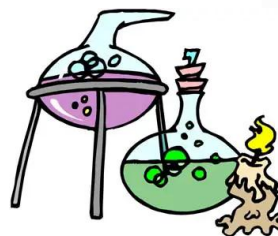




Physical and chemical changes

Subject-Science
Grade-7



Cygnus World School

Vadodara, Gujarat
Affiliated to C.B.S.E.

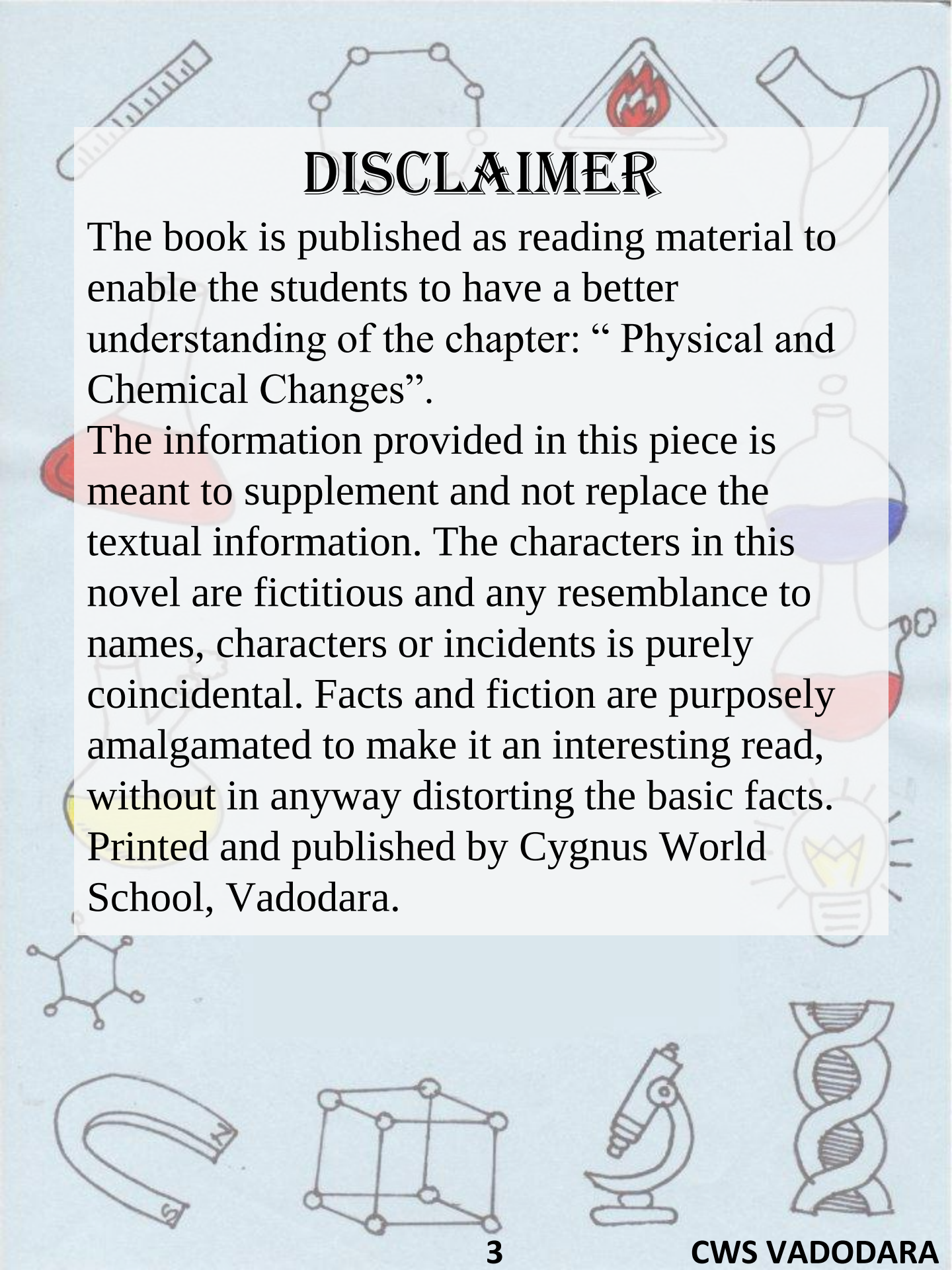


0758CH05

ACKNOWLEDGEMENTS

I express sincere gratitude to all those who helped in the process of creating this Graphic Novel. My sincere thanks to our Principal, Ms. Kanchan Joshi for her vision, encouragement, trust and support. My sincere thanks to our advisor Mr. Sandeep Sethi for being the torchbearer. Heartfelt thanks to Ms. Yesha Shah and Ms. Navjot Sohal for creating beautiful illustrations and to Ms. Varsha Sharma for designing this novel.

Ms Smita Debata
Teacher for Science
Cygnus World School



DISCLAIMER

The book is published as reading material to enable the students to have a better understanding of the chapter: “ Physical and Chemical Changes”.

The information provided in this piece is meant to supplement and not replace the textual information. The characters in this novel are fictitious and any resemblance to names, characters or incidents is purely coincidental. Facts and fiction are purposely amalgamated to make it an interesting read, without in anyway distorting the basic facts. Printed and published by Cygnus World School, Vadodara.

TABLE OF CONTENTS

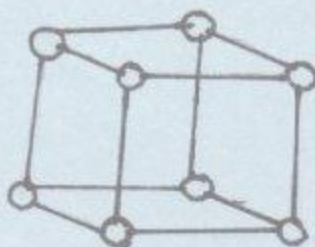
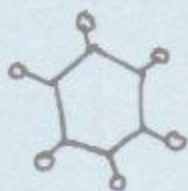
Preface	5
Learning Outcomes	6
Story Board	7
Introduction Of Characters	8
Scene 1	9
Scene 2	15
Scene 3	20
Scene 4	25
Scene 5	31
Scene 6	36
Scene 7	41
Scene 8	46
Principal's Desk	55
Bibliography	56

PREFACE

The idea for the novel germinated because of my love for science as a subject and also because of the need of creating content for my students.

Ever since I was a child I was keen on Science behind things, nature and everything that goes around us. I feel Science exists everywhere. We need to give our students the same vision that is to observe and learn from things. Creating an illustrated book on complex topics like Physical and Chemical Changes in order to help students comprehend the difficult concepts in a simple manner.

The story revolves around the lives of two young, curious, and observant children who are inquisitive about changes they observe in their day to day lives. This leads them to understand the various types of changes around us. As the story progresses, they become more aware of the characteristic features of each change and learn a few practical applications of these changes as well.



LEARNING OUTCOMES



Students will be able to differentiate between physical and chemical changes and its properties.



They will be able to understand that a chemical change produces a new substance, while a physical change does not.



They will be able to summarize that we can reverse some physical changes to recover the original matter, even if it doesn't look exactly the same whereas in a chemical change, this is not possible.



They will be able to differentiate between a physical change and a chemical change on the basis of the following points- In a physical change, the appearance or form of matter changes but the kind of matter in the substance does not.

STORY BOARD

Identify a physical change

Illustrate the usage of crystallization

Design an experiment to prevent rusting

Summarize various features

Analyze crystallization

Investigate why rusting of iron is a chemical change

Differentiate physical changes from other changes

Illustrate chemical changes with specific examples

Evaluate a given set of changes (in daily life)

CHARACTERS

Rina- The smart adolescent daughter aged 13.



Ram- The young son aged 9-10 years.

Father- A 34 years old man. He patiently responds to and solves the queries of the kids and supports the family in every way.



Mumma - A 32 years old lady. She cares for her family. She encourages and satisfies the curiosity of her kids and supports them in every way.

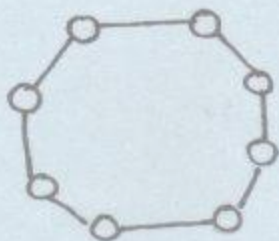
Grandfather- A 64 years old male. He shares his experience and knowledge with his grandchildren.



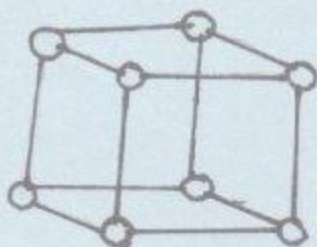
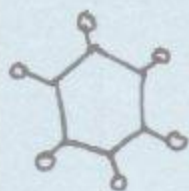
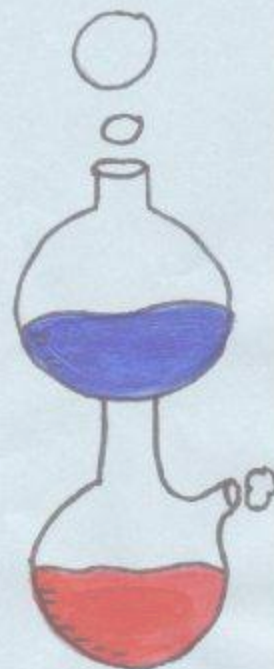
Grandmother- A 62 years old female. She shares her expertise and wisdom with her grandchildren.

Dr. O- A parrot who is a scientist.





Scene 1



Mumma has gone to pick up your grandparents.

Papa, when will she come back?

She will be back by the evening.

Oh! Okay. Then what will we have for dinner today?

Why? Together we will all cook a delicious meal for Mumma and your grandparents.

Wow! That sounds exciting.

Sure dear

Father, let me chop the vegetables.

That sounds great!

Father, I shall clean the dishes and keep them on the table.

Children and father are working in the kitchen.

The children stand under the guava tree in their garden.



Didi, look at that parrot..

Ram, it seems the parrot is hungry. See the way it is eating the fruit.

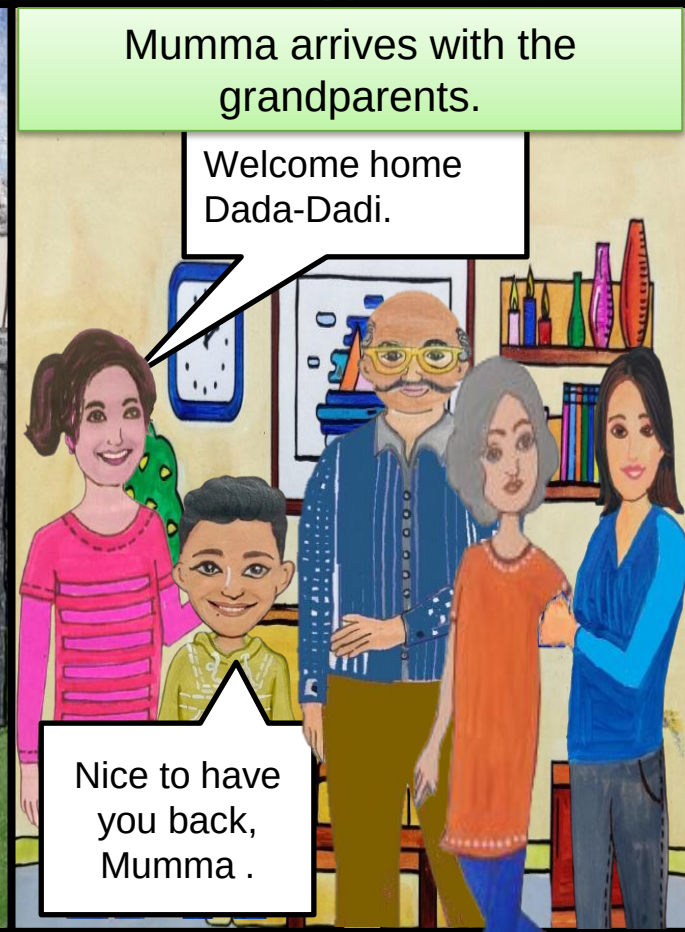
Yes, Didi.



Mumma arrives with the grandparents.

Welcome home Dada-Dadi.

Nice to have you back, Mumma .



Everyone freshens up and assembles in the living room.

Dada, Dadi, would you like to have a cup of tea?

Yes of course, dear. We would love that.

Dadi, wait! I will make tea for you all today.

Sure dear!

Rina notices the milk container is out of the refrigerator and the milk has started to curdle.

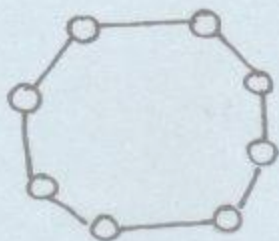
Ohh! We forgot to keep the milk container in the refrigerator. So it has curdled.



