

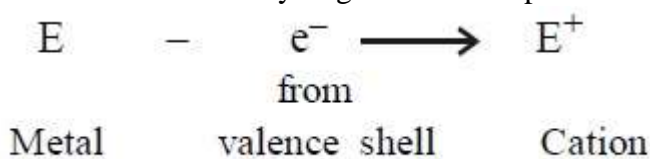
Assignments in Science Class X

Topic: -Metals and Non-metals

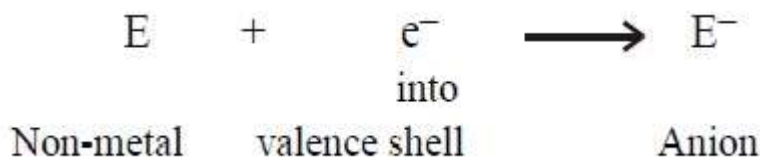
IMPORTANT NOTES

1. **Element** is a substance which cannot be further subdivided into simpler substances by any physical or chemical means.
2. **Metals** are the elements (except hydrogen) which form positively charged ions by losing electrons from their valence shell and form oxides which are basic in nature.
3. **Non-metals** are the elements which form negatively charged ions by accepting electrons in their valence shell and form acidic or neutral oxides.
4. **All metals** have one to three electrons in their valence shell.
5. **All non-metals** have four to seven electrons in their valence shell.
6. **Physical Properties of Metals** Metals generally :
 - (i) are solids,
 - (ii) are hard,
 - (iii) have lustre,
 - (iv) have high densities,
 - (v) have high melting and boiling points,
 - (vi) are malleable,
 - (vii) are ductile,
 - (viii) have high tensile strength,
 - (ix) are good conductors of heat and electricity,
 - (x) are monoatomic,
 - (xi) and can form alloys.
7. **Physical Properties of Non-metals** Non-metals generally : (i) are brittle solids or gases, (ii) are soft, (iii) have low densities, (iv) have no lustre, (v) have low melting and boiling points, (vi) are not malleable, (vii) are not ductile, (viii) have no tensile strength, (ix) are bad conductors of heat and electricity, (x) are polyatomic, (xi) do not form alloys.
8. **Chemical Properties of Metals :**
 - (i) Metals generally react with oxygen to form their oxides which are **basic in nature**.
 - (ii) Metal oxides of aluminium, zinc, lead and tin react with alkalises as well as acids. Such oxides are called **amphoteric oxides**.
 - (iii) Active metals like potassium, sodium, calcium, magnesium, aluminium, zinc and iron react with water or steam to form their hydroxides/oxides and hydrogen gas.
 - (iv) Active metals react with dilute mineral acids to form their respective salts and hydrogen gas.
 - (v) Active metals displace less active metals from their aqueous salt solutions. The reaction which takes place is called chemical displacement reaction.
 - (vi) A table of metals arranged in the order of their decreasing chemical reactivity, is called metal reactivity series.
9. **Chemical Properties of Non-metals**

- (i) Non-metals generally react with oxygen to form their oxides, which are either neutral or acidic in nature.
- (ii) Neutral oxides of non-metals are CO, NO, H₂O and N₂O.
- (iii) Non-metals do not displace hydrogen from water or dilute mineral acids.
- (iv) Non-metals react with one another to form covalent compounds.
- (v) Non-metals react with metals to form ionic compounds.
10. An atom or an ion having duplet or octet configuration like noble gases is said to be in the **minimum state of energy** and hence is **chemically inactive**.
11. The atoms of an element can attain stable electronic configuration of the nearest noble gas :
1. by donating (losing) one or more electrons from their valence shell to another atom,
 2. by accepting (gaining) one or more electrons in their valence shell from another atom,
 3. by sharing electrons from their valence shell with another atom/atoms.
12. The atom which accepts or donates electron/ electrons from its valence shell so as to acquire a configuration of the nearest noble gas gets electrically charged and becomes an **ion**.
13. The **metals** generally **donate electrons** from their valence shell and hence form **positively charged ions**. These positively charged ions are called **cations**, because, they discharge at the **cathode** to form neutral atoms.
14. The **non-metals** generally **accept electrons** in their valence shell and hence form **negatively charged ions**. The negatively charged ions are called **anions**, because, they discharge at the **anode** to form neutral atoms.
- 15. Characteristics of Cations :**
1. Only metals form cations, because, they have 1 to 3 electrons in their valence shell which they can easily donate to acquire a stable configuration of the nearest noble gas.
 2. There is no change in atomic number of an element as it forms a cation, because, the number of protons do not change.
 3. The atomic radii of a cation is smaller than neutral atom, because of the disappearance of the valence shell.
- 16. Characteristics of Anions :**
1. Only non-metals form anions, because, they have 4 to 7 electrons in their valence shell. Thus, they accept electrons in their valence shell to acquire a stable configuration of the nearest noble gas.
 2. There is no change in the atomic number of an anion as the number of protons in it are the same as in the neutral atom.
 3. The atomic radii of an anion slightly increases, because the effective pull of the nucleus slightly decreases due to addition of extra electron/electrons in the valence shell.
17. **Electropositive elements:** The elements which have a tendency to donate electrons from their valence shell and become positively charged ions (cations) are called **electropositive elements**. All metals and hydrogen are electropositive elements.



