



CHEMISTRY

BOOKS - MTG IIT JEE FOUNDATION

METALS AND NON METALS

Illustrations

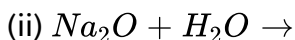
1. The number of metals among the following element are

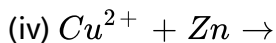
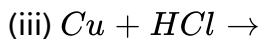
$$\frac{24}{12}X, \frac{19}{9}Y, \text{ and } \frac{31}{15}Z$$



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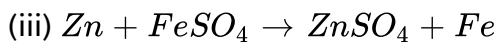
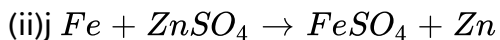
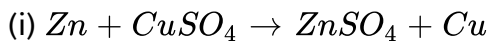
2. Complete and balance the following equations :





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3. State which of the following chemical reactions will take place or not, giving suitable reason for each.



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4. Explain why carbon can reduce copper oxide to copper but not calcium oxide to calcium.

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5. Do all non-metals exist in two states - solids and gases only ?

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6. Write equations for the following reactions :

(a) Iron with steam

(b) Calcium with water

(c) Potassium with water

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7. Amongst silver and magnesium, which metal is more reactive ? Give three reasons in support of your answer.

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8. A metal M forms an oxide having the formula M_2O_3 . It dissolves both in dilute hydrochloric acid and dilute sodium hydroxide solution. Identify the metal and write equations for the reactions involved.

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9. Copper sulphate was placed in an aluminium can. After a few days holes appeared in the can. Explain this observation.

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10. A metal X is placed in the aqueous solution of a sulphate of metal Y. After sometime it is observed that metal Y is deposited on metal X. Which metal is more reactive out of the two?

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11. Represent the formation of $MgCl_2$ with the help of diagram of their electronic configuration.

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12. Why potassium bromide (KBr) is non-conducting in solid state but it conducts electricity in molten state or in aqueous solution ?

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13. Mention the principles of concentration of ore for various methods.

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14. Why is thermite process used for joining railway tracks or cracked machine parts?

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15. How NaCN acts as depressant?

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Solved Examples

1. An element reacts with oxygen to form an oxide which dissolves in dilute hydrochloric acid. The oxide formed also turns a solution of red litmus blue. Is the element a metal or a non-metal? Explain your answer.

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2. (a) Explain what corrosion of iron means.

(b) Why is it that aluminium which is more reactive than iron does not corrode like iron?

(c) How is corrosion of iron prevented by coating it with a layer of oil?

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3. A, B and C are three elements which undergo chemical changes

according to following equations : (i) $A_2O_3 + 2B \rightarrow B_2O_3 + 2A$

(ii) $3CSO_4 + 2B \rightarrow B_2(SO_4)_3 + 3C$

(iii) $3CO + 2A \rightarrow A_2O_3 + 3C$

(a) Which of these is most reactive ?

(b) Which of these is least reactive ?

(c) Arrange these elements in order of increasing reactivity.

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4. What are strategic metals? Give one example also.

(b) State the reason for the following behaviour of zinc metal:

On placing a piece of zinc metal in a solution of mercuric chloride, it acquires a shining silvery surface but when it is placed in a solution of magnesium sulphate no change is observed.

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5. Most jewellery is made of 22 carat gold. What is the percentage of gold in it ?

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6. What is the effect of calcination on metal halide ores?

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7. How does the term ore differ from mineral? Give an example.

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8. Name the following :

(i) A molten metal that catches fire in chlorine gas and gives off white fumes.

(ii) A metal that forms two types of oxides and rust in moisture, write the

formulae of oxides.

(iii) A metal used in hot water apparatus.

(iv) A metal used in long distance cable wires.

(v) A metal added to gold to harden it.

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9. Give reasons :

(i) Metals displace hydrogen from acids whereas non-metals do not.

(ii) Carbonate and sulphide ores are usually converted into oxide.

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10. State reasons for the following :

(i) Aluminium oxide is called an amphoteric oxide.

(ii) Hydrogen gas is not evolved when most metals react with nitric acid.

(iii) Nitrogen is used to preserve food.

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11. What is aqua regia ? Why are gold and platinum soluble in it ?

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12. From the options given along the side of each statement, select the most appropriate.

- (i) A metal that gets covered with a protective film of its oxide : Al, Cu, Ag
- (ii) A metal which burns in air will golden flame : Zn, K, Na
- (iii) A metal which can displace hydrogen from boiling water as well as steam : K, Zn, Fe
- (iv) A metal that does not react with air at room temperature. : Na, Mg, Ca

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13. How does calcination differ from roasting ?

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14. Metal M reacts with oxygen to form metallic oxide MO. This oxide reacts with moisture and carbon dioxide of the atmosphere to form a basic carbonate. Metal M can prevent rusting of iron. Identify metal M.

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15. When calcium metal is added to water, the gas evolved does not catch fire but the same gas evolved on adding sodium metal to water catches fire. Why is it so?

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Ncert Section

1. Give an example of a metal which
 - (i) is a liquid at room temperature.
 - (ii) can be easily cut with a knife.

(iii) is the best conductor of heat.

(iv) is a poor conductor of heat

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2. Explain the meanings of malleable and ductile.

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3. Why is sodium kept immersed in kerosene oil?

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4. Write equations for the reactions of

(i) iron with steam

(ii) calcium and potassium with water

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5. Samples of four metals A, B, C and D were taken and were added to the following solutions one by one.

The results obtained have been tabulated as follows :

Metal	Solution to which metal is added		
	Iron(II) sulphate	Copper(II) sulphate	Zinc sulphate
A	No reaction	Displacement	—
B	Displacement	—	No reaction
C	No reaction	No reaction	No reaction
D	No reaction	No reaction	No reaction

Use the table given above to answer the following questions :

(a) Which is the most reactive metal ?

(b) What would you observe when B is added to solution of copper(II) sulphate ?

(c) Arrange the metals A, B, C and D in order of increasing reactivity.

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6. Which gas is produced when a reactive metal reacts with dilute hydrochloric acid ? Write the chemical reaction when iron reacts with dilute H_2SO_4 .

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7. What would you observe when zinc is added to a solution of iron (II) sulphate?

Write the chemical reaction that takes place.

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8. (i) Write the electron-dot structures for sodium, oxygen and magnesium.

(ii) Show the formation of Na_2O and MgO by the transfer of electrons.

(iii) What are the ions present in these compounds?

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9. Why do ionic compounds have high melting points?

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10. Define the following terms.

(i) Mineral

(ii) Ore

(iii) Gangue



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11. Name two metals which are found in nature in the free state.



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12. What chemical process is used for obtaining a metal from its oxide?



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13. Metallic oxides of zinc, magnesium and copper were heated with the following metals.

Metal	Zinc	Magnesium	Copper
Zinc oxide			
Magnesium oxide			
Copper oxide			

In which cases will you find displacement reactions taking place?