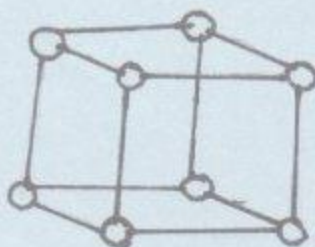
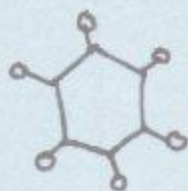
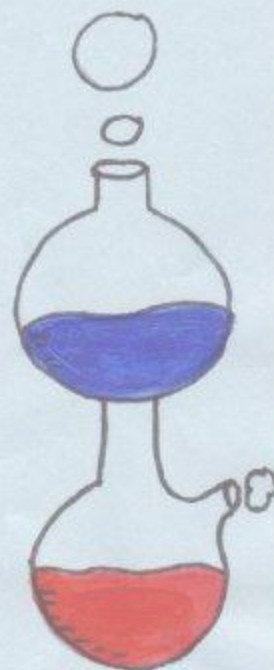
Dadi takes out the ice tray and asks Rina and Ram to taste the ice.



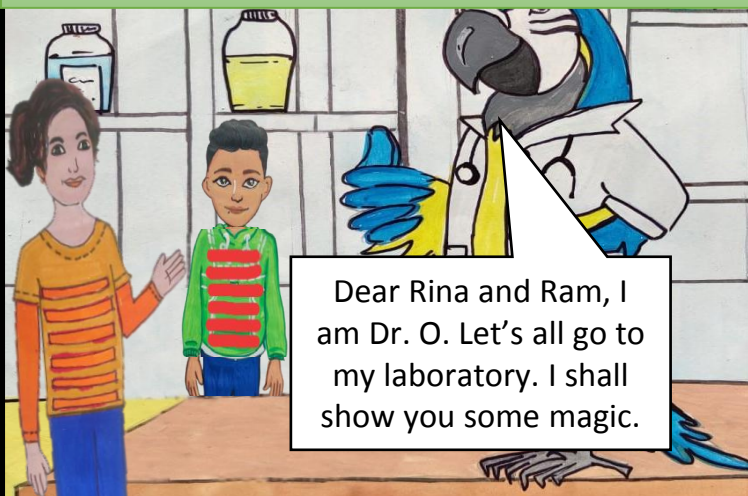




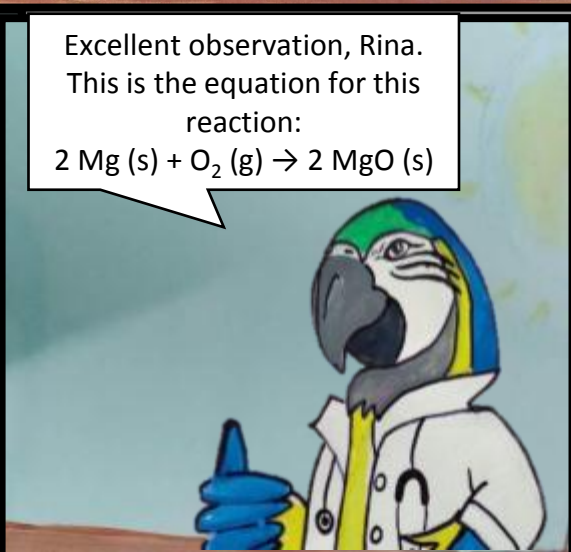
Scene 2



Rina dreams in her sleep and sees Ram and Dr.O.



Dr. O shows the reaction of a Magnesium ribbon burning with a bright white flame.



Dr. O adds an iron nail to copper sulphate solution and keeps it undisturbed for sometime.



Look Didi, the blue solution has turned light green. Wow! It's magic.

Yes Ram. It looks like magic. It's actually a displacement reaction taking place here.

Iron, being more reactive than copper, displaces copper from its salt solution and forms iron sulphate which is green in colour.

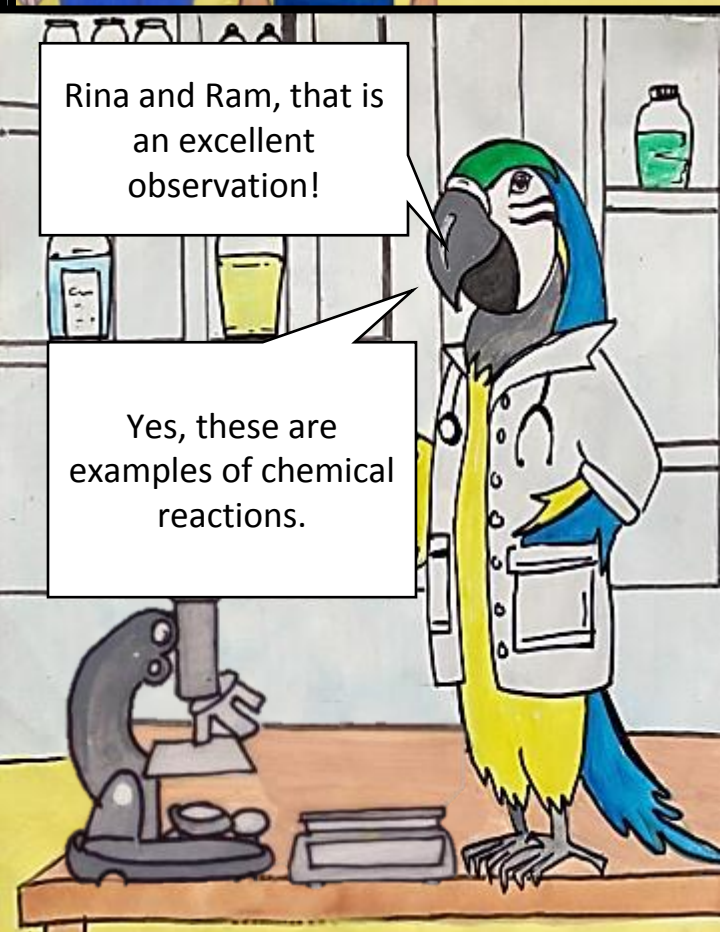
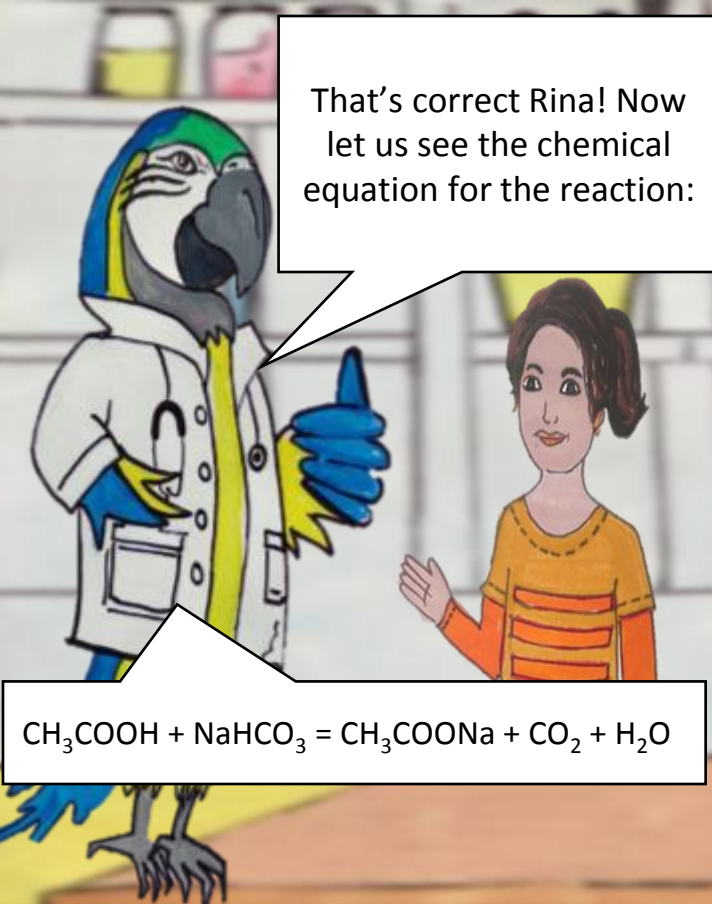
This is the equation for the reaction:
$$\text{Fe(s)} + \text{CuSO}_4\text{(aq)} \rightarrow \text{FeSO}_4\text{(aq)} + \text{Cu(s)}$$

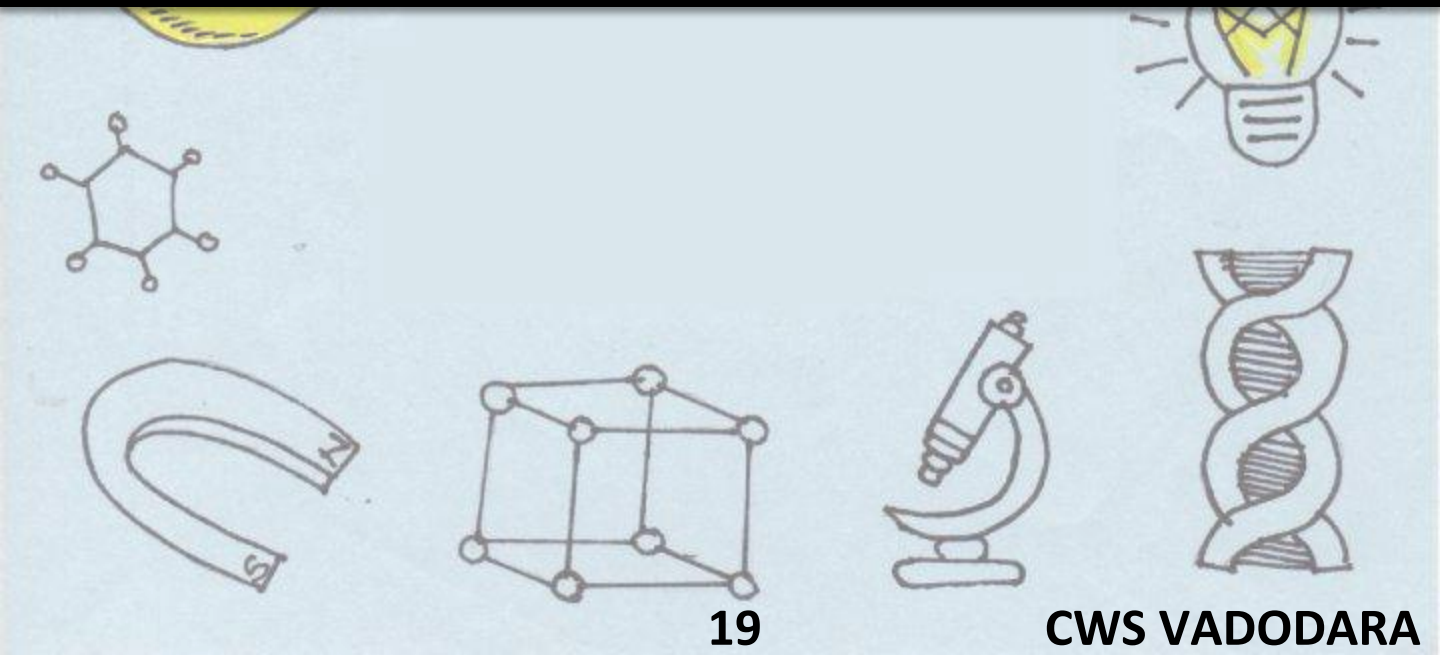
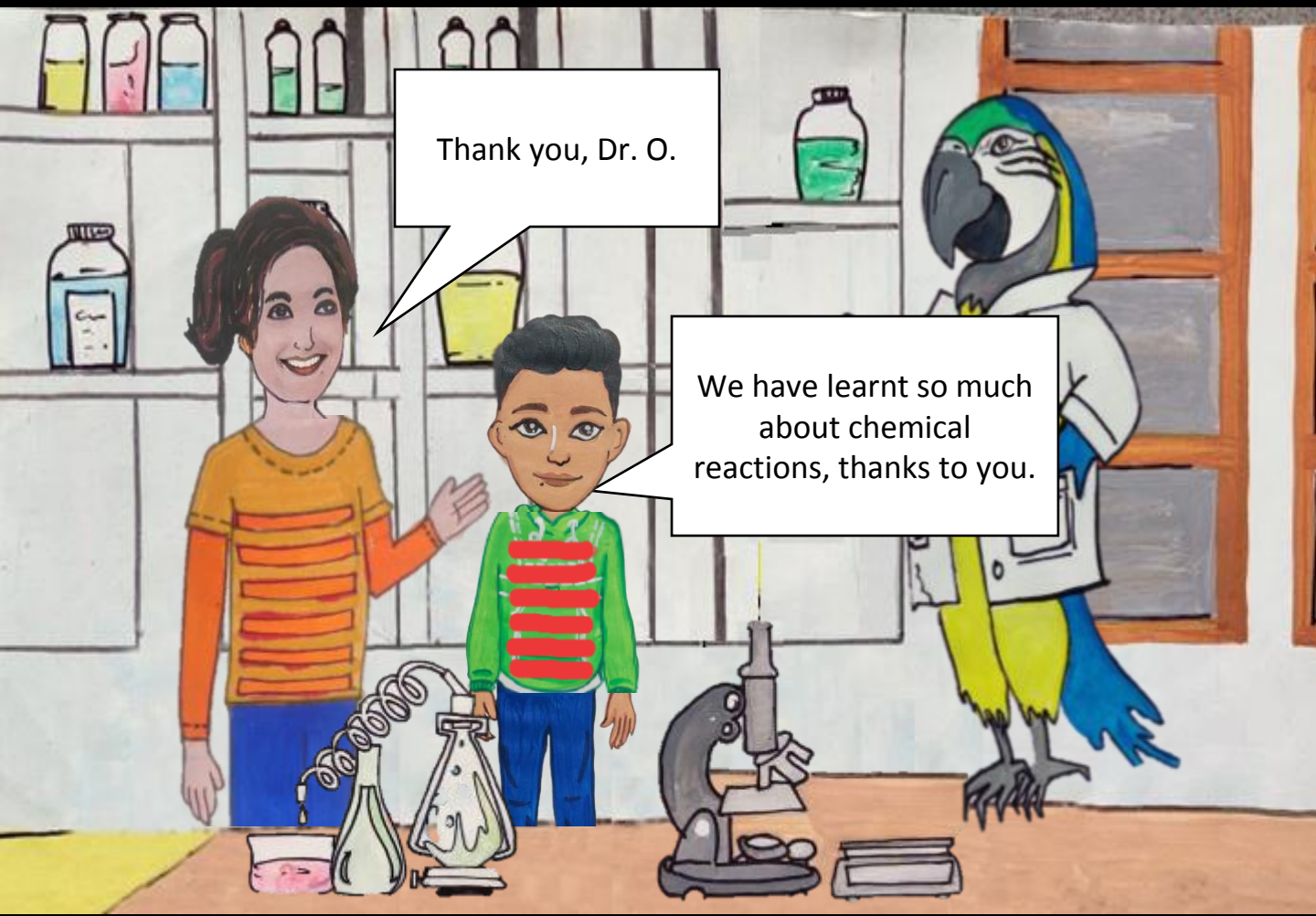
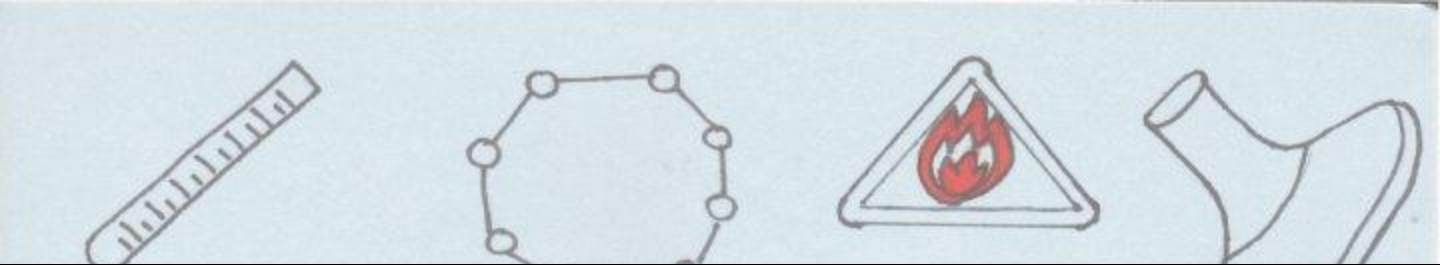
Come children, let's see another reaction.

