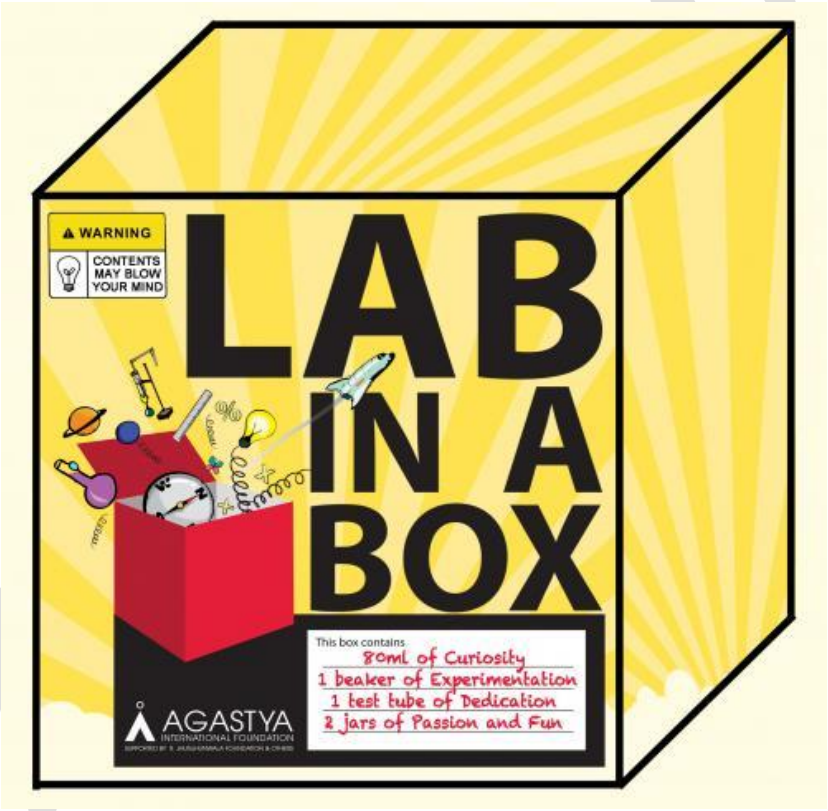
Lab in a Box 6

CHEMISTRY



Inventory

S.No	Materials	Quantity
Glassware		
1	Beaker (Glass) – 250 ml	1
2	Dropper (1 ml)	2
3	Gas jar (plastic)	1
4	Test tubes	6
5	Glass rod	1
Equipment		
6	Aluminium wire	1 meter
7	Copper wire	1 meter
8	Deflagrating spoon	1
9	Electronic configuration model with marbles	1
10	Hammer	1
11	Spatula	2
12	Spirit lamp	1
13	Test tube stand	2
14	Burette stand	1
15	Plastic wire	1 meter
16	Wooden stick	1 meter
17	Blue litmus paper	1 packet
18	Red litmus paper	1 packet
19	1.5 V bulbs	5
20	1.5 V bulb holders	5
Chemicals and Reagents		
21	Copper sulphate	100 gm
22	Copper turnings	100 gm
23	Hydrochloric acid	500 ml
24	Iron fillings	100 gm
25	Iron sulphate	100 gm
26	Zinc metal	100 gm
27	Potassium permanganate	100 gm
28	Sulphur powder	50 gm
Consumables		
29	1.5 V Cell	2
30	A4 Sheets	1 bundle
31	Fevicol (125 gm)	1
32	Iron nails	10
33	Match box	1
34	Pencil	1
35	Thermocol balls	3 packets
36	Scale (long – 30 cm)	1

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1. Electronic configuration

Aim

To explain the electronic configuration of elements according to Bohr's Model

Materials Required

Electronic configuration board (model),marbles

Procedure

Step 1

Take the electronic configuration board and count the holes of each different colour in each circle.

Step 2

Each circle represents a shell and assume that a hole in each shell can accommodate an electron.

Step 3

For example, consider sodium metal which has 11 electrons. Take 11 marbles and try to arrange the marbles in the electron configuration board. Begin by filling marbles in the innermost orbit as shown. Similarly we can try with different elements present in the periodic table.

Observation

In the periodic table, all elements have different number of electrons, and they are arranged in their respective shells.

Inference

- According to Bohr's model, there areshells around the nucleus,namely K, L, M, N ….
- The inner most shell is Kand L, M, Nare the next outer shellsrespectively.
- K-shell can hold 2 electrons.
- L- shell can hold8 electrons
- M- shell can hold 18 electrons.
- N-shell can hold 32
- Electrons are filled in the respective shells accordingly.
- For Sodium, there are 2 electrons in K shell, 8 electrons in L shell and 1 electron in M shell
- Today, further studies have been made on the structure of atom. Bohr's model is only an approximate model.

