

NSO - National Science Olympiad

Metals and Non-metals

1. Properties of substances W, X, Y and Z are listed below:

W: A liquid metal

X: A liquid non-metal

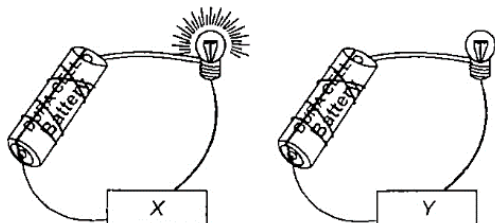
Y: Gaseous non-metal

Z: A non-metal which conducts electricity.

W, X, Y and Z are respectively

- Iron, iodine, hydrogen and oxygen
- Gold, sulphur, chlorine and hydrogen
- Copper, phosphorus, nitrogen and carbon
- Mercury, bromine, oxygen and graphite.

2. Materials 'X' and 'Y' in the figure are



X	Y
(a) Aluminium foil	Pencil lead
(b) Pencil lead	Copper block
(c) Pencil lead	Wooden block
(d) Copper block	Pencil lead

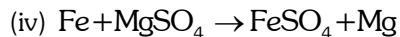
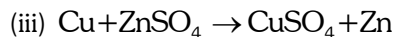
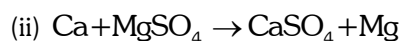
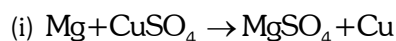
3. An unknown metal X when placed in copper sulphate solution, red brown pieces of copper fall to the bottom of the test tube. When metal X is placed in aluminium sulphate solution, no change is observed. Metal X can be

- Sodium
- Potassium
- Iron
- Calcium.

4. Substance X reacts with dilute HCl violently, Y reacts slowly while Z does not react at all. X, Y and Z could be respectively

- Cu, Al, Fe
- Al, Na, Cu
- Na, Cu, Fe
- K, Al, Cu

5. Which of the following reactions are possible?



- (iii) and (iv) only
- (i) and (iv) only
- (ii) and (iii) only
- (i) and (ii) only

6. Match column I with column II and select the correct option from the codes given below.

	Column I	Column II
(A)	A non-metal, essential for respiration	(i) Graphite
(B)	A non-metal, the source of energy in Sun	(ii) Silicon
(C)	A non-metal, good conductor of electricity	(iii) Oxygen
(D)	A non-metal, used in semiconductors	(iv) Hydrogen

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

7. Which of the following statements is incorrect?

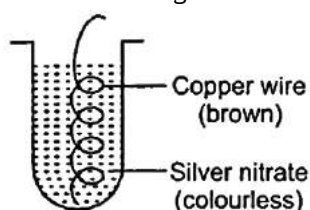
- Gold and silver are the most malleable and ductile metals.
- All metals are hard and strong.
- Mercury and gallium are metals which exist in liquid state at room temperature.
- Most of the metals have high specific gravities.

8. What will happen if you keep a solution of copper sulphate in an iron container for a few days? What is the reason for your observation?

- The surface of iron container will develop a green layer due to corrosion caused by copper sulphate.
- Copper metal will be deposited in iron container since copper is more reactive than iron.
- Nothing will happen since no reaction takes place between copper sulphate and iron.
- Holes will be formed in the container since iron is more reactive than copper hence iron displaces copper from a solution of copper sulphate.

9. Kanika takes a burning substance and collects the evolved vapours in a test tube, making sure that they do not escape. A small amount of water is added to the test tube. To the solution obtained, a few drops of blue litmus solution are added. The litmus solution turns red. Which of the following could be the burning substance?
- (a) Mg (b) S
(c) Na (d) Fe

10. Vidisha placed a copper wire in silver nitrate solution as shown in the figure.



Which of the following represents the correct observation?

- (a) The colour of the solution turned blue and precipitate of solid silver was obtained.
(b) Colour of solution turned green and copper wire turned blue.
(c) There was no change in the colour of solution or colour of the wire.
(d) Colour of the solution became silver and there was no change in the colour of copper wire.
11. Read the following statements carefully and identify X, Y and Z respectively.
- (i) X is stored under kerosene.
(ii) Y catches fire on exposure and stored in water.
(iii) Z reacts with steam.
- (a) Na, Mg, Cu (b) Na, P, Fe
(c) Cu, Zn, K (d) Zn, Cu, Na

12. Read the given statements and select the correct option.
- Statement 1:** Silver objects become green and lose their shine with the passage of time.
Statement 2: Silver reacts with carbon dioxide and moisture present in the atmosphere.
- (a) Both statements 1 and 2 are true and statement 2 is the correct explanation of statement 1.

