

Chemical Reactivity

Long Answer Questions

Q1. Define metals. Write down physical and chemical properties of metals.

Ans. Metals

Metals are the elements which are electropositive and form cations by losing electrons. Metals can be categorized.

- a. **Very reactive:** potassium, sodium, calcium, magnesium and aluminium
- b. **Moderately reactive:** Zinc, iron, tin and lead.
- c. **Least reactive or noble metals:** copper, mercury, silver and gold.

Physical Properties of Metals

- i. Almost all metals are solids except mercury.
- ii. Metals have high melting and boiling points.
- iii. Metals possess metallic luster and can be polished.
- iv. Metals are malleable (can be hammered into sheets), ductile (can be drawn into wires) and give off a tone when hit.
- v. Metals are good conductor of heat and electricity.
- vi. Metals have high density.
- vii. Metals are hard (except sodium and potassium).

Chemical Properties of Metals

- i. Metals easily lose electrons and form positive ions.
- ii. Metals readily react with oxygen to form basic oxides.
- iii. Metals usually form ionic compounds with non metals.
- iv. Metals have metallic bonding.

Q2. Write a note on electropositive character of metals.

Ans. Electropositive character or Metallic character

Metals have the tendency to lose their valence electrons. This property of a metal is termed as electropositivity or metallic character.

Explanation

A metal lose its electrons more easily, therefore more electropositive it will be. The number of electrons lost by an atom of a metal is called its valency. For example, sodium atom can lose 1 electron to form a positive ion.



So the valency of sodium metal is 1.

Similarly zinc metal can lose two electrons from its valence shell. Therefore, its valency is 2



Trends of electro positivity

In Group

Electropositive character increases down the group because size of atoms increases. For example, lithium metal is less electropositive than sodium which is in turn less electropositive than potassium.

In Period

Electropositive character decreases across the period from left to right in periodic table because size of atoms decrease due to increase of nuclear charge. It means elements in the start of a period are more metallic. This character decreases as we move from left to right along the period.

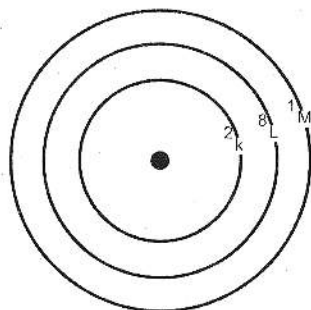
Q3. What is the relationship between electropositivity and ionization energy?

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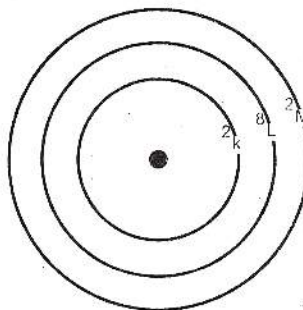
Compare the ionization energies of alkali and alkaline earth metals

Ans. Relationship between Electropositivity and ionization energy

Electropositive character depends upon the ionization energy which in turn depends on size and nuclear charge of the atom. Small sized atoms with high nuclear charge have high ionization energy. In this way atoms having high ionization energy are less electropositive or metallic. That is the reason alkali metals have the largest size and the lowest ionization energy in their respective periods. Therefore, they have the highest metallic character. For example, a comparison of sodium and magnesium metals is given below for understanding.



Sodium Atom
3s¹ electron configuration
having atomic size 186pm,
and ionization energy 496KJmol⁻¹



Magnesium Atom
3s² electron configuration
having atomic size 160pm,
and ionization energy 1450KJmol⁻¹

The 1st ionization energy of magnesium is high but the 2nd ionization energy of magnesium is very high. It becomes very difficult to remove second electron from the Mg⁺ ion as nuclear

charge attracts the remaining electrons strongly. As a result of this attraction, the size of the ion decreases. Similarly all the elements of alkaline earth metals have high ionization energies as compared to alkali metals as shown in table.

Metal	Atomic Number	Electronic Configuration	IE	Metal	Atomic Number	Electronic Configuration	IE ₁	IE ₂
Li	3	[He] 2 s ¹	520	Be	4	[He] 2 s ²	899	1787
Na	11	[Ne] 3 s ¹	496	Mg	12	[Ne] 3 s ²	738	1450
K	19	[Ar] 4 s ¹	419	Ca	20	[Ar] 4 s ²	590	1145
Rb	37	[Kr] 5 s ¹	403	Sr	38	[Kr] 5 s ²	549	1064
Cs	55	[Xe] 6 s ¹	377	Ba	56	[Xe] 6 s ²	503	965

Note: Low ionization energies of alkali metals make them more reactive than alkaline earth metals.

Q4. Write a note on reactivities of Alkali and Alkaline earth metals.

Ans. Alkali and Alkaline earth metals

The elements in first two groups of the periodic table Group-1 and Group-2 are called Alkali and Alkaline-earth metals respectively.

Explanation

Alkali metals are extremely reactive elements because of their ns¹ valence electronic configuration. As there is only one electron in the valence shell, it can be easily given out. It is the reason that they are always found in nature as cations with + 1 oxidation state. Therefore, they readily form salts with non metals.

The alkaline earth metals atoms are smaller and have more nuclear charge. They have two electrons in their valence shells. They are also reactive but less than alkali metals.

Q5. Compare the chemical properties of Alkali and Alkaline earth metals.