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14. Which metals do not corrode easily?

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15. What are alloys?

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16. Which of the following pairs will give displacement reactions?

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

Answer: D

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17. Which of the following methods is suitable for preventing an iron frying pan from rusting?

A. Applying grease

B. Applying paint

C. Applying a coating of zinc

D. All of the above

Answer: C

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18. An element reacts with oxygen to give a compound with a high melting point. This compound is also soluble in water. The element is likely to be:

- A. calcium
- B. carbon
- C. silicon
- D. iron

Answer: A



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19. Food cans are coated with tin and not with zinc because

- A. zinc is costlier than tin
- B. zinc has higher melting point than tin

C. zinc is more reactive than tin

D. zinc is less reactive than tin.

Answer: C

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20. You are given a hammer, a battery, a bulb, wires and a switch.

(a) How could you use them to distinguish between samples of metals and non-metals?

(b) Assess the usefulness of these tests in distinguishing between metals and non – metals.

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21. What are amphoteric oxides? Give two examples of amphoteric oxides.

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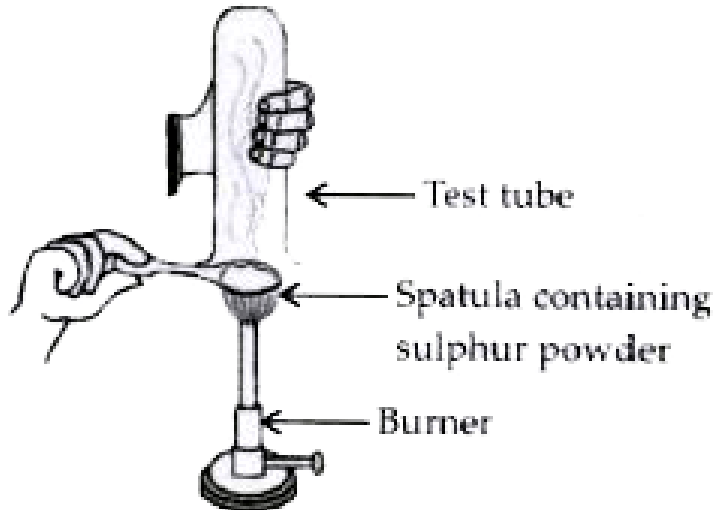
22. Name two metals which will displace hydrogen from dilute acids, and two metals which will not.

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23. In the electrolytic refining of a metal M, what would you take as the anode, the cathode and the electrolyte?

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24. Pratyush took sulphur powder on a spatula and heated it. He collected the gas evolved by inverting a test tube over it, as shown in figure below



(a) What will be the action of gas on

(i) dry litmus paper ?

(ii) moist litmus paper ?

(b) Write a balanced chemical equation for the reaction taking place.

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25. State two ways to prevent the rusting of iron.

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26. What type of oxides are formed when non-metals combine with oxygen?

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27. Give reasons

(a) Platinum, gold and silver are used to make jewellery.

(b) Sodium, potassium and lithium are stored under oil.

(c) Aluminium is a highly reactive metal, yet it is used to make utensils for cooking.

(d) Carbonate and sulphide ores are usually converted into oxides during the process of extraction.

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28. You must have seen tarnished copper vessels being cleaned with lemon or tamarind juice. Explain why these sour substances are effective in cleaning the vessels.



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29. Differentiate between metal and non-metal on the basis of their chemical properties.



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30. A man went door to door posing as a goldsmith. He promised to bring back the glitter of old and dull gold ornaments. An unsuspecting lady gave a set of gold bangles to him which he dipped in a particular solution. The bangles sparkled like new but their weight was reduced drastically. The lady was upset but after a futile argument the man beat a hasty retreat. Can you play the detective to find out the nature of the solution he had used?



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31. Give reasons why copper is used to make hot water tanks and not steel (an alloy of iron).

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Exercise Multiple Choice Questions Level 1

1. Which metal cannot be used as a reducing agent in smelting ?

A. C

B. Al

C. Cu

D. Na

Answer: C

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2. Method used for obtaining highly pure silicon which is used as a semiconductor material is

- A. oxidation
- B. electrochemical
- C. crystallisation
- D. zone refining.

Answer: D



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3. When a metal X is added to dilute HCl solution, there is no evolution of gas. The metal X is

- A. K
- B. Na
- C. Ag

D. Zn

Answer: C



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4. Which of the following is an oxide ore ?

A. Bauxite

B. Cuprite

C. Haematite

D. All of these

Answer: D



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5. The poorest conductor of heat is

A. aluminium

B. silver

C. gold

D. lead.

Answer: D

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6. Brass is a mixture of

A. copper and zinc

B. copper and tin

C. copper, nickel and zinc

D. aluminium copper and traces of Mg and Mn.

Answer: A

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7. Duralumin is a mixture of

- A. copper and zinc
- B. copper and tin
- C. copper, nickel and zinc
- D. aluminium copper and traces of Mg and Mn.

Answer: D



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8. Which of the following elements produces basic oxide on reacting with oxygen ?

- A. Chlorine
- B. Sulphur
- C. Phosphorus

D. Magnesium

Answer: D



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9. Which of the following steps is not involved in metallurgy of iron ?

A. Calcination

B. Smelting

C. Concentration of ore

D. Conversion of ore into oxide

Answer: D



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10. Which of the following metals form amphoteric oxide?

A. copper

B. silver

C. Aluminium

D. Iron

Answer: C

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11. Beakers A, B and C contain zinc sulphate, silver nitrate and iron (II) sulphate solutions respectively. Copper pieces are added to each beaker.

Blue colour will appear in case of

A. beaker A

B. beaker B

C. beaker C

D. all the beakers.

Answer: B



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12. Pure gold is

A. 14 carat

B. 24 carat

C. 18 carat

D. 22 carat

Answer: B



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13. The process of electrolysis is used for obtaining such metals which are

A. highly reactive

B. moderately reactive

C. highly unreactive

D. all types of metals.

Answer: A



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14. Which one of the following is not a method of concentration of metal ores ?

A. Gravity separation

B. Froth floatation process

C. Electromagnetic separation

D. Smelting

Answer: D



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15. Zone refining process is used for the

- A. concentration of an ore
- B. reduction of a metal oxide
- C. purification of metal
- D. purification of an ore.

Answer: C



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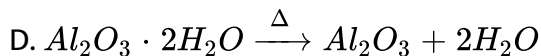
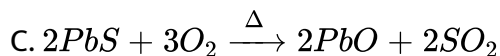
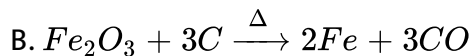
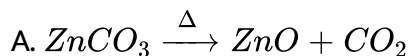
16. The purpose of smelting an ore is

- A. to oxidise it
- B. to reduce it
- C. to separate volatile impurities
- D. to obtain an alloy.