- (b) Both statements 1 and 2 are true but statement 2 is not the correct explanation of statement 1.
(c) Statement 1 is true and statement 2 is false.
(d) Both statements 1 and 2 are false.

13. Mr. Ramakant, a science teacher organised a quiz in the class. He stated few applications of non-metals and asked students to guess the names of the non-metals. Mark the correct option.
- (a) Non-metals used in fertilisers-K, Cl
(b) Non-metal used in water purification process-Br
(c) Non-metal used in crackers-N
(d) Non-metal used as an antiseptic-I

14. Read the given passage and fill in the blanks by choosing an appropriate option. Non-metals find wide applications in industries. For example i is used in electrodes, ii is used in welding metals, iii is used to make antiseptic creams while iv is used as a preservative due to its inert nature.

(i)	(ii)	(iii)	(iv)
(a) Carbon	Hydrogen	Chlorine	Phosphorus
(b) Hydrogen	Oxygen	Chlorine	Nitrogen
(c) Graphite	Hydrogen	Sulphur	Nitrogen
(d) Phosphorus	Sulphur	Oxygen	Carbon

15. The oxide of sulphur (which can be further oxidised) when dissolved in water gives
- (a) H_2S (b) H_2SO_3
(c) H_2SO_4 (d) H_2

Achievers Section (HOTS)

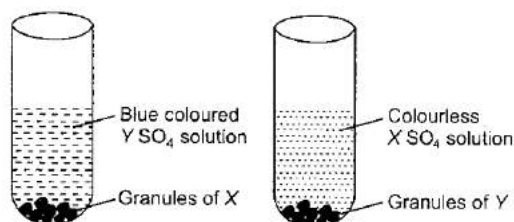
16. Study the given table carefully and select the appropriate option.

Sample	Conductor of Electricity	Malleability
I	✓	×
II	×	✓
III	×	✓
IV	✓	✓

- (a) I is copper; II is sulphur

- (b) II is sulphur; III is coal
 (c) III is iron; IV is copper
 (d) II is coal; IV is copper

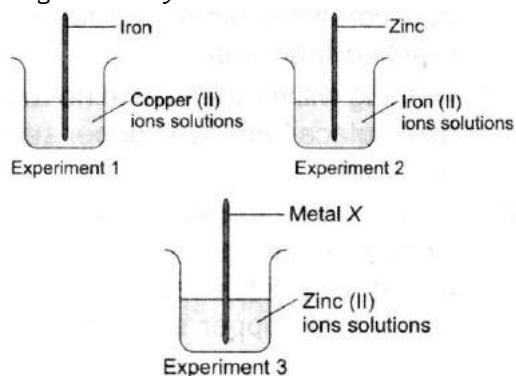
17. Observe the given figure carefully.



X and Y respectively are

- (a) Zn and Ag (b) Au and Cu
 (c) Fe and Cu (d) Zn and Cu

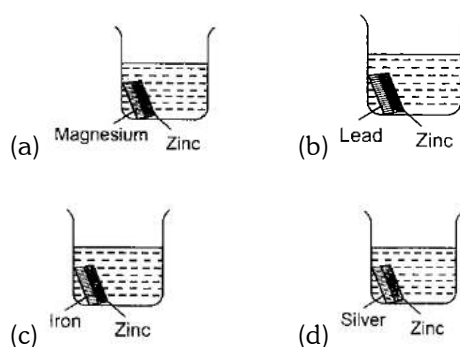
18. Aditya, a class 8 student investigated the reactivity of four metals, iron, copper, zinc and an unknown metal X. He arranged three experimental set-ups as shown in the diagram and observed the changes carefully.



If reactions occur in all the three beakers then, the metal X is

- (a) Cu (b) Mg
 (c) Fe (d) Au

19. Each beaker contains two metal strips of same size fastened together and immersed in hydrochloric acid. After 5 minutes, which beaker will contain the least amount of zinc ions?



