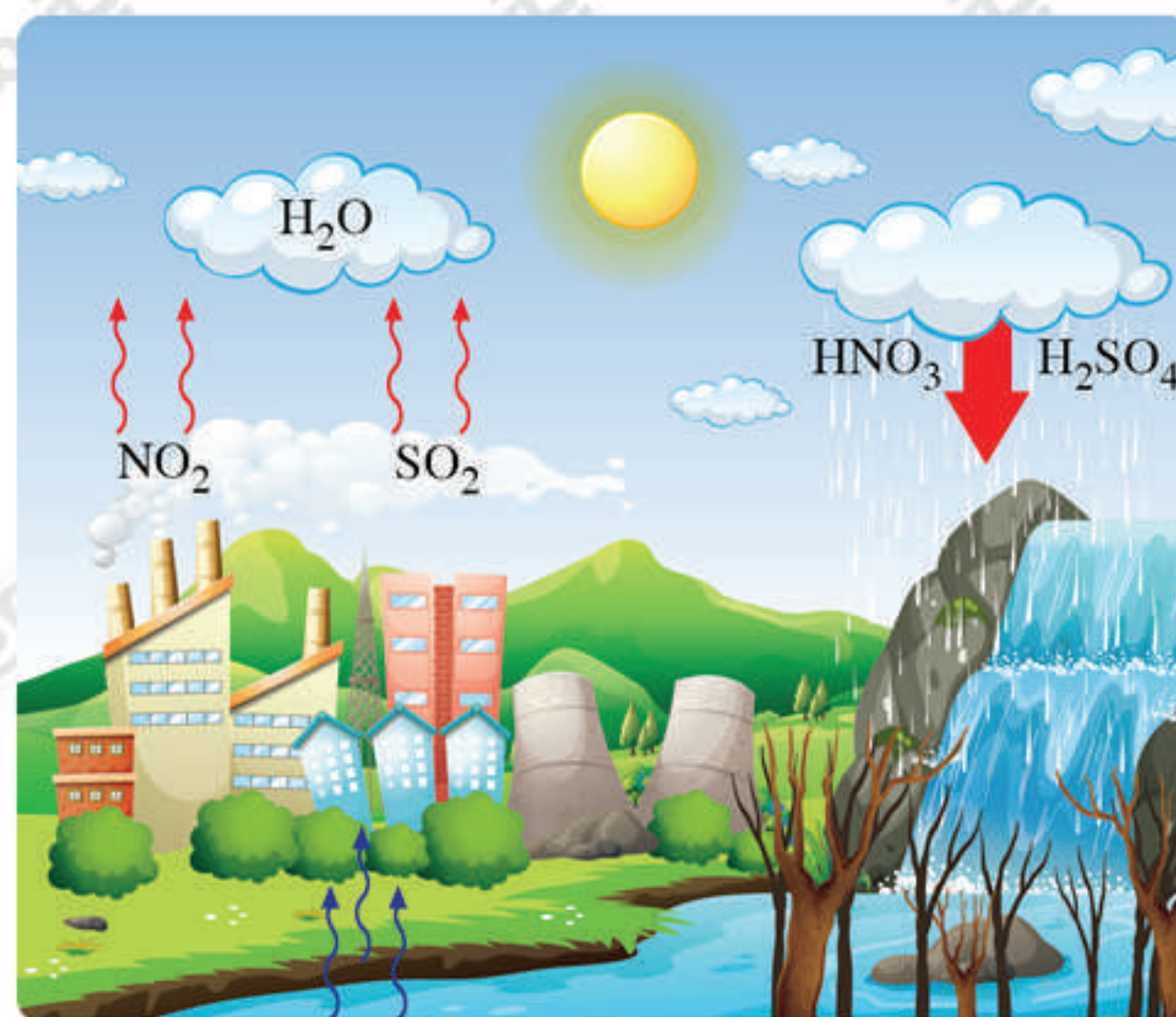
Metal oxides react with acids but they do not react with alkalis

Nonmetal oxides react with alkalis but they do not react with acids

Acid Rains

Burning of fossil fuels (such as petrol and coal) in cars, power plants (power stations), and factories causes the evolution of acidic oxides such as nitrogen dioxide NO_2 and sulphur dioxide SO_2 .

The dissolution of these oxides in atmospheric water vapour and their accumulation in the clouds leads to precipitation (falling rains) known as **acid rains**.