Answer: B

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17. which of the following processes involve smelting



Answer: B

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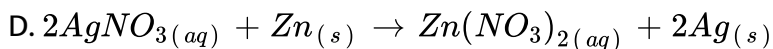
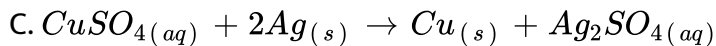
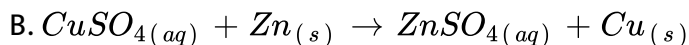
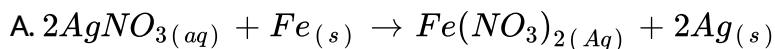
18. Metals like copper, mercury and lead are obtained from their oxide ores by

- A. carbon reduction
- B. aluminium reduction
- C. self-reduction
- D. electrolytic reduction.

Answer: C

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19. Which of the following reactions cannot occur ?



Answer: C

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20. Malachite is an ore of

- A. iron
- B. copper
- C. mercury
- D. zinc.

Answer: B



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21. Colour of basic copper carbonate is

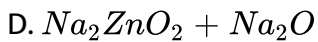
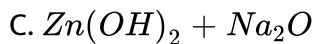
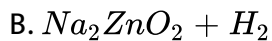
- A. blue
- B. yellow
- C. red

D. green

Answer: D

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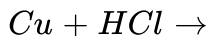
22. Complete the reaction : $Zn + 2NaOH \rightarrow$



Answer: B

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23. Which of the following is correct for the reaction?



- A. react vigorously
- B. no reaction
- C. react moderately
- D. react slowly.

Answer: B



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24. Non-metals generally act as

oxidizing agents

reducing agents

Both (A) & (B)

None of these

A. oxidizing agents

B. reducing agents

C. both (a) and (b)

D. none of these

Answer: A



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25. An element 'X' forms an oxide XO_2 , which is a very useful gas used in photosynthesis process. The element is

A. sulphur

B. nitrogen

C. carbon

D. phosphorus.

Answer: C

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26. 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.

Answer: B

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27. Which of the following ores cannot be concentrated by electromagnetic separation ?

- A. Chromite
- B. Magnetite

C. Pyrolusite

D. Cuprite

Answer: D

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28. Which of the following oxides cannot be reduced with carbon to obtain the metal ?

A. MnO_2

B. $Cr_2O(3)$

C. Al_2O_3

D. None of these

Answer: D

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29. The process of zone refining is used in the purification of

A. Si

B. Al

C. Ag

D. Cu

Answer: A



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30. Flux is used to remove

A. basic impurities

B. acidic impurities

C. all types of impurities

D. both acidic and basic impurities.

Answer: D

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Exercise Multiple Choice Questions Level 2

1. Which one of the following ores is best concentrated by froth flotation method:

- A. Galena
- B. Cassiterite
- C. Magnetite
- D. Malachite

Answer: A

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2. Which of the following statements is correct regarding the slag obtained during the extraction of a metal like copper or iron?

- A. The slag is lighter and has lower melting point than the metal.
- B. The slag is heavier and has lower melting point than the metal.
- C. The slag is lighter and has higher melting point than the metal.
- D. The slag is heavier and has higher melting point than the metal.

Answer: A



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3. When the sample of copper with zinc impurity is to be purified by electrolysis, the appropriate electrodes are .

- A. Cathode Anode
Pure iron Pure copper
- B. Cathode Anode
Impure sample Pure copper
- C. Cathode Anode
Impure Iron Impure sample

- | | | |
|----|-------------|---------------|
| | Cathode | Anode |
| D. | Pure copper | Impure sample |

Answer: D

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4. Which is not the correct statement ?

- A. Cassiterite and haematite are concentrated by hydraulic washing.
- B. Pure Al_2O_3 is obtained from the bauxite ore by leaching in the Baeyer's process.
- C. Sulphide ore is concentrated by calcination method.
- D. Roasting can convert sulphide into oxide or sulphate and part of sulphide may also act as a reducing agent.

Answer: C

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5. An alloy which does not contain copper is

- A. solder
- B. bronze
- C. brass
- D. bell metal.

Answer: A



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6. A student puts one big iron nail each in four test tubes containing solutions of zinc sulphate, aluminium sulphate, copper sulphate and iron sulphate. A reddish-brown coating was observed only on the surface of iron nail which was put in the solution of

- A. zinc sulphate
- B. iron sulphate

C. copper sulphate

D. aluminium sulphate.

Answer: C

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7. When iron fillings are heated in a steam of dry hydrogen chloride the compound formed is $FeCl_x$, where x is

A. 1

B. 2

C. 3

D. 4

Answer: B

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8. An alloy of zinc and copper is dissolved in dilute hydrochloric acid.

Hydrogen gas is evolved. In this evolution of gas

- A. only zinc reacts with dilute hydrochloric acid
- B. only copper react with dilute hydrochloric acid
- C. both zinc and copper react with dilute hydrochloric acid
- D. only copper reacts with water.

Answer: A



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9. Gravity separation method is based upon

- A. preferential washing of ores and gangue particles
- B. difference in densities of ore particles and impurities
- C. difference in chemical properties of ore particles and impurities
- D. none of these.

Answer: B



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10. The process of removing lighter gangue particles by washing in a current of water is called:

- A. levigation
- B. liquation
- C. leaching
- D. cupellation.

Answer: A



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11. Which ore contains both iron and copper?

- A. Cuprite
- B. Chalcoite
- C. Copper pyrite
- D. Malachite

Answer: C

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12. Hydrogen gas is not widely used as a reducing agent because

- A. hydrogen decomposes to atomic hydrogen at higher temperature
- B. hydrogen isomerises to ortho hydrogen at higher temperature
- C. many metals form hydrides at lower temperature.
- D. here is a risk of explosion from oxygen and hydrogen in air.

Answer: D

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13. A large volume of copper(II) sulphate solution is left in an iron container overnight. Identify the correct statement.

- A. The solution evaporates completely and some copper(II) sulphate crystals are left behind.
- B. part of the container in contact with the solution is coated with copper.
- C. Some fine iron particles are formed in the solution.
- D. Atmospheric oxygen reacts with the copper(II) sulphate to give black copper(II) oxide.

Answer: B



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14. Metals are refined by using different methods. Which of the following metals are not refined by electrolytic refining?

(i) Au

(ii) Cu

(iii) Na

(iv) K

A. (i) and (ii)

B. (i) and (iii)

C. (ii) and (iii)

D. (iii) and (iv)

Answer: D



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15. Identify the metal that occurs in the native state in nature.

A. Potassium

B. Copper

C. Aluminium

D. Zinc

Answer: B

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16. Four metals P, Q, R, S are tested with water, steam and dilute hydrochloric acid. The table given below shows the results of the experiment.