2. States of matter

Aim

To show molecular arrangement in solid, liquid and gas.

Materials Required

A4 sheets,scale,pencil,thermocol balls and fevicol

Procedure

Step1

Take A4 sheet and draw three equalsquares(These three squares represent solid, liquid, and gaseous states respectively)

Step2In the first square, stick the thermocol balls with the help of fevicol very closely. There should not be any gap between the balls. The first square represents the molecules in solid state.

Step3 Stickthe thermocol balls in second squarewithsmallgaps between them. The secondsquarerepresents the molecules in liquid state(due to random orientation of molecules).

Step4In third square, stick the thermocol balls leaving big gaps between them as showed in the diagram.This squarerepresents the molecules in gaseous state(due to more randomly arrangement of molecules).

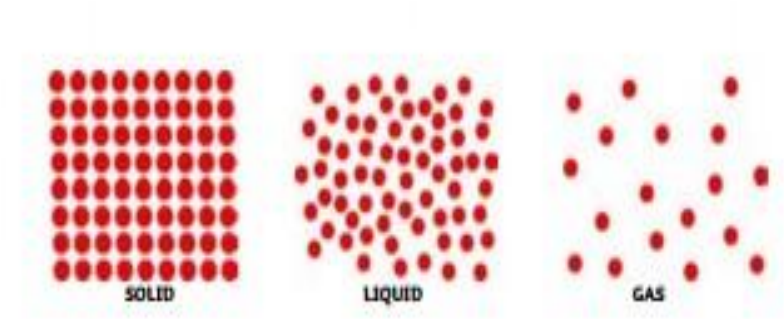
Observation

In the solid state the space between the molecules is veryvery less, in liquids the space between the molecules is more as compared to solids but in gases the space between the molecules iseven more.

Inference

In a solid state, the molecules are very closely packed because of the higher van der Waal's force of attraction between molecules; they cannot move freely and can onlyvibrate.

But in the case of liquids,the inter-molecular force of attraction is lower, so the molecules can move from one place to another within the volume of liquid.



In gaseous molecules, molecular arrangement is entirely different because the intermolecular force of attraction is veryveryweak, so the molecules are free to move from one place to another. They can spread out if not contained in space.

2.1Dilution method

Aim

To demonstrate the dilution of asolution.

Materials required

Test tube, dropper,beaker,glass rod, Potassiumpermanganate, test tube stand

Procedure

Step1

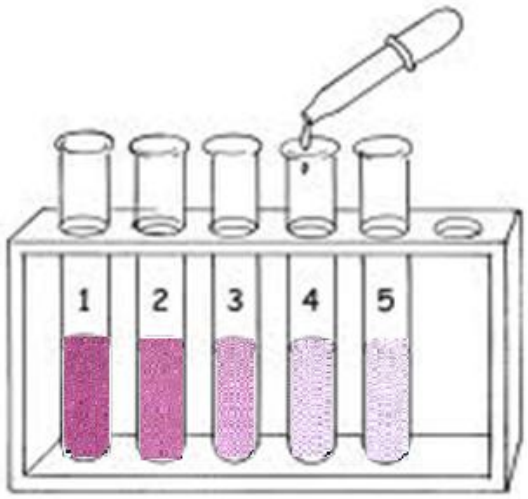
Take five test tubes and label them as 1,2,3,4 and 5.

Step 2

Take 10ml of water in first test tube and now add 3-4 potassium permanganate crystals into that test tube and stir it using glass rod.

Step3

Take 1 ml of solution from the first test tube and pour this solution to the second test tube which contains 9 ml of water.



Step 4

Take 1 ml of solution from the second test tube and pour this solution to the third test tube with 9 ml of water.

Step 5

Repeat the same procedure serially up to fifth test tube as shown in the figure. Compare the intensity of colour among the test tubes.

Observation

It is observed that the water in the last test tube is still colored but the intensity of colour is less when compared with other test tubes.

Inference

When the potassium permanganate is dissolved in the first test tube, the concentration of $KMnO_4$ is higher, so the higher colour of the solution. On

dilution, the concentration of $KMnO_4$ decreases so intensity of the colour also decreases.

A solution is made by adding few crystals (x grams) of $KMnO_4$ into 10 ml of water. Say the concentration is C.
In step 3, to get dilution, 1 ml of solution is added to 9 ml of water, concentration becomes 0.1 C
In step 4, it is diluted to .01C and finally to .001C in step 5. Clearly the intensity of colour decreases as solution becomes more and more dilute.
It is also understood from the activity that the minute particles of $KMnO_4$are separately dispersed in the solvent.

3. Malleability propertyof metals

Aim

To demonstrate the malleability property of metals and non-malleability or brittleness of non metals

Materials Required

Aluminiumwire, ironnail, copperwire, magnesium wire, charcoal, graphite and hammer.

