Metals and Non-metals

Case Study Based Questions

Case Study 1

Metals are lustrous, malleable, ductile and are good conductors of heat and electricity. They are solids at room temperature, except mercury which is a liquid. Metals combine with oxygen to form basic oxides. Different metals have different reactivities with water and dilute acids. Non-metals have properties opposite to that of metals.

Read the above passage carefully and give the answer of the following questions:

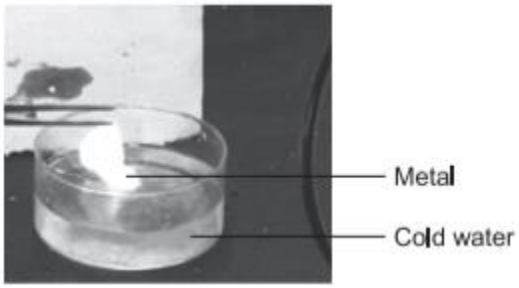
Q1. The ability of metals to be drawn into thin wire is known as:

a. conductivity
b. malleability
c. sonority
d. ductility

Q2. Which of the following metals do not react with oxygen even at high temperatures?

(i) Ag
(ii) Al
(iii) Au
(iv) Fe
a. (i) and (iv)
b. (ii) and (iv)
c. (i) and (iii)
d. (i) and (ii)

Q3. Study the image below that shows the reaction of a metal with cold water.



Which of the following metal explains this event?

a. K

b. Ca

c. Mg

d. Fe

Q4. Which among the following statements is incorrect for magnesium metal?

a. It burns in oxygen with a dazzling white flame

b. It reacts with cold water to form magnesium oxide and evolves hydrogen gas

c. Both a. and b.

d. It reacts with hot water to form magnesium hydroxide and evolves hydrogen gas

Q5. Generally metals react with acids to give salt and hydrogen gas. Which of the following acids does not give hydrogen gas on reacting with metals (except Mn and Mg)?

a. H_2504

b. HCL

c. HNO3

d. All of these

Answers

1. (d) ductility
2. (c) (i) and (iii)
3. (a) K
4. (b) It reacts with cold water to form magnesium oxide and evolves hydrogen gas
5. (c) HNO3

Case Study 2

A student, took four metals P, Q, R and S and carried out different experiments to study the properties of metals. Some of the observations were.

(i) All metals could not be cut with knife except metal R.

(ii) Metal P combined with oxygen to form an oxide M2O3 which reached with both acids. and bases.

(iii) Reaction with water.

P - Did not react either with cold or hot water but reacted with steam

Q - Reacted with hot water and the metal started floating
R - Reacted violently with cold water
S - Did not react with water at all

Read the above passage carefully and give the answer of the following questions: (CBSE 2021 Term-1)

Q1. Out of the given metals, the one which needs to be stored under kerosene is:
a. P
b. R
c. S
d. Q

Q 2. Out of the given metals, the metal Q is:
a. Iron
b. Zinc
c. Potassium
d. Magnesium

Q3. Metal which forms amphoteric oxides is:
a. P
b. Q
c. R
d. 5

Q4. The increasing order of the reactivity of the four metals is:
a. P<Q<R<5
b. 5<R<Q<P
C. S<P<Q<R
d. P<R<Q<5

Answers

1. (b) R
2. (d) magnesium
3. (a) P
4. (c) S<P<Q<R

Case Study 3

Study the given table and answer the following questions: A student took the samples of four metals A, B, C and D and added following solution one by one. The results obtained have been tabulated as follows:

Metal	Iron (II) sulphate	Copper (II) sulphate	Zinc sulphate	Silver nitrate
A	No reaction	Displacement	—	—
B	Displacement	—	No reaction	—
C	No reaction	No reaction	No reaction	Displacement
D	No reaction	No reaction	No reaction	No reaction

Read the above passage carefully and give the answer of the following questions:

Q1. Which is the least reactive metal and why?

Q2. Which is the most reactive metal and why?

Q3. Arrange the metals A, B, C and D in order of increasing reactivity.

Q4. Write the chemical formulae of product formed when C reacts with AgCl solution.