Ans. Chemical properties of Alkali and Alkaline earth metals

Alkali Metals		Alkaline Earth Metals	
1	Occurrence	They are very reactive and always occur in combined form	
		They are fairly reactive and also occur in combined form.	
2	Electropositivity	These are highly electropositive. They have ionization energy values ranging from 520 kJ.mol ⁻¹ for Li to 376 kJ.mol ⁻¹ for Cs.	
		They are less electropositive, They have ionization energy values ranging from 1757 kJ.mol ⁻¹ for Be to 965 kJ.mol ⁻¹ for Ba.	
3	Reaction with water	They react with water vigorously at room temperature to give strong alkaline solution and hydrogen gas.	
		They react with water less vigorously and on heating they produce weak bases.	
		$2\text{Na} + 2\text{H}_2\text{O} \longrightarrow 2\text{NaOH} + \text{H}_2$ $\text{Mg} + \text{H}_2\text{O} \longrightarrow \text{MgO} + \text{H}_2$ $\text{MgO} + \text{H}_2\text{O} \longrightarrow \text{Mg}(\text{OH})_2$	

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4	Reaction with O₂	
	They immediately tarnish in air giving their oxides which form strong alkalis in water $4\text{Na} + \text{O}_2 \longrightarrow 2\text{Na}_2\text{O}$ $\text{Na}_2\text{O} + \text{H}_2\text{O} \longrightarrow 2\text{NaOH}$	They are less reactive towards oxygen and oxides are formed on heatings. $2\text{Mg} + \text{O}_2 \longrightarrow 2\text{MgO}$
5	Reaction with Hydrogen	
	They form ionic hydrides with H ₂ at high temperature $2\text{Na} + \text{H}_2 \longrightarrow 2\text{NaH}$	They give hydrides under strong conditions of temperature and pressure $\text{Ca} + \text{H}_2 \longrightarrow \text{CaH}_2$
6	Reaction with Halogens	
	They react violently with halogens at room temperature to give halides $2\text{Na} + \text{Cl}_2 \longrightarrow 2\text{NaCl}$	They react slowly with halogens to give their halides. $\text{Ca} + \text{Cl}_2 \longrightarrow \text{CaCl}_2$
7	Reaction with nitrogen	
	They do not form nitrides directly	They form stable nitrides when heated with nitrogen. $3\text{Mg} + \text{N}_2 \longrightarrow \text{Mg}_3\text{N}_2$
8	Reaction with Carbon	
	They do not react with carbon directly	They give stable carbides on heating with carbon. $\text{Ca} + 2\text{C} \longrightarrow \text{CaC}_2$

Q6. Write a comparison of physical properties of alkali metals and alkaline earth metals.

Ans. Physical properties of alkali metals and alkaline earth metals

Property	Sodium	Magnesium	Calcium
Appearance	Silvery white having a metallic luster, very soft and can be cut with knife	Silvery white and hard	Silvery grey and fairly harder
Atomic/Ionic size (pm)	186,102	160,72	197,99
Relative density	0.98gcm ⁻³ . Floats on water	1.74 gcm ⁻³	1.55 gcm ⁻³
Malleability	Very malleable and ductile	Malleable and ductile	Malleable and ductile
Conductivity	Good conductor of heat and electricity	Good conductor of heat and electricity	Good conductor of heat and electricity

M.P	97°C	650°C	851°C
B.P	883 °C	1090 °C	1484 °C
Ionization energy	496 kJ/mol	IE ₁ 738,1450 IE ₂ J/mol	590 IE ₁ 1145 IE ₂ kJ/mol
Flame in air	Golden yellow	Brilliant white	Brick red

Q7. Explain Inertness of Noble Metals

Ans. Inertness of Noble Metals

The elements in which d-orbital are in the process of filling, constitute a group of metals called transition metals or d-group elements. They exhibit a variety of oxidation states. Figure shows that metals of 4th, 5th and the 6th period of the periodic table which are called transition metals. There are three series of transition elements, each series consisting of ten elements.

	3	4	5	6	7	8	9	10	11	12
1										
2										
3										
4	Sc 21 Scandium 47.907	Ti 22 Titanium 47.88	V 23 Vanadium 50.9415	Cr 24 Chromium 51.9961	Mn 25 Manganese 54.938044	Fe 26 Iron 55.845	Co 27 Cobalt 58.933195	Ni 28 Nickel 58.6934	Cu 29 Copper 63.546	Zn 30 Zinc 65.38
5	Y 39 Yttrium 88.90584	Zr 40 Zirconium 91.224	Nb 41 Niobium 92.90638	Mo 42 Molybdenum 95.94	Tc 43 Technetium 98	Ru 44 Ruthenium 101.07	Rh 45 Rhodium 102.9055	Pd 46 Palladium 106.3675	Ag 47 Silver 107.8682	Cd 48 Cadmium 112.411
6	Hf 72 Hafnium 178.49	Ta 73 Tantalum 180.94788	W 74 Tungsten 183.84	Re 75 Rhenium 186.207	Os 76 Osmium 190.23	Ir 77 Iridium 192.222	Pt 78 Platinum 195.084	Au 79 Gold 196.966569	Hg 80 Mercury 200.59	

Chemical behaviour of the first transition series is similar to active metals except copper. Three transition metals belonging to group 11 are copper, silver and gold. Out of them gold and silver are relatively inactive metals because they do not lose electrons easily.

Q8. Write a note on silver, gold and platinum.