Metals	Reaction with water	Reaction with steam	Reaction with dil. HCl
P	×	✓	✓
Q	×	×	✓
R	✓	✓	✓
S	×	×	×

Between which two metals should hydrogen be placed in the activity series ?

A. P and Q

B. Q and S

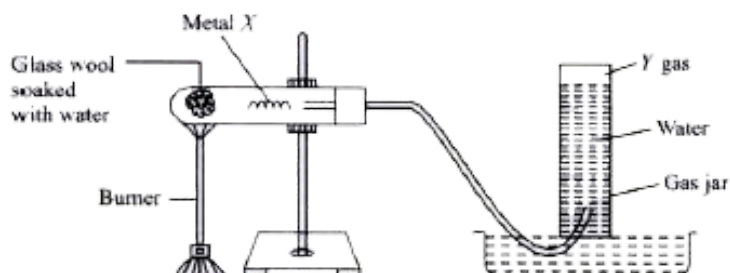
C. P and R

D. R and S

Answer: B

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17. An experimental set up is shown in the figure. Identify the metal X and gas Y respectively in the figure.



A. Zinc, H_2 gas

B. Copper, CO_2 gas

C. Aluminium, CO_2 gas

D. Platinum, H_2 gas

Answer: A



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18. 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

B. I and II

C. I, III and IV

D. I, II and IV

Answer: D



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19. 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. $K \rightarrow Cu, L \rightarrow Zn, M \rightarrow K, M \rightarrow Pb$

Answer: D



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20. Which one of the following metal oxides show s both acidic and basic characters ?

A. Na_2O

B. K_2O

C. CuO

D. Al_2O_3

Answer: D



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Exercise Match The Following

List-I

List-II

- | | |
|-----------------|--------------------------|
| (P) Galena | 1. Fe_2O_3 |
| 1. (Q) Cinnabar | 2. $Al_2O_3 \cdot 2H_2O$ |
| (R) Haematite | 3. HgS |
| (S) Bauxite | 4. PbS |

A. P-2, Q-3, R-4, S-1

B. P-4, Q-3, R-1, S-2

C. P-3, Q-2, R-1, S-4

D. P-4, Q-3, R-2, S-1

Answer: B



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List-I (Alloy)

List-II (Uses)

- | | |
|---------------------|-----------------|
| (P) Stainless steel | 1. Aircrafts |
| 2. (R) Duralumin | 3. Medals |
| (S) Magnalium | 4. Balance beam |

A. P-2, Q-3, R-1, S-4

B. P-3, Q-2, R-4, S-1

C. P-4, Q-2, R-3, S-1

D. P-2, Q-1, R-3, S-4

Answer: A



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3.

List-I

(P) A metal unreactive towards dilute acids and oxygen

(Q) A metal stored in kerosene

(R) A metal used for galvanisation

(S) A metal used for making foils for wrapping food

List-II

1. Zinc

2. Aluminium

3. Gold

4. *Sodium*

A. P-3, Q-1, R-2, S-4

B. P-1, Q-3, R-4, S-2

C. P-3, Q-2, R-4, S-1

D. P-3, Q-4, R-1, S-2

Answer: D



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L1st-I

(P) 2, 8, 1

4. (Q) 2, 8, 7

(R) 2,8,6

(S) 2,8

L1st-II

1. Neon

2. Sulphur

3. Chlorine

4. Sodium

A. P-4, Q-3, R-2, S-1

B. P-4, Q-2, R-3, S-1

C. P-2, Q-4, R-3, S-1

D. P-1, Q-4, R-3, S-2

Answer: A



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L1st-I

(P) Good conductor of heat and electricity

5. (Q) Soluble in water

(R) Poor conductor of electricity

(S) Yellow flame

L1st-II

1. NaCl

2. S

3. Cu

4. Na

A. P-3, Q-2, R-4, S-1

B. P-4, Q-2, R-3, S-1

C. P-3, Q-1, R-2, S-4

D. P-1, Q-3, R-2, S-4

Answer: C

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Exercise Assertion Reason Type

1. Assertion : Zinc is used in the galvanisation of iron.

Reason : Its coating on iron articles increases their life by protecting iron from rusting.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. IF both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: a

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2. Assertion : Froth floatation process is based on the different wetting properties of ore and gangue particles.

Reason : Mustard oil is used as frothing agent in the process.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. IF both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: c

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3. Assertion : Different metals have different reactivities with water and dilute acids.

Reason : Reactivity of a metal depends on its position in the reactivity series.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. IF both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: a



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4. Assertion : Aluminium is used as a reducing agent in the extraction of chromium from its oxide (Cr_2O_3).

Reason : Reduction by aluminium is known as Gold Schmidt thermite process or aluminothermite process.

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. IF both assertion and reason are true but reason is not the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If both assertion and reason are false.

Answer: b



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5. Assertion : Sulphide ores such as zinc blende (ZnS), copper pyrites ($CuFeS_2$), galena (PbS) etc. are generally concentrated by froth floatation method.

Reason : The method is based on the fact that the surface of the sulphide ore is preferentially wetted by oils while that of gangue is preferably wetted by water.

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. IF both assertion and reason are true but reason is not the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If both assertion and reason are false.

Answer: a



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6. Assertion : Zinc is obtained from the roasted or calcined ore (ZnO) by heating with calculated quantity of coal or coke in a reverberatory furnace, when C reduces the metal oxide to free metal.

Reason : The process of extracting the metal by reduction of its oxide ore with carbon is called smelting.

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. IF both assertion and reason are true but reason is not the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If both assertion and reason are false.

Answer: b

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7. Assertion : For acidic impurities like SiO_2 present in an ore, basic fluxes are used.

Reason : Silica is a basic flux.

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. IF both assertion and reason are true but reason is not the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If both assertion and reason are false.

Answer: c



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8. Assertion : Gold occurs in native state.

Reason : Gold is a reactive metal.

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. IF both assertion and reason are true but reason is not the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If both assertion and reason are false.

Answer: c

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9. Assertion : The composition of rust is Fe_3O_7 .

Reason : Iron gets rusted in dry air.

- A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. IF both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: d

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10. Assertion : Bronze contains Sn (80%), Cu(10%) and Zn (10%).

Reason : Bronze get corroded in presence of air and water.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. IF both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: d

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Exercise Comprehension Type

1. Metals occur in nature in the free as well as in the combined state. The less reactive metals are generally found in the free state. Most of the metals, however are found in the combined form as minerals. The minerals from which metals can be obtained on a commercial scale are called ores. In other words, the minerals from which metals can be extracted profitably are called ores. Thus, bauxite ($Al_2O_3 \cdot 2H_2O$) and clay ($Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$) are minerals of aluminium. However, it is bauxite that is chiefly used to obtain aluminium commercially. So, bauxite, and not clay, is an ore of aluminium.