Acid rain

Acid Rains

Rain resulting from the dissolution of acidic oxides in atmospheric water vapour.

Harmful impacts of acid rains

Acid rains cause severe damage, including :



1. Destruction of forests.



2. Harming the aquatic organisms (which live in water).



3. Corrosion of buildings.



4. Health problems in the human respiratory system.



Impact of acid rain on statues

Test ? Your Understanding 2

Answered

1 Choose the correct answer :

(1) The ion present in lemon juice that causes the colour change in litmus strip is

- (a) NH_4^+ (b) O^{2-} (c) H^+ (d) OH^-

(2) Which of the following is a property of sodium hydroxide ?

- (a) It dissolves in water, producing H^+ ions.
(b) Its aqueous solution turns blue litmus strip to red.
(c) Its solution reacts with hydrochloric acid forming salt and water.
(d) Its solution reacts with lithium hydroxide solution forming salt and water.

(3) The red litmus strip turns blue when placed in each of the following, except

- (a) oven cleaner.
(b) ketchup.
(c) toothpaste.
(d) baking soda solution.

(4) What is the substance which dissolves in water and turns it into an alkaline solution ?

- (a) MgO (b) SO_3
(c) NO_2 (d) CO_2

(5) Which of the following oxides, when dissolved in atmospheric water vapour, produces acid rains ?

- (a) SO_2 (b) CaO
(c) Na_2O (d) MgO

2 How can you differentiate between nitric acid and nitrous acid ?

.....

Questions ?

UNIT 1

Lesson 2

First

School Book Questions

Answered

1 Choose the correct answer for the questions from (1) : (5).

- (1) If the anion which composes the acid HClO is called hypochlorite, then the acid is called
- (a) hypochlorous acid. (b) hypochloric acid.
(c) perchloric acid. (d) chlorous acid.
- (2) What is the ion whose percentage in the solution increases when an acidic oxide dissolves in water ?
- (a) H^+ (b) OH^- (c) Cl^- (d) Na^+
- (3) Element (X) forms the oxide XO which reacts with acids. Which of the following represents (X) and XO ?
- (a) (X): Metal, XO : Acidic oxide. (b) (X): Nonmetal, XO : Acidic oxide.
(c) (X): Metal, XO : Basic oxide. (d) (X): Nonmetal, XO : Basic oxide.
- (4) On dissolving calcium oxide in water, and placing two litmus strips in the solution, the colour of one of them changes into
- (a) red. (b) purple. (c) blue. (d) yellow.
- (5) Which of the following are properties of solid sodium hydroxide ?
- (a) It dissolves in water, and reacts with HCl acid.
(b) It dissolves in water, and does not react with HCl acid.
(c) It does not dissolve in water, and does not react with HCl acid.
(d) It does not dissolve in water, and reacts with HCl acid.

2 Write the names of the following acids and alkalis :

- (1) H_2CO_3 (2) HF (3) $\text{Mg}(\text{OH})_2$ (4) LiOH

3 Write the chemical formula of each of the following compounds :

- (1) Sulphuric acid. (2) Sodium hydroxide.

4 Can the type of potassium hydroxide solution be identified by using the blue litmus strip ? Explain.

5 Element (X) oxide has the following properties :

- It can react with acids.
- It does not react with alkalis.

Is element (X) sulphur or copper ? Explain.

- 6 The opposite figures show the same statue left in open air for nearly 100 years :

Why did the details of the statue disappear according to what you have studied ?



Second Questions Bank of EL-MOASSER

Answered

- 1 Write the scientific term for each of the following statements :

The molecular formulas of acids and their importance

- (1) An ion composed of more than one atom of more than one element.
- (2) A scientist who clarified that alkalis are substances that dissolve in water and give (produce) hydroxide ions.
- (3) Acids produced from the combination of hydrogen with one of the negatively charged atomic groups, excluding hydroxide group.
- (4) An acid secreted by the stomach that participates in food digestion.
- (5) An acid formed in the muscles of the body during their lack of oxygen, causing muscle cramps.

Properties of acids and alkalis

- (6) A substance whose dissolution in water leads to an increase in the percentage of H^+ cations in the solution.
- (7) A substance whose dissolution in water leads to an increase in the percentage of OH^- anions in the solution.
- (8) Acids that are good electrical conductors.
- (9) Metal oxides, some of which dissolve in water forming alkalis.
- (10) Nonmetal oxides that dissolve in water forming acids.
- (11) Rains which result from the dissolution of acidic oxides in the atmospheric water vapour.