18. Electronegative elements: The elements which have a tendency to accept electrons in their valence shell and become negatively charged ions (anions) are called *electronegative elements*. All non-metals are electronegative elements.



- 19. Electrovalent bond or Ionic bond:** A chemical bond formed between two different atoms, by the transfer of one or more electrons from the valence shell of an electropositive or metallic element to the valence shell of a nonmetallic element, is called an *electrovalent bond* or an *ionic bond*.
- 20. Electrovalency :** The number of electrons which an atom of an element donates or accepts in its valence shell, so as to have a stable configuration like that of the nearest noble gas is called *electrovalency*.
- 21. Electropositive valency :** The number of electrons which an atom of an element (metal or hydrogen) donates from its valence shell, so as to have a stable configuration like that of a noble gas, is called *electropositive valency*.
- 22. Electronegative valency :** The number of electrons which an atom of an element (nonmetal) accepts in its valence shell, so as to have a stable configuration like that of a noble gas is called *electronegative valency*.
- 23. Electrovalent compound or Ionic compound:** The chemical compound formed as a result of transfer of electrons from the valence shell of an atom (metal or hydrogen) of an element to the valence shell of an atom of another element (non-metal) is called *electrovalent compound or ionic compound*.
- 24. Properties of Electrovalent (ionic) Compounds:**
1. They are generally hard and crystalline solids.
 2. They are generally non-volatile and hence have high melting and boiling points.
 3. They are good conductors of electricity in the fused state.
 4. They are generally soluble in water and their aqueous solutions are good conductors of electricity.
 5. The chemical reaction between the aqueous solutions of ionic compounds is very fast.
- 25. Metallurgy** encompasses various processes in the extraction of a metal from its ore and then refining the metal including study of its properties and uses.
- 26. Gangue or Matrix** are the unwanted impurities, such as sand, stones, mud, limestone, mica, etc. associated with the naturally occurring ore.
- 27. Dressing of ore** involves processes, (such as hand picking, grinding and crushing and pulverizing) which give an ore such a physical form, so that gangue can be easily removed from the ore.
- 28. Concentration of ore** involves processes, which help in the removal of gangue from the dressed ore, thereby increasing the concentration of the metal in the ore.
- 29. Electromagnetic separation** is the concentration process followed for the dressed ore, if
1. the ore is magnetic in nature.
 2. ore contains magnetic impurities (such as Fe_2O_3).

30. Gravity process or Hydraulic washing method of concentration is followed for such dressed ores which have metallic ores of high density as compared to the density of gangue. It is not followed in case of sulphide ores.

31. Froth floatation process for the concentration is followed for sulphide ores only. In this process, the sulphide ore is immersed in a mixture of pine oil and water and then strongly agitated with compressed air. The sulphide ore rises up along with the froth produced by the oil, but the gangue sinks to the bottom.

32. Chemical method for the concentration of ore is followed for such ores (ore of aluminium), in which density of the ore and the gangue is almost same.