Ans. Properties of Silver

- It is a white lustrous metal.
- It is an excellent conductor of heat and electricity.
- It is also highly ductile and malleable metal.
- Its polished surfaces are good reflectors of light.
- Formation of thin layer of oxide or sulphide on its surface makes it relatively inactive. Under normal conditions of atmosphere air does not affect silver. It tarnishes in presence of sulphur containing compounds like H₂S.

Uses of Silver

Being is very soft metal, it is rarely used as such. Alloys of silver with copper are widely used in making coins, silver-ware and ornaments. Compounds of silver are widely used in photographic films and dental preparations. Silver also has important applications in mirror industry.

Properties of Gold

- It is a yellow soft metal. It is most malleable and ductile of all the metals.

- ii. one gram of gold can be drawn into a wire of one and half kilometer long.
- iii. Gold is very non-reactive or inert metal. It is not affected by atmosphere. It is even not affected by any single mineral acid or base.

Uses of Gold

Because of its inertness in atmosphere, it is an ornamental metal as well as used in making coins. Gold is too soft to be used as such. It is always alloyed with copper, silver or some other metal.

Properties of Platinum

- i. It is used to make jewelry items because of its unique characteristics like colour, beauty, strength, flexibility and resistance to tarnish.
- ii. It provides a secure setting for diamonds and other gemstones, enhancing their brilliance
- iii. Platinum alloyed with palladium and rhodium is used as catalyst in auto-mobiles as catalytic convertor. They convert most of the gases being emitted by vehicles into less harmful carbon dioxide, nitrogen and water vapour.

Uses of Platinum

Platinum is used in the production of hard disk drive coatings and fiber optic cables, platinum is used in the manufacturing of fiber-glass reinforced plastic and glass for liquid crystal displays (LCD).

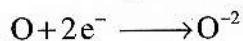
Q9. What are non-metals? Explain electronegative characteristics of non-metals

Ans. Non Metals

Non- metals form negative ions (anions) by gaining electrons. In this way, non-metals are electronegative in nature and form acidic oxides. The valency of some non-metals depends upon the number of electrons accepted by them. For example valency of chlorine atom is 1, as it accepts only one electron in its valence shell.



Similarly, oxygen atom can accept two electrons; therefore, its valency is 2.



Explanation

The non-metallic character depends upon the electron affinity and electronegativity of the atom. Small sized elements having high nuclear charge are electronegative in nature, They have high electron affinity. Therefore, they possess non-metallic nature. Hence non-metallic character decreases in a group downward and increases in a period from left to right up to halogens. That is the reason fluorine is the most non-metallic in character.

The non-metals are, therefore, elements in Group-14 (carbon), Group-15 (nitrogen and phosphorus), Group-16 (oxygen, sulphur and selenium) and in Group-17 halogens (fluorine, chlorine, bromine and iodine) of the periodic table. Figure shows position of non-metals in the periodic table.

					18
					He
	14	15	16	17	
1	6 C Carbon 12.0107	7 N Nitrogen 14.00674	8 O Oxygen 15.9994	9 F Fluorine 18.998403	10 Ne Neon 20.1797
2		15 P Phosphorus 30.97376	16 S Sulphur 32.065	17 Cl Chlorine 35.4527	18 Ar Argon 39.948
3			34 Se Selenium 78.96	35 Br Bromine 79.904	36 Kr Krypton 83.80
4				53 I Iodine 126.90447	54 Xe Xenon 131.29
5					
6					

Q10. Explain the physical properties of non-metals.

Ans. The physical properties of non-metal change gradually but uniquely in a group of non-metals. Non-metals usually exist in all three physical states of matter. At the top of the group, they exist in the form of gases, while others are either liquids or solids.

- Solid non-metals are brittle (break easily).
- Non-metals are non conductor of heat and electricity (except graphite).
- They have dull surfaces (except iodine which is lustrous like metals).
- They are generally soft (except diamond, graphite and silicon).
- They have low melting and boiling points (except diamond).
- They have low densities.

Q11. Write down the important chemical properties of non-metals.

Ans. The important chemical properties of non-metals are following:

- Their outer most shell is deficient of few electrons, therefore, they readily accept electrons to complete their valence shells and become stable.
- They form ionic compounds with metals and covalent compounds by reacting with other non-metals e.g. CO_2 , NO_2 etc.
- Non-metals usually do not react with water.
- They do not react with dilute acids because non-metals are itself electron acceptors.

The decreasing order of electro negativity is as under



Q12. What is meant by halogens? Compare the reactivity of halogens in detail.

Ans. Halogens

Halogen means salt formers. Elements of Group-17 of the periodic table consist of fluorine, chlorine, bromine, iodine and astatine. They are collectively called halogens.

Explanation

Fluorine and chlorine exist as diatomic gases at room temperature. Interestingly, the intermolecular forces of attraction increases downward in the group due to the increase in the size of atom. Due to this reason bromine exists as a liquid and iodine as solid. Some physical properties of halogens are shown in table.

Elements	Atomic Numbers	Electronic Configuration	Colour	Electronegativity values	Melting Point (K)	Boiling Point (K)
F	9	[He] 2s ² 2p ⁵	Pale yellow	4.0	53	85
Cl	17	[Ne]3s ² 3p ⁵	Greenish Yellow	3.2	172	238
Br	35	[Ar]4s ² 4p ⁵	Radish Brown	3.0	266	332
I	53	[Kr]5s ² 5p ⁵	Purple Black	2.7	387	457

In general they have valence shell electronic configuration of ns² np⁵. Since halogens have only one electron deficit in their valence shell; either they can readily accept an electron from a metal or they can share an electron with other non-metals. Thus halogens form ionic bonds with metals and covalent bond with non-metals.

