PONY

سلسلة كتب الأستاذ

SCIENCE

February Revision



1st Prep

Second Term

Prepared by:

Amira Ahmed

Pony Revision on Unit 1 – Lesson 1

Metals and Nonmetals

First Week

1 Complete the following sentences:

1. The outermost energy level of metals contains **less than** four electrons, while that of nonmetals contains **more than** four electrons.
2. Element (A), with its outermost energy level (M) containing two electrons, is a **metal**, while element (B), with its outermost energy level (L) containing six electrons, is a **nonmetal**.
3. All metals are solids, except for **mercury**, which is a liquid.
4. All nonmetals are bad conductors of electricity, except for **carbon (graphite)**, which is a good conductor of electricity.
5. Some nonmetals are solid materials, such as **carbon**; gaseous materials, such as **nitrogen**; and the only liquid is **bromine**.
6. The atoms of solid metals are arranged in a structure known as **crystal lattice**.
7. The metallic bond is formed due to the attraction between the positive **ions** of a metal and the cloud of valence negative **electrons** surrounding it.
8. The bronze alloy is composed of **tin** at 5% and **copper** at 95%.
9. The bronze alloy is used in manufacturing **medals** and **jewelry**.
10. The bronze alloy is characterized by being **harder** than copper and **resistant** to rust.

2 Cross out the odd word, and then write the relation between the remaining words:

1. Gold – Silver – Bromine – Mercury (**Bromine**)
   (They are metallic elements.)
2. Phosphorus – Bromine – Mercury – Sulfur (**Mercury**)
   (They are nonmetallic elements.)
3. Graphite – Bromine – Phosphorus – Sulfur (**Graphite**)
   (They are bad electric conductors.)
4. Iodine – Sulfur – Carbon – Hydrogen (**Hydrogen**)
   (They are solid nonmetallic elements.)
5. Bronze – Chlorine – Copper – Tin (**Chlorine**)
   (It is an alloy and its components.)

3 How do you differentiate between each of the following:

1. Phosphorus and iron, in terms of:
   - a. Metallic luster
   - b. Malleable and ductile
   - c. Conductivity of heat and electricity
   - d. Melting point

P.O.C	Phosphorus	Iron
a. Metallic luster	It has no metallic luster.	It has a metallic luster.
b. Malleable and ductile	It is not malleable or ductile.	It is malleable and ductile.
c. Conductivity of heat and electricity	It is a bad conductor of heat and electricity.	It is a good conductor of heat and electricity.
d. Melting point	It has a low melting point.	It has a high melting point.

2. Sodium and graphite, in terms of:
   - a. Metallic luster
   - b. Which one is opaque

P.O.C	Sodium	Graphite
a. Metallic luster	It has a metallic luster.	It has no metallic luster.
b. Which one is opaque?	Shiny	Opaque

3. Sulfur and copper, in terms of:
   - a. Malleable and ductile
   - b. Which one is more brittle?

P.O.C	Sulfur	Copper
a. Malleable and ductile	It is not malleable or ductile.	It is malleable and ductile.
b. Which one is more brittle?	Brittle	Hard

4. Silver and phosphorus, in terms of:

Conductivity of electric current

P.O.C	Silver	Phosphorus
Conductivity of electric current	**It is a good conductor of electricity.**	**It is a bad conductor of electricity.**

4 What is meant by each one of the following:

1. Metallic bond

It is the attraction force between the positive metal ions and the cloud of negative valence electrons surrounding them.

2. Alloy

It is a mixture that is composed of two or more molten metals.

3. Recycling

It is the process of conversion of the wastes into new usable substances.

5 What is the benefit of recycling metal wastes?

Recycling metals is much cheaper and easier than extracting them from their ores.

6 If elements (A & B) have melting points of (1538 & 115.21) respectively, answer the following questions:

1. What is the type of each one of them? And why?

- A is a metal because it has a high melting point.

- B is a nonmetal because it has a low melting point.

2. Which one of them is a good conductor of electricity?

- A is a good electric conductor of electricity because it is a metal.

3. Which one of them is malleable and ductile?

- A is malleable and ductile because it is a metal.