Q5. What would be observed, if'B' is added to a solution of copper (II) sulphate and why?

Answers

1. D is the least reactive metal as it has not displaced any metal amongst the solutions.

2. B is the most reactive metal as it has displaced the most reactive metal amongst the solutions, i.e., Fe of Fe504

3. D<C<A<B

4. When C reacts with AgCl, Ag and CCl_2 are formed.

5. The blue colour of CuSO4 solution fades away. If B is added to CuSO, solution, it will displace Cu because B has displaced Fe, so it can also displace Cu.

Case Study 4

The melting points and boiling points of some ionic compounds are given below:

Compound	Melting Point (K)	Boiling Point (K)
NaCl	1074	1686
LiCl	887	1600
$CaCl_2$	1045	1900
CaO	2850	3120
$MgCl_2$	981	1685

These compounds are termed ionic because they are formed by the transfer of electrons from a metal to a non-metal. The electron transfer in such compounds is controlled by the electronic configuration of the elements involved. Every element tends to attain a completely filled valence shell of its nearest noble gas or a stable octet.

Read the above passage carefully and give the answer of the following questions:

Q1. Show the electron transfer in the formation of magnesium chloride.

Q2. List two properties of ionic compounds other than their high melting and boiling points.

Q3. While forming an ionic compound say sodium chloride how does sodium atom attain its stable configuration?
Give reasons:

Or

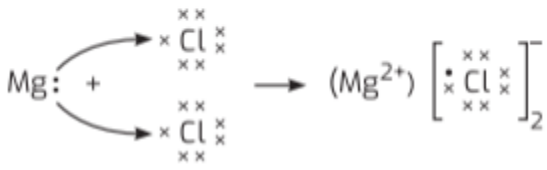
(i) Why do ionic compounds in the solid state not conduct electricity?
(ii) What happens at the cathode when electricity is passed through an aqueous solution of sodium chloride? (CBSE 2023)

Answers

1.

$$\underset{2,8,2}{Mg} \longrightarrow \underset{2,8}{Mg^{2+}} + 2e^-$$

$$\underset{2,8,7}{Cl} + e^- \longrightarrow \underset{2,8,8}{Cl^-}$$



2. (a) Ionic compounds are solids, hard and brittle.
(b) They are soluble in water and insoluble in solvents such as petrol, kerosene etc.

3. (A) The atomic number of sodium is 11, so its electronic configuration is 2, 8, 1. Sodium atom has only 1 electron in its outermost shell. A stable arrangement has usually 8 electrons in its outermost shell. Hence, in order to attain stable configuration, sodium atom donates 1 e to chlorine.

$$\underset{2,8,1}{Na} \longrightarrow \underset{2,8}{Na^+} + e^-$$

Or

(B) (i) Ionic compounds in the solid state do not conduct electricity because movement of ions in the solid is not possible due to their rigid structure.
(ii) When electricity is passed through an aqueous solution of sodium chloride, sodium ions move towards cathode and get deposited there.
At cathode: Na+ + e → Na.

Case Study 5

Different methods are used for extracting metals of different reactivity.

Metal	Method of extraction
K, Na, Ca, Mg, Al	Electrolysis of molten chloride or oxide
Zn, Fe, Pb, Cu	Reduction of oxide with carbon
Cu, Hg	Heating sulphide in air (Reduction by heat alone)
Ag, Au, Pt	Found in native state (as metals)

Based on the above table, answer the following questions:

Q1. Why is carbon not used for reducing aluminium from aluminium oxide?

Q2. Why sulphide and carbonate ores are converted into oxides?

Q3. Name the ore of mercury. How mercury is extracted from its ore?

Q4. What is thermite reaction?

Q5. Write a balanced chemical equation for representing the chemical reaction between manganese dioxide and aluminium powder.