Q13. Explain the significance of non-metals.

Ans. Although non-metals are fewer than metals, yet they are highly significant. They are equally important for human beings, animals and plants, In fact, life would not have been possible without the presence of non-metals on earth.

i. Composition

Major components of earth's crust, oceans and atmosphere are non-metals: oxygen has the highest percentage in earth's crust (47%) and oceans (86%) and it is the second (21%) to nitrogen in atmosphere. It indicates the importance of oxygen in nature. To maintain the balance for the amount of non-metals in nature, different cycles like water cycle, nitrogen cycle etc have been established naturally.

ii. Important role in the composition of living organisms

Non-metals are essential part of the body structure of all living things. Human body is made up of about 28 elements. But about 96% of the mass of the human body is made up of just four elements i.e. oxygen 65% carbon 18% hydrogen 10% and nitrogen 3%. Similarly, plant bodies are made up of cellulose, which is composed of carbon, hydrogen and oxygen.

iii. Essential for life

Life owes to non-metals as without O₂ and CO₂ (essential gases for respiration of animals and plants respectively), life would not have been possible. In fact, these gases are essential for the existence of life.

iv. Maintenance of life

All eatables like carbohydrates, proteins, fats, vitamins, water, milk etc which are necessary for the growth and development of body are made up on non-metals, carbon hydrogen or oxygen. It shows that non-metals play a vital role for the maintenance of life.

V. Essential for the survival of life

The essential compound for the survival of life of both animals and plants is water, which is made up of non-metals, water is not only major part by mass of animals and plants bodies, but it is also essential to maintain the life. We can survive without water for days but not for a long period: its shortage may cause death.

vi. Importance of nitrogen

Another important non-metal is nitrogen, which is 78% in atmosphere. It is necessary for the safety of life on earth. It controls the fire and combustion processes, otherwise all the things around us could burn with a single flame.

vii. Important role for the communication in life

Non-metals are playing essential role for the communication in life. All fossil fuels which are the major sources of energy, coal, petroleum and gas are made up of carbon and hydrogen. Even the essential component of combustion of fossil fuels, oxygen is also a non-metal.

viii. Mode of protection in our daily life

Non-metals protect us in a way, the clothes we wear are made of cellulose (natural fiber) or polymer (synthetic fiber).

ix. Role in industrial goods

In addition to all of these, other items used in daily life such as wooden or plastic Furniture, plastic sheets and bags, plastic pipes and utensils are made of non-metallic elements.

x. Role in the manufacturing of medicinal items

All the pesticides, insecticides, fungicides and germicides consist of non-metals as major Constituents.

Q14. Discuss the inert character of silver and gold?

Ans. Inert Character of silver

Silver is white lustrous metal. Formation of thin layer of oxides or supplied on its surface makes it relatively unreactive. Under normal conditions of atmosphere, air does not affect silver. It tarnishes in presence of sulphur containing compounds like H_2S

Inert Character of Gold;

Gold is yellow soft metal. Gold is very non reactive or inert metal because it is not affected by atmosphere. It is even not affected by any single mineral acid or base.

Q15. What are the physical properties of calcium metal? Give its uses.

Ans. Physical properties of calcium

There are following physical properties of calcium.

- i. Calcium is silvery grey and fairly harder.
- ii. Its density is 1.55gcm^{-3} .
- iii. It is malleable and ductile.
- iv. It is good conductor of heat and electricity.
- v. Its melting point is 851°C and boiling point is 1484°C .
- vi. Its flame colour is brick red.

Uses of Calcium

- i. It is used to remove sulphur from petroleum products.
- ii. It is used as reducing agent to produce Cr, U and Zr.

Q16. Why cations are smaller and anions are bigger in size than their respective neutral atoms?

Ans. Cation is smaller than its neutral atom

We know that a cation is formed by the removal of one or more electrons from the atoms. Thus a cation has smaller number of electrons than its parent atom. With the decrease of number of electrons, the magnitude of effective nuclear charge increases, which pulls the electron cloud of the cation near to the nucleus and thus makes the cation smaller in size than its parent's neutral atom.

Anion is bigger in size than its neutral atom

Anion is formed by addition of electron, the coming electron reduce the attraction of nucleus to electrons that is why, its size increases as compare to neutral atom.

Q18. Discuss why hardness and softness of a metal depends upon its metallic bonding

Ans. Softness and hardness of metals can be explained with the help of metallic bond. Metals are soft if they have weak metallic bond and they have the spaces between the metal atoms that is why they are soft metals. While some metals have strong metallic bond and free electrons spread the charge in the space, due to strong charge density.

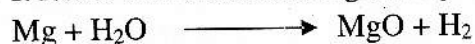
Q19. Give the chemical properties of magnesium and its uses.

Ans. Chemical properties of magnesium

Chemical properties of magnesium are following:

i. Reaction with water

It reacts with water less vigorously and on heating produces weak base.