7 Complete the following table that shows some materials & their properties.

You can choose the color from the following words bank:

(Black – Colorless – Yellow – Waxy white – Silver – Red)

Element	Type	Physical State	Electric Conductivity	Color
1- Oxygen	Nonmetal	Gas	Bad conductor	Colorless
2- Gold	Metal	Solid	Good conductor	Yellow
3- Carbon	Nonmetal	Solid	Good conductor	Black
4- Bromine	Nonmetal	Liquid	Bad conductor	Red
5- Nitrogen	Nonmetal	Gas	Bad conductor	Colorless
6- Mercury	Metal	Liquid	Good conductor	Silver
7- Phosphorus	Nonmetal	Solid	Bad conductor	Waxy White

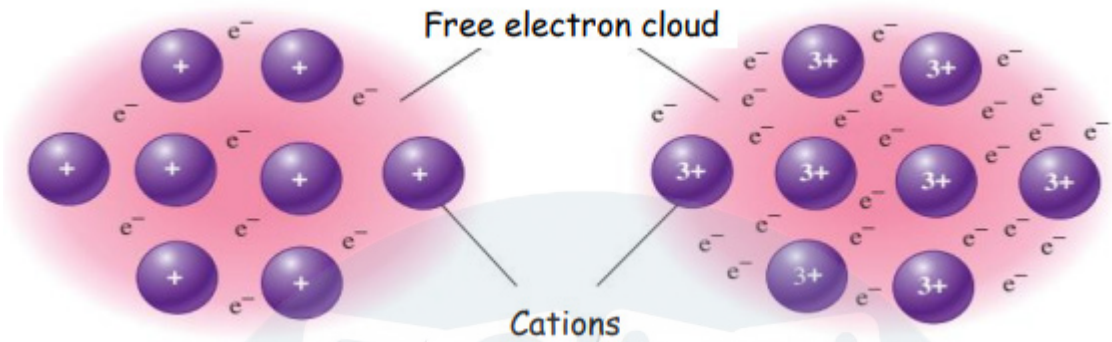
8 Give reasons for the following:

1. Calcium ($_{20}$Ca) is a metal, while Chlorine ($_{17}$Cl) is a nonmetal.
   - **Calcium ($_{20}$Ca) is a metal because it has 2 electrons in its outermost energy level.**
   - **Chlorine ($_{17}$Cl) is a nonmetal because it has 7 electrons in its outermost energy level.**
2. Carbon is used in the manufacture of dry cells although it is a nonmetal.
   - **Because carbon is a good conductor of electricity.**
3. Calcium ($_{20}$Ca) is harder than sodium ($_{11}$Na).
   - **Because the metallic bond in calcium is stronger than that in sodium, as calcium has two valence electrons, while sodium has one valence electron only.**
4. A bronze alloy is used in the manufacture of medals instead of copper.
   - **Because a bronze alloy is harder than copper and it doesn't rust.**

9 What happens if we knock on a piece of graphite?

- **The piece of graphite breaks off easily because graphite is a brittle nonmetal.**

10 **The following figure shows a bond between two different elements:**



1. What are the types of the two elements in the figure? And why?
   - **The two elements are metals.**
   - **Because they have less than four electrons in their outermost energy levels.**
2. What is the valency of each?
   - **Sodium (Na) is monovalent +1** - **Aluminum (Al) is trivalent +3**
3. What is the type of bond in both of them?
   - **Metallic bond**
4. Which is stronger in terms of the bond? And why?
   - **The metallic bond in aluminum is stronger than that in sodium.**
   - **Because the strength of the metallic bond increases by increasing the number of valence electrons.**

   (Aluminum has three valence electrons, while sodium has only one valence electron, so aluminum's metallic bond is stronger than sodium's metallic bond.)
5. What happens if we increase the number of valence electrons in the metal atoms according to the metallic bond?
   - **The strength of the metallic bond increases.**
6. What happens if we mix molten gold with molten copper?
   - **An alloy, which has different properties than gold and copper, is formed.**