Answers

1. Because aluminium has more affinity for oxygen than carbon.

2. Because it is easier to obtain a metal from its oxide, as compared to its sulphides and carbonates.

3. Cinnabar (HgS) is an ore of mercury.

Extraction: $2HgS + 3O_2 \xrightarrow{Heat} 2HgO + 2SO_2$

$2HgO \xrightarrow{Heat} 2Hg + O_2$

4. Reduction of iron oxide to iron by aluminium is called thermite reaction.

$Fe_2O_3 + 2Al \longrightarrow 2Fe + Al_2O_3 + Heat$

5. $3MnO_2 + 4Al \longrightarrow 3Mn + 2Al_2O_3 + Heat$

Case Study 6

Two students decided to investigate the effect of water and air on iron object under identical experimental conditions. They measured the mass of each object before placing it partially immersed in 10 mL of water. After a few days, the object were removed, dried and their masses were measured. The table shows their results.

Student	Object	Mass of Object before Rusting (in g)	Mass of the coated object (in g)
A	Nail	3.0	3.15
B	Thin plate	6.0	6.33

Read the above passage carefully and give the answers of the following questions:

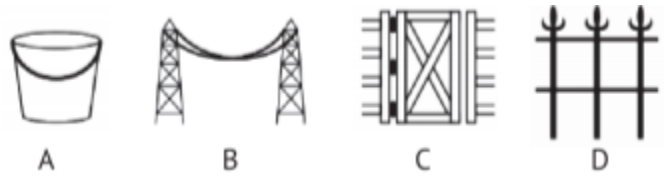
Q1. What might be the reason for the varied observations of the two students?

Q2. In another set up, the students coated iron nails with zinc metal and noted that, iron nails coated with zinc prevents rusting. They also observed that zinc initially acts as a

physical barrier, but an extra advantage of using zinc is that it continues to prevent rusting even if the layer of zinc is damaged. Name this process of rust prevention and give any two other methods to prevent rusting.

Or

In which of the following applications of Iron, rusting will occur most? Support your answer with valid reason.



A- Iron Bucket electroplated with Zinc
B- Electricity cables having iron wires covered with aluminium
C- Iron hinges on a gate
D-Painted iron fence (CBSE SQP 2022-23)

Answers

1. Rusting occurs in both A and B so there is an increase in mass. As the surface area of B is more, so extent of rusting is also more.
2. Galvanisation is the process of applying zinc coating to iron to prevent rusting. Two other methods to prevent rusting are:
(i) Greasing, (ii) Painting, (iii) Alloying, (iv) Chromium plating. (Any two)

Or

C-iron hinges on a gate because Iron is in contact with both atmospheric oxygen and moisture.

Solutions for Questions 7 to 16 are Given Below

Case Study 7

Read the following and answer any four questions from 1(i) to 1(v).

The chemical reactivity of an element depends upon its electronic configuration. All elements having less than eight electrons in the outermost shell show chemical reactivity. During chemical reactions, atoms of all elements tend to achieve a completely filled valence shell. Metals are electropositive in nature. They have tendency to lose one or more electrons present in the valence shell of their atoms to form cations and achieve nearest noble gas configuration. The compounds formed by the transfer of electrons from one element to other are known as ionic or electrovalent compounds.

(i) The electronic configurations of three elements *X*, *Y* and *Z* are :

X : 2 *Y* : 2, 8, 7 *Z* : 2, 8, 2

Which of the following is correct regarding these elements?

(a) *X* is a metal. (b) *Y* is a metal.

(c) *Z* is a non-metal. (d) *Y* is a non-metal and *Z* is a metal.

(ii) Element *X* reacts with element *Y* to form a compound *Z*. During the formation of compound *Z*, atoms of *X* lose one electron each whereas atoms of *Y* gain one electron each. Which of the following properties is not shown by compound *Z*?

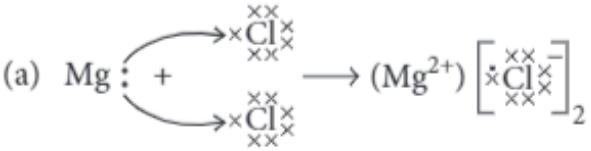
(a) High melting point

(b) Low melting point

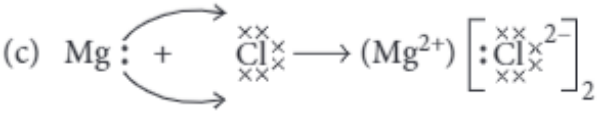
(c) Occurrence as solid

(d) Conduction of electricity in molten state

(iii) Which of the following is correct representation of formation of magnesium chloride?