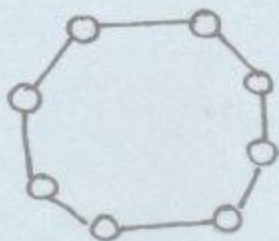
Wow! Didi, see the bubbles coming out of it.

We use this reaction to show colourful volcanic eruptions in science fairs.

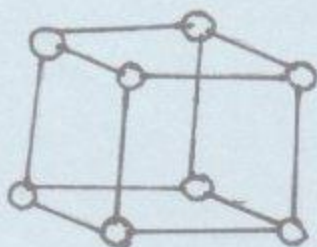
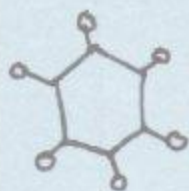
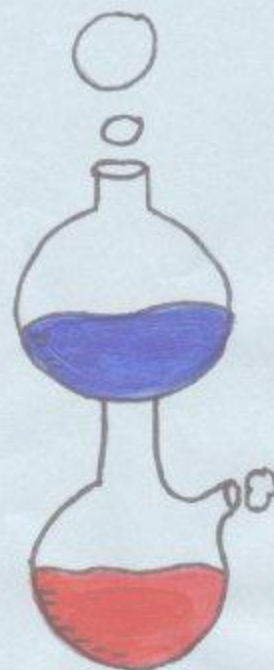
Dr. O adds some vinegar to the baking soda.







Scene 3



Ram, I dreamed about you and Dr. O explaining to us. I will tell you all about it today.

Yes Didi, I would love to hear from you.



Ram and Rina, Good morning. We need to go to the orphanage for the birthday celebration.

Our happiness multiplies when we share it.



Why orphanage Dadi?

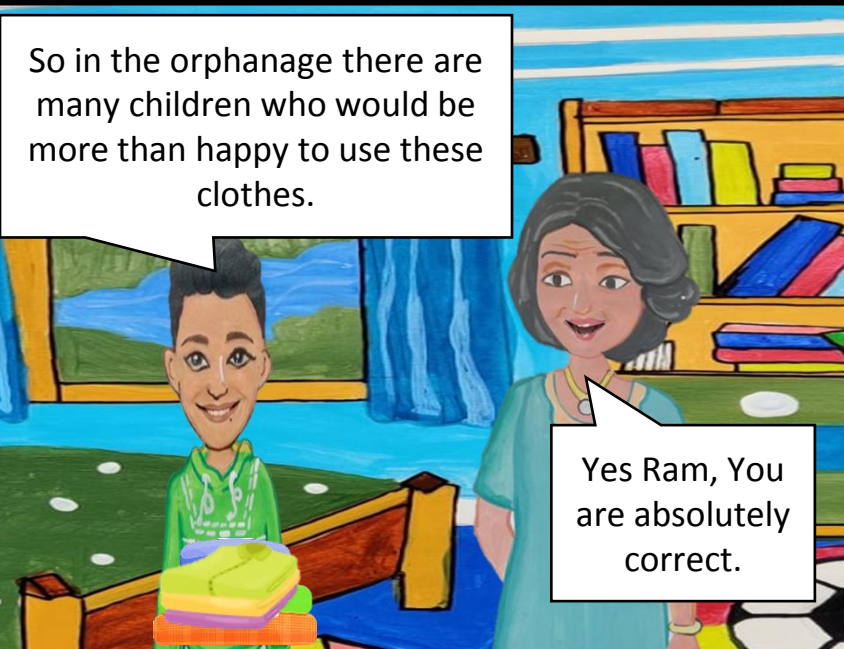
Both of you, please also pack your old clothes, which do not fit you any more.

Rina, when we outgrow of a dress, we can donate it to put it to better use.



Why should we pack clothes, Dadi?

So in the orphanage there are many children who would be more than happy to use these clothes.

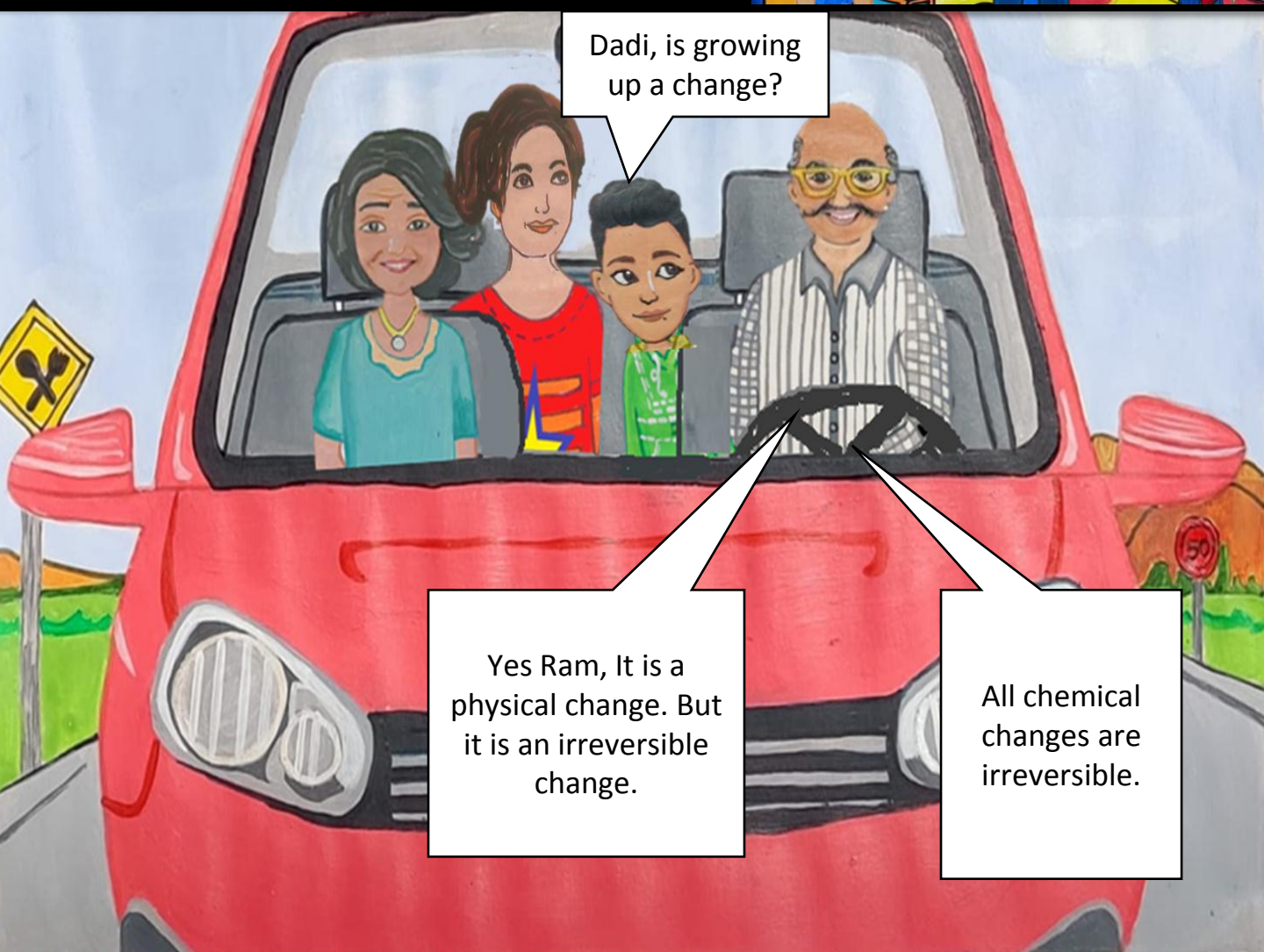


Yes Ram, You are absolutely correct.

The children go and pack their clothes.