Procedure

Step 1

Take iron nail, keep it on the floor and hit the iron nail using hammer.

Step 2

Similarly repeat for the rest of the materials.

What do you observe?

Observation

Metal objects get flattened upon hammering while non-metal breaks.

Inference

Metals are malleable (Ex: aluminumwire, ironnail, copper wire etc)where as non-metals (Ex: graphite and charcoal) are brittle.

3.1 Conductivity in metals

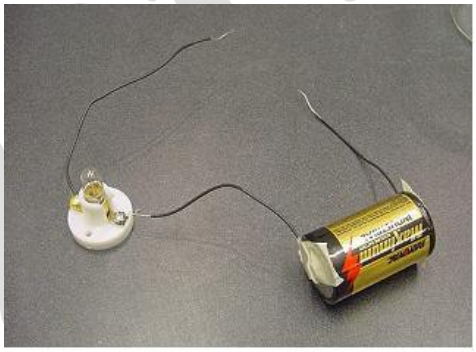
Aim

To demonstrate the conductivity of metals and graphite.

Materials Required

Aluminiumwire, iron nail, copper wire, magnesium wire, pencil, piece of glass, wood, dry cell, a bulb (low voltage) with base and terminals. (bulb holders).

Procedure



Step 1

Connect the cell, bulb and copper connecting wires as shown in the figure. Place the aluminum wire in contact, with free ends of the connecting wires. The bulb glows.

Step 2

Similarly repeat the experiment with other materials provided.

Observation

The bulb glows when metals and graphite are connected to the cell, whereas for non metals like wood, plastic and glass, the bulb doesn't glow.

Inference

Metals and graphite are good conductors of electricity due to presence offree electrons in their outer most orbits. In case of wood, plastic and glass, there are no free electrons, hence they are insulators in nature.

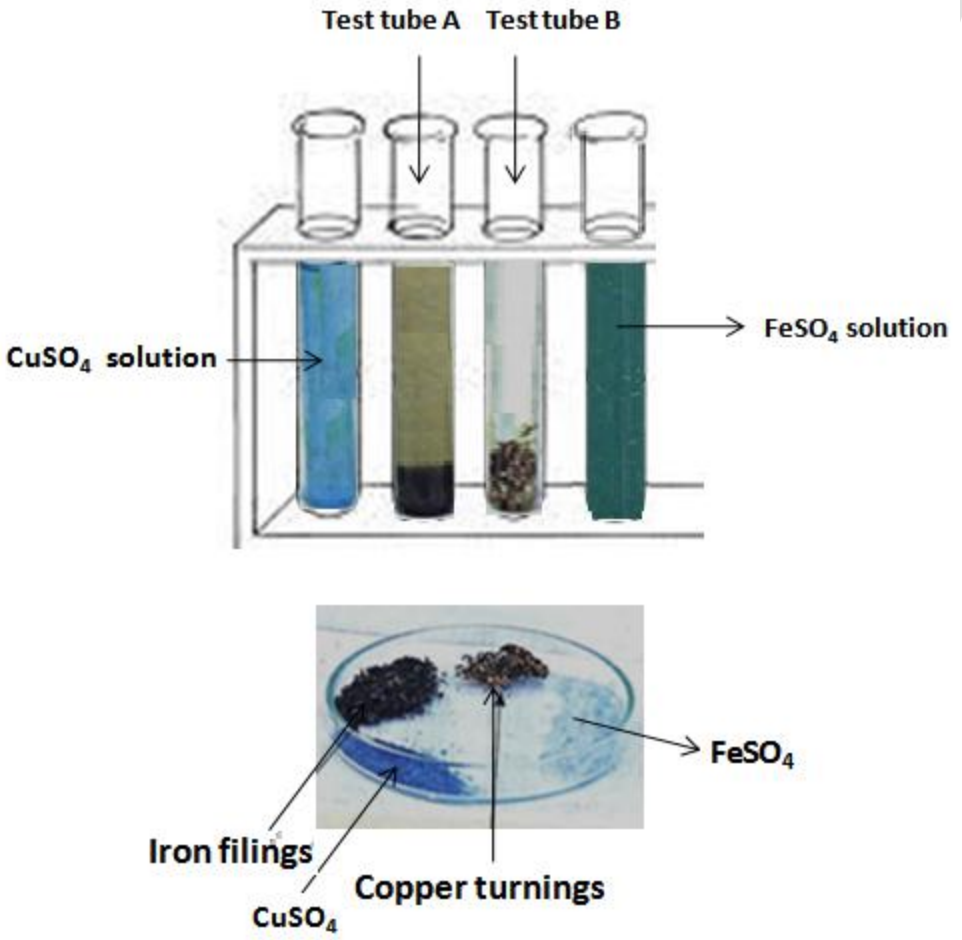
3.2 Reaction of metals

Aim

To prove that iron is more reactive than copper

Materials Required

Iron fillings, copper turnings, copper sulphate solution, iron sulphate solution, test tubes, test tube stand and dropper.