Metal which occurs in native state is

A. Na

B. Ca

C. Mn

D. Ag

Answer: D



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2. Metals occur in nature in the free as well as in the combined state. The less reactive metals are generally found in the free state. Most of the metals, however are found in the combined form as minerals. The minerals from which metals can be obtained on a commercial scale are called ores. In other words, the minerals from which metals can be extracted profitably are called ores. Thus, bauxite ($Al_2O_3 \cdot 2H_2O$) and clay ($Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$) are minerals of aluminium. However, it is bauxite that is chiefly used to obtain aluminium commercially. So, bauxite,

and not clay, is an ore of aluminium.

Which of the following is a sulphide ore ?

A. Galena

B. Cryolite

C. Cuprite

D. Bauxite

Answer: A



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3. Metals occur in nature in the free as well as in the combined state. The less reactive metals are generally found in the free state. Most of the metals, however are found in the combined form as minerals. The minerals from which metals can be obtained on a commercial scale are called ores. In other words, the minerals from which metals can be extracted profitably are called ores. Thus, bauxite ($Al_2O_3 \cdot 2H_2O$) and clay ($Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$) are minerals of aluminium. However, it is

bauxite that is chiefly used to obtain aluminium commercially. So, bauxite, and not clay, is an ore of aluminium.

Halide ore is

- A. Cinnabar
- B. galena
- C. calamine
- D. horn silver.

Answer: D



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4. Metals occur in nature in the free as well as in the combined state. The less reactive metals are generally found in the free state. Most of the metals, however are found in the combined form as minerals. The minerals from which metals can be obtained on a commercial scale are called ores. In other words, the minerals from which metals can be extracted profitably are called ores. Thus, bauxite ($Al_2O_3 \cdot 2H_2O$) and

clay ($Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$) are minerals of aluminium. However, it is bauxite that is chiefly used to obtain aluminium commercially. So, bauxite, and not clay, is an ore of aluminium.

The most abundant metal on the earth's crust is

- A. copper
- B. aluminium
- C. iron
- D. zinc.

Answer: B



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5. The ore mined from the earth contains some unwanted substances called gangue. Enrichment of ore is done by various methods depending upon the nature of the impurities. Hydraulic washing is the process based on the difference in densities of ore and gangue particles. Froth floatation method is used for ores with different wetting properties of

ore and gangue particles. On adding sulphide ore in a mixture of oil and water, the sulphide particles are wetted by oil and gangue particles are wetted by water. On passing air in this mixture, sulphide ore particles form light oily froth and reach the surface whereas gangue particles settle down at the bottom. Few ores are enriched by chemical processes.

WHich method is used for the purification of bauxite ore ?

- A. Levigation
- B. leaching
- C. Electrolysis
- D. Magnetic separation

Answer: B

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6. The ore mined from the earth contains some unwanted substances called gangue. Enrichment of ore is done by various methods depending upon the nature of the impurities. Hydraulic washing is the process based

on the difference in densities of ore and gangue particles. Froth floatation method is used for ores with different wetting properties of ore and gangue particles. On adding sulphide ore in a mixture of oil and water, the sulphide particles are wetted by oil and gangue particles are wetted by water. On passing air in this mixture, sulphide ore particles form light oily froth and reach the surface whereas gangue particles settle down at the bottom. Few ores are enriched by chemical processes. In the froth, floatation process for the concentration of minerals, the ore particles float because

- A. they are light
- B. they are insoluble
- C. their surface is preferentially wetted by oil
- D. they bear an electrostatic charge.

Answer: C



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7. The ore mined from the earth contains some unwanted substances called gangue. Enrichment of ore is done by various methods depending upon the nature of the impurities. Hydraulic washing is the process based on the difference in densities of ore and gangue particles. Froth floatation method is used for ores with different wetting properties of ore and gangue particles. On adding sulphide ore in a mixture of oil and water, the sulphide particles are wetted by oil and gangue particles are wetted by water. On passing air in this mixture, sulphide ore particles form light oily froth and reach the surface whereas gangue particles settle down at the bottom. Few ores are enriched by chemical processes. The process in which lighter earthy particles are removed by jet of water is called

- A. leaching
- B. levigation
- C. froth floatation
- D. none of these.

Answer: B



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8. The ore mined from the earth contains some unwanted substances called gangue. Enrichment of ore is done by various methods depending upon the nature of the impurities. Hydraulic washing is the process based on the difference in densities of ore and gangue particles. Froth floatation method is used for ores with different wetting properties of ore and gangue particles. On adding sulphide ore in a mixture of oil and water, the sulphide particles are wetted by oil and gangue particles are wetted by water. On passing air in this mixture, sulphide ore particles form light oily froth and reach the surface whereas gangue particles settle down at the bottom. Few ores are enriched by chemical processes.

The rocky and silica matter associated with an ore is called

A. slag

B. mineral

C. gangue

D. flux.

Answer: C



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9. 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 like the behaviour shown by metals. Thus,



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

A. Zinc

B. Silver

C. Iron

D. Lead

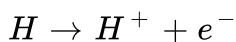
Answer: B



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10. 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 like the behaviour shown by metals. Thus,



An element 'X' after reacting with acids liberate hydrogen gas and can displace lead and tin from their salt solution. The metal 'X' is

A. copper

B. gold

C. nickel

D. hydrogen.

Answer: C

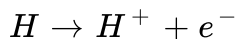


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11. The arrangement of metals in a vertical column in the decreasing order of their reactivities is called the reactivity series or activity series of metals. The most reactive metal is at the top position of the reactivity series. The least reactive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

shown by metals. Thus,



The most reactive metal is

A. Potassium

B. barium

C. sodium

D. calcium.

Answer: A

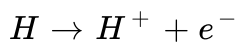


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12. The arrangement of metals in a vertical column in the decreasing order of their reactivities is called the reactivity series or activity series of metals. The most reactive metal is at the top position of the reactivity series. The least reactive 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 like the behaviour shown by metals. Thus,



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

A. zinc

B. lead

C. tin

D. gold.

Answer: D



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13. 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 like the behaviour shown by metals. Thus,



The only non-metal involved in activity series of metal is

- A. sulphur
- B. chlorine
- C. hydrogen
- D. magnesium.

Answer: C



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14. Corrosion may be defined as the process of slow eating up of a metal by the gases and water vapours present in air due to formation of certain chemical compounds.

Corrosion is favoured by the following factors:

(i) Position of metal in the reactivity series: Active metals placed above hydrogen in the reactivity series are easily corroded as compared to the metals which are placed below hydrogen.

(ii) Air and moisture: The presence of water vapours and gases like CO_2 , SO_2 etc. in air helps the process of corrosion.

(iii) Uneven metal surface: If the surface of metal is uneven, it will have certain depressions. Water drops will stick in these and take part in the chemical process leading to corrosion.

(iv) Presence of salts: Presence of salts or electrolytes in water promotes corrosion. For example, rusting of iron is faster in sea water (also called saline water) than in ordinary water or distilled water.