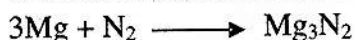
ii. Reaction with oxygen

It reacts with oxygen and oxides magnesium is formed on heating



iii. Reaction with Nitrogen

It forms stable nitrides when heated with nitrogen



Uses of Magnesium

There are following uses of magnesium

- i. Magnesium is used in flash lights and in fire works
- ii. It is used in the manufacture of light alloys.
- iii. Magnesium ribbon is used in Thermite process to ignite aluminum powder
- iv. Magnesium is used as anode for prevention of corrosion

Q20. Give the reaction of sodium with H_2O , O_2 , Cl_2 and H_2

Ans. Reactions of Sodium

There are following reactions of sodium

Reaction of Sodium with water

Sodium reacts with water vigorously at room temperature to give strong alkaline solution and hydrogen gas.



Reaction of Sodium with Oxygen

Sodium immediately tarnishes in air giving sodium oxide which form strong alkali in water.



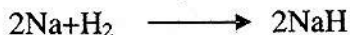
Reaction of Sodium with Chlorine

Sodium reacts violently with halogens at room temperature to give halides.



Reaction of Sodium with Hydrogen

Sodium form ionic hydride with H_2 at high temperature



Q21. Explain the important reactions of halogens.

Ans. Important Reactions of Halogens

i. Oxidizing properties

All halogens are oxidizing agents. Fluorine is the strongest oxidizing element while iodine is the least i.e. is mild oxidizing agent. Fluorine will oxidize any of halide ion (\bar{X}) in solution and changes itself to F^{-1} ion. Similarly chlorine will displace Br^{-} and I^{-} ion from their salt solutions and oxidize them to bromine and iodine.

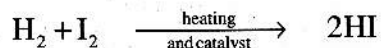
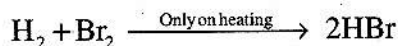
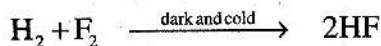


Solution turns from colourless to reddish brown.



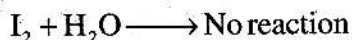
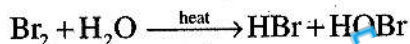
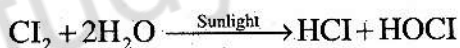
ii. Reaction with hydrogen

All halogens (X_2) combine with hydrogen to give hydrogen halides (HX). However the chemical affinity for H_2 decreases down the group from F_2 to I_2 . Fluorine combines with hydrogen even in the dark and cold states. Chlorine reacts with hydrogen in the presence of sunlight. Bromine and iodine react with hydrogen only on heating.



iii. Reaction with water

Fluorine (F_2) decomposes water in cold state and in dark. Chlorine decomposes water in presence of sunlight. Bromine only react with water under special conditions. Iodine does not give this reaction.



iv. Reaction with methane

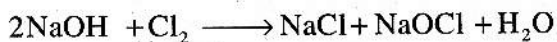
Fluorine (F_2) reacts violently with methane (CH_4) in dark. Chlorine (Cl_2) does not react with methane in dark. However in the presence of bright sunlight the reaction is violent.



In presence of diffused sunlight the reaction of chlorine with methane is slow and gives series of compounds i.e CH_3Cl , CH_2Cl_2 , CHCl_3 and CCl_4 .

v. Reaction with Sodium hydroxide

Chlorine reacts with cold dilute NaOH to give sodium hypochlorite.



Cl_2 reacts with hot conc. NaOH to give sodium chlorate.



Short Answer Questions

Q1. Define metal. How metals, can be categorized?

Ans. Metals are the elements which are electropositive and form cations by losing electrons. Metals can be categorized in followings.

1. Very reactive metals
2. Moderately metals
3. Least reactive metals

Q2. Write down any two physical properties of metals.

Ans. Physical properties of metals are:

- (i) Almost all metals are solids.
- (ii) All metals have high melting and boiling points.

Q3. Write down any two chemical properties of metals.

Ans. Chemical properties of metals are:

- i. Metals can easily lose electrons and form positive ions.
- ii. Metals readily react with oxygen to form basic oxides.

Q4. Define electropositive character.

Ans. Metals have the tendency to lose their valence electrons. This property of a metal is called electropositive character or metallic character e.g.



Q5. Write down the trends of electropositive character in periodic table.

Ans. Electropositive character increases down the group and decreases from left to right in a period.

Q6. Why the 2nd ionization energy of magnesium is very high than the first one?

Ans. The 2nd ionization energy of magnesium is very high because, it is difficult to remove second electron from the Mg⁺ ion as nuclear charge attracts the remaining electrons strongly. As a result of nuclear attraction size of the ion decreases. So, it is difficult to remove 2nd electron from magnesium ion.

Q7. What type of elements are metals?

Ans. The elements which are electropositive and form cation by losing electrons. This type of elements are metals.

Q8. Name the metal which exists in liquid form.

Ans. Mercury exists in liquid state at room temperature.

Q9. What is the nature of metallic oxides?

Ans. The metallic oxides are basic in nature because they change red litmus paper to blue.

Q10. Which group of metals is highly reactive?

Ans. Group-1 of the periodic table is highly reactive in nature.

Q11. Sodium metal is more reactive than magnesium. Why?

Ans. Because sodium is oxidized easily and has low ionization energy where as magnesium is not easily oxidized and has high ionization energy that is why sodium is more reactive.

Q12. Name the metal which can be cut with knife?

Ans. Sodium metal can be cut with knife.

Q13. Name the best ductile and malleable metal

Ans. Cesium is the best ductile and malleable metal.

Q14. Name the metal which is the poorest Conductor of heat?

