Types Of Reactions & Changes – Experiment, Viva Voce

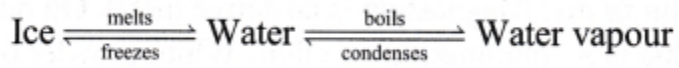
Experiment

Aim
To carry out the following chemical reactions and classify them as physical or chemical changes.

1. Iron with copper sulphate solution in water.
2. Burning of magnesium ribbon in air.
3. Zinc with dilute sulphuric acid.
4. Heating of copper sulphate.
5. Sodium sulphate with barium chloride in the form of their solutions in water.

Theory

1. **Physical Change:** When there is no change in the composition of a substance and no change in chemical nature of the substance, such change is called as physical change.
2. In physical change, the interconversion of state takes place. For example,



3. **Chemical Change:** It is a change which brings change in the chemical properties of matter and a new substance is obtained. For example, burning of oil, fuel.
4. In a chemical change – heat is evolved or taken in, formation of bubbles, gas, fumes takes place, there is a change in colour of the reactants when they form a product.

$$Reactants \longrightarrow Products$$
$$A + B \longrightarrow C(Chemical \quad reaction)$$

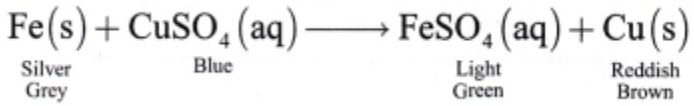
The chemical reactions are of four types:

1. Combination reaction: Two elements/compounds combine to form a single product.
2. Decomposition reaction: When a compound decomposes/breaks due to energy, heat, light or electricity to form simpler substance.

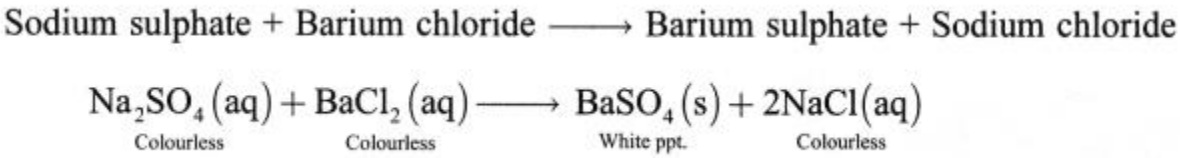
$$CaCO_3(s) \xrightarrow{heat} CaO(s) + CO_2(g)$$

$$2H_2O(l) \xrightarrow{electricity} 2H_2(g) + O_2(g)$$

3. Displacement reaction: It takes place when more reactive metal reacts with the salt of less reactive metal and displaces it to form a new compound.



4. Double displacement reaction: In this reaction when two salts are mixed together in solution form then exchange of ions takes place and a new product is obtained.
E.g.



Materials Required
Test tubes, test tube stand, test tube holder, a pair of tongs, Bunsen burner.

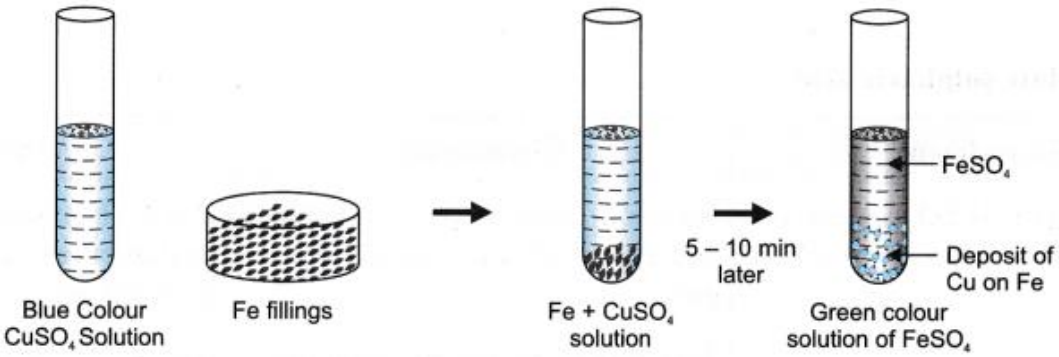
Chemicals Required
Iron filings, copper sulphate solution, magnesium ribbon, zinc granules, dilute sulphuric acid, sodium sulphate and barium chloride solutions and copper sulphate crystals.

