

Chemical Reactions and Equations

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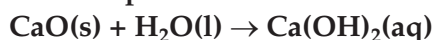
Objective Section _____ (1 marks each)

- Q. 1. In which of the following, the identity of initial substance remains unchanged?
- (a) Curdling of milk
 - (b) Formation of crystals by process of crystallisation
 - (c) Fermentation of grapes
 - (d) Digestion of food

[CBSE OD, Set 1, 2020]

Ans. (b) Formation of crystals by process of crystallisation.

- Q. 2. Calcium oxide reacts vigorously with water to produce slaked lime.



This reaction can be classified as:

- (A) Combination reaction
- (B) Exothermic reaction
- (C) Endothermic reaction
- (D) Oxidation reaction

[CBSE Delhi, Set 1, 2020]

Which of the following is a correct option?

- (a) (A) and (C)
- (b) (C) and (D)
- (c) (A), (C) and (D)
- (d) (A) and (B)

Ans. (d) (A) and (B).

- Q. 3. When hydrogen sulphide gas is passed through a blue solution of copper sulphate, a black precipitate of copper sulphide is obtained and the sulphuric acid so formed remains in the solution. The reaction is an example of a:

[CBSE Delhi, Set 1, 2020]

- (a) Combination reaction
- (b) Displacement reaction
- (c) Decomposition reaction
- (d) Double displacement reaction

Ans. (a) Combination reaction

- Q. 4. In a double displacement reaction such as the reaction between sodium sulphate solution and barium chloride solution:

[CBSE Delhi, Set 1, 2020]

- (A) exchange of atoms takes place
- (B) exchange of ions takes place
- (C) a precipitate is produced
- (D) an insoluble salt is produced

The correct option is:

- (a) (B) and (D)
- (b) (A) and (C)
- (c) only (B)
- (d) (B), (C) and (D)

Ans. (d) (B), (C) and (D)



Very Short Answer Type Questions _____ (1 marks each)

- Q. 1. Aqueous solution of which of the following is colourless?

- (a) FeSO_4
- (b) ZnSO_4
- (c) $\text{Al}_2(\text{SO}_4)_3$
- (d) Both (b) and (c)

[CBSE, Term 1, Set 1, 2015]

Ans. (d) Both (b) and (c)

- Q. 2. Which of the following solution is coloured?

- (a) ZnSO_4
- (b) FeSO_4
- (c) $\text{Al}_2(\text{SO}_4)_3$
- (d) Na_2SO_4

[CBSE, Term 1, Set 1, 2015]

Ans. (b) FeSO_4



Short Answer Type Questions-1 _____ (2 marks each)

Q. 1. In the experimental set up to show that "CO₂ is given out during respiration", name the substance taken in the small test tube kept in the conical flask. State its function and the consequence of its use. [CBSE Delhi, Set 1, 2019]

Ans. The chemical kept in the test tube is KOH–Potassium hydroxide. The function of this chemical is to absorb the vapours of CO₂.

Consequences: The water level rises in the test tube dipped.

Q. 2. What would a student report nearly after 30 minutes of placing duly cleaned strips of aluminium, copper, iron and zinc in freshly prepared iron sulphate solution taken in four beakers? [CBSE OD, Set 1, 2019]

Ans. Aluminium displaces the iron from iron sulphate and the colour of two solution changes from green to colourless.

No change takes place when copper strip is dipped in iron sulphate solution.

No change will be observed when iron strips are dipped in iron sulphate solution.

The colour of the solution changes from green to colourless when zinc is added to iron sulphate solution.

Q. 3. What is observed when a solution of sodium sulphate is added to a solution of barium chloride in a test tube? Write equation for the chemical reaction involved and name the type of reaction in this case. [CBSE, 2018]

Ans. $\text{Na}_2\text{SO}_4(\text{aq.}) + \text{BaCl}_2(\text{aq.}) \rightarrow \text{BaSO}_4\downarrow(\text{s}) + 2\text{NaCl}(\text{aq.})$
Sodium sulphate Barium chloride Barium sulphate Sodium chloride

It is an example of double displacement reaction.