- 2 Choose the correct answer :

The molecular formulas of acids and their importance

- (1) All the molecular formulas of the following ions are correct, except

Ⓐ sulphate SO_4^{2-}	Ⓑ phosphate PO_4^{3-}
Ⓒ hydride OH^-	Ⓓ nitrite NO_2^-
- (2) Which of the following expresses sulphite and nitrate ions respectively ?

Ⓐ SO_2^- , NO_2^-	Ⓑ SO_3^{2-} , NO_2^-	Ⓒ SO_3^{2-} , NO_3^-	Ⓓ SO_2^- , NO_3^-
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- (3) The structures of all the negative atomic groups which you have studied include
- (a) hydrogen element. (b) oxygen element.
 - (c) nitrogen element. (d) sulphur element.
- (4) Carbonate group and sulphate group are similar in
- (a) charge and number of elements only.
 - (b) charge and number of atoms only.
 - (c) number of elements and number of atoms only.
 - (d) charge, number of elements and number of atoms.
- (5) The molecular formula of hydrochloric acid is
- (a) HCl (b) HClO (c) HClO₂ (d) HClO₃
- (6) The correct name of H₂SO₃ acid is
- (a) sulphuric acid. (b) hypochloric acid.
 - (c) sulphurous acid. (d) hypochlorous acid.
- (7) Which of the following is the correct formula for an oxyacid ?
- (a) H₂O₃S (b) H₂S (c) H₂SO₃ (d) SO₃H
- (8) Acids can contain the following atomic groups, except
- (a) carbonate group. (b) sulphate group.
 - (c) nitrate group. (d) hydroxide group.
- (9) Each of the following expresses the compound H₂S, except
- (a) it is known as hydrogen sulphide in its gaseous state.
 - (b) it is known as hydrosulphuric acid in its solution form.
 - (c) its cation carries two positive charges.
 - (d) its anion carries two negative charges.

Properties of acids and alkalis

- (10) Which of the following substances are acids ?
- (a) Lemon and baking soda. (b) Ketchup and grapes.
 - (c) Soap and toothpaste. (d) Detergents and ketchup.
- (11) The ion which is responsible for the acidic properties is
- (a) NH⁺ (b) O²⁻ (c) H⁺ (d) OH⁻
- (12) Each of the following expresses the solution of HI acid, except
- (a) gas dissolved in water. (b) it turns blue litmus strip to red.
 - (c) it reacts with HCl acid. (d) it contains H⁺ ions.
- (13) Dissolving sulphuric acid H₂SO₄ in water produces
- (a) H⁺ cations and SO₃²⁻ anions. (b) H⁺ cations and S₂O₃²⁻ anions.
 - (c) H⁺ cations and S²⁻ anions. (d) H⁺ cations and SO₄²⁻ anions.



- (14) The alkaline solution which is poured in the clogged drains to clear them is likely to be
(a) HCl (b) H_2O (c) NaCl (d) NaOH
- (15) All the following acids are strong, except
(a) nitric acid. (b) acetic acid. (c) sulphuric acid. (d) hydrochloric acid.
- (16) Each of the following is a weak electrical conductor, except
(a) ammonium hydroxide. (b) sulphurous acid.
(c) sodium hydroxide. (d) nitrous acid.
- (17) The compound which is used in antacids is
(a) $MgCl_2$ (b) $Mg(OH)_2$ (c) H_2CO_3 (d) NaCl
- (18) Among the basic oxides is
(a) SO_2 (b) SO_3 (c) NO_2 (d) Na_2O
- (19) All the following are properties of alkalis, except
(a) they contain OH^- ions.
(b) they turn red litmus strip to blue.
(c) they can react with sodium hydroxide solution.
(d) they can react with hydrochloric acid solution.
- (20) When hydrochloric acid HCl reacts with sodium hydroxide NaOH, the formed salt is
(a) $NaCl_2$ (b) H_2O (c) Na_2O (d) NaCl
- (21) Among the oxides produced from burning fossil fuels are
(a) SO_3 , Na_2O (b) MgO , CaO (c) NO_2 , SO_2 (d) Na_2O , SO_2
- (22) All the following are harmful impacts of acid rains, except
(a) destruction of forests. (b) destruction of the human digestive system.
(c) corrosion of buildings. (d) death of aquatic organisms.