Chemically rust is

A. hydrated ferrous oxide

B. hydrated ferric oxide

C. only ferric oxide

D. none of these.

Answer:



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15. Corrosion may be defined as the process of slow eating up of a metal by the gases and water vapours present in air due to formation of certain chemical compounds.

Corrosion is favoured by the following factors:

- (i) Position of metal in the reactivity series: Active metals placed above hydrogen in the reactivity series are easily corroded as compared to the metals which are placed below hydrogen.
- (ii) Air and moisture: The presence of water vapours and gases like CO_2 , SO_2 etc. in air helps the process of corrosion.
- (iii) Uneven metal surface: If the surface of metal is uneven, it will have certain depressions. Water drops will stick in these and take part in the chemical process leading to corrosion.
- (iv) Presence of salts: Presence of salts or electrolytes in water promotes corrosion. For example, rusting of iron is faster in sea water (also called

saline water) than in ordinary water or distilled water.

Following processes are very common for checking rusting of iron

A. galvanisation

B. tinning

C. electroplating

D. all of these.

Answer:



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16. Corrosion may be defined as the process of slow eating up of a metal by the gases and water vapours present in air due to formation of certain chemical compounds.

Corrosion is favoured by the following factors:

(i) Position of metal in the reactivity series: Active metals placed above hydrogen in the reactivity series are easily corroded as compared to the metals which are placed below hydrogen.

(ii) Air and moisture: The presence of water vapours and gases like CO_2 , SO_2 etc. in air helps the process of corrosion.

(iii) Uneven metal surface: If the surface of metal is uneven, it will have certain depressions. Water drops will stick in these and take part in the chemical process leading to corrosion.

(iv) Presence of salts: Presence of salts or electrolytes in water promotes corrosion. For example, rusting of iron is faster in sea water (also called saline water) than in ordinary water or distilled water.

Copper and silver get corroded in air by developing a coloured. layer. The colour of the layers respectively is

A. green and black

B. brown and black

C. green and blue

D. black and green.

Answer:



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1. Which metal is a constituent of green colouring matter in plants ?

What is the name of this matter ?

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2. Out of zinc and iron, which evolves hydrogen more readily on reacting with dilute HCl ?

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3. How do alloys brass and bronze differ in composition ?

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4. Name the non-metal which can conduct electricity.

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5. Write the names of two neutral oxides.

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6. Arrange the following metals in order of their decreasing reactivity: Fe, Zn, Ca, Mg, Cu, Ag.

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7. Which is the name of the bond formed when a metal atom combines with the atom of a non-metal ?

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8. The electronic configuration of two elements A and B are 2, 8, 2 and 2, 6 respectively. What is the compound formed when they combine?



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9. If vapours of dry ammonia gas are brought in contact with red litmus strip, what will happen to the colour of the litmus strip?



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10. Why can metals conduct electricity?



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11. Name two non-metals which exist in the solid state the two non-metals which exist in the gaseous state.



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12. Name two metals which do not react with oxygen even at high temperature.

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13. Why oxides of highly reactive metals cannot be reduced by carbon ?

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14. Why are non-metals brittle ?

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15. Name the non-metal which is lustrous.

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Exercise Subjective Problems Short Answer Type

1. Name the properties of metals used in the following cases :

- (a) Aluminium foil
- (b) Metal jewellery
- (c) Cable wires
- (d) Bells

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2. What is anodising ? Why is it done ?

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3. What happens when Mg and Al reacts with dil. HCl ? Give reaction.

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4. Would it be right to store :

(a) A solution of $AgNO_3$ in Cu vessel ?

(b) A solution of $ZnSO_4$ in Pb vessel ?

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5. Why is iron galvanised with zinc ? Can it be galvanised with copper ? If not, why ?

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6. Write the chemical equations showing roasting and calcination of zinc ores.

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7. What reaction takes place when manganese dioxide is heated with aluminium powder ?

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8. Give examples of few metal oxides which are reduced by aluminium. Why they cannot be reduced by carbon?

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9. An ore on heating in air produces sulphur dioxide. Which process would you suggest for its concentration ? Describe briefly any two steps involved in the conversion of this concentrated ore into related metal.

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10. Give reasons for the following:

(a) Zinc can displace copper from copper sulphate solution.

(b) Silver articles become black after sometime when exposed to air.

(c) A metal sulphide is converted to its oxide to extract the metal from a sulphide ore.



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11. A is an element which is amongst Cu, Zn, Al and Fe. It shows following properties :

(a) One of its ore is rich in A_2O_3 .

(b) A_2O_3 is not affected by water.

(c) IF forms two chlorides $AcCl_2$ and $AcCl_3$ Identify A.



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12. An ore gives carbon dioxide on treatment with a dilute acid. What steps will you take to convert such a concentrated ore into free metal?



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13. (a) Name a liquid metal which is good conductor of electricity?

(b) If pure water is used, no electrolysis takes place. Why?



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14. An element E combines with oxygen to form an oxide E_2O which is a good conductor of electricity. Give the following information :

(a) How many electrons will be present in the valence shell of element E ?

(b) Write the formula of the compound formed when the element E combines with chlorine.



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15. Give four properties of electrovalent compounds.



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Exercise Subjective Problems Long Answer Type

1. Explain the factors which promote corrosion.

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2. How does formation of alloys improve the properties of metals ?

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3. Why is galvanisation considered better than tinning?

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4. What is alloying of gold? Why is it done? What is meant by 24 carat gold?

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5. (a) Write the steps involved in the extraction of pure metals in the middle of the activity series from their carbonate ores.

(b) How is copper extracted from its sulphide ore? Explain the various steps supported by chemical equations.

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6. Define an alloy and an amalgam. State the main constituents of the following alloys: Stainless steel, bronze. In which property is each of them different from its main constituent?

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7. Explain extraction of magnesium by electrolytic reduction method.

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8. Give reasons for the following :

(a) Silicon counts among metalloids.

(b) Carbon is not used for making aluminium from aluminium oxide.

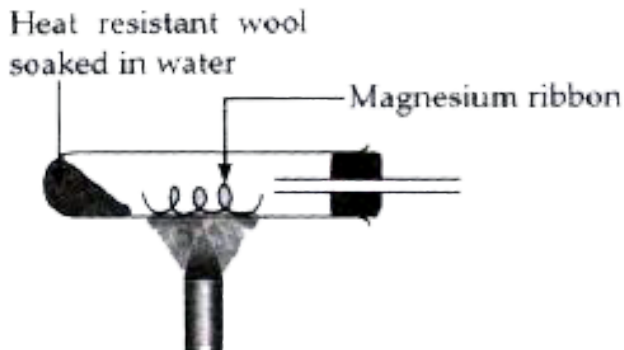
(c) Metals conduct electricity.

(d) For making gold ornaments, 22-carat gold is preferred to 24-carat gold.