Q. 4. A student added few pieces of aluminium metal to two test tubes A and B containing aqueous solution of iron sulphate and copper sulphate. In the second part of her experiment, she added iron metal to another test tube C and D containing aqueous solution

of aluminium sulphate and copper sulphate.

In which test tube or test tubes will she observe colour change? On the basis of this experiment state which one is the most reactive metal and why?

[CBSE, 2018]

Ans. Only in test tubes A, B and D she will observe colour change from green to colourless in A because aluminium is more reactive than iron, it will displace iron. She will observe colour change from green to colourless in test tube B. She will also observe colour change in test tube D from blue to light green. Aluminium is the most reactive metal because it displaces all the other three metals.

Q. 5. Rahul has been collecting copper coins and silver coins. One day he observed a green coating on copper coins and a black coating on silver coins. State the chemical phenomenon responsible for these coating and also write chemical names of each coating. [CBSE, Term 1, Set 1, 2016]

Ans. The chemical phenomenon responsible for the coatings is corrosion. Copper and silver metals in presence of moist air gets oxidised forming protective layer over them. Silver turns black due to the formation of silver sulphide (Ag₂S) while copper turns green due to the formation of a mixture of copper carbonate and copper hydroxide [CuCO₃·Cu(OH)₂].

Q. 6. While studying the double displacement reaction, the solutions of barium chloride and sodium sulphate are mixed together.

(i) What do you observe as soon as the two solutions are mixed together?

(ii) What will happen in the above observation made by you after ten minutes?

[CBSE, Term 1, Set 1, 2015]

Ans. (i) The reaction mixture becomes white in colour as a precipitate of BaSO₄ i.e. Barium sulphate is formed.

(ii) White precipitate settles down after 10 minutes.



Short Answer Type Questions-II _____ (3 marks each)

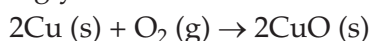
Q. 1. Mention with reason the colour changes observed when:

- silver chloride is exposed to sunlight.
- copper powder is strongly heated in the presence of oxygen.
- a piece of zinc is dropped in copper sulphate solution.

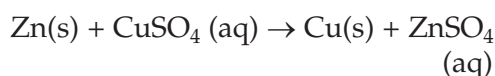
[CBSE, OD, Set 1, 2020]

Ans. (i) When silver chloride (white) is exposed to sunlight, it undergoes photochemical decomposition forming black metallic coloured silver and greenish yellow gas chlorine. Thus, the change in colour is observed due to the oxidation of silver chloride in the presence of sunlight.

- Heated copper metal reacts with oxygen to form the black copper oxide. Thus, the change in colour is observed when copper powder is strongly heated.



- On adding zinc to CuSO_4 solution, zinc displaces copper from copper sulphate and forms zinc sulphate solution. This is indicated by colour change from blue to colourless. CuSO_4 solution has a blue colour while ZnSO_4 solution is colourless.



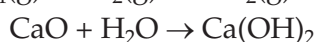
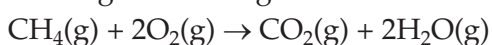
Q. 2. Identify the type of each of the following reactions. Also write balanced chemical equation for each reaction.

- A reaction in which the reaction mixture becomes warm.
- A reaction in which an insoluble substance is formed.

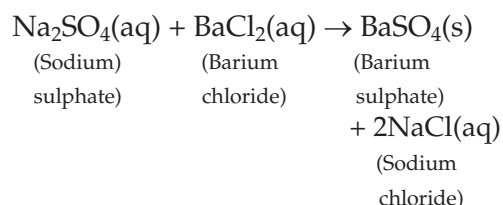
[CBSE, OD, Set 3, 2020]

Ans. (i) Reactions in which the reaction mixture becomes warm and heat is released along with the formation of products are called exothermic reactions. Example of exothermic reactions:

Burning of natural gas



- Reactions in which an insoluble substance is formed is known as precipitation reaction. For example: Solutions of barium chloride and sodium sulphate in water react to give insoluble barium sulphate and the solution of sodium chloride.