33. Calcination is the process of heating the concentrated ore in the absence of air, such that it decomposes to form its metallic oxide. Following are the objectives achieved during calcination:

1. removes moisture from the ore
2. makes the ore porous
3. expels the volatile impurities
4. decomposes carbonate ores to oxide ores.

34. Roasting is the process of heating the concentrated ore (only sulphide ores) in the presence of excess of air, such that it changes to the oxide ore.

Following are the objectives achieved during roasting:

1. removes moisture from the ore
2. makes the ore porous
3. expels the volatile impurities
4. oxidises sulphide ores to oxide ores.

35. Smelting or reduction of ore is the process of conversion of the metal oxide ore into metal, by reducing it with a suitable reducing agent. The reducing agents commonly used are coke, carbon monoxide and hydrogen. For reducing ores of highly active metals, electrolytic reduction is employed.

36. Refining of metals is done by a number of methods. However, the best method is electrolytic method. In this method the pure metal is made the cathode, and the impure metal is made the anode. The cathode and the anode are immersed in the aqueous solution of metal. On the passage of electric current, the pure metal from the anode is transferred to the cathode.

37. Thermite mixture consists of three parts of ferric oxide and one part of powdered aluminium. It is commonly employed in spot welding, such as broken railway lines.

38. Alloy is a homogeneous mixture of two or more metals, obtained by melting them together.

39. (a) Major alloys of aluminium are

(i) ***Duralumin or Dural***

[Al = 95%; Cu = 4%; Mn = 0.5%;
Mg = 5%]

(ii) ***Magnalium*** [Al = 95%; Mg = 5%]

(b) Major alloys of iron are

(i) ***Stainless steel***

[Fe = 73% – 80%; C = 1.0%; Cr = 18%;
Ni = 1%]

(ii) ***Manganese steel***

[Fe = 83% – 84%; Mn = 15%; C =
1% – 1.5%]

(iii) ***Tungsten steel***

[Fe = 79% – 85%; W = 10% – 20%;
C = 1%] and

(iv) ***Alnico***

[Fe = 60%; Al = 12%; Ni = 20%,
Co = 5%]

(c) Major alloys of copper are :

(i) ***Aluminium bronze*** [Cu = 90%; Al =
10%]

(ii) ***Brass*** [Cu = 60% – 80%; Zn = 20%
– 40%]

(iii) ***Bronze*** [Cu = 80%; Zn = 10%; Sn =
10%]

(iv) ***Gun metal*** [Cu = 88%; Sn 10%; Zn
= 1% – 2%] and

(v) ***German silver***

[Cu = 30% – 60%; Zn = 25% – 35%;
Ni = 15% – 35%].

40. **Gold** is alloyed with metals like copper, silver, cadmium, so as to make it hard and workable at low temperature.
41. **Purity of gold** is measured in carats. 100% pure gold is 24 carat, while 1 carat = 4.1666 g per 100 g of alloy.
42. **Corrosion of metals** is the formation of layers of undesirable compounds on the surface of metals due to the action of moist air containing impurities.
43. **Corrosion of metal** take place only, if the surface of metal comes in direct contact with moist air for prolonged time.
44. **Rusting:** The slow conversion of iron into hydrated ferric oxide in the presence of moist air is called rusting.
45. **Rust** is a flaky, non-sticky brown powder formed on the surface of iron, when the iron is exposed to moist air.
46. **Factors which promote rusting :** In addition to moist air : (i) the presence of salts such as sodium chloride, (ii) presence of more active metals than iron and the presence of pollutants such as NO₂; SO₂; CO₂ in air, promote rusting.
47. **Rusting can be prevented by** coating the metal surface with (i) red lead (ii) paints
48. (iii) enamel (iv) oil or grease (v) plastic coating (vi) galvanising (vii) tinning (viii) electroplating with nickel or chromium (ix) converting iron into stainless steel.

VERY SHORT ANSWER QUESTIONS

IMPORTANT QUESTIONS

1. Name two acidic non-metallic oxides.
2. Name a non-metal which is highly tensile.
3. Name a non-metal which forms positively charged ions.
4. Name two metals whose density is less than 1 gcm⁻³.
5. Name a naturally occurring non-metal, which is the hardest substance.
6. Name a metal which does not react with conc. nitric acid.
7. Generally, when metals are treated with mineral acids, hydrogen gas is liberated but when metals (except Mn and Mg) are treated with HNO₃, hydrogen is not liberated, why? [**HOTS**]
8. Amongst the metals, non-metals and noble gases, to which category do the element belong if they have:
 - (i) positive valency; (ii) negative valency; (iii) zero valency.