(a) 

(b) 

(c) 

(d) None of these

(iv) The electronic configuration of sodium ion is

(a) 2, 8, 8 (b) 2, 8, 2 (c) 2, 6 (d) 2, 8.

(v) Which of the following represents an electropositive element?

(a) 2, 8, 6 (b) 2, 8, 8 (c) 2, 8, 8, 1 (d) 2, 7

Case Study 8

Read the following and answer any four questions from 2(i) to 2(v).

The arrangement of metals in a vertical column in the decreasing order of their reactivities is called the reactivity series or activity series of metals. The most reactive metal is at the top position of the reactivity series. The least reactive metal is at the bottom of the reactivity series.

Hydrogen, though a non-metal, has been included in the activity series of metals only for comparison. Apart from it, the hydrogen atom also has tendency to lose its valence electron and form cation which behaves like metal.

$$H \rightarrow H^+ + e^-$$

(i) Which metal can be displaced by copper from its salt solution?

(a) Zinc (b) Silver (c) Iron (d) Lead

(ii) An element '*X*' after reacting with acids liberates hydrogen gas and can displace lead and mercury from their salt solutions. The metal '*X*' is

(a) copper (b) gold (c) calcium (d) hydrogen.

(iii) The most reactive metal is

(a) potassium (b) barium (c) zinc (d) calcium.

(iv) The metal which does not liberate hydrogen gas after reacting with acid is

(a) zinc (b) lead (c) iron (d) gold.

(v) Which of the following metals does not react with water at all?

(I) Sodium (II) Copper (III) Aluminium (IV) Lead

(a) I and III only (b) IV only (c) II and IV only (d) I, II, III and IV

Case Study 9

Read the following and answer any four questions from 3(i) to 3(v).

Metals as we know, are very useful in all fields, industries in particular. Non-metals are no less in any way. Oxygen present in air is essential for breathing as well as for combustion. Non-metals form a large number of compounds which are extremely useful, *e.g.*, ammonia, nitric acid, sulphuric acid, etc.

Non-metals are found to exist in three states of matter. Only solid non-metals are expected to be hard however, they have low density and are brittle. They usually have low melting and boiling points and are poor conductors of electricity.

(i) _____ is a non-metal but is lustrous.

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

(ii) Which of the following is known as 'King of chemicals'?

(a) Urea (b) Ammonia (c) Sulphuric acid (d) Nitric acid

(iii) Which of the following non-metals is a liquid?

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

(iv) Hydrogen is used
(a) for the synthesis of ammonia
(b) for the synthesis of methyl alcohol
(c) in welding torches
(d) all of these.

(v) Generally, non-metals are bad conductors of electricity but '*X*' which is a form of carbon is a good conductor of electricity and is an exceptional non-metal. '*X*' is
(a) diamond (b) graphite (c) coal (d) coke.

Case Study 10

Read the following and answer any four questions from 4(i) to 4(v).

Ionic compound is a chemical compound in which ions are held together by ionic bonds. An ionic bond is the type of chemical bond in which two oppositely charged ions are held through electrostatic forces. We know that, metal atoms have loosely bound valence electrons in their valence shell and non-metal atoms need electrons in their valence shell to attain noble gas configuration. The metal atom loses the valence electrons while non-metal atom accepts these electrons. By losing electrons, metal atoms change to cations and by accepting electrons, non-metals form anions. Ionic compounds are generally solid and exist in the form of crystal. They have high melting and boiling points.