Ans. Lead metal is the poorest conductor of heat.

Q15. What do you mean by malleable and ductile?

Ans. Malleable means can be hammered into sheets and ductile means can be drawn into wires.

Q16. What do you mean by metallic character?

Ans. Metals have the tendency to lose their valence electrons. This property of metal is termed as metallic character.

Q17. Why metallic character increases in group and decreases in a period?

Ans. Metallic character increases in group and decreases in a period because top to bottom in a group atomic size increases and left to right in a period atomic size decreases.

Q18. Define transition elements.

Ans. The elements in which d-orbital's are in the process of filling, constitute a group of metals called transition metals.

Q19. Give the application of silver

Ans. Silver has important applications in mirror industry.

Q20. Why silver is not used in pure form?

Ans. Because, the formation of oxide or sulphide layer on the surface of silver, makes it relatively inactive in nature, therefore, silver is not used in pure form.

Q21. What do you mean by 24 carat of Gold?

Ans. Purity of gold is shown by carats. That indicates the number of parts by weight a gold that is present is 24 parts of alloy. 24 carat gold is pure in nature.

Q22. Why gold is used to make jewelry?

Ans. Because of its inertness in atmosphere, it is an ornamental metal so it is used to make jewelry.

Q23. Why platinum is used for making jewelry?

Ans. Platinum is used to make jewelry items because of its unique strength, flexibility and resistance to tarnish.

Q24. Write down the difference between steel and stainless steel.

Ans. Difference between steel and stainless steel

Steel	Stainless steel
Pure steels is the alloy of iron with other metals like nickel, tungston etc.	Stainless steel is the alloy of iron with chromium

Q25 How platinum is used as a catalyst in automobile and what we advantage of this use?

Ans. Platinum alloyed with palladium and rhodium is used as catalyst in automobiles as catalytic converter. They convert most of the gases being emitted by vehicles into less harmful carbon dioxide, nitrogen and water vapours.

Q26. What are non-metals?

Ans. Non-metals form negative ions (anions) by gaining electrons. In this way non metals are electronegative in nature and form acidic oxides.

Q27. On what factor non-metallic character depends?

Ans. The non-metallic character depends upon the electron affinity and electronegativity of the atom.

Q28. Write down the non-metallic character in periodic table

Ans. Non-metallic character decreases from top to bottom in any group and increases left to right in a period.

Q29. Write down two physical properties of non metals.

Ans. Physical properties of non metals are:

- i. Non metals are non conductor of heat and electricity.
- ii. Non metals have low melting and boiling points.

Q30 Write down two chemical properties of non metals.

Ans. Chemical properties of non metals are:

- i. Non metals form ionic compounds with metals and covalent compounds by reacting with one another e.g. CO_2 , NO_2 etc.
- ii. Non metals usually do not react with water.

Q31. What are halogens?

Ans. Halogen means salt former. Elements of group-17 of the periodic table consist of fluorine, chlorine, bromine iodine and astatine. They are collectively called halogens.

Q32. Write down the physical properties of halogens.

Ans. Both fluorine and chlorine exist in gases form, bromine exists in liquid form and iodine exists in solid form.

Q33 Why valency of chlorine is 1?

Ans. Valency of chlorine atom is 1 because it accepts only 1 electron in its outermost shell.

Q34. Which factor controls the non metallic character of the elements?

Ans. The non metallic character depends upon the electron affinity and electronegativity of the atom.

Q35. Why fluorine is more non-metallic than chlorine?

Ans. Because non-metallic character decreases in a group downward and increases in a period from left to right. Fluorine is the first member of group 17 and non metallic character decreases down the group that is why fluorine is more non metallic than chlorine.

Q36. Iodine exists in solid state; can it be beaten with hammer to form sheets?

Ans. No, only solid substances or metals that have the ability to change in sheets by beaten with hammer.

Q37. Can liquids and gases be brittle?

Ans. No, because it is not the property of liquids and gases.

Q38. Why the oxygen is called non-metal?

Ans. Oxygen is non metal because all non metals form negative ions by gaining electrons.

Q39. Name two non metals which are both brittle and non ductile.

Ans. Silicon and graphite are two non metals which are brittle and non ductile.

Q40. Name the most abundant non metal in the earth's crust.

Ans. Oxygen has the highest percentage in earth s crust i.e. 47% and in ocean 86%

Q41. Give the non metallic trend of halogens.

Ans. Non metallic character decreases from top to bottom in halogens because of increasing atomic size of atoms.

Q42. Why do the non metals accept electrons readily?

Ans. The non metals accept electrons readily because non metals are electronegative in nature and electron deficient in nature so they form an anion by gaining electrons.

Q43. Why non metals do not react with dilute acids while metals do react with acid?

Ans. The non metals do not react with dilute acids because non metals are itself electron acceptor and metals loss electrons readily.

Q44. How can we distinguish a metal from a non metal by simple physical method?

Ans. Difference between metals and non metals are

	Metal		Non metal
i.	Metals are good conductor of heat and electricity	i.	Non Metals are bad conductor of heat and electricity
ii.	Metals possess high melting and boiling points.	ii.	Non Metals possess low melting and boiling points.
iii.	Metals bear positive charge	iii.	Non metals bear Negative charge

Q45. How we can distinguish a substance is metal or non metals with the help of an acid?