QUESTIONS FROM CBSE EXAMINATION PAPERS

1. Why do silver ornaments lose their shine when kept for some time?
2. Name a metal other than aluminium that is covered with an oxide film layer.
3. Name one metal and one non-metal which exists in liquid state at room temperature?
4. Name a non-metal which is lustrous and a metal which is non-lustrous.

5. Name two metal which have very low melting point.
6. If copper metal is heated over a flame, it develops a coating. What is the colour and composition of this coating?
7. Why is sodium metal kept immersed in kerosene oil?
8. Name one metal which react with very dilute HNO_3 to evolve hydrogen gas.
9. A non-metal X exists in two different forms Y and Z. Y is the hardest natural substance, whereas Z is a good conductor of electricity. Identify X, Y, and Z.
10. An element A form two oxides AO and AO_2 . The oxide AO is neutral whereas the oxide AO_2 is acidic in nature. Would you call element A a metal or non-metal.
11. In the refining of silver the recovery of silver from silver nitrate solution involves displacement by copper metal. Give the reason for the same.
12. Name two metals which are both ductile as well as malleable.
13. The reaction of iron (III) oxide Fe_2O_3 with aluminium is used to join cracked iron parts of machines.
14. Give reason for the following:
(a) Ionic compounds conduct electricity in the molten state.
15. Give reason for the following: Metals can be given different shapes according to our needs.
16. How will you test for the gas which is liberated when hydrochloric acid reacts with an active metal?
17. Which reducing agent is used in the reduction of alumina?
18. What are metalloids?
19. Why are titanium and chromium classified as strategic metals?
20. Which one of the following metals does not react with oxygen even at high temperatures?
(i) Calcium (ii) Gold (iii) Sodium
21. Give reasons for the following: Addition of some silver to pure gold for making ornaments.
22. Give reason for the following: Alumina is dissolved in molten cryolite for electrolysis to obtain aluminum metal.
23. Write the chemical equation to represent the reaction taking place between sodium metal and cold water.
24. Why is tungsten metal selected for making filaments of incandescent lamp bulbs?
25. Name a metal which offer higher resistance to the passage of electricity than copper.
26. Write the chemical equation for the reaction of hot aluminium with steam.
27. How does the metal magnesium differ from the metal calcium in their reaction with water?
28. What is seen to happen when a piece of sodium metal is dropped into water?

SHORT ANSWER QUESTIONS

IMPORTANT QUESTIONS

1. Describe briefly the froth floatation process for the concentration of sulphide ores.
2. What is a thermite reaction?
3. Does every mineral have a definite and fixed composition? Explain.
4. What important properties of aluminium are responsible for its great demand in the industry?
5. Why is iron more useful when it is mixed with a little carbon?
6. What is 24 carat gold? How will you convert it into 18 carat gold?
7. Name the alloy of:

- (i) aluminium in the construction of aircrafts,
 - (ii) lead used in joining metal for electrical work,
 - (iii) copper used in household vessels.
8. Zinc is higher in the electrochemical series than iron, yet it is used for preventing the rusting of iron. Explain.
9. Give the reaction involved during extraction of zinc from its ore by
- (a) roasting of zinc ore
 - (b) calcination of zinc ore
10. Explain the following:
- (i) Iron articles are galvanised.
 - (ii) Metals like Na, K, Ca and Mg are never found in their free state in nature.
11. What happens when?
- (a) ZnCO_3 is heated in the absence of oxygen?
 - (b) a mixture of Cu_2O and Cu_2S is heated?
12. What are the constituents of solder alloy? Which property of solder makes it suitable for welding electrical wires?
13. Name two metals which displace hydrogen from strong caustic alkalis. Write chemical equations in support of your answer.
14. Name two non-metals which occur in:
- (i) solid state,
 - (ii) gaseous state.
15. What kind of oxide is ZnO ? Support your answer by writing two chemical equations.
16. Name one metal which:
- (i) displaces copper,
 - (ii) does not displace copper, from copper nitrate solution.
17. What happens when iron is placed in copper sulphate solution?
18. State the reactions if any of the following metals reacts with ferrous sulphate solution:
- (i) zinc,
 - (ii) copper,
 - (iii) silver.
19. A metal P is placed in an aqueous solution of Q. In a few hours metal Q was deposited on metal P. Which metal amongst P and Q is more reactive and why?
20. Write chemical equations for the following reactions.
- (i) Aluminium and hydrochloric acid
 - (ii) Magnesium and steam