Pony Revision on Unit 1 – Lesson 2

Acids and Alkalis

Second and Third Weeks

1 Complete the following sentences:

1. The scientist **Arrhenius** clarified that acids are substances that dissolve in water and produce **positive hydrogen ions**, while bases, when dissolved in water, produce **negative hydroxide ions**.
2. The molecular formula of the carbonate group is **CO_3^{-2}**, while the molecular formula of the sulphate group is **SO_4^{-2}**.
3. Oxygenated acids are those that contain **oxygen** element, such as **sulphuric acid** and **nitric acid**.
4. Non-oxygenated acids don't contain **oxygen** element, such as **hydrochloric acid** and **hydrobromic acid**.
5. The number of hydrogen atoms in an acid molecule is equal to the charge of the **anion** that forms it.
6. The number of hydroxide groups in a base molecule equals the charge of the **cation** that forms it.
7. Lactic acid provides the muscles with **energy** during a lack of oxygen, and its accumulation in the muscles causes **muscle cramps**.
8. The molecular formula of acids starts with a positive **hydrogen** cation, and their names are associated with the **anion** in their composition.
9. The molecular formula of alkalis (bases) ends with a **hydroxide group**, and their names are associated with the **cation** in their composition.
10. The molecular formula of alkalis (bases) that contain a cation Ca^{-2} is **$Ca(OH)_2$**.
11. The total charge of molecules of any compound equals **zero**.
12. The stomach secretes **hydrochloric** acid, which helps in **food digestion**.
13. Lemon and ketchup are considered **acidic** substances, while toothpaste and baking soda are considered **alkaline** substances.
14. When hydrochloric acid dissolves in water, it produces a **positive**

Hydrogen (H^+) ion and a negative chloride (Cl^-) ion.

15. When magnesium hydroxide dissolves in water, it forms a positive magnesium ion and a negative hydroxide ion.
16. Acids react with alkalis to form salt and water.
17. Nitric acid is considered from strong acids, while nitrous acid and sulfurous acid are considered from weak acids.
18. Metals burn in the presence of oxygen gas, forming metal oxides, and most of them are known as basic oxides.
19. Nonmetals burn in the presence of oxygen gas, forming nonmetal oxides, and most of them are known as acidic oxides.
20. The dissolution of sulphur trioxide (SO_3) in water forms sulphuric acid H_2SO_4.
21. Dissolving magnesium oxide (MgO) in water forms magnesium hydroxide.
22. The combustion of fossil fuels produces oxides of SO_2 and NO_2.

2 How to differentiate between:

1. The bicarbonate group and the sulphate group, in terms of the number of charges they carry - the molecular formula.

P.O.C	Bicarbonate group	Sulphate group
a. The number of charges they carry	One negative charge	Two negative charges
b. The molecular formula	HCO_3^-	SO_4^{-2}

2. Sulphuric acid and calcium hydroxide, in terms of the molecular formula.

P.O.C	Sulphuric acid	Calcium hydroxide
The molecular formula	H_2SO_4	$Ca(OH)_2$

3. Sulphurous acid and sulphuric acid, in terms of the molecular formula.

P.O.C	Sulphurous acid	Sulphuric acid
The molecular formula	H_2SO_3	H_2SO_4

4. Acidic oxides and basic oxides,
according to the definition - the result of their dissolution in water.

P.O.C	Acidic oxides	Basic oxides
a. Definition	They are nonmetal oxides that dissolve in water, forming acids.	They are metal oxides that dissolve in water, forming alkalis.
b. The result of their dissolution in water	Acids	Alkalis

5. Sulphurous acid and sulphuric acid,
according to the molecular formula - strength and weakness.

P.O.C	Sulphurous acid	Sulphuric acid
a. The molecular formula	H_2SO_3	H_2SO_4
b. Strength and weakness	Weak acid	Strong acid

3 Give one example of each of the following:

1. A positive atomic group.
Ammonium atomic group (NH_4^+)
2. A non-oxygenated acid that forms an anion in a liquid state.
Hydrochloric acid (HCl)
3. An acid secreted by the stomach.
Hydrochloric acid (HCl)
4. An oxygenated acid that carries three negative charges.
Phosphoric acid (H_3PO_4)
5. An acid secreted by the muscles.
Lactic acid
6. A weak acid.
Nitrous acid (HNO_2)
7. A strong acid.
Hydrochloric acid (HCl)