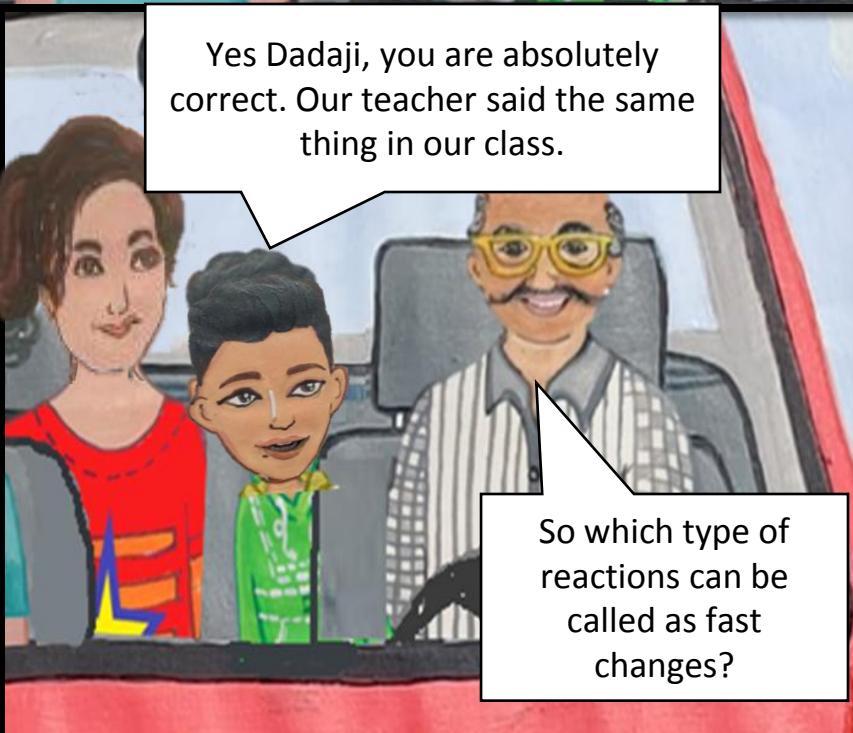
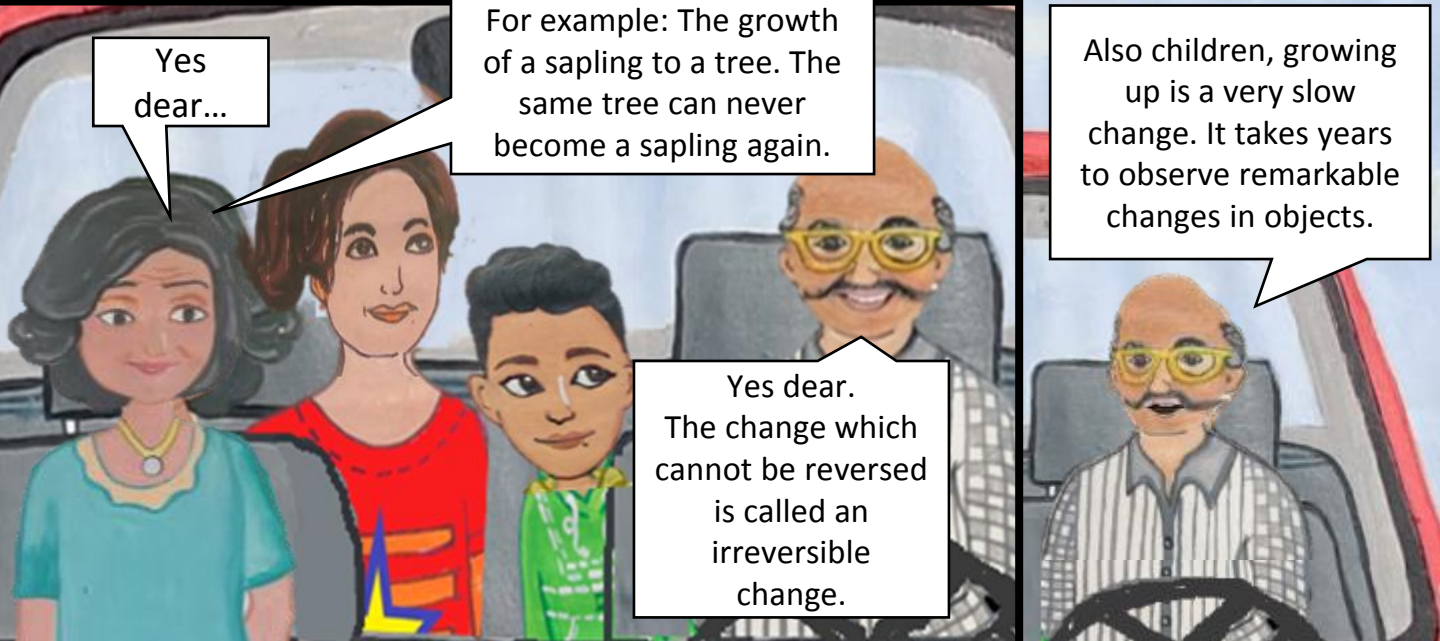


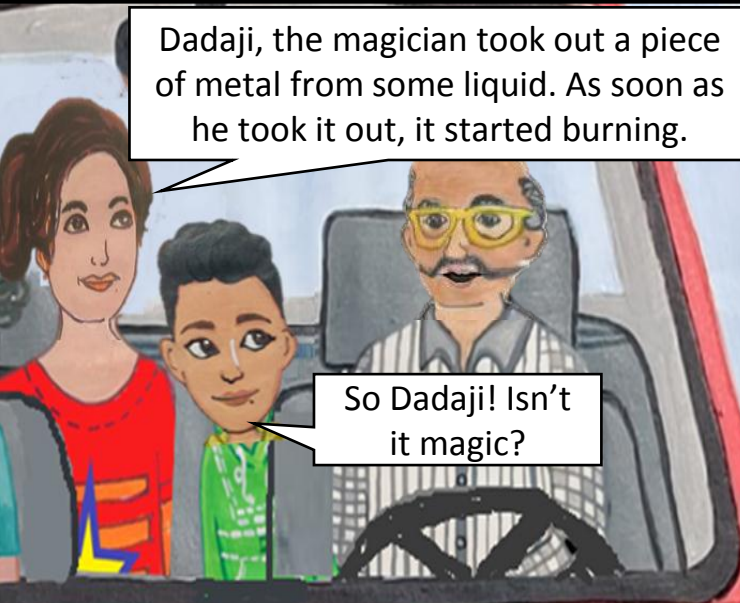
Dadi, is growing up a change?



Yes Ram, It is a physical change. But it is an irreversible change.

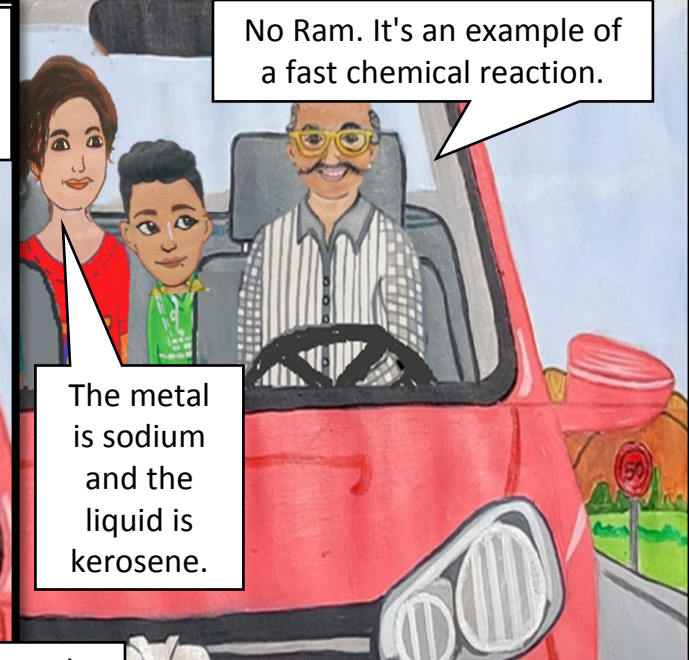
All chemical changes are irreversible.





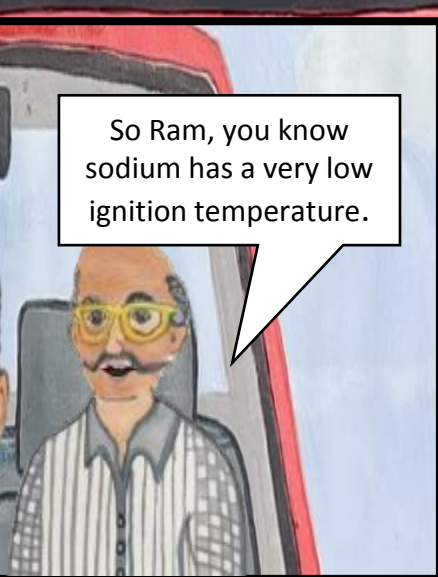
Dadaji, the magician took out a piece of metal from some liquid. As soon as he took it out, it started burning.

So Dadaji! Isn't it magic?



No Ram. It's an example of a fast chemical reaction.

The metal is sodium and the liquid is kerosene.



So Ram, you know sodium has a very low ignition temperature.



It catches fire as soon as it comes in contact with air. So it is preserved in kerosene.

Wow! Dadaji, you know so many things.

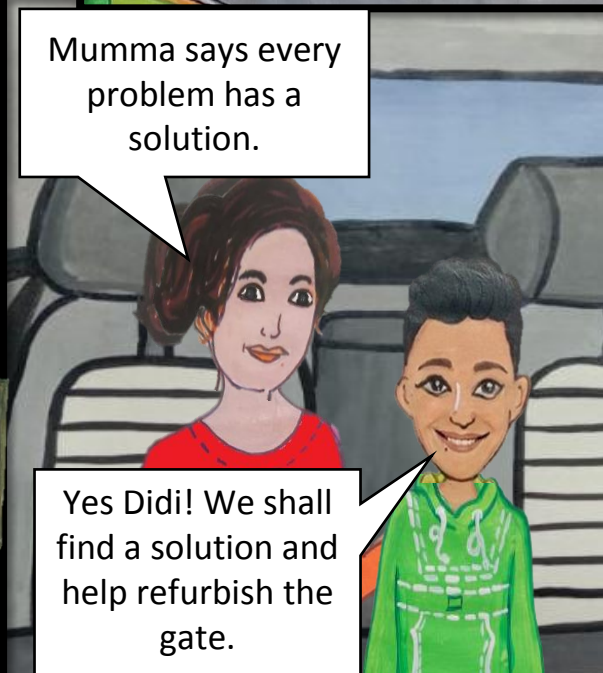


Look Ram! The gate looks so old. It has developed a brown coat on it.



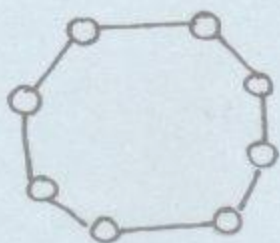
Didi! We shall ask Dr. O about this tomorrow. Maybe, he will tell us the reason for this.

Yes Ram, certainly. We need to do something about it.

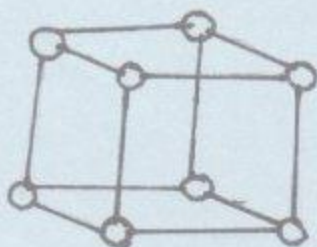
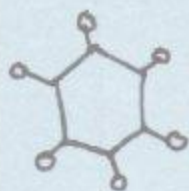
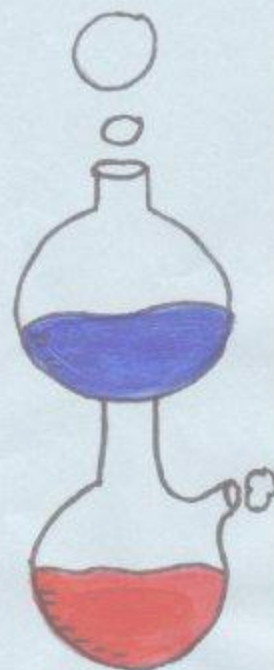


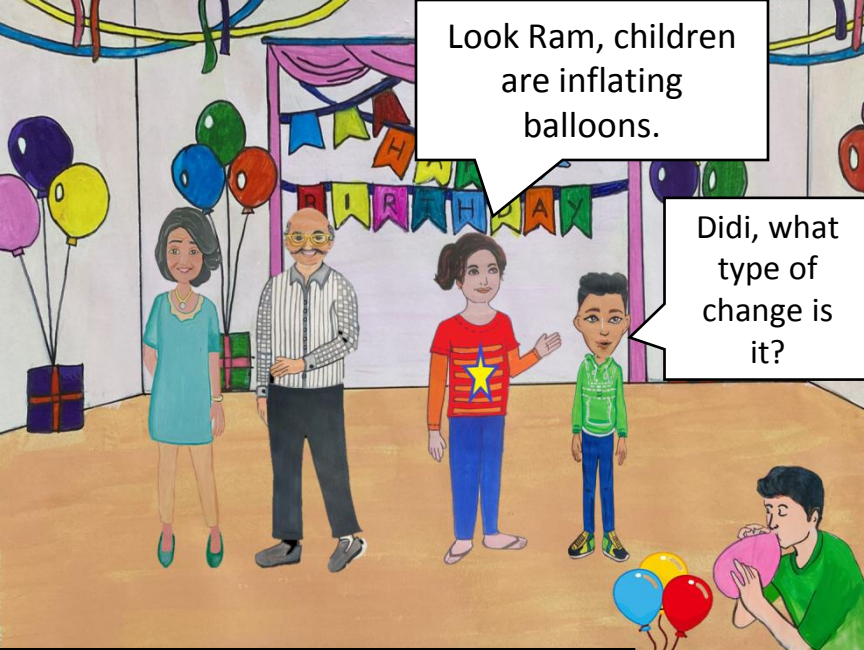
Mumma says every problem has a solution.

Yes Didi! We shall find a solution and help refurbish the gate.