QUESTIONS FROM CBSE EXAMINATION PAPERS

1. Aluminium occurs in combined state whereas gold is found in Free State. Why?
2. Most metals do not react with bases, but zinc metal does. Suggest a reason. Write an equation for the reaction between Zn and NaOH.
3. Write chemical equations for the reactions taking place when
 - (i) zinc sulphide is heated in air
 - (ii) calcination of zinc carbonate is done.
4. How pure copper is obtained from impure copper by electrolytic refining?
5. When a metal X is treated with cold water, it gives a basic salt Y with molecular formula XOH (Molecular mass = 40) and liberates a gas Z which easily catches fire. Identify X, Y, Z.

6. Write the equations for the following metals which are obtained from their compounds by reduction process.
 - (i) Metal X which is low in reactivity series.
 - (ii) Metal Y which is middle of series.
7. Explain, why most of the metals do not displace hydrogen from Nitric acid.
8. Explain, why calcium metal after reacting with water starts floating on its surface? Write the chemical equation for the reaction.
9. Name the chemicals used in the acid fire extinguisher and the gas evolved from it when used?
10. State reasons for the following :
 - (i) Electric wires are covered with rubberlike material.
 - (ii) From dilute hydrochloric acid zinc can liberate hydrogen gas but copper cannot.
11. State reasons for the following observations:
 - (i) The shining surface of some metals becomes dull when exposed to air for a long time.
 - (ii) Metals sulphides occur mainly in rocks but metal halides occur mostly in sea and lake.
12. Differentiate between roasting and calcination processes used in metallurgy. Give an example of each.
13. Give reason for the following:
 - (a) Gold and silver are used to make jewellery.
 - (b) Carbonate and sulphide ores are usually converted into oxides prior to reduction during the process of extraction.
14. With a labelled diagram describe an activity to show that metals are good conductors of electricity.
15. Name an alloy
 - (i) Which has a lower melting point than its constituents.
 - (ii) Which is more hard, tough and strong than its constituents.
16. Define the term 'alloy'. Write two advantages of making alloys.
17. State reasons for the following:
 - (i) Metals are good conductors of heat
 - (ii) Inability of non-metals for displacing hydrogen from dilute sulphuric acid.
18. Choose the metal (from the list given below) which can displace zinc from zinc sulphate solution-Lead, Copper, Magnesium, Silver. Write the equation of the chemical reaction involved.
19. A copper plate was dipped into a solution of AgNO_3 . After sometime, a black layer was deposited on the copper plate. State the reason for it. Write the chemical equation of the reaction involved.

SHORT ANSWER QUESTIONS

IMPORTANT QUESTIONS

1. Iqbal treated a lustrous, divalent element M with sodium hydroxide. He observed the formation of bubbles in the reaction mixture. He made the same observations when this element was treated with hydrochloric acid. Suggest how he can identify the produced gas. Write chemical equations for both the reactions.

2. An alkali metal A gives a compound B (molecular mass = 40) on reacting with water. The compound B gives a soluble compound C on treatment with aluminium oxide. Identify A, B and C and give the reaction involved.
3. Give one example of an article made from iron which is protected from rusting by:
- (i) red lead paint (ii) enamelling
 - (iii) plastic coating (iv) tinning
 - (v) electroplating (vi) oiling or greasing
4. During extraction of metals, electrolytic refining is used to obtain pure metals.
- (a) Which material will be used as anode and cathode for refining of silver metal by this process?
 - (b) Suggest a suitable electrolyte also.
 - (c) In this electrolytic cell, where do we get pure silver after passing electric current?
5. Compound X and aluminium are used to join railway tracks.
- (a) Identify the compound X
 - (b) Name the reaction
 - (c) Write down its reaction.
6. Give the steps involved in the extraction of metals of low and medium reactivity from their respective sulphide ores.
7. (i) Why is gold alloyed? Give two reasons.
(ii) Name two metals which are commonly used for alloying gold.