Procedure

Step 1

Take few gm of iron fillings in a test tube and add half test tube full of copper sulphate solution with the help of a dropper (test tube –A).

Step 2

Take few gm of copper turnings in a test tube and add half test tube full of iron sulphate solution with the help of another dropper (test tube B).

Observation

In test tube A, iron fillings turns to brown and the solution turns to pale green. No reaction is observed in the test tube B

Inference

In test tube A, iron fillings turn to brown due to the deposition of copper. Because Cu^{2+} ions are easily reduced to copper atom by accepting electrons from iron and the solution turns to pale green and the formation of iron sulphate.

But in case of test tube B, no reaction takes place with respect to copper fillings and iron sulphate solution because copper in reduced state,will not oxidise easily. Iron therefore is more reactive than copper as shown in the reaction.

The reaction can be written as

Test tube A

$$\underset{\text{Fillings}}{\mathbf{Fe}} + \underset{\text{Solution}}{\mathbf{CuSO_4}} \longrightarrow \mathbf{FeSO_4 + Cu}$$

i.e.

$$Fe \longrightarrow Fe^{2+} + 2e^-$$

$$Cu^{2+} + 2e^- \longrightarrow Cu$$

$$Fe + Cu^{2+} \longrightarrow Cu + Fe^{2+}$$

Test tube B

No reaction

3.3 Reaction of non-metals

Aim

To prepare a non metallic oxide and to test its solution using litmus paper

Materials Required

Sulphurpowder, deflagrating spoon, spatula, gas jar, water, spirit lamp, match box and blue litmus paper

Procedure

Step 1

Place a little sulphur powder in the deflagrating spoon and heat it. When it starts to burn, place it in the gas jar.

Step 2

Pour about50 ml of water in to the gas jar.

Step 3

Dip the blue litmus paper in the water. Observe the colour of litmus paper.

Observation

Blue litmus paper turns red.

Inference

Sulphur burns in presence oxygen and forms sulphur dioxide. When water is added to sulphur di oxide, it forms sulphurous acid.

$$S + O_2 \longrightarrow SO_2\ (g)$$

$$SO_2 + H_2O \longrightarrow H_2S0_3$$

Note: Avoidsulphur contact with eyes, mouth or mucous membranebecause it is corrosive

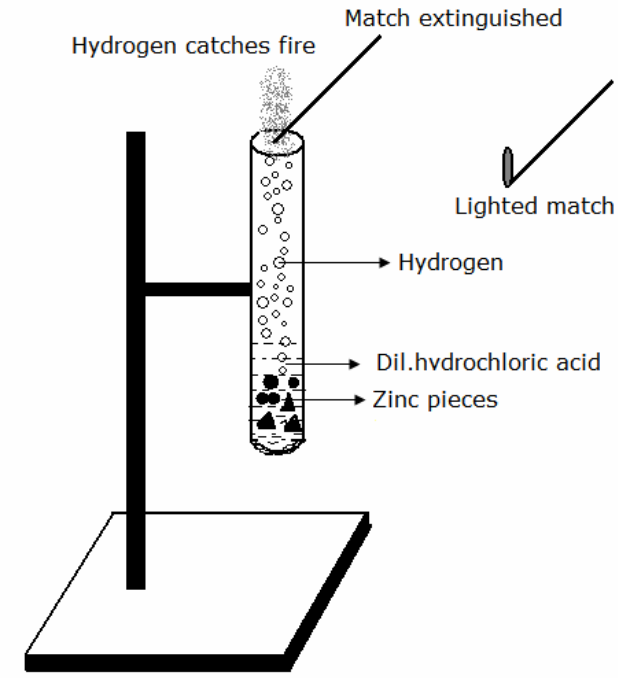
3.4 Reaction between acid and metal

Aim

To demonstrate the displacement reaction between acid and metal

Materials Required

Test tubes, burette stand, zinc metal pieces, dilute hydrochloric acid and match box



Procedure

Step 1

Take a test tube and clamp it to the burette stand. Put few zinc metal pieces in to the test tube.

Step 2

By means of dropper add dilute hydrochloric acid into the test tube

Step 3

Light a matchstick and bring it near the mouth of the test tube.

Observation

When the match stick is placed at the mouth of the test tube, the evolved gas catches a fire and gives a bursting sound while the match stick is extinguished.

Inference

Zinc metal is highly reactive with hydrochloric acid, it displaces hydrogen to form zinc chloride with the release of hydrogen gas.

$$Zn + 2HCl \longrightarrow ZnCl_2 + H_2\uparrow$$