3 Complete the following statements :

The molecular formulas of acids and their importance

- (1) group has a positive charge, while the charge of group is -3
- (2) The molecular formula of an acid begins with the symbol of cation, while the molecular formula of an alkali ends with the symbol of anion.
- (3) Hydrogen cation combines with sulphite anion to form an acid known as with the molecular formula
- (4) The compound HI in its gaseous state is known as, while its name in its solution form is
- (5) Hydrobromic acid is composed of cation and anion.

Properties of acids and alkalis

- (6) Lemon is, while the grease cleaner is
- (7) When acids dissolve in water, the percentage of cations in the solution increases, while when alkalis dissolve in water, the percentage of anions increases.
- (8) The gas dissolves in water forming cations which are responsible for the properties of acids and Cl^- anions.
- (9) is a strong alkali, while is a weak acid.
- (10) Oxides are divided into oxides and oxides.
- (11) burns forming SO_3 , which dissolves in water to form solution.
- (12) The dissolution of oxides in water forms acids, while the dissolution of oxides in water forms alkalis.
- (13) Metal oxides can react with but they do not react with
- (14) When an acid reacts with an alkali, ... and are produced.

4 Mark (✓) or (x) for each statement, with correction :

Molecular formulas of acids and their Importance

- (1) All nonmetallic element ions end with the suffix (– ate). ()
- (2) The bicarbonate and nitrate groups are similar in the number of atoms and the charge. ()
- (3) The symbol of aluminum cation is Al^{3+} , while the formula of ammonium group is NH_4^{3-} . ()
- (4) The acid which contains chlorite anion ClO_2^- is known as chloric acid. ()
- (5) The molecular formula of nitric acid is HNO_3 , while the molecular formula of sulphuric acid is H_2S . ()
- (6) The stomach secretes lactic acid which participates in the food digestion. ()

Properties of acids and alkalis

- (7) When lithium hydroxide dissolves in water, the percentage of OH^- cations in the solution increases. ()
- (8) S^{2-} anions in H_2S acid solution are responsible for its acidic properties. ()
- (9) Acids and alkalis conduct electric current to variant degrees depending on their strength. ()
- (10) Milk of magnesia contains MgO . ()
- (11) NO_2 is an acidic oxide, while SO_2 is a basic oxide. ()
- (12) When calcium oxide dissolves in water and two litmus strips are placed in the solution, one of them turns purple. ()
- (13) Sulphur oxides dissolve in atmospheric water vapour, forming basic rains that cause the corrosion of buildings. ()

5 Give one example for each of the following :

- | | |
|---|---|
| (1) An atomic group with a charge of -1 | (2) An atomic group with a charge of -2 |
| (3) A negatively charged atomic group. | (4) An oxyacid. |
| (5) A strong acid. | (6) A weak acid. |
| (7) A strong alkali. | (8) A weak alkali. |

6 Write the chemical formula for each of the following compounds :

- | | |
|--------------------------|-----------------------|
| (1) Hydrobromic acid. | (2) Nitric acid. |
| (3) Hydrosulphuric acid. | (4) Carbonic acid. |
| (5) Lithium hydroxide. | (6) Sodium hydroxide. |

7 Write the name for each of the following acids and alkalis :

- | | | |
|--------------------|------------------------------|-----------------------------|
| (1) HNO_2 | (2) HCl | (3) H_2SO_4 |
| (4) HI | (5) $\text{Mg}(\text{OH})_2$ | (6) NH_4OH |

8 Give reasons for each of the following :

The molecular formulas of acids and their importance

- (1) The total charge of the molecule of any compound equals zero.
- (2) The molecular formula of magnesium hydroxide includes two hydroxide groups.
- (3) The stomach secretes hydrochloric acid during eating food.

Properties of acids and alkalis

- (4) Acids turn blue litmus strip to red.
- (5) It is possible to distinguish between acids and alkalis by using litmus strips.
- (6) Hydrochloric acid is a strong acid, while acetic acid is a weak acid.
- (7) Sodium hydroxide can be differentiated from ammonium hydroxide by using the electrical conductivity.
- (8) Milk of magnesia is used as a temporary treatment for gastric acidity.
- (9) The dangers of burning fossil fuels in cars, factories and power plants (stations).
- (10) Acidic oxides are extremely harmful to human health.
- (11) Acid rains have severe harmful impacts on human and the environment in general.