QUESTIONS FROM CBSE EXAMINATION PAPERS

1. Most metals do not react with bases but zinc metal does. Suggest a reason and write an equation for the reaction between zinc and NaOH.
2. A magnesium ribbon is burnt in oxygen to give a white compound X accompanied by emission of light.
- (a) Write the chemical formulae of X
 - (b) Write a balanced chemical equation, when X is dissolved in water.
3. Metal compound A reacts with dilute hydrochloric acid and to produce effervescence. The gas evolved extinguishes a burning candle and turns the limewater milky.
- Write balanced chemical equations for the reactions.
4. (a) Why metals are not found in their free state generally?
(b) If a strip of aluminium with scratched clean surface is dipped into an aqueous solution of copper sulphate for little time, surface of the strip becomes brownish. What is the reason for this? Write the balanced chemical equation for the reaction.
5. (a) What type of reaction is to be performed to ascertain and verify the position of metals in the reactivity series?
(b) If an iron nail immersed in the aqueous solution of copper sulphate, what are the changes happening to the nail and to the solution?
(c) Write the balanced chemical equation for the reaction between iron metal and aqueous copper sulphate solution.
6. (a) Using a simple experiment, how can you prove that magnesium is placed above zinc in reactivity series?
(b) Why copper metal cannot liberate hydrogen when reacting with dil. HCl?
7. Give reasons for the following:

- (i) Zinc oxide is considered as an amphoteric oxide.
 - (ii) Non-metals in general do not displace hydrogen from dilute acids.
 - (iii) Metals conduct electricity.
- 8.** An ore on heating in air produces sulphur dioxide. Which process would you suggest for its concentration? Describe briefly any two steps involved in the conversion of this concentrated ore into the related metal.
- 9.** What is meant by 'rusting'? With labelled diagrams describe an activity to find out the conditions under which iron rusts.
- 10.** Give reasons for the following observations:
- (i) Ionic compounds in general have high melting and boiling points
 - (ii) Highly reactive metals cannot be obtained from their oxides by heating them with carbon.
 - (iii) Copper vessels get a green coat when left exposed to air in the rainy season.
- 11.** Name two metals which react violently with cold water. Write any three observations you would make when such a metal is dropped into water. How would you identify the gas evolved, if any, during the reaction?
- 12.** (a) Give an example of a metal which
- (i) can be easily cut with a knife
 - (ii) is a liquid at room temperature.
- (b) Write chemical equation for the reaction when
- (i) steam acts on red hot iron
 - (ii) zinc is added to iron (II) sulphate solution.
- 13.** (a) Name a metal for each case :
- (i) It does not react with cold as well as hot water but reacts with steam.
 - (ii) It does not react with any physical state of water.
- (b) When calcium metal is added to water the gas evolved does not catch fire but the same gas evolved on adding sodium metal to water catches fire. Why is it so?
- 14.** (a) Name the chief ore of iron. Write its formula.
- (b) How is an iron ore concentrated? Describe it briefly.
- 15.** Give reasons for the following:
- (i) Metals are regarded as electropositive elements.
 - (ii) When a piece of copper metal is added to a solution of zinc sulphate no change takes place, but the blue colour of copper sulphate fades away when a piece of zinc is placed in its solution.
 - (iii) Articles made of aluminium do not corrode even though aluminium is an active metal.
- 16.** (i) Explain the term 'roasting' as used in metallurgical processes. Give one suitable example for it.
- (ii) What changes take place when cinnabar (HgS) is heated in air for a long enough time?
- 17.** Explain the following terms by giving one example of each: (i) Mineral (ii) Ore (iii) Gangue
- 18.** Give reasons for each of the following:
- (i) Germanium is called a metalloid.
 - (ii) Zirconium is known as a strategic metal.
 - (iii) Nitrogen is used to preserve food.