Procedure

Iron with copper sulphate solution in water

Experiment	Observation	Inference
Take $CuSO_4$ solution in a test tube, add pinch of iron filings in it.	After 5–10 minutes the blue colour $CuSO_4$ solution changes into green colour. Iron filings gets coating of reddish brown copper metal.	Chemical change takes place, shows displacement reaction. Iron is more reactive than copper and it displaces Cu from $CuSO_4$ solution.

Reactions of Fe+$CuSO_4$

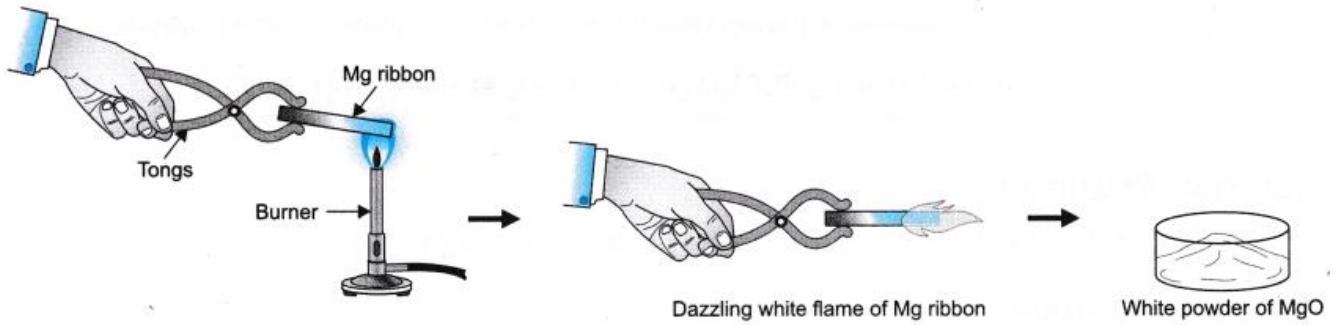


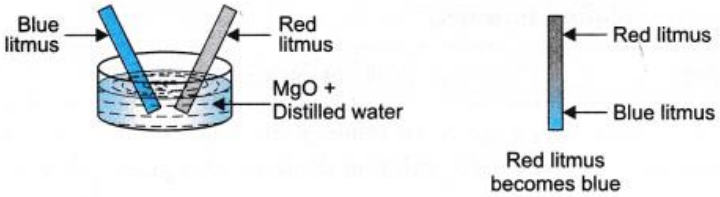
Reaction: $\underset{\text{Silver grey}}{Fe(s)} + \underset{\text{blue soln.}}{CuSO_4(aq)} \longrightarrow \underset{\text{light green}}{FeSO_4(aq)} + \underset{\text{reddish brown}}{Cu(s)}$

Burning of magnesium ribbon in air

Experiment	Observation	Inference
Hold a small piece of magnesium ribbon with a pair of tongs and burn it on Bunsen burner.	It burns with dazzling white flame and forms white powdery mass of magnesium oxide.	It is a chemical change, shows combination reaction.
	Add MgO (white powder) to a test tube containing water and test it with litmus paper.	Red litmus turns blue. $Mg(OH)_2$ is basic in nature.

