1. What do you understand by the following terms:
   (i) metals  (ii) non-metals  (iii) metalloids  

Ans. (i) **Metals** : The elements, which are generally hard, malleable, ductile, good conductors of heat and electricity, and have a lustre are called metals.  
**Examples** : Gold, silver, iron and copper.  
(ii) **Non-metals** : The elements which are generally gases or brittle solids, are not malleable and ductile are called non-metals.  
**Examples** : Hydrogen, oxygen, carbon, sulphur.  
(iii) **Metalloids** : Elements which exhibit some properties of metals and some properties of non-metals are called metalloids.  
**Examples** : Arsenic, antimony, germanium, silicon.  

2. Give five physical differences between the metals and non-metals.  

Ans.  

<table>
<thead>
<tr>
<th>Metals</th>
<th>Non-metals</th>
</tr>
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<tbody>
<tr>
<td>1. Metals are generally solids at room temperature.</td>
<td>1. Non-metals are gaseous or liquids or brittle solid at the room temperature.</td>
</tr>
<tr>
<td>2. Metals have lustre.</td>
<td>2. Non-metals do not have lustre.</td>
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<tr>
<td>3. Metals in molten state dissolve in each other to form alloys.</td>
<td>3. Non-metals do not form alloys.</td>
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<tr>
<td>4. Except sodium and potassium, metals generally have a high density.</td>
<td>4. Except diamond Non-metals generally have low density.</td>
</tr>
<tr>
<td>5. Metals are generally malleable and ductile.</td>
<td>5. Non-metals are generally non-malleable and non-ductile.</td>
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3. Bring out differences between metals and non-metals on the basis of:
   (i) arrangement of valence electrons,
   (ii) formation of ions, (iii) oxidising/reducing action,
   (iv) nature of oxides

   **Ans. (i)** Arrangement of valence electrons: Metals have one to three electrons in their valence shell. (Except hydrogen, which has only one electron in its valence shell.) Non-metals have four to seven electrons in their valence shell. (Except hydrogen, which has one electron in its valence shell.)

   **(ii)** Formation of ions: Metals readily lose valence electrons to form cations, whereas non-metals gain electrons in their valence shell and hence form anions.

   **(iii)** Oxidising/reducing action: Metals are reducing agents and by themselves are oxidised. Non-metals are oxidising agent and by themselves are reduced, except carbon which is oxidised and is a reducing agent.

   **(iv)** Nature of oxides: Metallic oxides are basic in nature. Non-metallic oxides are acidic in nature.

4. Give the names of the following metals:
   (i) A metal which is in liquid state at the room temperature. [1]
   (ii) A metal which dissolves in cold water to form a turbid solution with the liberation of hydrogen gas. Support your answer with a chemical equation. [2]
   (iii) A metal which catches fire when brought in contact with air or water. [1]
   (iv) A metal which burns with a non-persistent green flame in air or oxygen. [1]
   (v) A metal which forms two different cations [1]

   **Ans. (i)** The metal is mercury.
   **(ii)** The metal is calcium.

\[
\text{Ca} + 2\text{H}_2\text{O} \xrightarrow{\text{heat}} \text{Ca(OH)}_2 + \text{H}_2 \ (g)
\]
(iii) Sodium metal catches fire when brought into contact with air or water.
(iv) Copper metal burns with a non-persistent green flame.
(v) Iron metal forms two cations, i.e., Fe$^{2+}$ and Fe$^{3+}$.

5. Give the names and formulae of the non-metals which exhibit the following properties : [1 × 11]
(i) A non-metal having lustre and is a good conductor of electricity.
(ii) A non-metal, which is the hardest naturally occurring substance.
(iii) Two non-metals whose oxides are neutral towards litmus.
(iv) A non-metal which is liquid at the room temperature.
(v) A non-metal which is kept under water.
(vi) A non-metal which is essential for organic compounds.
(vii) A non-metal which is essential for respiration.
(viii) A non-metal which is essential for producing steel.
(ix) A non-metal which is the source of energy in the sun and stars.
(x) A non-metal which is used in the purification of drinking water.
(xi) A non-metal used for curing skin diseases.