8. A strong alkali.
   Sodium hydroxide (NaOH)
9. A weak alkali.
   Ammonium oxide (NH_4OH)
10. A metallic oxide.
    Magnesium oxide (MgO)
11. A non-metallic oxide.
    Sulphur trioxide (SO_3)

4 Write the chemical formula for the following compounds:

1. Hydrosulphuric acid (**H_2S**)
2. Hydrobromic acid (**HBr**)
3. Sulphurous acid (**H_2SO_3**)
4. Phosphoric acid (**H_3PO_4**)
5. Ammonium hydroxide (**NH_4OH**)
6. Hydrochloric acid (**HCl**)
7. Sulphuric acid (**H_2SO_4**)
8. Nitric acid (**HNO_3**)
9. Potassium hydroxide (**KOH**)
10. An atomic group consisting of three elements (**HCO_3**)
11. Nitrous acid (**HNO_2**)

5 Write the names of the following chemical compounds and state their type:

1. H_2SO_4 (**Sulphuric acid**) (**Acid**)
2. H_2CO_3 (**Carbonic acid**) (**Oxyacid**)
3. HCl (**Hydrochloric acid**) (**Acid that doesn't contain oxygen**)
4. HNO_2 (**Nitrous acid**) (**Oxyacid**)
5. MgO (**Magnesium oxide**) (**Basic oxide**)
6. SO_3 (**Sulphur trioxide**) (**Acidic oxide**)
7. $Mg(OH)_2$ (**Magnesium hydroxide**) (**Alkali**)
8. H2S (**Hydrosulphuric acid**) (**Acid that doesn't contain oxygen**)

9. H_3PO_4 (**Phosphoric acid**) (**Oxyacid**)
10. NaCl (**Sodium chloride**) (**Salt**)

6 What is meant by each of the following:

1. Atomic group

   It is an ion composed of more than one atom of more than one element.

2. Acids

   They are substances that dissolve in water and give positive hydrogen ions H^+.

3. Alkalis

   They are substances that dissolve in water and give negative hydroxide ions OH^-.

4. Acidic oxides

   They are nonmetal oxides that dissolve in water, forming acids.

5. Basic oxides

   They are metals oxides that dissolve in water, forming alkalis.

6. Acid rains

   They are rains resulting from the dissolution of acidic oxides in the water vapor of the atmosphere.

7 What is the benefit of each of the following:

1. Stomach acid

   It participates in the food digestion.

2. Lactic acid

   It provides the muscle with oxygen when oxygen is lacking.

3. Milk of magnesia

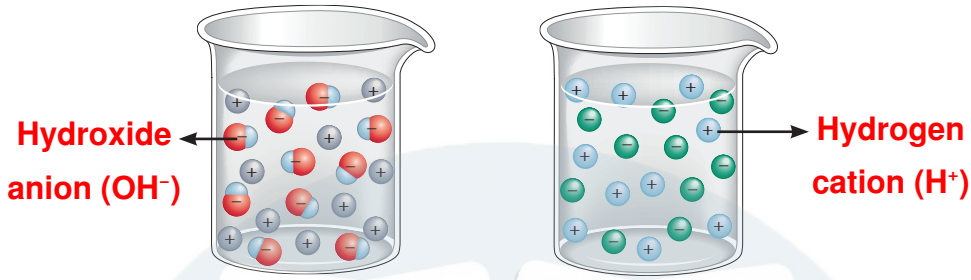
   To neutralize gastric acidity as it contains magnesium hydroxide.

4. Litmus paper

   To differentiate between acids and alkali, as acids turn the litmus paper into red, while alkalis turn the litmus paper into blue.

8 Study the following figures, and then answer the questions below:

The two figures show two compounds, one alkaline and the other acidic.



1. Which is acidic and which is alkaline?
   Compound (1) is acidic, while compound (2) is alkaline.
2. Which of them results from the dissolution of a nonmetal and which results from the dissolution of a metal?
   1. An acidic compound results from the dissolution of a nonmetal.
   2. An alkaline compound results from the dissolution of a metal.
3. What is the result of adding the first tube to the second tube?
   Salt and water
4. How do you differentiate between them with a litmus strip?
   Compound (1) turns the blue litmus strip into red.
   Compound (2) turns the red litmus strip into blue.