Reaction of $Mg \quad + \quad O_2$





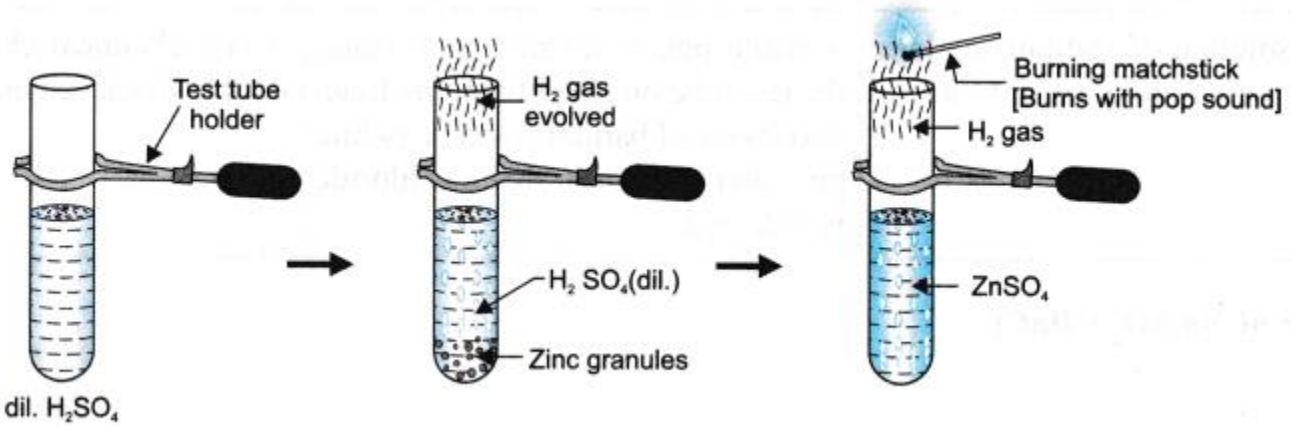
Reaction: (*i*) $\underset{\text{Silver colour}}{2Mg(s)} + O_2(g) \xrightarrow{\text{Heat}} \underset{\text{White powder mass}}{2MgO(s)}$

(*ii*) $MgO(s) + H_2O(l) \longrightarrow Mg(OH)_2(aq)$

Zinc with dilute sulphuric acid.

Experiment	Observation	Inference
Take 5 mL of dil. H_2SO_4 solution in a test tube and add a zinc granule in it.	Reaction takes place, tiny bubbles and a gas is released that is hydrogen gas. Test hydrogen gas by bringing a burning matchstick near the mouth of the test tube.	It is a chemical change and shows displacement reaction with heat evolving out. Hydrogen gas burns with a pop sound.