(i) Which of the following can change to a cation?
(a) Fluorine (b) Oxygen (c) Potassium (d) Neon

(ii) Which of the following can change to an anion?
(a) Iodine (b) Magnesium (c) Calcium (d) Xenon

(iii) Ionic compounds are soluble in _____ .
(a) Kerosene (b) Petrol (c) Water (d) None of these

(iv) Which of the following statements is correct about ionic compounds?
I. They conduct electricity in solid state.
II. They conduct electricity in solutions.
III. They conduct electricity in molten state.
(a) I only (b) II only (c) III only (d) II and III only

(v) Select the incorrect statement.
(a) Ionic compounds are generally brittle.
(b) Ions are the fundamental units of ionic compounds.
(c) Formation of ionic bonds involve sharing of electrons.
(d) NaCl is an ionic compound.

Case Study 11

Read the following and answer any four questions from 5(i) to 5(v).

An element is a pure substance made up of same kind of atoms. At present, nearly 118 elements are known but all of them do not occur free in nature, some of them have been synthesized by artificial methods. Based on their properties, they are mainly classified as metals and non-metals. Metals are those elements which lose electrons and form positive ions *i.e.,* they are electropositive in nature. They are generally hard, good conductors of heat and electricity, malleable, ductile and have striking lustre. They have a significant role to play in our daily life.

(i) Metals which are of vital importance to the national defence, energy and industry sector are called strategic metals. Which of the following is a strategic metal?
(a) Titanium (b) Zirconium (c) Manganese (d) All of these

(ii) Which metal is the best conductor of electricity?
(a) Silver (b) Platinum (c) Nickel (d) Iron

(iii) Which of the following metals is not a coinage metal?
(a) Copper (b) Silver (c) Iron (d) Gold

(iv) Which of the following are the most malleable metals?
(I) Sodium (II) Gold (III) Potassium (IV) Silver
(a) (I) and (IV) (b) (II) and (III) (c) (III) and (IV) (d) (II) and (IV)

(v) Identify the correct statement(s).
(I) The wires that carry current in our homes have a coating of PVC or a rubber like material.
(II) School bells are made of metals.
(III) Metals do not conduct electricity.
(IV) Metals which produce a sound on striking a hard surface are said to be non-sonorous.
(a) (I) and (III) (b) (I) and (II) (c) (III) and (IV) (d) Only (II)

Case Study 12

Read the following and answer any four questions from 6(i) to 6(v).

The chemical properties of metals are mostly linked with the electron releasing tendency of their atoms. Greater the tendency, more will be the reactivity of the metal. They react with oxygen, water, hydrogen, acids, etc. Since they can lose electrons, they act as reducing agents. Some reactions of metals are given as :

Metal + Oxygen $\longrightarrow$ Metal oxide

Metal + Water $\longrightarrow$ Metal hydroxide + Hydrogen

Metal + $Acid_{(dilute)}$ $\longrightarrow$ Metal salt + Hydrogen

Metal X + Salt solution of metal Y $\longrightarrow$ Salt solution of X + Y (Displacement reaction)

(i) Metals such as _____ and _____ react so vigorously that they catch fire if kept in the open. Hence, to protect them and to prevent accidental fires, they are kept immersed in _____.
(a) phosphorus, magnesium, water (b) sodium, potassium, kerosene oil
(c) sodium, potassium, water (d) tin, lead, alcohol

(ii) Which of the following pairs will give displacement reaction?
(a) NaCl solution and copper metal (b) $MgCl_2$ solution and aluminium metal
(c) $FeSO_4$ solution and silver metal (d) $AgNO_3$ solution and copper metal

(iii) There are four metals K, L, M and N. Identify them by using the hints given below.
K forms basic oxide.
L forms amphoteric oxide.
Oxide of M dissolves in water to form alkali.
N does not react with water at all.
(a) $K \rightarrow Zn$, $L \rightarrow Al$, $M \rightarrow Na$, $N \rightarrow Fe$ (b) $K \rightarrow Fe$, $L \rightarrow Na$, $M \rightarrow K$, $N \rightarrow Zn$
(c) $K \rightarrow K$, $L \rightarrow Cu$, $M \rightarrow Pb$, $N \rightarrow Na$ (d) $K \rightarrow Cu$, $L \rightarrow Zn$, $M \rightarrow K$, $N \rightarrow Pb$

(iv) Which metal does not react with dilute hydrochloric acid?
(a) Iron (b) Sodium (c) Zinc (d) Copper

(v) Food cans are coated with tin and not with zinc because
(a) zinc is costlier than tin (b) zinc has a higher melting point than tin
(c) zinc is more reactive than tin (d) zinc is less reactive than tin.