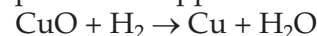
Q. 3. 1 g of copper powder was taken in a China dish and heated. What change takes place on heating? When hydrogen gas is passed over this heated substance, a visible change is seen in it. Given the chemical equations of reactions, the name and the colour of the products formed in each case.

[CBSE Delhi, Set 1, 2020]

Ans. When the copper powder is heated in a China dish, the copper powder surface becomes coated with black colour substance due to the formation of copper oxide by surface oxidation. Copper reacts with oxygen in the air upon heating and forms copper oxide. The black colour is due to the formation of this copper oxide.



When hydrogen gas is passed over hot copper oxide, the black coating on the surface turns brown as the reverse reaction takes place and copper is obtained.

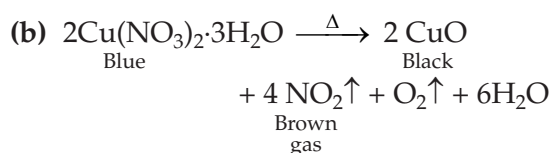


Q. 4. On heating blue coloured powder of copper (II) nitrate in a boiling tube, black copper oxide, O_2 and a brown gas X is formed.

- Identify the type of reaction and the gas X.
- Write balanced chemical equation of the reaction.
- Write the pH range of aqueous solution of the gas X.

[CBSE OD, Set 1, 2019]

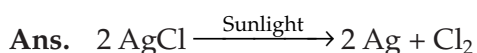
Ans. (a) Decomposition reaction
The gas X is nitrogen dioxide (NO_2)



(c) Oxides of non-metals are acidic. Therefore aqueous solution of NO_2 would be acidic. The pH would be less than 7 or 6.9.

Q. 5. 2 g of silver chloride is taken in a China dish and the China dish is placed in sunlight for sometime. What will be your observation in this case? Write the chemical reaction involved in the form of a balanced chemical equation. Identify the type of chemical reaction.

[CBSE Delhi, Set 1, 2019]



Initially the colour of silver chloride is white but when it is kept in sunlight it

Q. 7. You might have noted that when copper powder is heated in a China dish, the reddish brown surface of copper powder becomes coated with a black substance. [CBSE, 2019]

(a) Why has this black substance formed?

(b) What is this black substance?

(c) Write the chemical equation of the reaction that takes place.

(d) How can the black coating on the surface be turned reddish brown?

breaks down to give silver and chlorine. Hence, the colour changes to grey.

It is an example of photochemical decomposition.

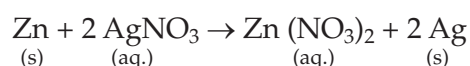
Q. 6. Identify the type of reactions taking place in each of the following cases and write the balanced chemical equation for the reactions.

(a) Zinc reacts with silver nitrate to produce zinc nitrate and silver.

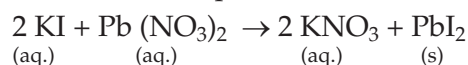
(b) Potassium iodide reacts with lead nitrate to produce potassium nitrate and lead iodide.

[CBSE Delhi, Set 1, 2019]

Ans. (a) The given reaction is a displacement reaction.



(b) It is a double displacement reaction.