Reactions of $Zn \quad + \quad H_2SO_4$

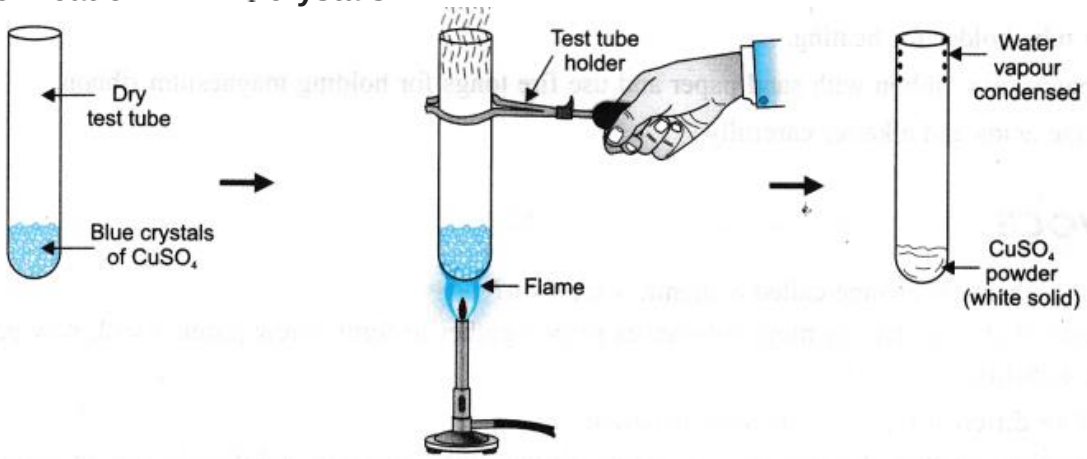


Reaction: Zn(s) + $Zn \quad + \quad H_2SO_4 \longrightarrow ZnSO_4(aq) + H_2(g)$

Heating of copper sulphate salt

Experiment	Observation	Inference
Heat copper sulphate crystals in a dry test tube	Water vapour comes out and condenses near the mouth of the test tube. Blue colour of crystals fades and turns into white powder.	$CuSO_4.5H_2O$ loses water of crystallisation.
Take small portion of white powder obtained in above reaction. Add water to it.	White solid powder will turn blue.	Copper sulphate is hydrated.

Reaction of heat on $CuSO_4$ crystals.



Reaction: On heating $CuSO_4.5H_2O$ crystals

$$\underset{\text{Blue crystals of copper sulphate}}{CuSO_4.5H_2O} \longrightarrow \underset{\text{anydrous copper sulphate}}{CuSO_4} + 5H_2O$$

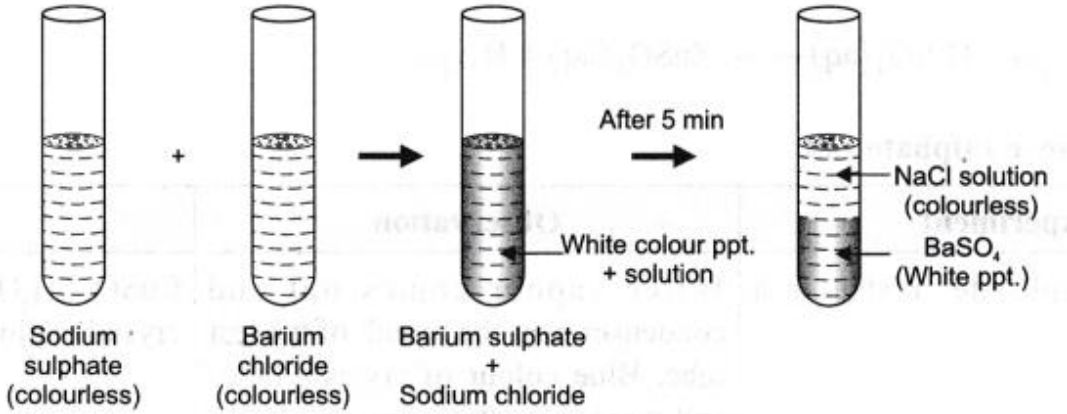
On adding water to white powder of anhydrous copper sulphate

$$\underset{\text{white solid}}{CuSO_4(s)} + \text{Water} \longrightarrow \underset{\text{blue solution}}{CuSO_4(aq)}$$

Reaction of sodium sulphate and barium sulphate solutions.

Experiment	Observation	Inference
Take a solution of sodium sulphate and barium chloride and mix it.	A white ppt. is formed on keeping the test tube on stand for some time, two layers of barium sulphate (white ppt.) and colourless sodium chloride is obtained.	It is a chemical change and shows double displacement reaction.

Reaction of $Na_2SO_4 + \quad BaCl_2$



Reaction: $Na_2SO_4(aq) + BaCl_2(aq) \longrightarrow \underset{\text{White ppt.}}{BaSO_4(s)} + 2NaCl(aq)$

Precautions

1. Use all the chemicals in very less quantity.
2. Use test tube holder for heating.
3. Clean magnesium ribbon with sand paper and use fire tongs for holding magnesium ribbon.
4. Handle the acids and alkalies carefully.

VIVA VOCE

Question 1:
Why is a chemical change called a chemical reaction?
Answer:
In chemical change, two or more substances react together to form a new product with new properties, so it is called a chemical reaction.

Question 2:
State four different types of chemical reactions.
Answer:
Combination reaction, decomposition reaction, displacement reaction and double displacement reaction.