9 What is meant by each of the following :

- | | | |
|-------------------|--------------------|-----------------|
| (1) Atomic group. | (2) Acid. | (3) Alkali. |
| (4) Basic oxides. | (5) Acidic oxides. | (6) Acid rains. |

10 State the importance of each of the following in the human body :

- (1) Hydrochloric acid.
- (2) Lactic acid.
- (3) Milk of magnesia.

11 What happens when :

- (1) Lactic acid accumulates in the muscles of the human body.
- (2) Calcium hydroxide Ca(OH)_2 dissolves in water.
- (3) Hydrogen chloride gas HCl dissolves in water.
- (4) Two litmus strips are placed in a beaker containing sulphuric acid.
- (5) A red litmus strip is placed in a beaker containing sodium hydroxide solution.
- (6) Magnesium burns in the presence of oxygen, then the product dissolves in water.
- (7) Sulphur burns in the presence of oxygen, then the product dissolves in water.
- (8) Acids react with alkalis.
- (9) Fossil fuels burn in factories and cars.
- (10) Sulphur and nitrogen oxides dissolve in the water of the rains.

12 Choose the odd word (or formula) out, then mention the relation between the rest :

Molecular formulas of acids and their Importance

- (1) Cl^- / S^{2-} / P^{3-} / OH^-
- (2) Hydroxide / Bicarbonate / Calcium / Phosphate.
- (3) Ammonium / Sulphate / Nitrate / Carbonate.
- (4) HBr / H_2O / H_2CO_3 / HNO_3
- (5) HClO_2 / HNO_3 / HCl / H_2SO_4

Properties of acids and alkalis

- (6) Lemon / Baking soda / Ketchup / Grapes.
- (7) Soap / Toothpaste / Potassium hydroxide / Ketchup.
- (8) HNO_3 / HBr / NaOH / H_2SO_4
- (9) Ca(OH)_2 / CO_2 / KOH / Mg(OH)_2
- (10) Nitric acid / Dilute acetic acid / Nitrous acid / Sulphurous acid.
- (11) Hydrochloric acid / Nitric acid / Sulphuric acid / Sulphurous acid.
- (12) MgO / CaO / Na_2O / NO_2
- (13) NO_2 / SO_2 / SO_3 / K_2O

13 Mention one difference between each of the following :

- (1) The nitrite group **and** the sulphite group.
- (2) Nitric acid **and** nitrous acid.
- (3) Sodium hydroxide **and** ammonium hydroxide.

14 Compare between each of the following :

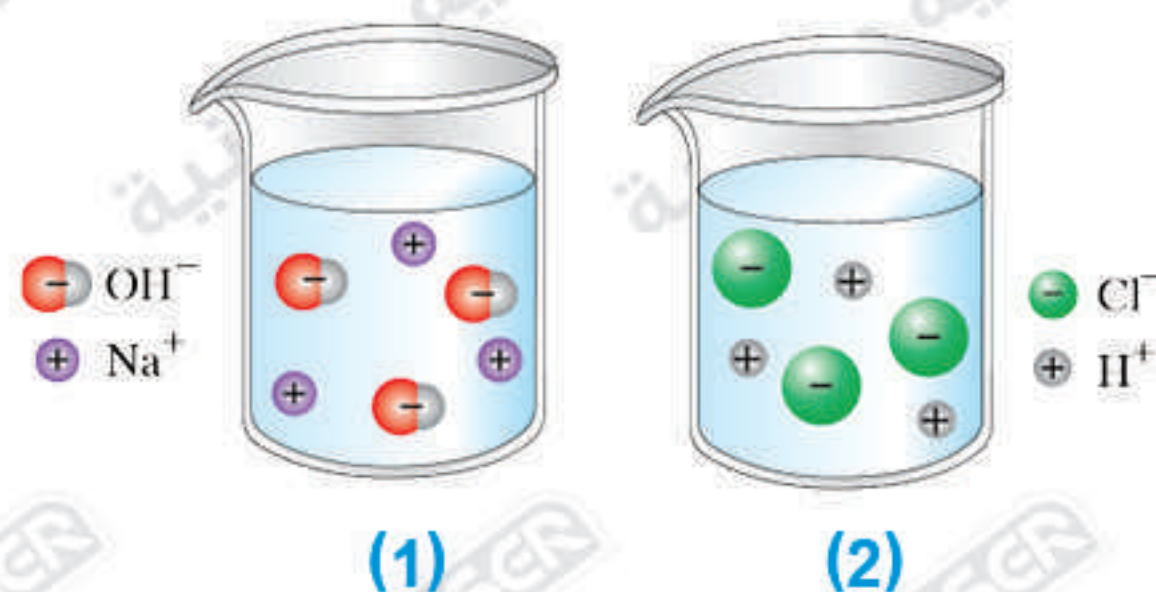
- (1) Carbonate group **and** bicarbonate group "In terms of : Molecular formula – Number and type of charges they carry".
- (2) Acid **and** alkali "In terms of : Definition – Effect on litmus strips - Examples".
- (3) HCl **and** NaOH "In terms of : Type of compound - The result of dissolving each of them in water – The effect of each of them on litmus strips".
- (4) Strong acids **and** weak acids.
- (5) Strong alkalis **and** weak alkalis.
- (6) Basic oxides **and** acidic oxides "In terms of : Definition - The result of dissolving each of them in water – Examples".