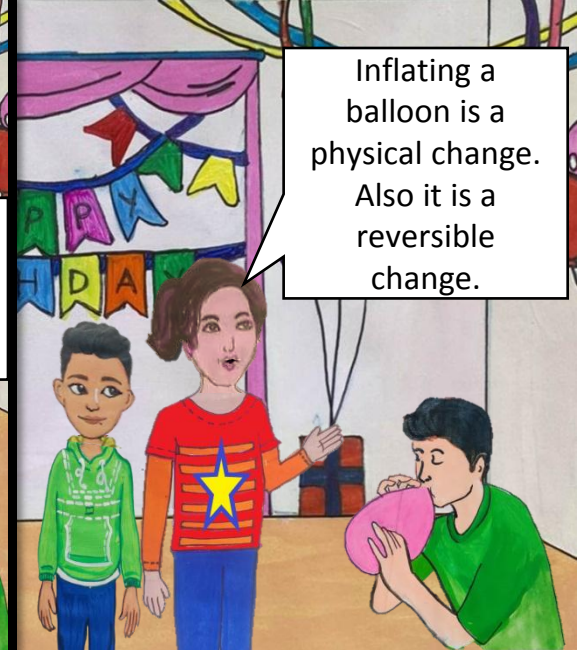
Scene 4



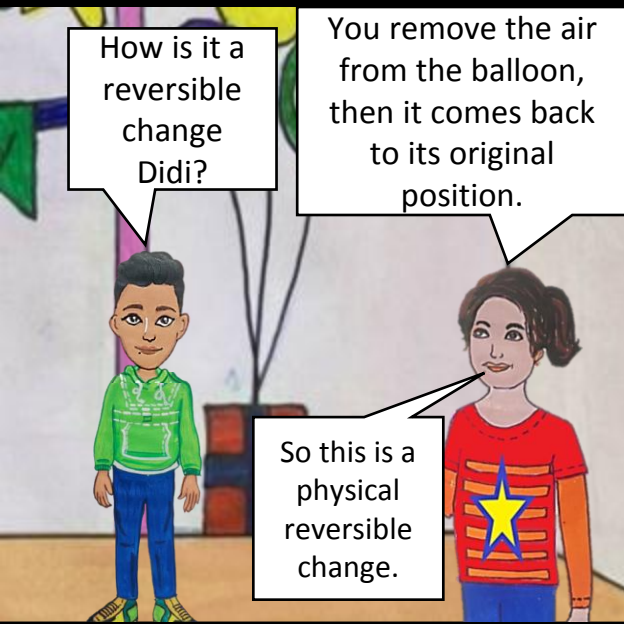


Look Ram, children are inflating balloons.

Didi, what type of change is it?



Inflating a balloon is a physical change. Also it is a reversible change.



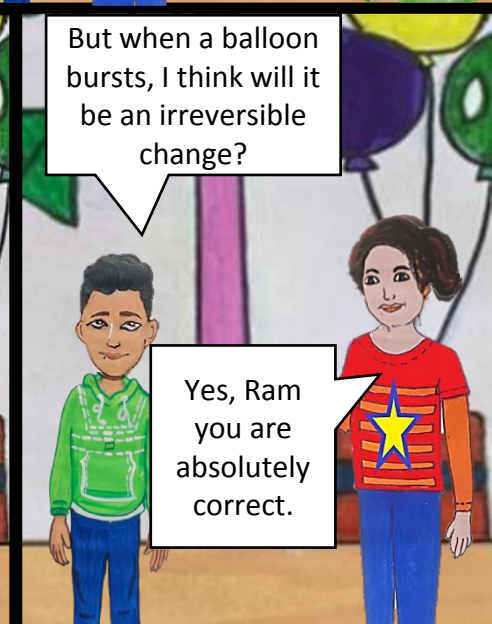
How is it a reversible change Didi?

You remove the air from the balloon, then it comes back to its original position.

So this is a physical reversible change.

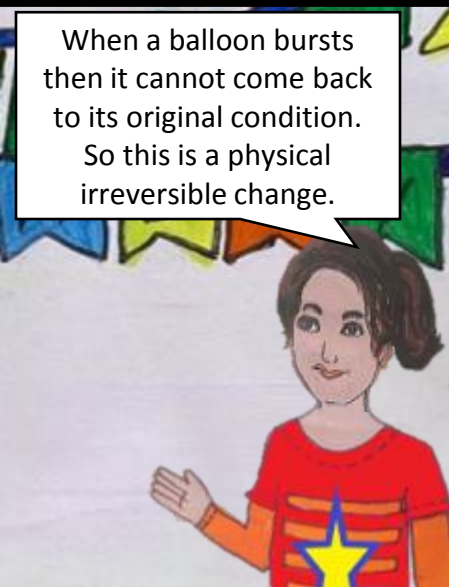


Yes Didi, you are correct.



But when a balloon bursts, I think it will be an irreversible change?

Yes, Ram you are absolutely correct.



When a balloon bursts then it cannot come back to its original condition. So this is a physical irreversible change.



Ram, let's help in distributing the clothes and sweets to the children.

Yes Didi.



Come Rina and Ram. It's time to cut the cake and celebrate.

Yes Dadaji, coming.



Didi, did you see how happy they were while receiving the clothes and sweets?

Yes Ram. They were very happy being a part of the celebration as well.



Didi, I feel giving happiness to others is the best thing to do in life.

Yes Ram. This is the best celebration we have ever had!



Didi, we should continue coming to this orphanage and share our time and happiness with these kids.

Of course! For sure.



Children, let's go home now.

Yes Dadi.

The Family goes back home.

EXERCISE

Q1. Which type of change is making tea?

- | | |
|--------------------|--------------------|
| A. Physical change | B. Chemical change |
| C. Both A and B | D. None of these |

Q2. What type of change is curdling of milk?

- | | |
|--------------------|--------------------|
| A. Physical change | B. Chemical change |
| C. Both A and B | D. None of these |

Q3. What type of change is conversion of water to ice and ice to vapour?

- | | |
|------------------------|--------------------|
| A. Physical change | B. Chemical change |
| C. Irreversible change | D. Periodic change |

Q4. _____ is not a chemical change.

- | | |
|--------------------|-----------------------------------|
| A. Photosynthesis | B. Digestion of food |
| C. Burning of coal | D. Beating aluminium to make foil |

Q5. Physical changes are:

- | | |
|-----------------|---------------|
| A. Temporary | B. Reversible |
| C. Both A and B | D. Permanent |

Q6. Burning of the wick of a candle is _____.

- | | |
|--------------------|--------------------|
| A. Physical change | B. Chemical change |
| C. Both A and B | D. None of these |

Q7. What is the type of change when a baby grows into an adult?

- | | |
|------------------------|--------------------|
| A. Physical Change | B. Chemical change |
| C. Irreversible change | D. Both A and C |

Q2. Fill in the blanks:

- a. _____ metal has a very low ignition temperature and is stored in kerosene.
- b. Breaking of a glass is a _____ change.
- c. In a _____ change, the composition of the original substance is changed.
- d. Melting of candle wax is a _____ change but burning of its wick is a _____ change.
- e. _____ is formed when Magnesium is burnt in presence of Oxygen.
- f. A student while having ice tea notices that the colour of the ice tea changes as the ice in the glass melts. This is a _____ type of change.

Q3. State whether the following are true / false:

- a. Cooking food is a physical change.
- b. Cutting an apple is a physical change.
- c. Eruption of a volcano is a reversible change.
- d. Formation of a cloud is a reversible change.
- e. In chemical changes, new substances are formed.

ANSWER KEY

Q1. MCQ

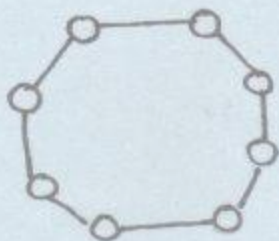
Q1. B. Chemical change, Q2. B. Chemical change, Q3. A. Physical change, Q4. D. Beating aluminium to make foil, Q5. C. Both A and B, Q6. B. Chemical change, Q7. D. Both A and C

Q2. Fill in the Blanks:

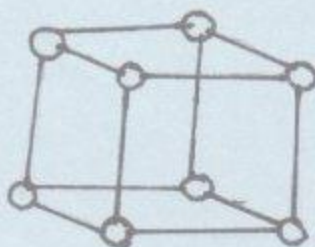
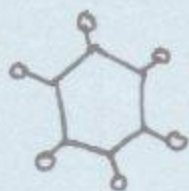
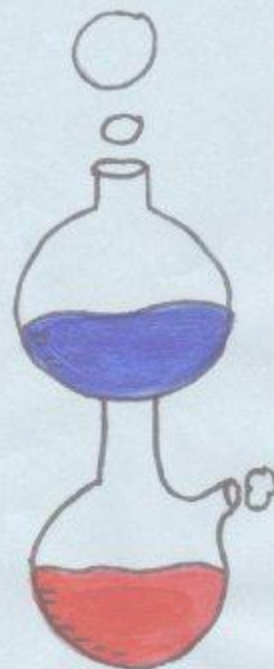
a. Sodium, b. physical, c. Chemical change, d. physical, chemical, e. Magnesium oxide, f. Physical change

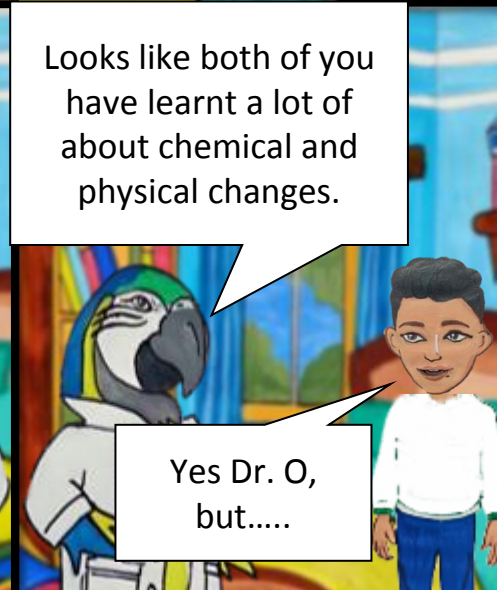
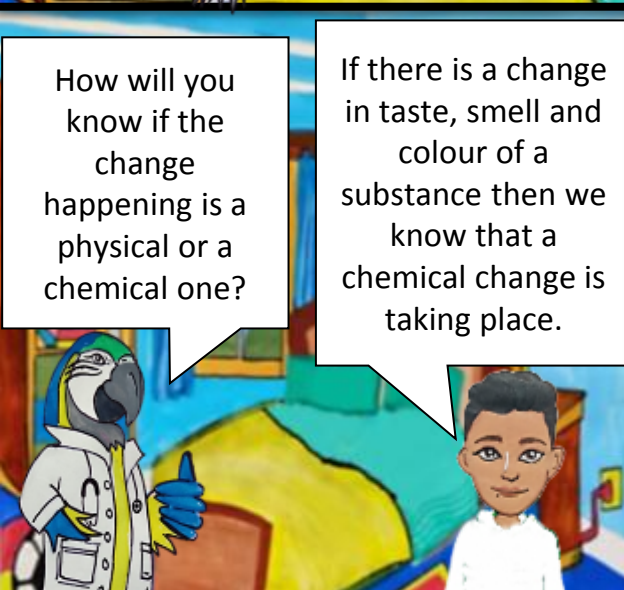
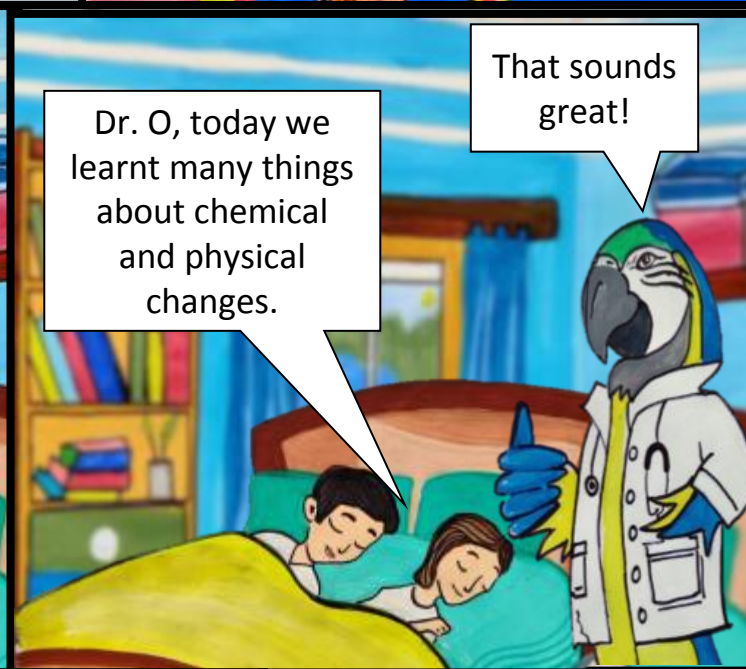
Q3. True/False:

a. False, b. True, c. False, d. False, e. True



Scene 5





What happened Ram? Is something bothering you?