Question 3:
Give two examples of combination reaction seen in daily life.
Answer:
Iron reacts with oxygen to form iron oxide and copper reacts with carbonates present in air to form copper carbonate.

Question 4:
Name the metal that is silver grey, brittle in nature, present in granules.
Answer:
Zinc.

Question 5:
Name the metal that is silvery white, present in ribbon form.
Answer:
Magnesium.

Question 6:
What would happen if you place zinc metal in copper sulphate solution?
Answer:
Zinc metal reacts with copper sulphate to form zinc sulphate, colourless solution and copper metal is displaced.

Question 7:
Give one example of a chemical reaction in which precipitate is formed.
Answer:
Sodium sulphate and barium chloride react together to form barium sulphate, which is white insoluble precipitate.

Question 8:
Give two physical properties of hydrogen gas.
Answer:
It is colourless, odourless and combustible gas.

Question 9:
What is the colour of iron sulphate crystals?
Answer:
It is green in colour.

PRACTICAL BASED QUESTIONS

Question 1:
Give one example/reaction which shows both physical change and chemical change.
Answer:
Burning of candle
Melting of wax ⟶ Physical change
Burning of wax ⟶ Chemical change

Question 2:
Why is burning of magnesium ribbon considered to be a chemical change?
Answer:
When magnesium ribbon is burnt, it reacts with oxygen to form magnesium oxide, a completely new product with new properties.

Question 3:
What happens to blue colour copper sulphate when zinc is added to it?
Answer:
The blue colour fades and becomes colourless because zinc displaces copper ions from copper sulphate to form zinc sulphate solution.

Question 4:
When sodium sulphate reacts with barium chloride, white ppt. is formed. What is it due to?
Answer:
When sodium sulphate reacts with barium chloride an insoluble white precipitate (ppt.) of barium sulphate is formed.

Question 5:
When zinc reacts with sulphuric acid, what is formed and how do you test the same?
Answer:
When zinc reacts with dilute sulphuric acid, zinc sulphate solution is formed and hydrogen gas is released, it can be tested by bringing a burning matchstick near the evolving gas which will bum with a pop sound.

Question 6:
Give the test for H_2 gas.
Answer:
Take a burning matchstick near the mouth of a test tube in which hydrogen gas is released, the matchstick burns with a pop sound.

Question 7:
What happens to the blue colour copper sulphate solution when you dip an iron nail into it?

Answer:
When iron nail is dipped into blue coloured copper sulphate solution, the blue colour changed to green as iron displaces copper ions and on the surface of iron, brown colour copper metal gets deposited.

Question 8:
Give two examples of decomposition reaction.
Answer:

1. Silver bromide decomposes to form silver and bromine gas, when exposed to light.
2. Lead nitrate on heating decomposes to form lead oxide, nitrogen dioxide and oxygen gas.

Question 9:
Give one example of exothermic reaction.
Answer:
Zinc + dil. sulphuric acid reaction is highly exothermic.

Question 10:
What type of reaction is the rusting of iron?
Answer:
Rusting of iron is a chemical change showing combination reaction.

Question 11:
What happens when copper metal is dipped in iron sulphate solution?
Answer:
No change as copper is less reactive than iron and cannot displace it.

Question 12:
What is your observation when you bum magnesium ribbon in air?
Ans.
It catches fire, bums with dazzling white flame and forms white powdery mass of magnesium oxide.

Question 13:
What happens when crystals of copper sulphate are heated in a test tube?
Answer:
The blue coloured copper sulphate crystals on heating loses water and turns white.

Question 14:
Why do we mb magnesium ribbon with sand paper before burning it?
Answer:
Magnesium metal is reactive in nature, it forms a layer of magnesium oxide on its

surface due to corrosion, hence to remove the impurities present on its surface we clean it with sand paper.