Ans. Yes, we can distinguish a substance is metal or non metal with the help of an acid

Metal	Non metals
Metals react with dilute acids because metals are itself electron donors.	Non metals do not react with dilute acids because non metals are itself electron acceptors.

Q46. Why is HF weak acid?

Ans. Because HF does not release its proton easily due to presence of hydrogen bonding

Q47. Write down the names of very reactive metals.

Ans. Potassium, sodium, calcium, magnesium and aluminum are the very reactive metals.

Q48. Write down the names of moderately reactive metals.

Ans. Zinc, iron, tin and lead are the moderately reactive metals.

Q49. Write down the names of least Reactive or Noble metals.

Ans. Copper, mercury, silver and gold are the least reactive metals.

Q50. Why reactivity of metals increase down the group?

Ans. The reactivity of metals increases down the group because of increasing atomic size.

Q51. State the physical properties of metals

Ans. i. Metals have high melting and boiling point

ii. Metals are good conductor of heat and electricity

Q52. Why nitrogen forms compounds with alkaline earth metals directly?

Ans. Because alkaline earth metals form stable nitride when heated with nitrogen directly.

Q53. Why the second ionization energy of magnesium is higher than the first one?

Ans. It become very difficult to remove second electron from the magnesium ion Mg^{+1} because nuclear charge attract the remaining electrons strongly as the result of this attraction size of the ion decreases.

Q54. How oxygen reacts with group II metals?

Ans. Alkaline earth metals are less reactive towards oxygen. They form oxides when heated with oxygen.



Q55. What is the relationship between electro positivity and ionization energy?

Ans. Electro positivity depends upon the ionization energy which in turn depends upon size and nuclear charge of the atoms. So smaller sized atoms with high nuclear charge have high ionization energy. Atoms having high ionization energy are less electro positive or metallic.

Q56. Why electro positivity decreases from left to right in a period?

Ans. Because electropositive character depends upon the size of the atom. Electropositive character decreases across the period due to decrease in atomic size.

Q57. How electro positivity depends upon the size and nuclear charge of an atom?

Ans. Electropositive character depends upon the size of the atom, greater the size of the atom, greater will be the electropositive character and less nuclear charge. Smaller the size of the atom, smaller will be the electropositive character and greater nuclear charge

Q58. Why ionization energies of alkaline earth metals are higher than alkali metals?

Ans. Ionization energy of alkaline earth metals is high than alkali metals because the atomic size of alkaline earth metals are smaller and greater nuclear charge.

Q59 Why silver and gold are less reactive?

Ans. Silver and gold are less reactive because gold and silver are relatively inactive metals and they do not loss electron easily that's why gold and silver are less reactive.

Q60. Can pure gold be used for making ornaments? If not why?

Ans. No, pure gold cannot be used for making ornaments because gold is too soft and it always used in alloy form with copper, silver or some other metals.

Q61. Why copper is used for making electrical wire?

Ans. Because it is good conductor of heat and electricity.

Q62. What is the trend of variation of in densities of alkali metals?

Ans. Densities of alkali metals increase down the group in the periodic table due to increase in atomic mass.

Q63. Which metal is used for metal work?

Ans. Metal work means fire work. The metals are used for the metal works or fire work due to its characteristics flame colour when they ignite in air for example sodium gives golden yellow colour and calcium gives red colour flame.

Q64. Why magnesium is harder than sodium?

Ans. Magnesium is harder than sodium because magnesium has high ionization energy and stronger metallic bond than sodium.

Q65. Why calcium is more electropositive than magnesium?

Ans. Calcium and magnesium are belonged to the same group and electro positivity of metals increases when we move from top to bottom in a group, that is why calcium is more electropositive than magnesium.

Q66. Why ionization energy of sodium is less than magnesium?

Ans. Because sodium has greater size than magnesium that is why the ionization of sodium is less than magnesium.

Q67. Why the ionization energy of sodium is more than potassium?

Ans. Because electro positive character depends upon the ionization energy which in turn depends on size and nuclear charge of the atom. So the electro positive character increases down the group and ionization value decreases, it become easier to lose their electrons. That's why ionization energy of sodium is more than potassium.

Q68. Write down the uses of Sodium

Ans. Uses of Sodium

- i. Sodium-potassium alloy is used as a coolant in nuclear reactor.

- ii. It is used to produce yellow light in sodium vapour lamp.
- iii. It is used as a reducing agent in the extraction of metals like Ti.

Q69. Write down the uses of Calcium.

Ans. Uses of Calcium

- i. It is used to remove sulphur from petroleum products.
- ii. It is used as reducing agent to produce Cr,U,Zr.

Q70. Write down the uses of Magnesium.

Ans. Uses of Magnesium

- 1. Magnesium is used in flash lights and in fire works.
- 2. It is used in the manufacture of light alloys.
- 3. Magnesium ribbon is used in Thermite process to ignite aluminum powder.
- 4. Magnesium is used as anode for prevention of corrosion.