Case Study 13

Read the following and answer any four questions from 7(i) to 7(v).

On the basis of reactivity of different metals with oxygen, water and acids as well as displacement reactions, the metals have been arranged in the decreasing order of their reactivities. This arrangement is known as activity series or reactivity series of metals.

The basis of reactivity is the tendency of metals to lose electrons. If a metal can lose electrons easily to form positive ions, it will react readily with other substances. Therefore, it will be a reactive metal. On the other hand, if a meal loses electrons less rapidly to form a positive ion, it will react slowly with other substances. Therefore, such a metal will be less reactive.

(i) Which of the following metals is less reactive than hydrogen?
(a) Copper (b) Zinc (c) Magnesium (d) Lead

(ii) Which of the following metals is more reactive than hydrogen?
(a) Mercury (b) Platinum (c) Iron (d) Gold

(iii) Which of the following metals reacts vigorously with oxygen?
(a) Zinc (b) Magnesium (c) Sodium (d) Copper

(iv) Which of the following represents the correct order of reactivity for the given metals?
(a) Na > Mg > Al > Cu (b) Mg > Na > Al > Cu (c) Na > Mg > Cu > Al (d) Mg > Al > Na > Cu

(v) Hydrogen gas is not evolved when a metal reacts with nitric acid. It is because HNO_3 is a strong oxidising agent. It oxidises the H_2 produced to water and itself gets reduced to any of the nitrogen oxides (N_2O, NO, NO_2). But _____ and _____ react with very dilute HNO_3 to evolve H_2 gas.
(a) Pb, Cu (b) Na, K (c) Mg, Mn (d) Al, Zn

Case Study 14

Read the following and answer any four questions from 8(i) to 8(v).

Non-metals are highly electronegative in nature. They have a tendency to gain electrons in their valence shell to achieve nearest noble gas configuration. Thus, they form anions and act as good oxidising agents.

$$\underset{\text{(non-metal atom)}}{X} + ne^- \longrightarrow \underset{\text{(anion)}}{X^{n-}}$$

They react with air or oxygen on heating to form oxides which react with water to form acids. Thus, non-metal oxides are acidic in nature. Non-metals do not react with dilute acids at all. This is because they are electronegative and therefore, cannot displace hydrogen from acids but they form covalent hydrides when heated with hydrogen.

(i) The acid formed when sulphur trioxide reacts with water is
(a) sulphurous acid (b) sulphuric acid (c) both (a) and (b) (d) none of these.

(ii) An element '*X*' forms an oxide XO_2, which is a very useful gas used in the process of photosynthesis. The element '*X*' is
(a) sulphur (b) nitrogen (c) carbon (d) phosphorus.

(iii) Non-metals generally act as
(a) oxidising agents (b) reducing agents (c) both (a) and (b) (d) none of these.

(iv) Which of the following elements produces basic oxide on reacting with oxygen?
(a) Chlorine (b) Sulphur (c) Phosphorus (d) Magnesium

(v) Which of the following is a covalent hydride?

(a) CH_4 (b) NH_3 (c) H_2S (d) All of these

Case Study 15

Read the following and answer any four questions from 9(i) to 9(v).

Although there is no sharp line of distinction between metals and non-metals yet there are some distinctive differences. The main points of differences are :

Property	Metals	Non-metals
Electronic structure	They have 1 to 3 electrons in the outermost shell of their atoms.	They have 4 to 8 electrons in the outermost shell of their atoms.
State of existence	They are mostly solid at room temperature except mercury and gallium which are liquid.	They are either solids or gases at room temperature (except bromine which is a liquid).
Density	They have high density.	They have low density.
Nature of ions	They are electropositive elements and hence, lose one or more electrons to form positive ions.	They are electronegative elements and hence, gain one or more electrons to form negative ions.
Nature of chlorides	They generally combine with chlorine to form solid ionic chlorides which conduct electricity in the aqueous solution or in the molten state.	They combine with chlorine to form covalent chlorides. These are either gases or liquids. Non-metal chlorides do not contain ions, therefore, they do not conduct electricity.
Nature of oxides	They form basic oxides, though some oxides are amphoteric also.	They form acidic or neutral oxides.
Displacement of hydrogen from acids	Metals which lie above hydrogen in the reactivity series displace hydrogen from acids.	They do not displace hydrogen from acids.