Question 15:
Give the chemical equation of double displacement reaction.
Answer:
$Na_2SO_4(aq) + BaCl_{2(aq)} \longrightarrow BaSO_4(ppt) + 2Nacl(aq)$

Question 16:
Give the chemical equation to show displacement reaction.
Answer:
$Fe(s) + CuSO_4(aq) \longrightarrow FeSO_4(aq) + Cu(s)$

NCERT LAB MANUAL QUESTIONS

Question 1:
Why should magnesium ribbon be cleaned before burning it in air?
Answer:
To remove the impurities from magnesium ribbon and use it in pure form. Magnesium has the tendency to form a layer of magnesium oxide on the strip.

Question 2:
Why does the red litmus paper turn blue when touched with aqueous solution of magnesium oxide?
Answer:
The aqueous solution of magnesium oxide is called magnesium hydroxide which is an alkali. The red litmus turns blue when it comes in contact with an alkali.

Question 3:
Is there a possibility of a compound other than MgO formed in the above reaction?
Answer:
If the ribbon is clean and the reaction takes place in controlled conditions then only MgO will be formed. But if the Mg ribbon is not pure or the air contains some other impurities then some other compound may also form.

Question 4:
Why is it suggested to wear dark coloured goggles while watching the burning of magnesium ribbon in air?
Answer:
The burning of magnesium ribbon produces white dazzling flame; to protect our eyes the dark coloured goggles are used.

MULTIPLE CHOICE QUESTIONS (MCQs)
Questions based on Procedural and Manipulative Skills

Question 1:
We want to carry out a reaction of zinc granules with sulphuric acid. One bottle contains concentrated sulphuric acid and the another bottle contains dilute sulphuric acid. The correct way of carrying out the reaction is to:
(a) use cone. H_2S0_4
(b) add water to cone. H_2S0_4 before using it
(c) use dilute sulphuric acid
(d) mix concentrated and dilute sulphuric acid and add water to it.

Questions based on Observational Skills

Question 2:
The colour of magnesium ribbon after rubbing with sand paper is
(a) Silvery white
(b) Grey
(c) Black
(d) Brown.

Question 3:
On burning of magnesium ribbon in air, the observation will be
(a) white powder substance is formed
(b) shiny powder substance is formed
(c) brown powder substance is formed
(d) grey powder substance is formed.

Question 4:
What happens when iron nails are added to copper sulphate solution?
(a) The solution becomes pale green and reddish brown copper metal gets deposited.
(.b) The solution becomes colourless
(c) There is no reaction
(d) Copper displaces iron.

Question 5:
When zinc granules are added to dilute sulphuric acid, we observe that
(a) a precipitate is formed
(.b) the reaction mixture turns yellow
(c) the container remains cool
(d) bubbles start coming from the surface of zinc granules.

Question 6:
The colour of barium sulphate is
(a) yellow
(b) green
(c) white
(d) colourless.

Question 7:
The colour of iron sulphate is
(a) yellow
(b) green
(c) blue
(d) brown.

Question 8:
The colour of sodium sulphate solution is
(a) colourless
(b) light blue
(c) milky white
(d) light green.

Question 9:
On adding 1 mL of $BaCl_2$ solution to 2 mL of Na_2S0_4 solution in test tube, the observation would be:
(a) a clear solution is obtained
(b) a white ppt. is obtained
(c) a yellow ppt. is obtained
(d) no reaction takes place.

Question 10:
What happens when zinc granules react with dil. H_2S0_4 acid?
(a) We observe a physical change
(b) We observe a chemical change
(c) We observe no change
(d) We observe both physical and chemical changes.

Question 11:
On dropping iron nail in water after two days the correct observation would be:
(a) no change is seen
(b) iron form brown flaky substance on its surface
(c) water becomes brown
(d) iron reacts with water to release H_2 gas.

Question 12:
When crystals of blue copper sulphate are heated in a test tube, the correct observation during the reaction is
(a) crystals turned red
(b) crystals turned white
(c) crystals turned pink
(d) none of these.