20. Fill in the blanks with the most appropriate option.

'W' is very reactive metal, reacts vigorously with oxygen and water therefore, stored in (1).

'X' is non-metal, soft and dull and forms (2) oxides with oxygen.

'Y' is very reactive (3), catches fire if exposed to air, therefore, stored in water. 'Z' does not react with dilute hydrochloric acid even on heating but it reacts with sulphuric acid. When it is exposed to moist air for long, it acquires a dull (4) coating.

- (a) 1 -Water, 2-basic, 3-metal, 4-reddish brown
 (b) 1-Kerosene, 2-acidic, 3-metal, 4-reddish brown
 (c) 1-Kerosene, 2-acidic, 3-non-metal, 4-green
 (d) 1-Water, 2-basic, 3-non-metal, 4-green

Answer key

1. D

2. C

3. C

4. D

5. D

6. A

7. B

8. D

9. B

10. A

11. B

12. D

13. D

14. C

15. B

16. D

17. D

18. B

19. A

20. C

HINTS & EXPLANATIONS

1. (d) Not Available
2. (c) Not Available
3. (c) : Iron is more reactive than copper hence, it displaces copper from copper sulphate solution but iron is less reactive than aluminium hence, no reaction takes place with aluminium sulphate.
4. (d): More reactive metals like Na, K react violently with dilute acids. Reaction is slower for less reactive metals and, copper, silver and gold do not react with acids.
5. (d) : As per reactivity series, the reactivity order is $\text{Ca} > \text{Mg} > \text{Zn} > \text{Fe} > \text{Cu}$.
Hence, only reactions (i) and (ii) are possible as more reactive metal can displace a less reactive metal from its salt.
6. (a) Not Available
7. (b) : Sodium and potassium are soft metals and can be easily cut with a knife.
8. (d): $\text{Fe} + \text{CuSO}_4 \rightarrow \text{FeSO}_4 + \text{Cu}$
9. (b) : As the solution turns blue litmus red so, it is an acidic solution. On burning metals and non-metals, their oxides are formed.
Non-metals form acidic oxides. Therefore, the substance which Kanika burned must be a non-metal (here Mg, Na and Fe are metals while S is a non-metal).
10. (a) : Copper is more reactive than silver so, it displaces silver from silver nitrate solution and blue coloured copper nitrate solution is formed.
11. (b) : Sodium reacts vigorously with oxygen and water, giving off a lot of heat so, it is stored in kerosene.
Phosphorus catches fire on exposure to air and hence, stored in water.
Iron reacts with steam.
12. (d) : Silver objects become blackened and lose their shine with the passage of time. This happens due to reaction of silver with hydrogen sulphide gas present in the atmosphere.
13. (d) : Non-metals used in fertilisers-N, P; in water purification process-Cl; in crackers-S, P.
14. (c) Not Available
15. (b)

S	+	O ₂	→	SO ₂
<i>sulphur</i>		<i>oxygen</i>		<i>Sulphur dioxide</i>
SO ₂	+	H ₂ O	→	H ₂ SO ₃
<i>Sulphur dioxide</i>		<i>water</i>		<i>Sulphurous acid</i>
16. (d) : Metals show malleability and are good conductors of heat and electricity. While, non-metals are non-malleable but are brittle and bad conductors of heat and electricity. So, II is a non-metal and IV is a metal.
17. (d) : Zinc is more reactive than copper so, Zn displaces Cu from its blue, CuSO₄ solution and forms colourless, ZnSO₄ solution.

$$\underset{\text{(X)}}{\text{Zn}} + \underset{\text{(Blue)}}{\text{CuSO}_4} \rightarrow \underset{\text{(Colourless)}}{\text{ZnSO}_4} + \underset{\text{(Y)}}{\text{Cu}}$$
18. (b) : Metal X should be more reactive than Zn to displace Zn from ZnSO₄ solution. Among the metals given, Mg is more reactive than Zn while Cu, Fe and Au are less reactive than Zn.
19. (a) : Magnesium is more reactive than zinc, so magnesium reacts with hydrochloric acid while zinc remains as it is. Zinc is more reactive than lead, iron and silver so, zinc reacts with hydrochloric acid to form Zn²⁺ ions.
20. (c) Not Available