Topper's Answers

9.

a) This black substance has been formed due to the oxidation of copper powder.

b) This black substance is ~~copper~~ Copper Oxide (CuO).

c)

$$\underset{\substack{\text{Copper} \\ \text{(reddish brown)}}}{2\text{Cu} (s)} + \underset{\substack{\text{(from} \\ \text{air)}}}{\text{O}_2 (g)} \xrightarrow{\text{Heat}} \underset{\substack{\text{Copper oxide} \\ \text{(black)}}}{2\text{CuO} (s)}$$

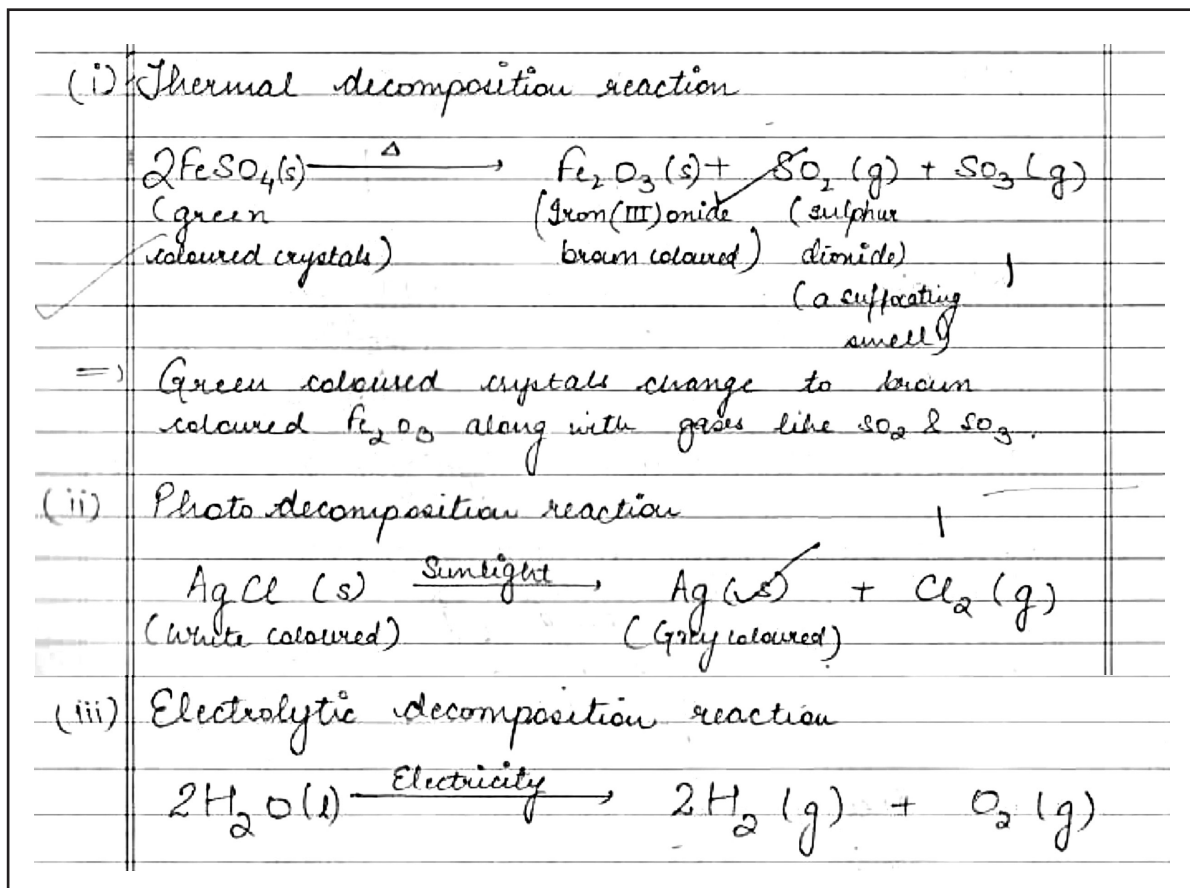
d) This black coating can be removed by treating the black compound with hydrogen.

$$\underset{\substack{\text{Copper} \\ \text{oxide} \\ \text{(black)}}}{\text{CuO} (s)} + \underset{\text{Hydrogen}}{\text{H}_2 (g)} \longrightarrow \underset{\substack{\text{Copper} \\ \text{metal} \\ \text{(shiny brown)}}}{\text{Cu} (s)} + \underset{\text{water}}{\text{H}_2\text{O} (l)}$$