9 Study the following figures, and then answer the questions below:

The two opposite figures show two alkali compounds, which are sodium hydroxide and ammonium hydroxide.

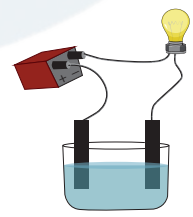


Figure 1

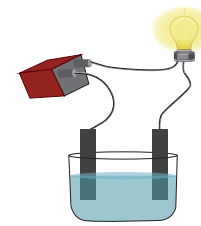


Figure 2

1. Write the chemical formula for each of them.
   Sodium hydroxide → NaOH
   Ammonium hydroxide → NH_4OH
2. Which one of them is weakly alkaline? And why?
   Figure 1 (ammonium hydroxide) because a weak alkali doesn't conduct electricity well, so the light bulb give weak light.
3. Which one of the two figures represents (NaOH)?
   Figure (2)

10 Study the following figures, and then answer the questions below:

The two figures show the combustion of two elements:



Combustion of a magnesium ribbon



Combustion of sulphur crystals

1. Which is a metal and which is a nonmetal?

Magnesium is a metal, while sulphur is a nonmetal

2. What is the result of combustion of each of them?

- The combustion of magnesium produces magnesium oxide (MgO).

- The combustion of sulphur produces sulphur trioxid (SO_3).

3. How do we differentiate between them through practical experience?

- When magnesium oxide dissolves in water, it forms an alkali, which turns the red litmus strip into blue.

- When sulphur trioxide dissolves in water, it forms an acid, which turns the blue litmus strip into red.

11 Give reasons for the following:

1. Acids turn the blue litmus paper into red.

- Because acids dissolve in water, giving a hydrogen cation H^+.

2. Alkalis turn the red litmus paper into blue.

- Because alkalis dissolve in water, giving a hydroxide anion OH^-.

3. Milk of magnesia is used to treat stomach acidity.

- To neutralize the gastric acidity, as it contains $Mg(OH)_2$.

12 What happens when:

1. An electric current passes through sulphuric acid and acetic acid, according to the lighting of the lamp?
   Sulphuric acid is a strong acid, so the light of the lamp will be strong, while acetic acid is a weak acid, so the light of the lamp will be weak.
2. Acids are mixed with alkalis?
   Salt and water are formed.
3. You heat a piece of magnesium, and then add water to the product?
   Magnesium oxide (MgO) is formed, which dissolves in water giving magnesium hydroxide $Mg(OH)_2$.
4. You heat a piece of sulphur?
   Sulphur trioxide (SO_3) is formed.
5. You add water to the previous product?
   Sulphuric acid (H_2SO_4) is formed.
6. You put a blue litmus paper in the solution?
   The litmus paper will turn into red.
7. Sulphur oxide is dissolved in rain water?
   Acid rain is formed.

13 Mention the damages caused by acid rains.

1. Destruction of forests. **2. Harming aquatic organisms.**
3. Harming the respiratory system. **4. Corrosion of buildings.**

Pony Revision on Unit 1 – Lesson 3

Chemical Indicators and Salts

Fourth Week

1 Complete the following sentences:

1. **Chemical indicators** are chemical substances that change their color in an acidic medium compared to a basic medium, such as **litmus indicator**.
2. Distilled water has a neutral effect and does not change the color of the litmus strip due to the equal number of **H^+** ions with **OH^-** ions.
3. There are many indicators, such as litmus strip and **universal indicator**.
4. We reduce soil acidity by adding **basic** materials, such as **calcium hydroxide $Ca(OH)_2$**.
5. The pH value of acids is **less** than 7, while the pH value of **bases** is greater than 7.
6. The pH value of a table salt solution (sodium chloride) is **seven**.
7. The pH value is accurately measured by using a device called **pH meter**.
8. Acidic gases include **carbon dioxide (CO_2)** and **nitrogen dioxide (NO_2)**.
9. Basic gases include **ammonia gas (NH_3)**.
10. Neutral gases, which do not affect a litmus strip, include **hydrogen gas (H_2)** and **oxygen gas (O_2)**.