Yes, Dr. O. The orphanage gate has developed a brown coat on it.

Is it harmful for the gate and the children in the orphanage?

I am very happy to see the care and concern you have for others. I shall help you.

So Dr. O, You know what this coat is?

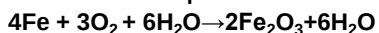
Yes of course! It's nothing but rust.

When iron objects come in contact with Oxygen and moisture, they develop a brown substance called rust.

Is this corrosion a chemical or a physical change?

It corrodes the metal surface layer by layer. This process is called corrosion.

It is a chemical change. The following is the chemical equation for it:



So this is a process where the upper layers of iron get damaged, right?

Oh! That's why the iron ships get rusted very quickly.

Yes, Ram!

Didi, do you remember, we had seen rusted ships while going to visit Elephanta caves via the sea?

Yes Ram! I do remember.

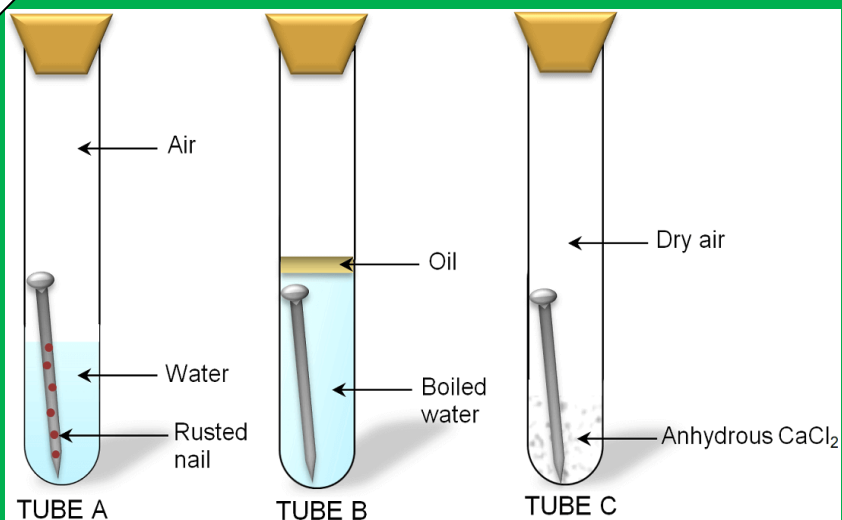
Dr. O! Is there any way to prevent corrosion?

Ram, do you remember! We paint our iron grills once a year.

I suppose it not only increases the beauty but also prevents corrosion.

That's absolutely correct, Rina.

Observe the setup kept here. In which case will rusting take place and why?



I feel in all the three cases it will rust.

No Ram. When iron is exposed to air and water together, only then will it rust.

When you protect the surface of iron from any of the factors of corrosion, it can be prevented.

That's absolutely correct Rina.



Some of the examples are painting, oiling, greasing, galvanization etc.

But how does this galvanization work?

Galvanization is a process of coating Zinc over iron.

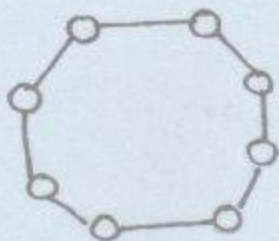
Dr. O! Painting, oiling and greasing form a layer on the iron surface thereby protecting the surface from Oxygen and moisture.

Zinc does not corrode or rust.

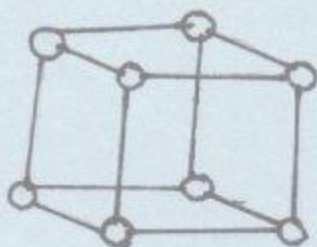
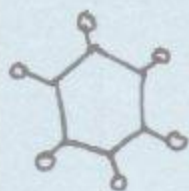
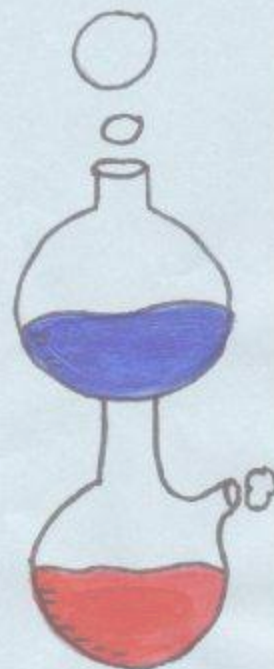
So electro-chemically coating iron with a layer of Zinc would help prevent corrosion.

Wow! That's awesome. Today we have learnt so much about corrosion and ways to prevent it.

Thank you, Dr. O. You are a genius.



Scene 6

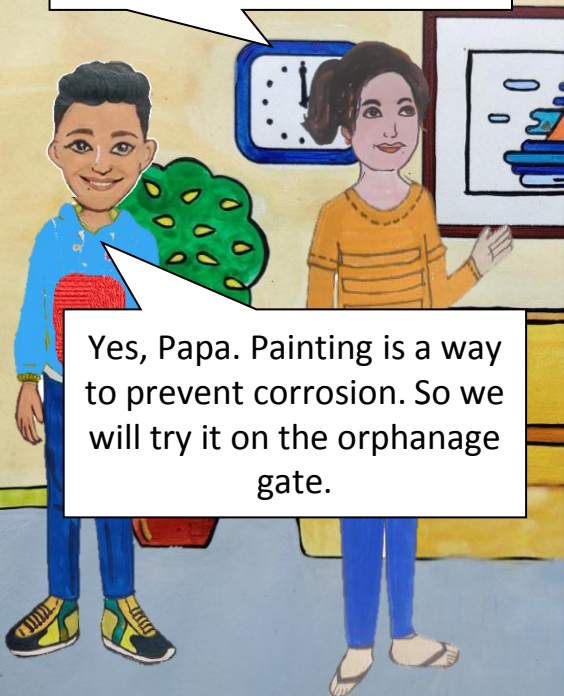


Dada, Dadi, we have thought a plan..



What plan dear?

Papa, we will paint the gate of the orphanage to make it corrosion-free.



Yes, Papa. Painting is a way to prevent corrosion. So we will try it on the orphanage gate.

That sounds good. So then let's bring the materials required.



Yes, Mumma. I will come with you to the shop to buy the required materials.



Mumma, look!
We should get all
the required
materials in that
shop.

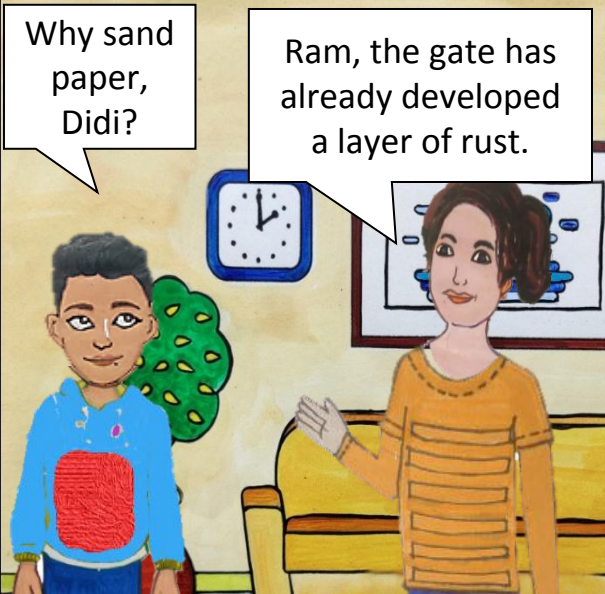
Fine dear.
Let's go
there.

They purchase the materials and return.



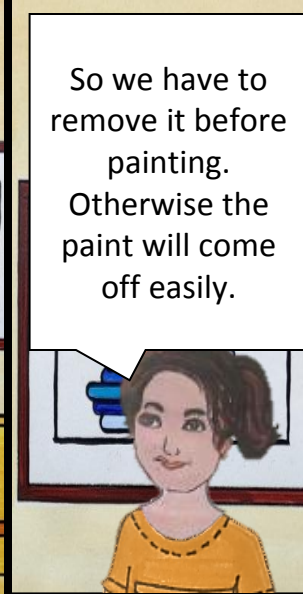
Didi, what do
we require?

We require oil
paints, paint
brushes and
some sand
papers.

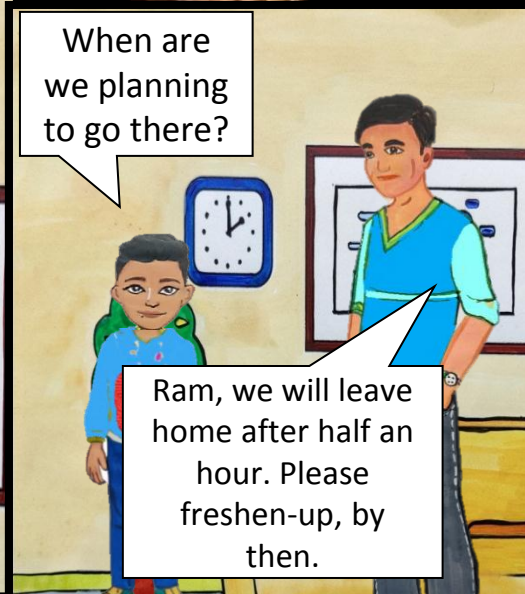


Why sand
paper,
Didi?

Ram, the gate has
already developed
a layer of rust.



So we have to
remove it before
painting.
Otherwise the
paint will come
off easily.



When are
we planning
to go there?

Ram, we will leave
home after half an
hour. Please
freshen-up, by
then.



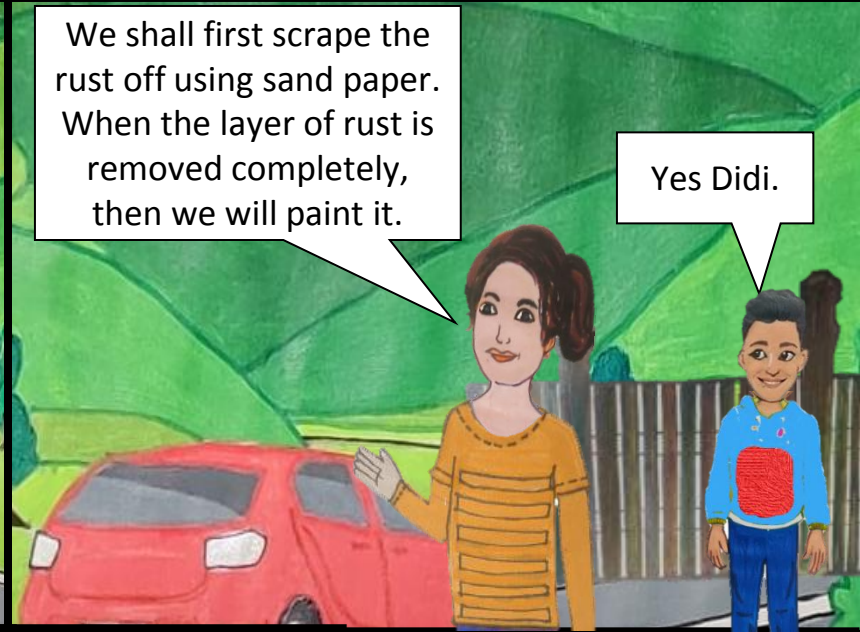
Rina and Ram,
have you taken
all the required
things for
painting?