(i) Match column-I with column-II and select the correct option using the given codes.

Column-I	Column-II
P. A metal that forms amphoteric oxides	(I) Ga
Q. A metal which melts when keep on our palm	(II) Au
R. A metal that has highest density	(III) Al
S. A metal which cannot displace hydrogen from acids	(IV) Os

(a) P-(II), Q-(I), R-(III), S-(IV) (b) P-(III), Q-(I), R-(IV), S-(II)

(c) P-(IV), Q-(II), R-(III), S-(I) (d) P-(III), Q-(II), R-(I), S-(IV)

(ii) State True (T) or False (F) for the following statements.

(I) Non-metals react with acids to give a salt and hydrogen gas.

(II) Zinc oxide is amphoteric in nature.

(III) Copper oxide is basic in nature.

(IV) Hydrogen gas is evolved when a metal reacts with dilute acid.

(V) Copper reacts vigorously with dilute HCl.

	(I)	(II)	(III)	(IV)	(V)
(a)	F	T	F	T	T
(b)	T	F	T	F	F
(c)	F	T	F	F	T
(d)	F	T	T	T	F

(iii) Tick (✓) the correct statements and cross (×) the incorrect statements.
(I) Non-metals are either solids or gases except mercury which is a liquid.
(II) Sodium is a metal and can lose its electrons easily.
(III) Most non-metals produce acidic oxides when dissolved in water. Most metals produce basic oxides on reaction with water.
(IV) Graphite is a conductor of electricity.

	(I)	(II)	(III)	(IV)
(a)	✓	×	✓	×
(b)	×	✓	×	✓
(c)	×	✓	✓	✓
(d)	×	✓	✓	×

(iv) An element X (atomic number 12) reacts with another element Y (atomic number 17) to form a compound Z. Which of the following statements are true regarding this compound?
I. Molecular formula of Z is XY_2.
II. It is soluble in water.
III. X and Y are joined by sharing of electrons.
IV. It would conduct electricity in the molten state.
(a) II and III only (b) I and II only (c) I, III and IV only (d) I, II and IV only

(v) Which of the following metals form an amphoteric oxide?
(a) Zn (b) Ca (c) Na (d) Cu

Case Study 16

Read the following and answer any four questions from 10(i) to 10(v).

Sample pieces of five metals P, Q, R, S and T are added to the tabulated solutions separately. The results observed are shown in the table given below :

Metal	Solutions			
	$CuSO_4$	$ZnSO_4$	$FeSO_4$	$AgNO_3$
P	No change	No change	No change	A coating on metal
Q	Brown coating	—	Grey deposit	A coating on metal
R	No change	No change	No change	No change
S	—	No change	No change	Brown deposit
T	Brown deposit	New coating	New coating	New coating

Based on the observations recorded in the table answer the following questions :

(i) Which is the most reactive metal?
(a) Q (b) R (c) S (d) T

(ii) Which is the least reactive metal?
(a) P (b) R (c) T (d) Q

(iii) Activity series of elements is
(a) the arrangement of elements in increasing order of reactivity.
(b) the arrangement of elements in decreasing order of reactivity.
(c) the arrangement of oxides of elements in increasing order of reactivity.
(d) none of these.

(iv) Which of the following metal is least reactive?

(a) Zn (b) Cu (c) Ag (d) Fe

(v) Decreasing order of reactivity is

(a) $P > Q > R > S > T$ (b) $Q > T > R > S > P$

(c) $T > Q > S > P > R$ (d) $S > R > Q > T > P$

HINTS & EXPLANATIONS

7. (i) (d)

(ii) (b): 'Z' is an ionic compound.