2 Cross out the odd word, and then write the relation between the remaining words:

1. Universal indicator strips – Litmus paper – Voltmeter – pH meter (**Voltmeter**)

   (The others are chemical indicators.)
2. N_2 – H_2O – H_2 – HCl (**HCl**)

   (The others have neutral effect on the litmus strip.)
3. SO_2 – Cl_2 – CO_2 – NH_3 (**NH_3**)

   (The others are acidic gases.)
4. HNO_3 – H_2SO_4 – H_2O – HCl (**HCl**)

   (The others are acids.)

3 How do you differentiate between each of the following:

1. Distilled water and hydrochloric acid in two ways

P.O.C	Distilled water	Hydrochloric acid
a. By litmus indicator	It doesn't change the color of the litmus strip.	It turns the color of the blue litmus strip into red.
b. By pH meter	The pH value equals seven.	The pH value is less than seven.

2. CO_2 and O_2 gases

P.O.C	CO_2	O_2
a. By a wet litmus strip	It turns the color of the blue litmus strip into red.	It doesn't change the color of the litmus strip.

3. Ammonia gas and nitrogen dioxide gas

P.O.C	Ammonia gas	Nitrogen dioxide
a. By a wet litmus strip	It turns the color of the red litmus strip into blue.	It turns the color of the blue litmus strip into red.

4 Give one example of each of the following:

1. A gas that turns the blue litmus strip into red. **Carbon dioxide gas**
2. A gas that turns the red litmus strip into blue. **Ammonia gas**
3. A gas that has a neutral effect on the litmus paper. **Hydrogen gas**
4. A chemical indicator that measures the pH accurately. **pH meter**

5 What is meant by each one of the following:

1. Indicators

They are chemical substances whose color differ in the acidic medium from the alkaline medium.

2. Universal indicator

It is a chemical indicator that can be used to distinguish between acids and alkalis, acids and each other, or alkalis and each other according to their strength.

3. pH value

It is a scale ranging from 0 to 14 that indicates the acidity of basicity of a solution.

6 Answer the following questions:

1. If you have nitric acid and nitrous acid:

(1) Write their molecular formula.

Nitric acid → HNO_3 **Nitrous acid → HNO_2**

(2) Which one is strong and which one is weak?

Nitric acid is a strong acid, while nitrous acid is a weak acid.

(3) How do you differentiate between them?

By measuring the pH value of them using a pH meter device, the pH value of nitrous acid is less than that of nitric acid.

2. If you have two compounds (A) & (B) and their pH values are (8.5 and 3) respectively:

(1) Determine the type of each one.

Compound (A), with pH value 8.5, is a base (alkali), while compound (B), with pH value 3, is an acid.

(2) What happens when you mix them together?

They will produce salt and water.

7 Give reasons for the following:

1. Litmus paper is not suitable for distinguishing between strong and weak acids.

Because the litmus strip gives the same color with both of them.

2. Litmus paper doesn't affect distilled water.

Because distilled water is a neutral solution, as the number of cations of H^+ equals the number of anions of OH^-.

3. Nitric acid turns the blue litmus paper into red.

Due to the presence of hydrogen cations (H^+).

4. Calcium hydroxide turns the red litmus paper into blue.

Due to the presence of hydroxide anions (OH^-).

8 What happens in each one of the following:

1. You put a piece of sugar in a test tube containing sulphuric acid?

The sugar becomes black (charred).

2. You place two red and blue litmus strips in a tube of hydrogen gas?

The colors of the two wet litmus strips don't change.

3. You place two red and blue litmus strips in a tube containing chlorine gas?

The color of the two wet litmus strips is removed.

4. You place two red and blue litmus strips in a tube containing carbon dioxide gas?

- The color of the blue wet litmus changes into red.

- The color of the red wet litmus does not change.

5. You place two red and blue litmus strips in a tube containing ammonia gas?

- The color of the blue wet litmus does not change.

- The color of the red wet litmus changes into blue.

6. You add calcium hydroxide to acidic soil?

Calcium hydroxide is an alkaline substance, so it will treat and reduce the soil acidity.