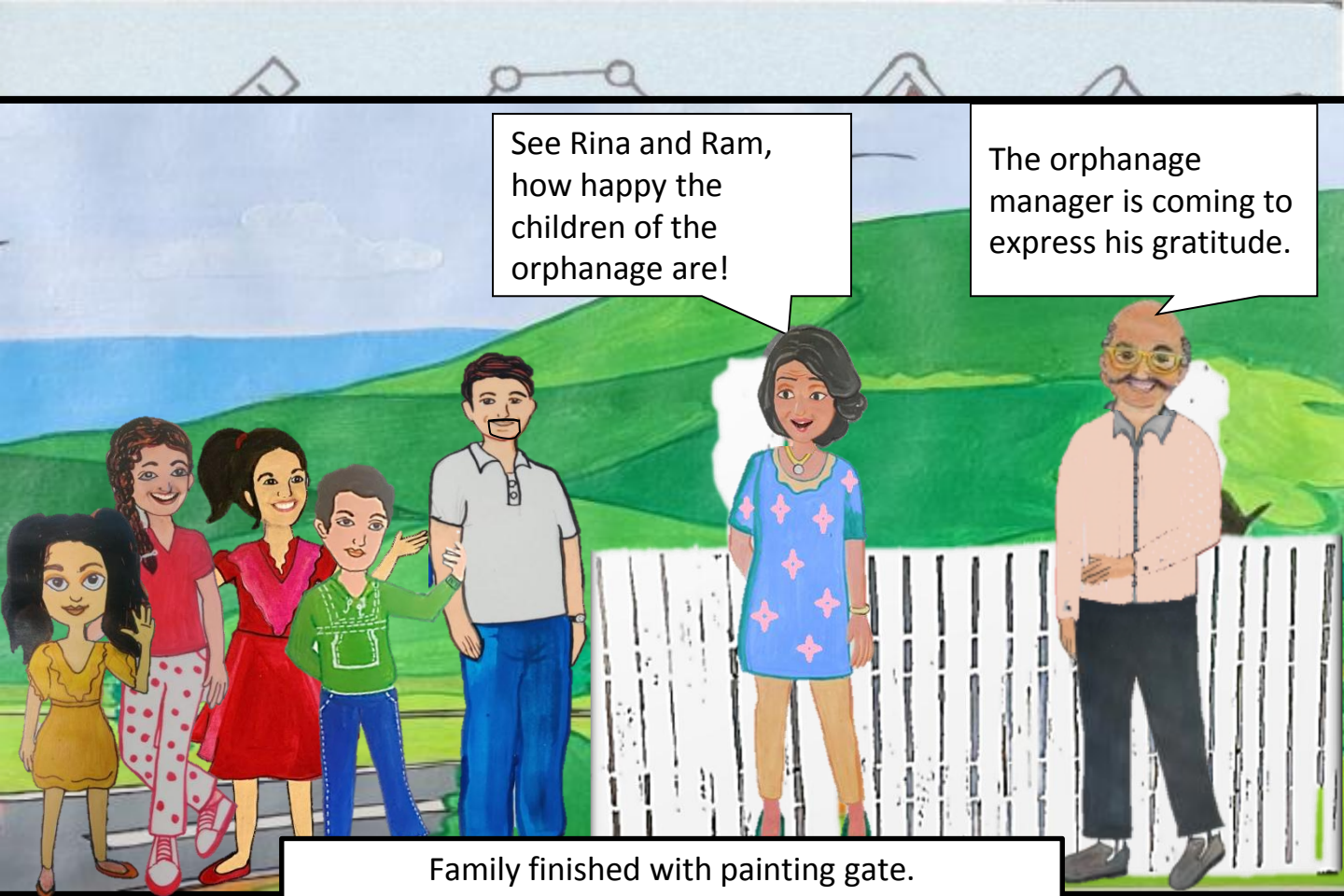
Yes Dadaji. I
have packed
everything.



We are very happy to see
how empathetic and
caring you are.

Yes, indeed! We
are proud of you.

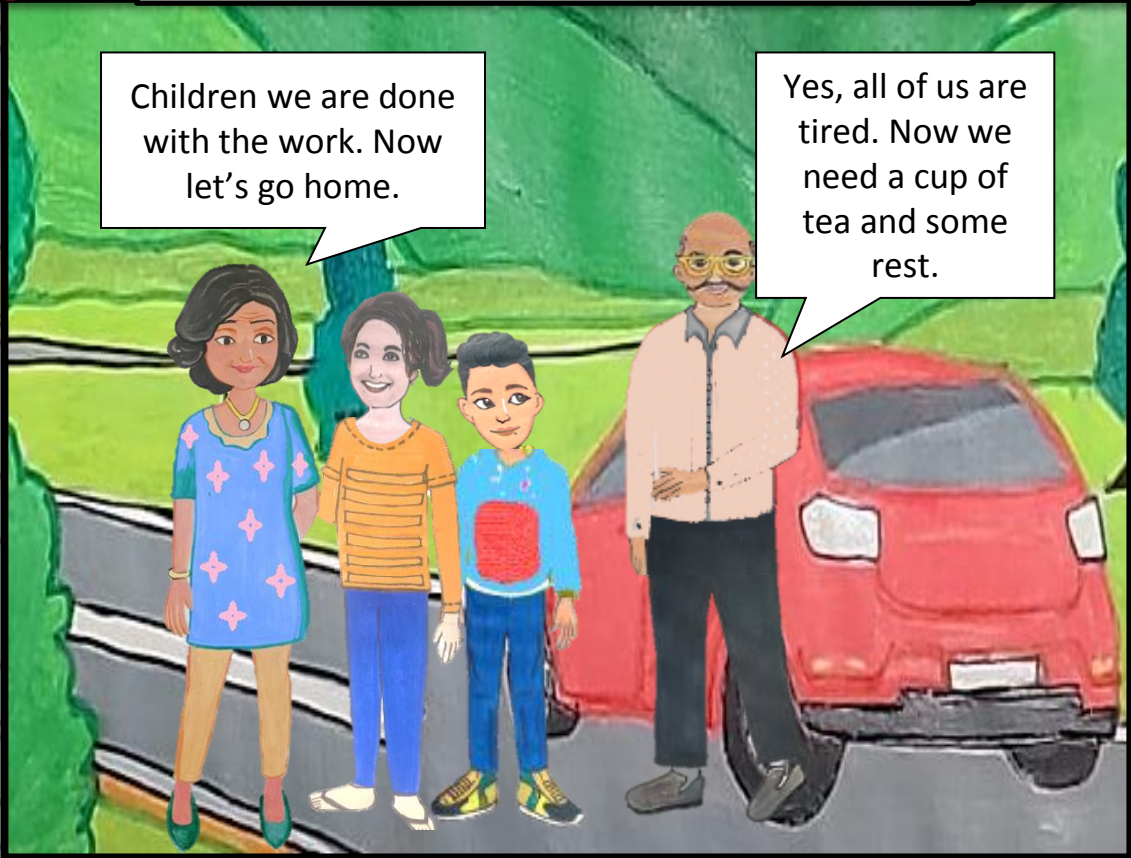




See Rina and Ram,
how happy the
children of the
orphanage are!

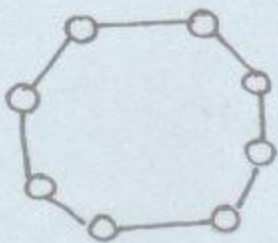
The orphanage
manager is coming to
express his gratitude.

Family finished with painting gate.

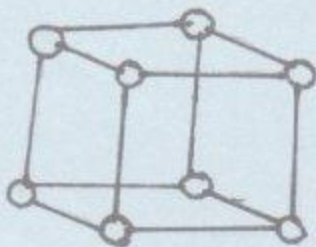
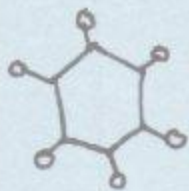
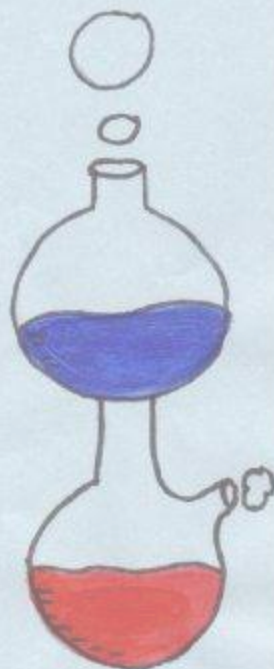


Children we are done
with the work. Now
let's go home.

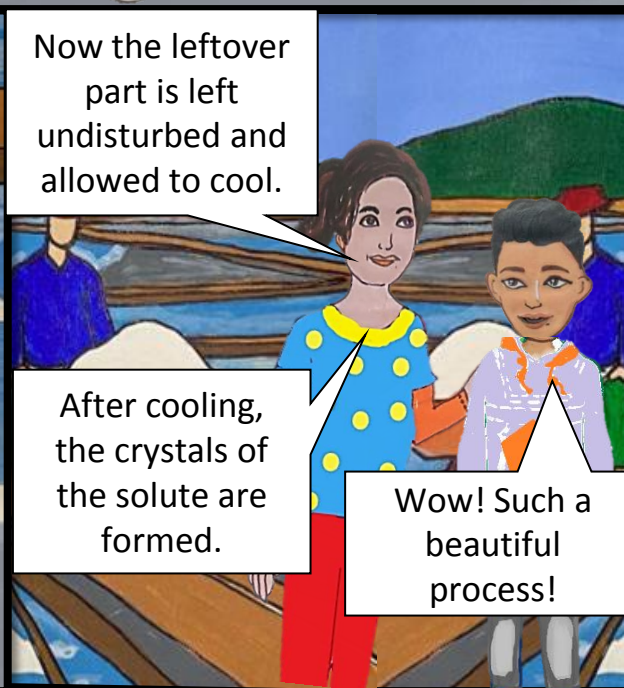
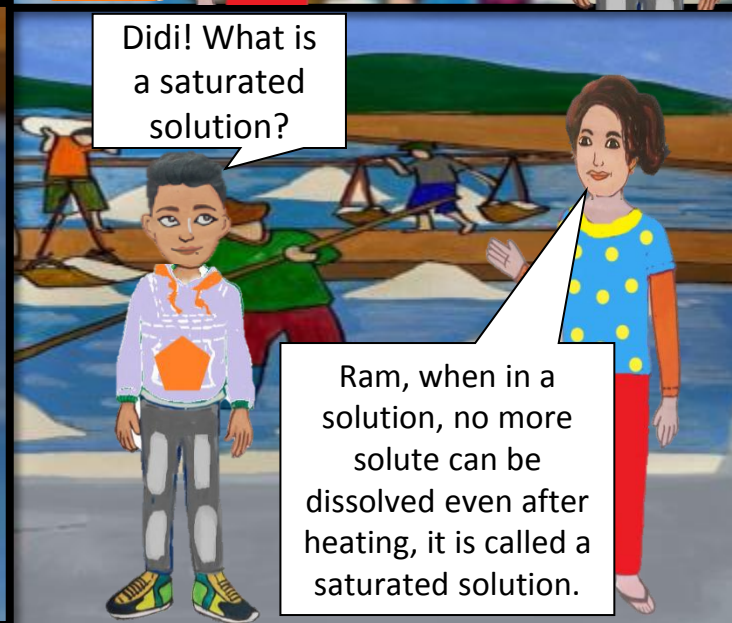
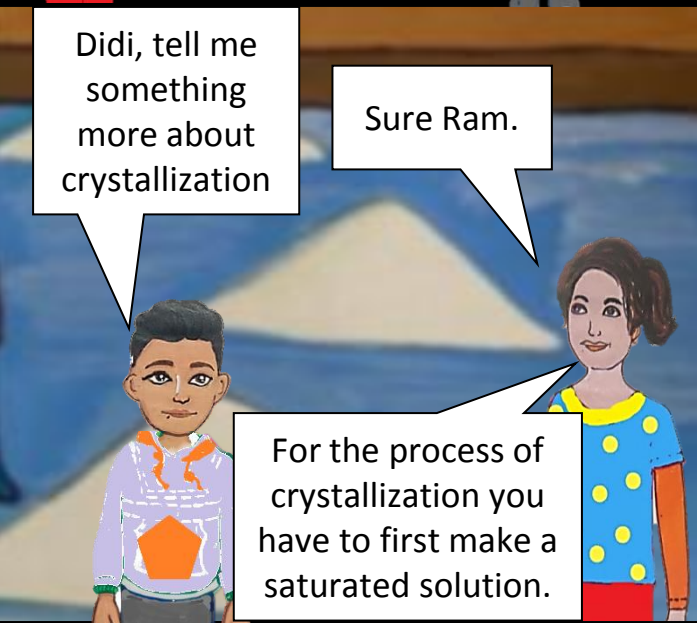
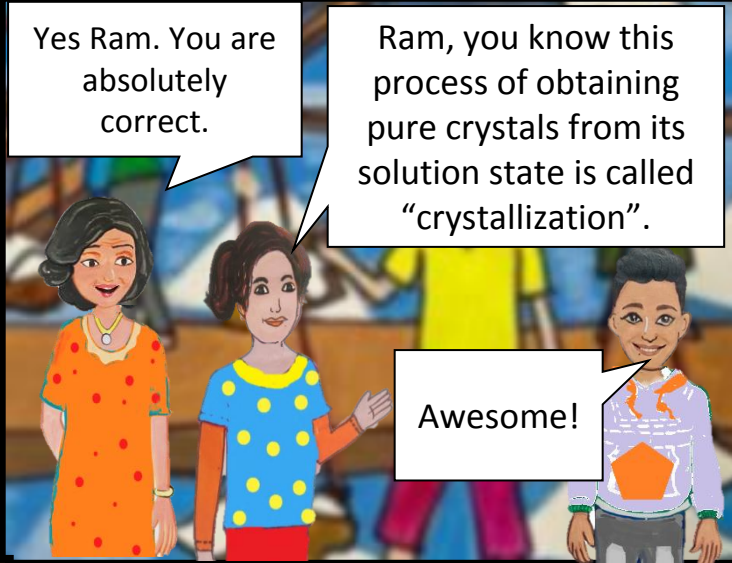
Yes, all of us are
tired. Now we
need a cup of
tea and some
rest.