Question 13:
On placing a zinc plate in a beaker containing $CuS0_4$ solution, it is observed that after some time a deposition has taken place on the zinc plate which is
(a) soft and black
(b) grey and hard
(c) reddish brown
(d) smooth and shiny.

Question 14:
When dilute hydrochloric acid is added to granulated zinc placed in a test tube, the observation made is:
(a) the surface of the metal turns shining
(b) the reaction mixture turns milky
(c) greenish yellow gas is evolved
(d) the colourless and odourless gas evolves with bubbles.

Question 15:
What is not observed when zinc granules are added to dilute sulphuric acid in a test tube?
(a) Precipitate at the bottom of the tube.
(b) Bubbles of gas escaping from the tube.
(c) Gradual decrease in the size of the granules.
(d) Heat energy evolved in the reaction.

Question 16:
When magnesium ribbon is burned the flame produced is:
(a) white
(b) dazzling white
(c) yellow
(d) blue

Question 17:
Amino acid is formed by decomposition of which component of our diet?
(a) Carbohydrate
(b) starch

(c) protein
(d) Fat

Question 18:
Sodium sulphate and barium chloride solutions are mixed in a test tube. The observation made is:
(a) greenish yellow gas is evolved
(b) a colourless gas is evolved
(c) a yellow precipitate is formed
(d) a white precipitate is formed

Question 19:
The colour of anhydrous copper sulphate is
(a) blue
(b) black
(c) white
(d) green

Question 20:
The colour of copper oxide is
(a) blue
(b) black
(c) white
(d) grey

Questions based on Reporting and Interpretation Skills

Question 21:
An iron nail was immersed in a salt solution. After some time a reddish brown deposit on the nail was seen. The salt solution could be:
(a) silver nitrate
(b) sodium sulphate
(c) aluminium chloride
(d) copper sulphate.

Question 22:
The crystals of copper sulphate on heating turns white, this is due to:
(a) loss of sulphate ions
(b) loss of copper ions
(c) loss of water of crystallization
(d) none of these.

Question 23:
Which of the following reactions will form a precipitate?
(a) barium chloride and sodium chloride
(b) copper sulphate and iron
(c) barium chloride and sodium sulphate
(d) sodium sulphate and sodium chloride.

Question 24:
A student puts one big iron nail in a test tube containing a solution of copper sulphate. What will happen?
(a) the solution remains blue in colour
(b) the nail is unchanged
(c) the solution turns colourless
(d) the solution turns light green.

Question 25:
Which one is true about the behaviour of MgO in the presence of water?
(a) It is basic.
(b) It is acidic.
(c) It is amphoteric.
(d) It is neutral.

Question 26:
What would happen when zinc granules are added to dil. sulphuric acid in a test tube?
(a) Zinc granules change to powder
(b) Colour of zinc changes from grey to white
(c) The size of the zinc granules keep decreasing
(d) The surface of zinc metal becomes bright.

Question 27:
When zinc metal is added to dil. H_2S0_4 acid, a colourless gas comes out of the flask. On bringing a candle flame at the mouth of the flask the candle flame goes off and the gas in the flask burns with a pop sound. This gas is:
(a) 02
(b) H_2S
(c) $S0_2$
(d) H_2

Question 28:
The products obtained when zinc reacts with dilute sulphuric acid are:
(a) zinc sulphate and hydrogen sulphide
(b) zinc sulphate and hydrogen gas
(c) zinc oxide and hydrogen gas
(d) zinc oxide and hydrogen sulphide.

Question 29:
$Zn + H_2SO_4 \longrightarrow ZnSO_4 + H_2$ the colour of zinc sulphate formed is:
(a) black
(b) white
(c) yellow
(d) colourless.

Question 30:
$Na_2SO_4 + BaCl_2 \longrightarrow BaSO_4 + 2Nacl$
The colour of sodium chloride and barium sulphate solutions formed respectively are
(a) colourless and green
(b) green and colourless
(c) white and colourless
(d) colourless and white.