Ans. (i) Graphite (an allotrope of carbon). Formula : C
(ii) Diamond (an allotrope of carbon). Formula : C
(iii) Oxides of hydrogen H$_2$O and nitrogen (NO) are neutral towards litmus. Formula : H$_2$ and N$_2$
(iv) Bromine is liquid at the room temperature. Formula : Br$_2$
(v) Phosphorus is kept under water. Formula : P$_4$
(vi) Carbon is the non-metal. Formula : C
(vii) Oxygen is the non-metal. Formula : O$_2$
(viii) Carbon is the non-metal. Formula : C
(ix) Hydrogen is the non-metal. Formula : H$_2$
(x) Chlorine is the non-metal. Formula : Cl$_2$
(xi) Sulphur is the non-metal. Formula : S$_8$
6. Define ‘metal’, with particular emphasis on (i) ionization (ii) electrochemical nature, (iii) formation of compounds, and (iv) valency.  
Ans. A metal is an element which (i) ionises with the donation (loss) of valence electrons, (ii) form positively charged ions (cations), (iii) forms electrovalent compounds, (iv) has electropositive valency, 1, 2 or 3.

7. Define ‘non-metal’, with particular emphasis on (i) ionization, (ii) electrochemical nature, (iii) formation of compounds, (iv) valency.  
Ans. A non-metal is an element which (i) ionises with acceptance (gain) of valence electrons, (ii) form negatively charged ions (anions), (iii) forms covalent compounds amongst each other, (iv) has electronegative valency 1 to 4.

8. State, why are alkali metals strong reducing agents?  
Ans. Any substance which loses (donates) electrons is said to be oxidised and hence is a reducing agent. As the alkali metals have only one electron in their valence shell, which they can lose (donate) easily, hence they are strong reducing agents.

9. State, why are halogens (non-metals) strong oxidising agents? 
Ans. Any substance which gains (accepts) electrons in its valence shell is said to be reduced and is an oxidising agent. As the halogens have 7 electrons in their valence shell therefore, they can easily accept an electron to form a stable electronic configuration of nearest noble gases. Thus, halogens (non-metals) are strong oxidising agents.
10. Name a metal from activity series which :
   (i) forms an oxide on exposure to air, (ii) displaces hydrogen from steam, (iii) does not react with HCl or H₂SO₄ (iv) forms an oxide or hydroxide soluble in water (v) forms a nitrate and on thermal decomposition leaves a metallic residue. Give balanced equations where-ever possible.

   **Ans. (i)** Sodium metal on exposure to air forms sodium oxide.
   
   \[ 4Na + O_2 \rightarrow 2Na_2O \]

   **(ii)** Heated iron metal, displaces hydrogen from steam.
   
   \[ 3Fe + 4H_2O(steam) \xrightarrow{\text{heat}} Fe_3O_4 + 4H_2 \]

   **(iii)** Gold does not react with HCl or H₂SO₄

   **(iv)** Sodium forms an oxide as well as hydroxide, which is soluble in water.
   
   \[ Na_2O + H_2O \rightarrow 2NaOH \]

   **(v)** Lead forms lead nitrate which decomposes on heating.
   
   \[ 2Pb(NO_3)_2 \xrightarrow{\text{heat}} 2PbO + 4NO_2(g) + O_2 (g) \]

11. Define : (a) alloy  (b) amalgam.

   **Ans.** (a) A homogeneous solid solution of two or more metals which are mixed in the molten state in fixed proportion is called an alloy.

   (b) A homogeneous solution of metals in mercury is called an amalgam.

12. State (i) composition (ii) reason for alloying (iii) one use for the following alloys

   (a) Stainless steel  (b) Brass  (c) Type metal
   (d) Bronze  (e) Solder  (f) Gun metal
   (g) German silver  (h) Magnalium  (i) Bell metal
   (j) Duralumin

   **Ans. (a)** Stainless steel: It contains Fe, Cr, C and Ni. It resists corrosion and is used for making kitchen utensils.

   **(b)** Brass: It contains copper and zinc. It can be easily moulded and is used in making shells of gun, ammunition and utensils.
(c) **Type metal**: It contains lead, tin and antimony. It is very hard and expands on cooling. It is used for making printing type.

(d) **Bronze**: It contains copper, zinc and tin. It does not corrode and take very high polish. It is used for making coins, statues and utensils.

(e) **Solder**: It contains lead and tin. It has a very low melting point of 200° C approx. It is used for making electric fuses and soldering electric wires.

(f) **Gun metal**: It contains copper, tin, zinc and lead. It is very hard and takes a good cast. It is used for making bells and gongs.

(g) **German silver**: It contains copper, zinc and nickel. It is white as silver and is malleable and ductile. It is used for making imitation silver jewellery.

(h) **Magnalium**: It contains magnesium and aluminium. It is light weight, strong and resists corrosion. It is used for making household appliances and scientific instruments.

(i) **Bell metal**: It contains copper and tin. It is hard and brittle, but produces sonorous sound. it is used for making bells and gongs.