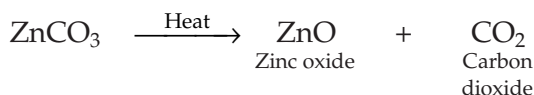
- Q. 8. Decomposition reactions require energy either in the form of heat or light or electricity for breaking down the reactants. Write one equation each for decomposition reactions where energy is supplied in the form of heat, light and electricity. [CBSE, 2018]



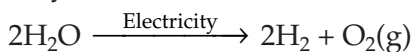
Topper's Answers



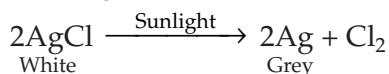
- Ans. Decomposition of zinc carbonate, when heat is applied.



Decomposition of water in presence of electricity:



Decomposition of silver chloride in presence of light:



- Q. 9. State the relationship between oxidation and oxidising agent in a redox reaction. Give an example of redox reaction showing the relationship between oxidation and oxidising agent.

[CBSE, Term 1, Set 1, 2016]

- Ans. Oxidation is addition of oxygen or removal of hydrogen. The oxidising agent causes oxidation of other compound by getting reduced itself.



CuO is getting reduced to Cu so it is an oxidising agent. It oxidises H_2 to H_2O .

- Q. 10. State which of the following chemical reactions will take place or not, giving suitable reason for each:

- (a) $\text{Zn}(\text{s}) + \text{CuSO}_4(\text{aq}) \rightarrow \text{ZnSO}_4(\text{aq}) + \text{Cu}(\text{s})$
 (b) $\text{Fe}(\text{s}) + \text{ZnSO}_4(\text{aq}) \rightarrow \text{FeSO}_4(\text{aq}) + \text{Zn}(\text{s})$
 (c) $\text{Zn}(\text{s}) + \text{FeSO}_4(\text{aq}) \rightarrow \text{ZnSO}_4(\text{aq}) + \text{Fe}(\text{s})$

[CBSE, Term 1, Set 1, 2016]

- Ans. (b) $\text{Fe}(\text{s}) + \text{ZnSO}_4(\text{aq}) \rightarrow \text{FeSO}_4(\text{aq}) + \text{Zn}(\text{s})$
 This chemical reaction is not possible, because Zn is more reactive than Fe so it cannot be replaced.

- Q. 11. (a) In electrolysis of water, why is the volume of gas collected over one electrode double that of gas collected over the other electrode?
- (b) (i) What is observed when a solution of potassium iodide is added to a solution of lead nitrate taken in a test tube?
- (ii) What type of reaction is this?
- (iii) Write a balanced chemical equation to represent the above reaction.
- [CBSE, Term 1, Set 2, 2015]

Ans. (a) In electrolysis of water (H_2O), the hydrogen goes to one test tube and oxygen goes to another. The two electrodes collect H and O separately. Since water (H_2O) consists of 2 parts of hydrogen and 1 part of oxygen, so the volume of hydrogen gas (H_2) collected over cathode (negative electrode) is double the volume of oxygen gas (O_2) collected over anode (positive electrode).

(b) (i) When potassium iodide solution is added to lead nitrate solution, then a yellow precipitate of lead iodide is produced along with potassium nitrate solution.

(ii) This is double displacement reaction.

(iii) $\text{Pb}(\text{NO}_3)_2 (\text{aq.}) + 2\text{KI} (\text{aq.}) \rightarrow$

Lead nitrate
Potassium iodide

$\text{PbI}_2 (\text{s}) + 2\text{KNO}_3 (\text{aq.})$

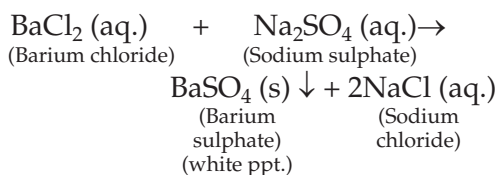
Lead iodide (yellow ppt)

- Q. 12. (a) What happens when an aqueous solution of sodium sulphate reacts with an aqueous solution of

barium chloride? State the physical conditions of reactants in which reaction between them will not take place. Write the balanced chemical equation for the reaction and also mention the type of reaction.