(e) Na, K and Ca metals form hydrides by combination with hydrogen gas, but most of the other metals do not.

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9. Magnesium reacts with steam to form magnesium oxide and a gas.



(a) Name the gas formed during the reaction.

(b) Complete the above diagram to show how the gas could be collected.

(c) Describe a test for the gas and state the result you would expect to obtain.



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10. What happens when

(a) Calcium reacts with water

(b) Iron reacts with steam

(c) Magnesium reacts with hot water

(d) Sodium reacts with water

Arrange the above metals in order of decreasing activity.



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Exercise Integer Numerical Value Type

1. The composition of aqua-regia is x parts of conc. HCl and y parts of conc. HNO_3 . The value of $x + y$ is

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2. The number of metals among the following element are

$$\frac{24}{12}X, \frac{19}{9}Y, \text{ and } \frac{31}{15}Z$$

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3. How many elements are solid non-metals among the following elements ?

Carbon, nitrogen, chlorine, helium, phosphorus, sulphur and iodine

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4. How many elements are alkali metals ?

How many elements are alkali metals ?

Magnesium, sodium, potassium, aluminium, silicon, lithium

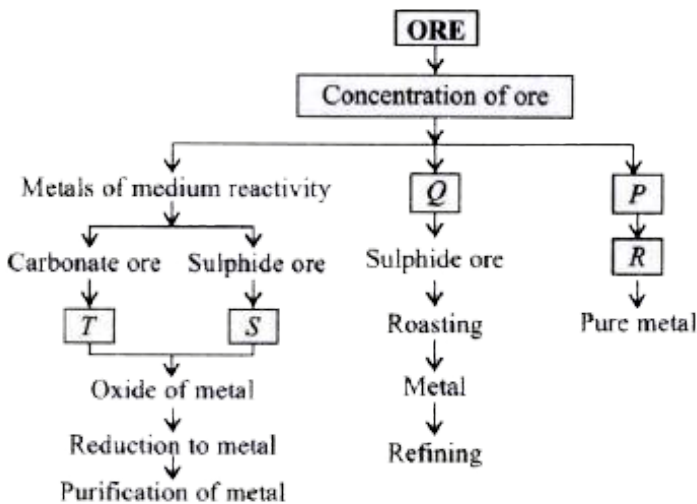
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5. Number of major oxides known of potassium are

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Olympiad Hots Corner

1. Metals are extracted from their ores by different methods depending on their position in the activity series



Match the Column-I with Column-II and select the correct option from the codes given below.

Column-I

- (A) Highly reactive metals
- (B) Calcination
- (C) Electrolytic reduction
- (D) Less reactive metal
- (E) Roasting

Column-II

- (i) S
- (ii) T
- (iii) P
- (iv) Q
- (v) Q

A. (A)-(v), (B)-(ii), (C)-(iv), (D)-(iii), (E)-(i)

B. (A)-(iv), (B)-(ii), (C)-(v), (D)-(iii), (E)-(i)

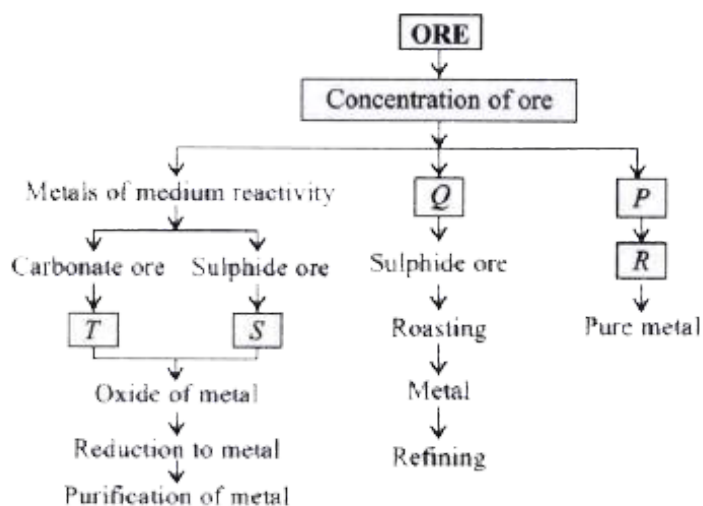
C. (A)-(iii), (B)-(ii), (C)-(iv), (D)-(v), (E)-(i)

D. (A)-(i), (B)-(ii), (C)-(v), (D)-(iii), (E)-(iv)

Answer: C

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2. Metals are extracted from their ores by different methods depending on their position in the activity series



Metals which are extracted by heating, electrolysis and by reduction with carbon respectively are

A. Copper, magnesium, zinc

B. Mercury, aluminium, lead

C. Mercury, sodium, calcium

D. Both (a) and (b)

Answer: D

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3. Which one of the following oxides gives pink colour with phenolphthalein indicator in aqueous solutions ?

A. N_2O

B. NO

C. CaO

D. CO_2

Answer: C

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4. Solder is an alloy of

A. Cu + Zn

B. Pb + Sn

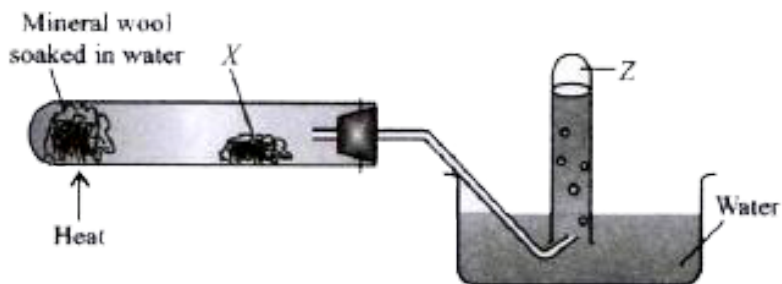
C. Pb + Sb

D. Cu + Sn

Answer: B

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5. The given apparatus shows the reaction of steam with heated solid 'X'.



The equation for the reaction is

Steam + solid 'X' \rightarrow Solid 'Y' + Gas 'Z'

X, Y and Z are respectively

A. copper, copper oxide, oxygen

B. lead, lead oxide, hydrogen

C. silver, silver oxide , oxygen

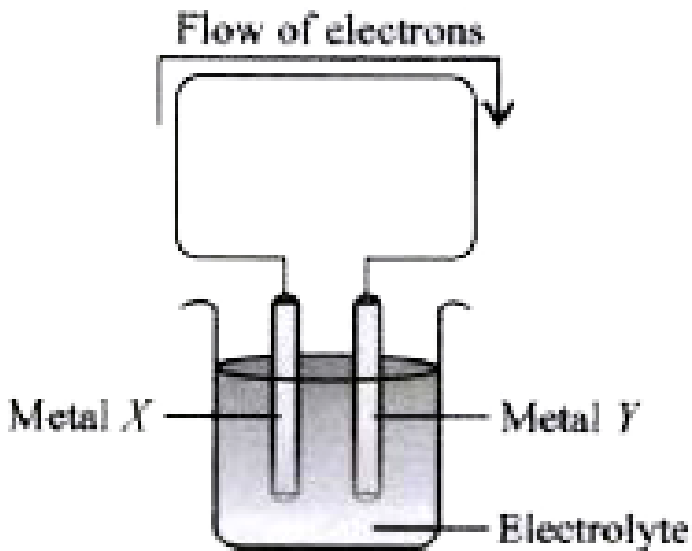
D. iron, iron oxide, hydrogen

Answer: D



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6. Observe the given figure carefully.