(j) **Duralumin**: It contains Al, Cu, Mn and Mg. It is light weight and as strong as steel. It is used for making aircraft frames and automobile agencies.

13. Complete the statements given below pertaining to chemical properties of a metals with correct word.

If ‘M’ is a metal:

(i) Its compound MY₂ is _________ [electrovalent/covalent].

(ii) It will form cation M²⁺ by electron _________ [gain/loss] and the metal M is _________ [oxidised/reduced].

(iii) The cation M²⁺ form metal M by _________ [loss/gain] of two electrons.

(iv) The oxide of metal MO is a/an _________ [acidic/basic/neutral] oxide.
(v) M is ___________ [less/more] electropositive than hydrogen and can replace the ___________ [hydrogen/chlorine] ion in hydrochloric acid to form a salt.

**Ans.** (i) electrovalent (ii) loss, oxidised (iii) gain (iv) basic (v) more, hydrogen.

14. Complete the statements given below pertaining to chemical properties of non-metals with correct word.

If ‘N’ is a non-metal.

(i) it will form anion N\(^{1-}\) by electron ________ [gain/loss] and non-metal N is ___________ [oxidised/reduced].

(ii) its oxide is an/a ___________ [acidic/basic/amphoteric] oxide.

(iii) its anion N\(^{1-}\) will form neutral atom at the ___________ [cathode/anode]

(iv) its valence shell will have ___________ [1/7/2] electron/electrons.

(v) it is highly electronegative and a ___________ [bad/good] conductor of heat.

**Ans.** (i) gain, reduced (ii) acidic (iii) anode (iv) 7 (v) bad

15. Complete the statement given below pertaining to group IA metal.

(i) Its electronic configuration is 2, 8, 1 and it belongs to period ___________ of periodic table [1/2/3].

(ii) It is highly electropositive metal, since it has a strong tendency to ___________ [gain/lose] electrons.

(iii) It is a ___________ [light/heavy] metal, since it has a ___________ [small/larger] atomic size and ___________ [low/high] density.

(iv) It is a ___________ [soft/hard] metal, since energy binding the atoms is ___________ [high/low]

(v) It is a strong ___________ [oxidising/reducing] agent and has ___________ [high/low] ionisation potential.

**Ans.** (i) 3 (ii) lose (iii) light, larger, low (iv) soft, low (v) reducing, low
16. Complete the statements given below pertaining to physical/chemical properties of metals and non-metals.

(i) The metal which has low melting point is _______ [Mg/K/Cu/Fe].
(ii) The metal which can be cut with a knife is _______ [Cu/Al/Na/Zn].
(iii) The non-metal present in the alloy stainless steel is _______ [P/S/C].
(iv) The metal whose cation is discharged at cathode by accepting two electrons from cathode is _______ [Na/K/Mg/Al].
(v) The non-metal whose oxide is a neutral oxide _______ [S/N/P].

Ans. (i) K (ii) Na (iii) C (iv) Mg (v) N

17. Complete the statements pertaining to metal activity series with correct words.

(i) The metal which does not react with water or dilute sulphuric acid, but reacts with concentrated sulphuric acid is _______ [Al/Cu/Zn/Fe].
(ii) The metal whose hydroxide does not decompose on heating, but its nitrate decomposes is _______ [Ca/Al/Na/Fe].
(iii) The metal whose carbonate and nitrate on thermal decomposition give a residue which is a metal _______ [Fe/Cu/Ag/Ca].
(iv) The divalent metal whose oxide is reduced to metal by electrolysis of its fused salt is _______ [Al/Na/Mg/K].
(v) The metal whose amphoteric oxide which is amphoteric is reduced to metal by carbon reduction is _______ [Fe/Cu/Zn/Al].

Ans. (i) Cu (ii) Na (iii) Ag (iv) Mg (v) Zn
18. Fill in the statements given below with correct words pertaining to alloys.

(i) The metal other than aluminium present both in magnalium and duralumin is ________ [copper/manganese/magnesium].
(ii) The metals zinc and tin are present in ________ [both brass and bronze/only brass/only bronze/bell metal].
(iii) German silver contains ________ [Cu-Zn-Sn/Cu-Zn-Ni/Cu-Pb-Ni].
(iv) Electrical fitting are generally made of ________ [germen silver/bell metal/brass].
(v) An alloy which is sonorous is ________ [duralumin/type metal/bell metal].
(vi) The major metals which make alloy type metal are ________ [tin, antimony and lead/tin and antimony/lead, tin and carbon].
(vii) Addition of ________ [antimony/tin] to lead lowers the melting point of the alloy solder.
(viii) Gun metal is an example of a/an ________ [lead alloy/copper alloy/brass alloy/aluminium alloy].
(ix) The non-metallic component in stainless steel is ________ [sulphur/phosphorus/carbon].
(x) Stainless steel contains in addition to iron, nickel and chromium which imparts ________ [hardness/tensile strength/lustre] to the alloy.