Multiple Choice Questions

Multiple Choice Questions

Put a (✓) on the correct answer

1. Metals can form ions carrying charges:

- (a) Uni positive (b) Di positive
- (c) Tri positive (d) All of them

2. Which one of the following metals burn with a brick red flame when heated in air?

- (a) Sodium (b) Magnesium
- (c) Iron (d) Calcium

3. Sodium is extremely reactive metal, but it does not react with:

- (a) Hydrogen (b) Nitrogen
- (c) Sulphur (d) Phosphorus

4. Which one the following is the lightest and floats on water ?

- (a) Calcium (b) Magnesium
- (c) Lithium (d) Sodium

5. Pure alkali metals can be cut simply by knife but iron cannot because of alkali metals have:

- (a) Strong metallic bonding
- (b) Weak metallic bonding
- (c) Non-metallic bonding
- (d) Moderate metallic bonding

6. Which of the following is less malleable?

- (a) Sodium (b) Iron
- (c) Gold (d) Silver

7. Metals lose their electrons easily because:

- (a) They are electronegative
- (b) They have electron affinity
- (c) They are electropositive
- (d) Good conductors of heat

8. Which one of the following is brittle?

- (a) Sodium (b) Aluminum

(c) Selenium (d) Magnesium

9. Which one of the following non-metal is lustrous?

(a) Sulphur (b) Phosphorus
(c) Iodine (d) Carbon

10. Non-metals are generally soft, but which one of the following is extremely hard?

(a) Graphite (b) Phosphorus
(c) Iodine (d) Diamond

11. Which one of the following will not react with dilute HCl?

(a) Sodium (b) Potassium
(c) Calcium (d) Carbon

12. Metals are the elements which

(a) Electropositive character
(b) Electronegative character
(c) Both a & b (d) None of these

13. Which one is very reactive metal?

(a) Potassium (b) Sodium
(c) Calcium (d) All of these

14. Which one is a moderately reactive metal?

(a) Copper (b) Mercury
(c) Silver (d) All of these

15. Which metal exists in liquid form at room temperature?

(a) Sodium (b) Potassium
(c) Mercury (d) None of these

16. Metals are conductor of heat and electricity.

(a) Good (b) Bad
(c) Moderately conductor
(d) All these

17. All metals bear:

(a) Positive charge
(b) Negative charge

(c) Both a & b

(d) None of these

18. Metals possess

(a) Ionic bond
(b) Covalent bond
(c) Co-ordinate bond
(d) Metallic bond

19. Sodium metal has electrons

(a) 10 (b) 12
(c) 11 (d) 14

20. Which group of elements has low ionization energies?

(a) Alkali Metals
(b) Alkaline earth metals
(c) Halogens
(d) Noble Gases

21. Density of sodium metal is:

(a) 0.98 gcm^{-3} (b) 1.74 gcm^{-3}
(c) 1.55 gcm^{-3} (d) 1.60 gcm^{-3}

22. Density of magnesium is:

(a) 0.98 gcm^{-3} (b) 1.74 gcm^{-3}
(c) 1.55 gcm^{-3} (d) 1.60 gcm^{-3}

23. Density of calcium is:

(a) 0.98 gcm^{-3} (b) 1.74 gcm^{-3}
(c) 1.55 gcm^{-3} (d) 1.60 gcm^{-3}

24. Melting point of sodium is:

(a) 97°C (b) 650°C
(c) 851°C (d) 801°C

25. Melting point of calcium is:

(a) 97°C (b) 650°C
(c) 851°C (d) 801°C

26. Boiling point of sodium is:

(a) 883°C (b) 1105°C
(c) 1494°C (d) 1500°C

27. Boiling point of magnesium is:

(a) 880°C (b) 1105°C
(c) 1090°C (d) 1500°C

28. Boiling point of calcium is:

- (a) 880 °C (b) 1484 °C
(c) 1494 °C (d) 1500 °C

29. Flame colour of sodium is:

- (a) Golden yellow
(b) Brilliant white
(c) Brick red
(d) Purple

30. The flame colour of magnesium is:

- (a) Golden yellow
(b) Brilliant white
(c) Brick Red
(d) Purple

31. The flame Color of calcium is:

- (a) Golden yellow
(b) Brilliant white
(c) Brick Red
(d) Purple

32. The elements in which d-orbital is in the process of filling constitute a group of metals called:

- (a) Alkali Metal
(b) Alkaline Earth Metal
(c) Transition Metals
(d) Noble gases

33. Which metal belongs to group-11?

- (a) Copper (b) Silver
(c) Gold (d) All

34. Which compounds are widely used in photography films and dental preparations?

- (a) Silver (b) Gold
(c) Platinum (d) copper

35. which of the following is a yellow metal?

- (a) Gold (b) Silver
(c) Platinum (d) Copper

36. 22 carat gold means that 22 part pure gold is alloyed with 2 parts of

- (a) Silver (b) Copper
(c) Platinum (d) both a & b

37. Platinum alloyed with which metal are used as catalyst in automobiles as catalytic convertor?

- (a) Palladium (b) Rhodium
(c) Gold (d) both a & b

38. Non metals form:

- (a) Positive ion (b) Negative ion
(c) Neutral (d) None

39. Non metallic oxides are:

- (a) Basic in nature
(b) Acidic in nature
(c) Amphoteric (b) All

40. Metals oxides are:

- (a) Basic in nature
(b) Acidic in nature
(c) Neutral (d) None

41. Non-Metals are conductor of heat and electricity:

- (a) Good (b) bad
(c) Moderately (d) None

42. The melting and boiling points of non metals are:

- (a) High (b) low
(c) Moderately (d) None

43. Which element has high electronegativity value?

- (a) Fluorine (b) Oxygen
(c) Chlorine (d) Nitrogen

44. Group 17 elements are called:

- (a) Alkali Metals
(b) Alkaline Earth Metals
(c) Halogens
(d) Noble gases