Question 31:
When you bum a magnesium ribbon on a burner, it bums with a blinding white light and some residue is left after burning. This residue appears to be like:
(a) lamp black
(b) charcoal ash
(c) powdered mass
(d) sand

Question 32:
On adding water to white solid of copper sulphate it becomes
(a) anhydrous
(b) hydrous
(c) aqueous
(d) hydrated

Question 33:
Heating of blue crystals of copper sulphate to form white anhydrous compound is a:
(a) chemical change
(b) physical change
(c) both (a) & (b)
(d) none of the above.

Question 34:
The gas evolved when zinc reacts with dilute sulphuric acid is:
(a) Colourless, odourless, combustible
(b) Colourless, foul smelling, combustible
(c) Colourless, pungent smelling, burns with a pop sound
(d) Brown coloured, pungent smelling, does not bum.

Question 35:
Student were asked to study the reaction between barium chloride and sodium sulphate. Four different reports of the experiment are given below.

Procedure	Observation
(*a*) Mixed powder of barium chloride and sodium sulphate.	The colour of the mixture changes to yellow.
(*b*) Mixed solution of barium chloride to sodium sulphate solution.	Thick white precipitate is formed.
(*c*) Added solution of barium chloride to sodium sulphate powder.	Solution become turbid.
(*d*) Added powder of barium chloride to sodium sulphate solution.	No change is observed.

SCORING KEY WITH EXPLANATION

1. (c) Concentrated acids are corrosive in nature and we need to be careful while handling them.
2. (a) Silvery white is the original appearance of Magnesium ribbon.
3. (a) Magnesium bums in air to form MgO (white powder).
4. (a) Fe will displace Cu from copper sulphate.
5. (d) Bubbles are of hydrogen gas.
6. (c) Barium sulphate is white in colour.
7. (b) Iron salts may be green (ferrous) and brown (ferric) in colour.
8. (a) Sodium salts are colourless.
9. (b) Barium sulphate is formed and it is white in colour.
10. (b) Zinc reacts with acid and hence chemical reaction takes place.
11. (b) Iron in water undergoes rusting and the product is brown flaky substance of iron oxide.
12. (6) The water of crystallisation is lost.
13. (c) Copper metal is displaced and it is reddish brown in colour.
14. (d) Hydrogen gas is released which is colourless and odourless.
15. (a) Zinc does not form any precipitate with acid.
16. (b) Magnesium bums with dazzling white flame in air to form MgO, a white powder.

17. (c) A complete protein is one that contains all of the essential amino acids in quantities sufficient for growth and repair of body tissue.
18. (d) Barium sulphate forms a white precipitate.
19. (c) Anhydrous means no water of crystallisation and hence it is white and not coloured.
20. (b) Copper oxide is black in colour.
21. (d) Copper metal is displaced and it is reddish brown in colour.
22. (c) Blue colour of copper sulphate is due to water of crystallisation.
23. (c) The precipitate of barium sulphate is formed, as it is insoluble in water.
24. (d) Fe will displace Cu from copper sulphate and the solution turns green due to the formation of ferrous sulphate.
25. (a) Metal oxides are basic in nature.
26. (c) The reactant is getting used up and hence size of zinc granules is reduced.
27. (d) Hydrogen gas test is mentioned in the question.
28. (b) The products would be zinc sulphate and hydrogen gas.
29. (d) Zinc sulphate is colourless.
30. (d) Sodium salts are colourless and barium sulphate is white precipitate.
31. (c) Magnesium oxide is white powder obtained on burning of magnesium ribbon.
32. (d) Dry copper sulphate becomes hydrated on adding water into it.
33. (b) On heating the crystals of copper sulphate to form anhydrous compound there is no chemical reaction involved.
34. (a) Hydrogen gas is released which is colourless, odourless and combustible.
35. (b) It is a double displacement reaction.