(iii) (a): $\underset{2,8,2}{Mg} \longrightarrow \underset{2,8}{Mg^{2+}} + 2e^-$

$\underset{2,8,7}{Cl} + e^- \longrightarrow \underset{2,8,8}{Cl^-}$

$Mg^{2+} + 2Cl^- \longrightarrow MgCl_2$

(iv) (d): $\underset{2,8,1}{Na} \longrightarrow \underset{2,8}{Na^+} + e^-$

(v) (c): (a) and (d) represent electronegative elements and (b) represents a noble gas.

8. (i) (b): Copper is more reactive than silver thus, it can displace silver from its salt solution.

(ii) (c): Calcium is more reactive than lead and mercury.

(iii) (a): Potassium is present at the top of the activity series.

(iv) (d): Gold is below hydrogen in the reactivity series so, it does not liberate hydrogen gas on reaction with acids.

(v) (c): Metals such as lead, copper, silver and gold do not react with water at all.

9. (i) (d): Iodine is a lustrous non-metal.

(ii) (c): H_2SO_4 is known as 'King of Chemicals'.

(iii) (b): Bromine exists as a liquid.

(iv) (d)

(v) (b): Graphite conducts electricity because of the delocalised electrons in its structure.

10. (i) (c): Potassium, being a metal, can change to cation by losing its valence electron.

(ii) (a): Iodine, being a non-metal, can change to anion by gaining electron.

(iii) (c): Ionic compounds are generally soluble in water and insoluble in kerosene and petrol.

(iv) (d): Ionic compounds do not conduct electricity in solid state as ions are very closely packed and are free to move.

(v) (c): Formation of ionic bonds involve complete transfer of electrons from metal atom to non-metal atom.

11. (i) (d): Titanium, zirconium and manganese are used in defence equipments as they are light and durable and therefore, are called strategic metals.

(ii) (a)

(iii) (c): Copper, silver and gold are called coinage metals because they are used in making coins, jewellery etc.

(iv) (d)

(v) (b): Metals conduct electricity. Metals which produce a sound on striking a hard surface are said to be sonorous.

12. (i) (b)

(ii) (d): As copper is more reactive than silver, it displaces silver from silver nitrate solution.

(iii) (d): CuO is basic in nature, ZnO is amphoteric in nature.
Oxide of potassium dissolves in water to form alkali.
$K_2O_{(s)} + H_2O_{(l)} \longrightarrow 2KOH_{(aq)}$
Pb does not react with water at all.
Thus, *K*, *L*, *M* and *N* are Cu, Zn, K and Pb respectively.

(iv) (d)

(v) (c): Zinc being more reactive than tin can react with food elements kept in food cans.

13. (i) (a): Copper is placed below hydrogen in activity series therefore, it is less reactive than hydrogen.

(ii) (c): Iron is placed above hydrogen in activity series therefore, it is more reactive than hydrogen.

(iii) (c) (iv) (a)

(v) (c)

14. (i) (b): $SO_3 + H_2O \longrightarrow H_2SO_4 + \text{heat}$

(ii) (c): Carbon forms CO_2 on reaction with oxygen. During photosynthesis plants take in CO_2.

(iii) (a): Non-metals act as oxidising agents since they can accept electrons.

(iv) (d): Magnesium, being a metal, produces basic oxide on reaction with oxygen.

$$2Mg + O_2 \longrightarrow 2MgO$$

(v) (d): Carbon, nitrogen and sulphur are non-metals hence, they form covalent hydrides.

15. (i) (b) (ii) (d)

(iii) (c)

(iv) (d): An element (*X*) with atomic number 12 is Mg. Element (*Y*) with atomic number 17 is Cl. Therefore, compound (*Z*) will be $MgCl_2$. It is soluble in water. It is an ionic compound and it conducts electricity in the molten state.

(v) (a)

16. (i) (d): The most reactive metal is *T*.

(ii) (b): The least reactive metal is *R*.

(iii) (b) (iv) (c)

(v) (c): $T > Q > S > P > R$