15 Study the following figures, then answer the questions below :

① From the two opposite figures :

(1) Identify the number of the figure which indicates :

- 1- The solution resulting from dissolving solid substance in water.
- 2- The solution resulting from dissolving a gas in water.



(2) Clarify the effect of each solution on litmus strips, with explanation.

- ②** The following two figures represent the electrical conductivity of hydrochloric acid and acetic acid at the same concentration "in no particular order". Identify the acid in each figure, with explanation.

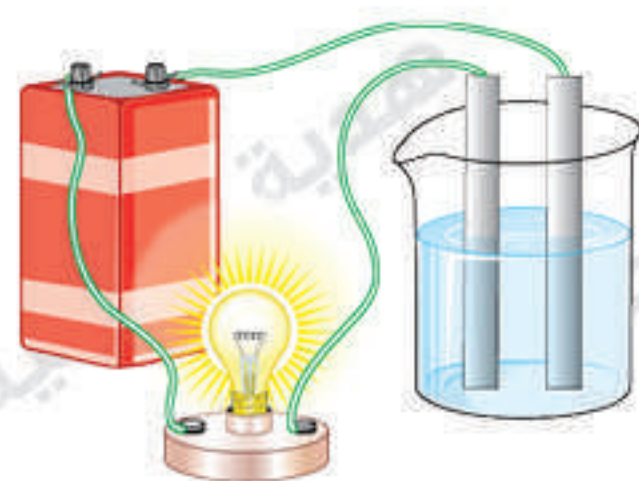


Figure (1)

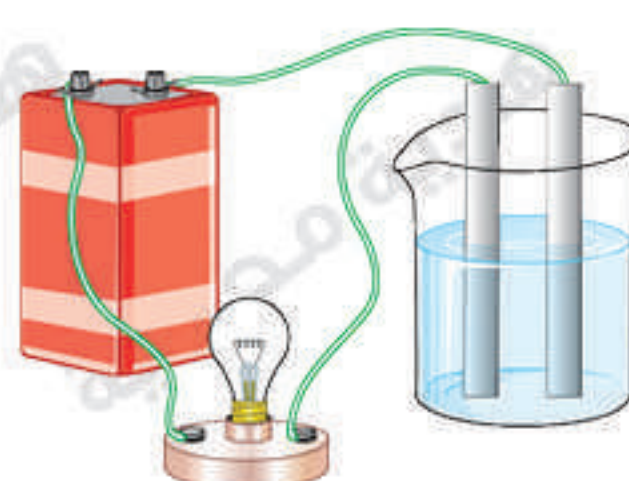


Figure (2)

③ The opposite figure illustrates the corrosion occurring in one of the statues left in open areas :

- (1) Identify the type of compounds that caused this corrosion.
- (2) Explain the reason of the corrosion.



16 Variant questions :

- ① You have two test tubes, one contains an acid and the other contains an alkali :
- (1) What is the name of the ion that characterizes each of them?
 - (2) How can you differentiate between them by using litmus strips?
 - (3) What is the result of the reaction between the contents of the two test tubes?
- ② What is the scientific basis for classifying the four acids which are in the two tables (1) and (2) :

Group (A)	Group (B)
Nitric acid	Hydrochloric acid
Nitrous acid	Hydroiodic acid

Table (1)

Group (A)	Group (B)
Sulphuric acid	Sulphurous acid
Hydrochloric acid	Nitrous acid

Table (2)

- ③ Mention one application of using the bases in the field of medicine.