Ans. (i) magnesium (ii) only bronze
(iii) Cu-Zn-Ni (iv) brass
(v) bell metal (vi) tin, antimony and lead
(vii) tin (viii) copper alloy
(ix) carbon (x) tensile strength
19. Select the correct answer from the choices A, B, C and D.

(i) A metal which has a large atomic size and light in weight.
   (a) aluminium (b) lithium
   (c) zinc (d) copper

(ii) A metallic oxide which is reduced to metal by electrolysis.
   (a) silver oxide (b) magnesium oxide
   (c) copper oxide (d) iron(III) oxide

(iii) A non-metal with a lustre, which conducts electricity
   (a) sulphur (b) silicon
   (c) graphite (d) iodine

(iv) A metal which does not react with dilute sulphuric acid
   (a) magnesium (b) aluminium
   (c) zinc (d) copper

(v) A neutral oxide
   (a) nitrous oxide (b) nitrogen dioxide
   (c) copper (II) oxide (d) carbon dioxide

Ans. (i) aluminium (ii) magnesium oxide
     (iii) graphite (iv) copper
     (v) nitrous oxide
20. Match the properties/uses of metals/alloys in column A with column B.

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) Heavy in weight and used in radiation shields and making bullets</td>
<td>(a) Brass</td>
</tr>
<tr>
<td>(ii) Lustrous, corrosion resistance and used for making surgical instruments.</td>
<td>(b) German silver</td>
</tr>
<tr>
<td>(iii) Stronger than aluminium and used for making light tools.</td>
<td>(c) Pig iron</td>
</tr>
<tr>
<td>(iv) Contains copper and zinc, is silvery and used for making decorative articles</td>
<td>(d) Stainless steel</td>
</tr>
<tr>
<td>(v) Easily cast, expands on solidification and used for making pipes.</td>
<td>(e) Lead metal</td>
</tr>
<tr>
<td>(f) Duralumin</td>
<td></td>
</tr>
</tbody>
</table>

Ans. (i) e (Lead metal)  (ii) d (Stainless steel)  (iii) f (Duralumin)  (iv) b (German silver)  (v) c (Pig iron)

21. (a) Name:
   (i) one metal which is found free or native in nature.
   (ii) one metal whose oxide can be reduced to metal by hydrogen or carbon monoxide.
   (iii) one metal which is extracted by electrolysis of its fused chloride.

Ans. (a) (i) Gold is found free or native in nature.
         (ii) Iron.
         (iii) Calcium.
22. (a) (i) Name the metal alloyed with copper to form brass. [1]
(ii) State two properties of brass that render it more useful for some purposes than its components. [2]
(b) (i) What type of reaction is used to extract iron from its ore? [1]
(ii) Suggest why the price of aluminium now-a-days is so much less than it was 150 years ago. [1]

Ans. (a) (i) Zinc metal when alloyed with copper, forms brass.
(ii) 1. Brass does not tarnish easily as compared to zinc and copper.
2. Brass can easily be cast and machined, but not zinc or copper.

(b) (i) The type of reaction in the extraction of iron is reduction.
(ii) 150 years ago, there was no large-scale production of electric energy. The electric current was obtained from chemical cells and it was very very expensive. Thus, aluminium obtained was very costly. However, due to large-scale production of electric energy, it is cheap and hence the cost of production of aluminium is less.

23. (a) (1) Place the following metals in the order in which they appear in the activity series, starting with most reactive first: lead, sodium, iron, zinc. [1]
(2) A fifth metal M reacts slowly with cold water, but vigorously when heated with steam. It reacts with dilute hydrochloric acid giving hydrogen gas and forming the chloride MCl₂.
(i) Where M should be placed in the activity series of four metals in (A) above? [1]
(ii) Write an equation for the thermal decomposition of carbonate of M. [1]
(iii) How can metal M be extracted? [1]
(b) Give two uses of zinc. [1]
(c) What is the name of gas evolved in each of the following cases?
   (i) When zinc is treated with dilute sulphuric acid. [1]
   (ii) When zinc is heated with concentrated sulphuric acid. [1]
(d) How will you identify the gas evolved in c (ii)?  