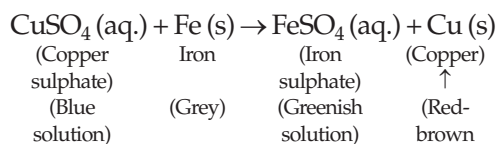
- (b) What changes in the colour of iron nails and copper sulphate solution do you observe after keeping the iron nails in copper sulphate solution for about half an hour?
- [CBSE, Term 1, Set 2, 2015]

Ans. (a) When barium chloride solution is added to sodium sulphate solution, then a white precipitate of barium sulphate is formed along with sodium chloride solution.



Reaction will not take place if the reactants are in a solid state.

- (b) When iron nails are dipped in copper sulphate solution, then iron sulphate solution and copper metal are formed.



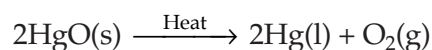
This displacement reaction occurs because iron is more reactive than copper. Also a brown substance will be deposited on the iron nail. This substance is nothing but copper metal.



Long Answer Type Questions _____ (5 marks each)

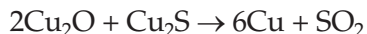
- Q. 1. Write balanced chemical equations to explain what happens, when
- (i) Mercuric oxide is heated.
- (ii) Mixture of cuprous oxide and cuprous sulphide is heated.
- (iii) Aluminium is reacted with manganese dioxide.
- (iv) Ferric oxide is reduced with aluminium.
- (v) Zinc carbonate undergoes calcination.
- [CBSE OD, Set 1, 2020]

Ans. (i) Cinnabar (HgS) is an ore of mercury. When it is heated in air, it is first converted into mercuric oxide (HgO). Mercuric oxide is then reduced to mercury on further heating.

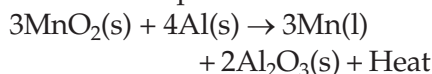


- (ii) When a mixture of copper oxide and copper sulphide is heated metallic copper is formed along with the evo-

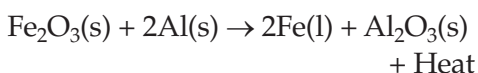
lution of the sulphur dioxide gas. The reaction equation is as follows:



- (iii) When aluminium powder is reacted with manganese dioxide, Manganese and aluminium oxide are formed with the evolution of heat and the following reaction takes place:

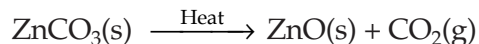


- (iv) When ferric oxide is reduced with aluminium a displacement reaction takes place and this reaction is highly exothermic. The amount of heat evolved is so large that the metals are produced in the molten state. In fact, the reaction of iron (III) oxide (Fe_2O_3) with aluminium is used to join railway tracks or cracked machine parts. This reaction is known as the thermite reaction.



- (v) The carbonate ores are changed into oxides by heating strongly in limited air. This process is known as

calcination. The chemical reaction that takes place during calcination of zinc ores can be shown as follows:



- Q. 2.** (a) Define corrosion. What name is given to the corrosion of iron?
(b) Name the colour of coating formed on silver and copper articles, when exposed to air?
(c) List two damages caused by corrosion and suggest how corrosion can be prevented.

[CBSE, Term 1, Set 1, 2016]

- Ans.** (a) Corrosion is a process by which an oxide layer is formed on a metal surface due to oxidation. The corrosion on iron is called rusting.
(b) Silver on exposure to air develops black coating and copper on exposure to air develops greenish coating.
(c) Damages caused by corrosion are:
(i) It reduces the strength of the metal.
(ii) It eats up the metal.

Prevention: Corrosion can be prevented by painting, galvanising, alloying or greasing.