Higher-order Questions

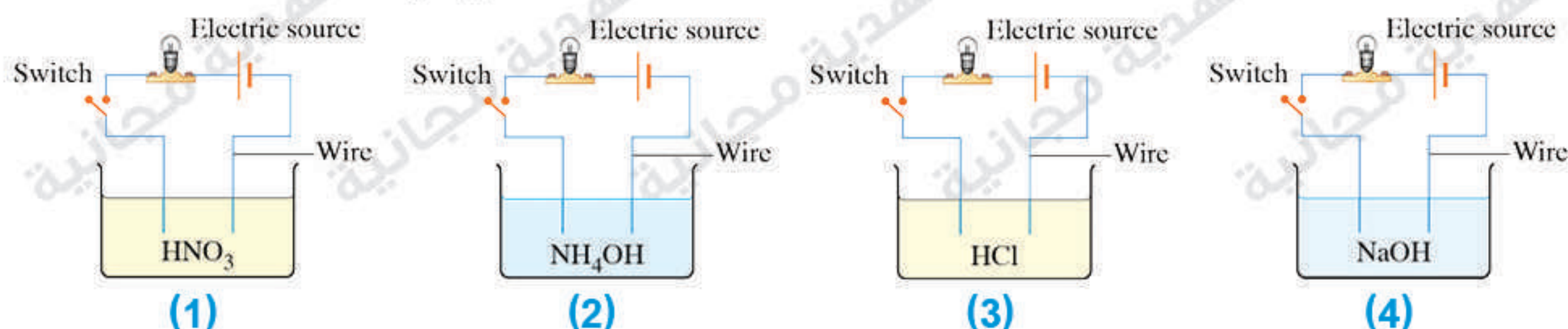
Answered

17 Choose the correct answer :

- (1) The molecules of both sodium hydroxide and sulphuric acid are similar in presence of
- hydrogen and nitrogen elements.
 - oxygen and sodium elements.
 - hydrogen and oxygen elements.
 - hydrogen and sodium elements.
- (2) Element (X) reacts with oxygen to form an acidic oxide.
What is the number of electrons which are likely to exist in the last energy level of element (X) ?

Number of electrons Choices	1	2	6	7
(a)	✓	X	X	X
(b)	✓	✓	X	X
(c)	X	X	X	✓
(d)	X	X	✓	✓

(3) From the following figures :



When the switch is turned on the least illumination of the bulb is in figure

- (a) (1). (b) (2). (c) (3). (d) (4).

(4) Nitrogen reacts with oxygen to form oxide (X), which dissolves in water to form solution (Y).

What is the type of each of oxide (X) and solution (Y) ?

- (a) (X): Basic oxide, (Y): Alkali. (b) (X): Acidic oxide, (Y): Acid.
(c) (X): Basic oxide, (Y): Acid. (d) (X): Acidic oxide, (Y): Alkali.

(5) Which of the following oxides react after dissolving in water ?

- (a) SO_2 , NO_2 (b) CaO , MgO (c) Na_2O , SO_2 (d) Na_2O , CaO

(6) When element (X) is burnt in air, a white powder is formed that turns red litmus strip wet with water to blue.

What is element (X) ?

- (a) Calcium. (b) Carbon. (c) Iodine. (d) Sulphur.

(7) Element (X) forms a basic oxide, it is also used as a main component in bronze alloys, and it is a good conductor of electricity.

What is element (X) ?

- (a) Zinc. (b) Copper. (c) Tin. (d) Carbon.

(8) Each of the following describes milk of magnesia, except

- (a) it can react with hydrochloric acid. (b) it is used to treat gastric acidity.
(c) it can react with magnesium oxide. (d) it is more alkalinity than water.

(9) (X) reacts with (Y) to form salt and water only.

Which of the following is correct ?

- (a) (X): Acetic acid, (Y): Sodium.
(b) (X): Barium hydroxide, (Y): Acetic acid.
(c) (X): Acetic acid, (Y): Hydrochloric acid.
(d) (X): Potassium hydroxide, (Y): Calcium carbonate.

18 Give reasons :

- (1) Acid rains cause an imbalance in aquatic ecosystems.
(2) Corrosion of buildings facades in industrial areas.