Ans. (a) (1) Sodium, zinc, iron, lead.
(2) (i) M should be placed between sodium and zinc.
     (ii) \( \text{MCO}_3 \xrightarrow{\text{heat}} \text{MO} + \text{CO}_2 \)
     (iii) M is extracted by electrolysis.
(b) (i) It is used in making alloys like, brass, bronze, bell metal, etc.
     (ii) It is used as a reducing agent in the laboratory.
(c) (i) Hydrogen gas is evolved
     (ii) Sulphur dioxide gas is evolved.
(d) Sulphur dioxide can be tested by acidified potassium dichromate solution, when it turns the solution green.

24. (a) Explain briefly how would you obtain copper from a solution of copper (II) sulphate
(NOT by electrolysis).
(b) Name a metal whose hydroxide is a weak base.
(c) What is an alloy?
(d) Name a magnesium alloy used in aircraft construction.

Ans. (a) To the copper sulphate solution, add powdered magnesium and stir.
The magnesium dissolves and displaces copper from copper sulphate solution. The copper so displaced, settles down in the form of red precipitate.
\[
\text{CuSO}_4 + \text{Mg} \rightarrow \text{MgSO}_4 + \text{Cu} \downarrow
\]
(b) Calcium metal.
(c) Alloy: A homogeneous solid solution of two or more metals which are mixed in the molten state in fixed proportion is called an alloy.
(d) The alloy is magnalium.
25. (a) Write one important use and the physical property on which the use depends for the following metals:

(i) Aluminium (ii) Lead (iii) Iron. [3]

(b) In each case given below, name a metal produced commercially by the process of:

(1) Electrolysis of molten ore
(2) Reduction by coke. [2]

Ans. (a) 
(i) Aluminium is used for making alloys like duralumin, magnalium, etc., because it is a lightweight metal.
(ii) Lead is used for making lead acid battery plates as it is not acted upon by dilute sulphuric acid.
(iii) Iron is used for making steel as it is very ductile and tensile.

(b) 1. The metal produced is aluminium.
2. The metal produced is zinc.

26. How would you prove chemically:

(a) 
(i) Sulphur is a non-metal? 
(ii) Sodium is a metal? [4]

(b) From the knowledge of activity series, name a metal:

(i) which reacts readily with cold water to displace hydrogen.
(ii) which displaces hydrogen from dilute sulphuric acid or hydrochloric acid.
(iii) whose hydroxide is a strong base.
(iv) whose carbonate does not decompose on heating.
(v) which displaces iron from iron (III) oxide or ferric oxide. [5]

(c) (i) How would you change a metal like copper into copper ions and how would you confirm the presence of copper ions? [3]
(ii) How would you change copper ions into copper metal other than by electrolysis? [2]
(iii) How would you change Fe$^{+2}$ ions present in the aqueous ferrous sulphate solution into Fe$^{+3}$ ions in the ferric sulphate solution? How would you confirm that change has taken place? [3]
Ans. (a) (i) Burn sulphur in air. It will form sulphur dioxide gas. Dissolve sulphur dioxide in water. It forms sulphurous acid. As an acid is formed from sulphur therefore it is a non-metal, because oxides of non-metals are acidic in nature.

(ii) Burn sodium in air. Dissolve the residue in water and test the solution with red litmus. The red litmus turns blue. It suggests that solution is basic in nature. Thus, sodium is a metal, as metals form basic oxides.

(b) (i) Sodium metal (ii) Zinc metal (iii) Sodium metal (iv) Sodium metal (v) Aluminium metal.

(c) (i) Dissolve copper metal in dil. nitric acid so as to obtain copper nitrate solution. To this solution, add ammonium hydroxide solution, in excess. The formation of bluish white ppt. which dissolves in excess of ammonium hydroxide to form deep blue solution confirms the presence of copper ions.

(ii) To the copper nitrate solution (containing copper ions), add magnesium powder. The copper ions are reduced to copper metal.

\[ \text{Cu}^{++} + \text{Mg} \rightarrow \text{Mg}^{++} + \text{Cu} \]

(iii) To the ferrous sulphate solution, add a few ml of conc. sulphuric acid and pass chlorine gas through it. The greenish colour of ferrous sulphate, changes to reddish-brown colour of ferric sulphate, on account of the formation of ferric ions.

\[ 2\text{FeSO}_4 + \text{H}_2\text{SO}_4 + \text{Cl}_2 \rightarrow \text{Fe}_2(\text{SO}_4)_3 + 2\text{HCl} \]

In order to confirm the formation of ferric ions, add sodium hydroxide solution. Formation of reddish-brown ppt. confirms the formation of ferric ions.