For which pair of metals would electrons flow in the direction shown ?

- A. Metal X Metal Y
Copper Zinc
- B. Metal X Metal Y
Iron Aluminium
- C. Metal X Metal Y
Iron Magnesium
- D. Metal X Metal Y
Zinc Silver

Answer: D



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7. Which gas is released when a metal reacts with an acid ?

A. Cl_2

B. O_2

C. H_2

D. SO_2

Answer: C



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8. When in the blue solution of Copper sulphate zinc strip is dipped, after some time the colour changes to

A. pink

B. green

C. colourless

D. remains blue.

Answer: C

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9. Extraction of highly electropositive metal is done by

A. electrolysis of aqueous solution of metal chloride

B. electrolysis of molten metal chloride

C. carbon reduction of the oxide of the metal

D. strongly heating the oxide of the metal.

Answer: B

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10. Some properties of substances P, Q, R and S are given in the table :

Substance	M. pt. ($^{\circ}\text{C}$)	B.pt. ($^{\circ}\text{C}$)	Electrical conductivity
P	44	280	Good
Q	-7.2	59	Poor
R	-101	-35	Poor
S	-39	357	Good

Which of the given substances represents a gaseous non-metal at room temperature ?

A. P

B. R

C. Q

D. S

Answer: B



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11. Match column-I with column-II and select the correct option using the given codes.

Column-I

P. A metal that forms two types of oxides

Q. A metal used in hot water apparatus

R. A metal which can displace hydrogen from steam only

S. A metal that does not react with air even at high temperature

Column-II

(i) Cu

(ii) Ag

(iii) Fe

(iv) Zn

A. P-(ii), Q-(i), R-(iii), S-(iv)

B. P-(iii), Q-(i), R-(iii), S-(iv), S-(ii)

C. P-(iv), Q-(ii), R-(iii), S-(i)

D. P-(iii), Q-(ii), R-(i), S-(iv), (ii)

Answer: B



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12. Ms. Neelam, a class 10 teacher took Cu, Al, Pb and Zn strips respectively in four test tubes labelled as, I, II, III and IV and added 10 mL of freshly prepared ferrous sulphate solution to each test tube as shown in the

figure :



Black residue would be obtained in test tubes

- A. I and II only
- B. I and III only
- C. II and III only
- D. II and IV only.

Answer: D



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13. Which reagent is able to dissolve gold and platinum ?

- A. Nitric acid
- B. Aqua-regia
- C. Hydrochloric acid
- D. Sulphuric acid

Answer: B



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14. Amalgam is

- A. alloy
- B. submetal
- C. compound
- D. heterogeneous mixture.

Answer: B

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15. A few chemical properties of three metals X, Y and Z are summarised in the given table.

Metal	Chemical properties
X	Reacts with hot water and starts floating on the surface of water
Y	Reacts with steam
Z	Does not react with dilute acids as well as steam

The methods which can be used to extract X, Y and Z from their ores are respectively

- A. electrolysis, reduction with carbon and heating alone
- B. heating with carbon, aluminothermy and electrolysis
- C. calcination, aluminothermy and roasting
- D. heating the metal oxide, heating with carbon and electrolysis.

Answer: A

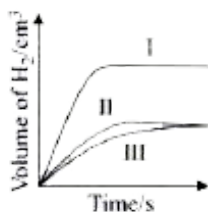
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16. Mitaali, a class 10 student wanted to study the speed of reactions of different acids with zinc metal. For this, she conducted the following experiments using zinc metal in excess.

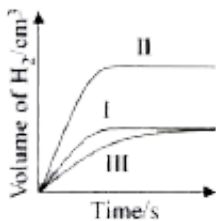
Experiment	Acid used
I.	100 mL of 0.2 mol/L HCl
II.	100 mL of 0.2 mol/L H_2SO_4
III.	100 mL of 0.2 mol/L CH_3COOH

She measured the volume of H_2 gas produced at regular time intervals and summarised her results in a graphical form.

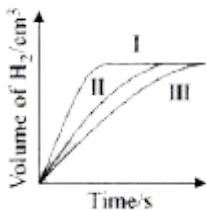
Which of the following graphs best represents the results obtained in experiments I, II and III?



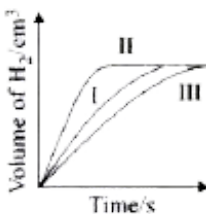
A.



B.



C.



D.

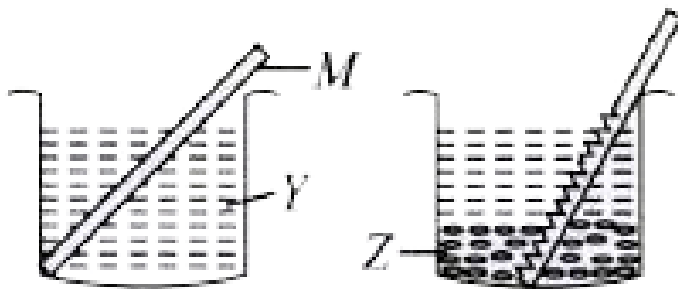
Answer: B



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17. A metal rod M was dipped in a coloured solution Y. After some time it was observed that the metal rod starts dissolving in the solution and the solution starts fading in colour. However, a coloured precipitate Z was

seen at the bottom of the beaker. M, Y and Z could be



- A. $M = Zn$, $Y = FeSO_4$, $Z = Fe$
- B. $M = Cu$, $Y = Al_2(SO_4)_3$, $Z = Al$
- C. $M = Ag$, $Y = CuSO_4$, $Z = Cu$
- D. $M = Fe$, $Y = ZnSO_4$, $Z = Zn$

Answer: A

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18. _____ is a non-metal but is lustrous.

A. Carbon

B. Sulphur

C. iodine

D. bromine

Answer: c



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19. Main objective of smelting of ore is

A. to oxidise ore

B. to reduce ore

C. to remove volatile impurities

D. alloy formation.

Answer: B



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20. A metal X is placed below Al and above Pb, in activity series. The extraction of metal is done by reacting carbon with its oxide. Metal oxide is used to join cracks of machine parts and rail lines by reacting it with Al.

The metal is

A. Zn

B. Cu

C. Fe

D. Mg

Answer: C



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