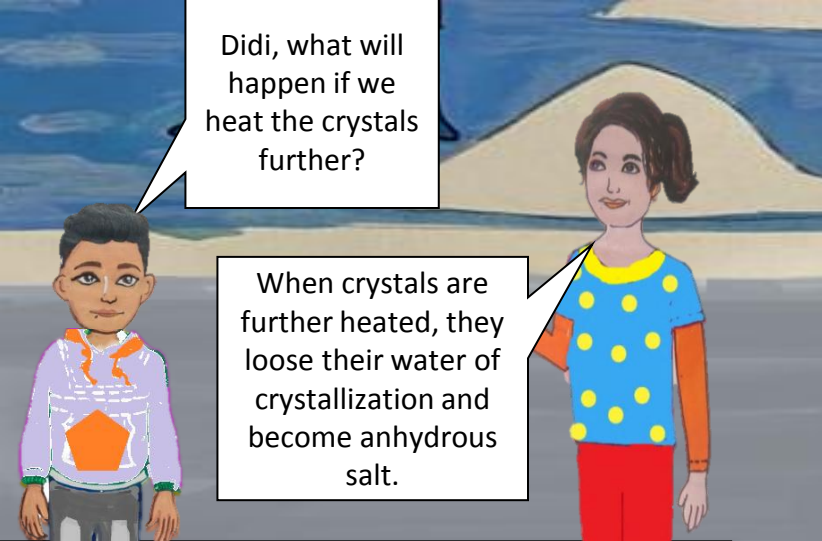


Scene 7









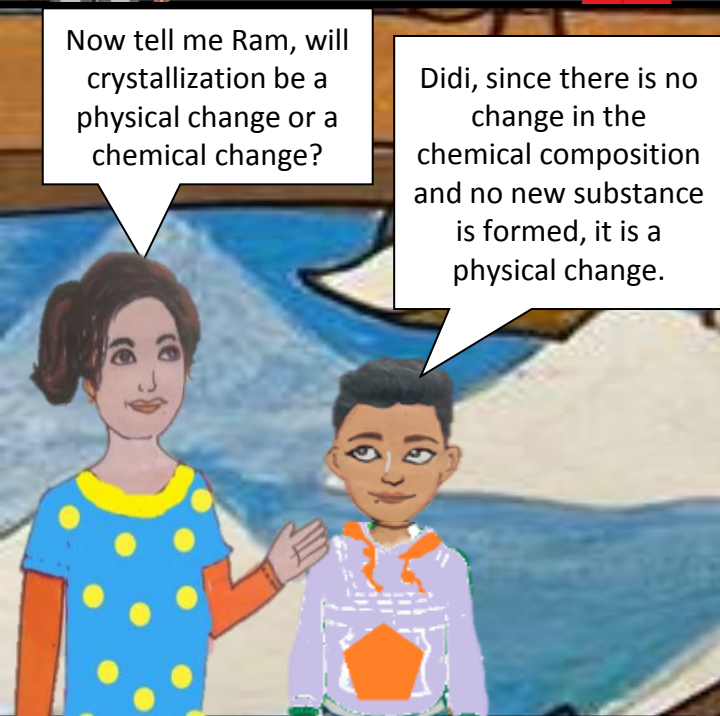
Didi, what will happen if we heat the crystals further?

When crystals are further heated, they lose their water of crystallization and become anhydrous salt.



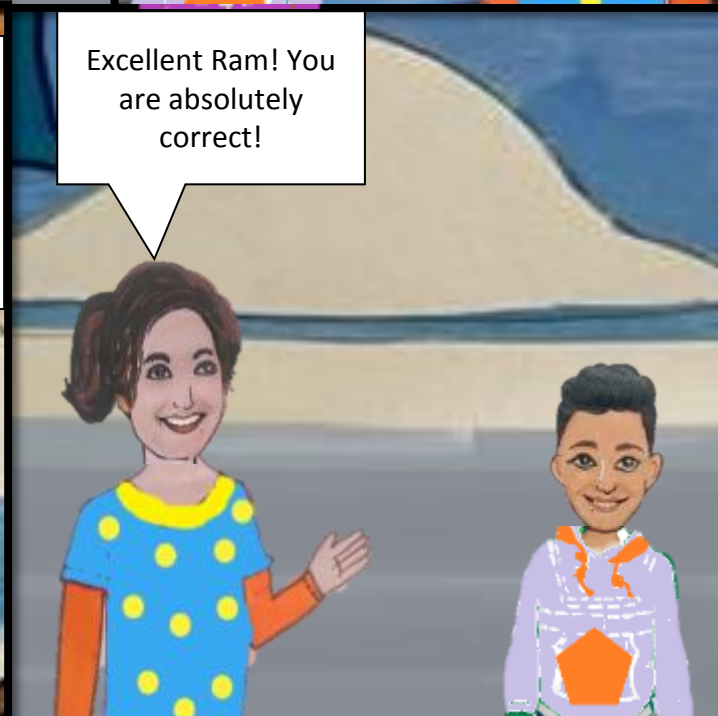
Do they lose their shape and colour?

Yes they become white in colour and powdery in texture.

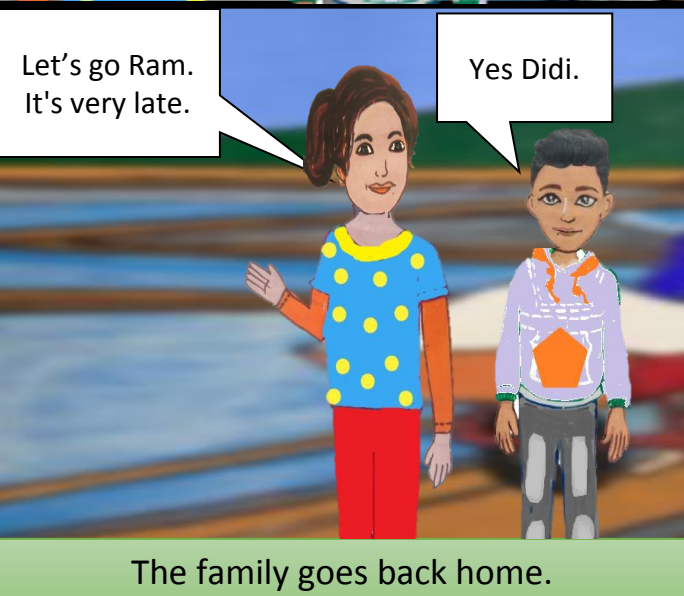


Now tell me Ram, will crystallization be a physical change or a chemical change?

Didi, since there is no change in the chemical composition and no new substance is formed, it is a physical change.

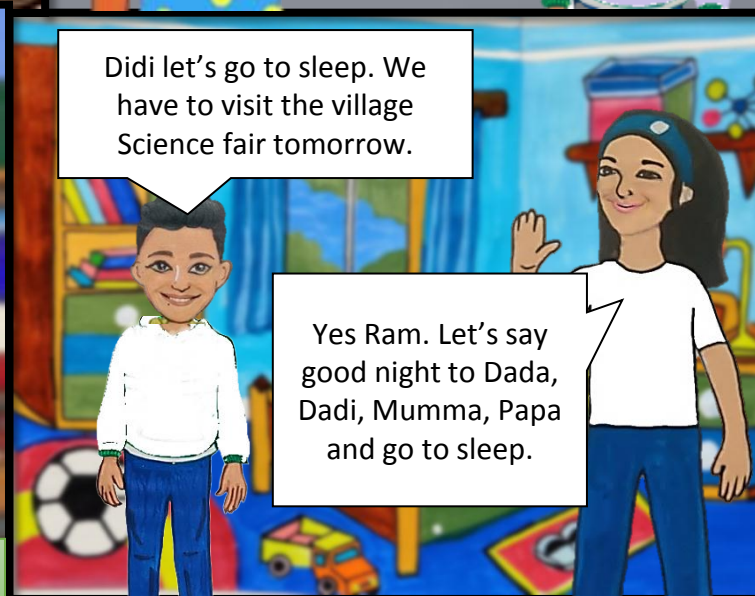


Excellent Ram! You are absolutely correct!



Let's go Ram. It's very late.

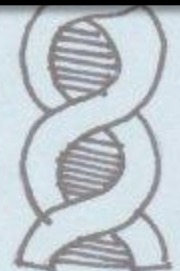
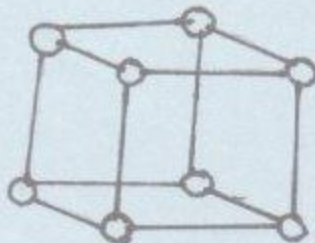
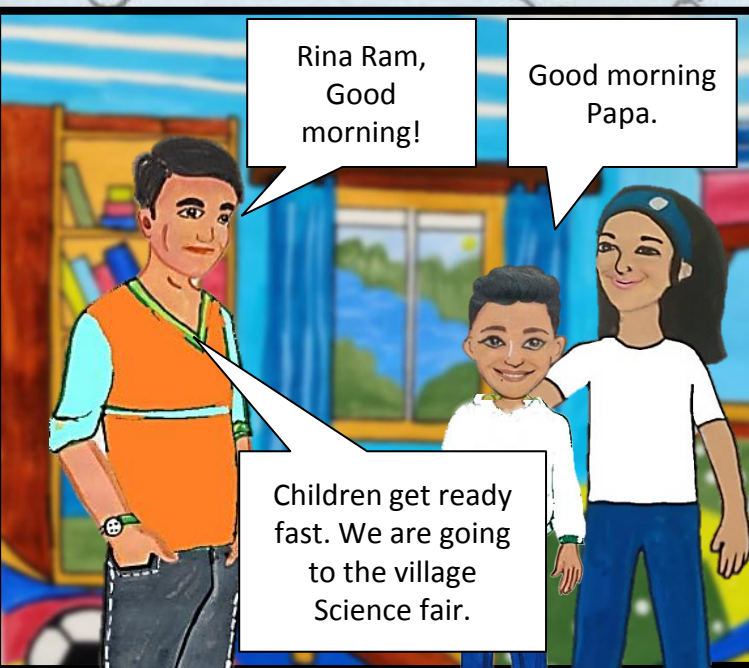
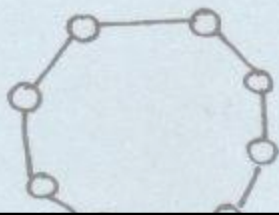
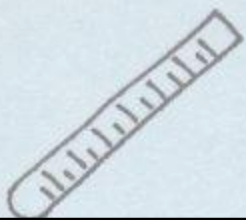
Yes Didi.

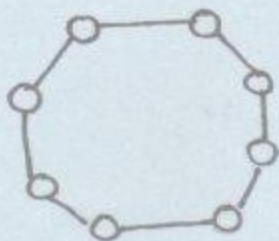


Didi let's go to sleep. We have to visit the village Science fair tomorrow.

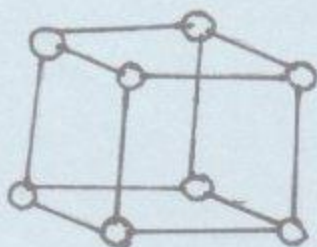
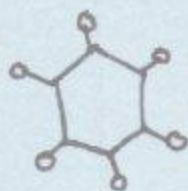
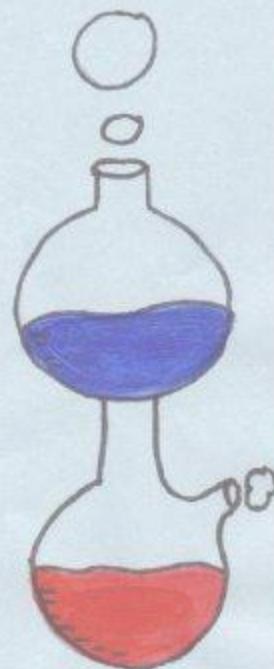
Yes Ram. Let's say good night to Dada, Dadi, Mumma, Papa and go to sleep.

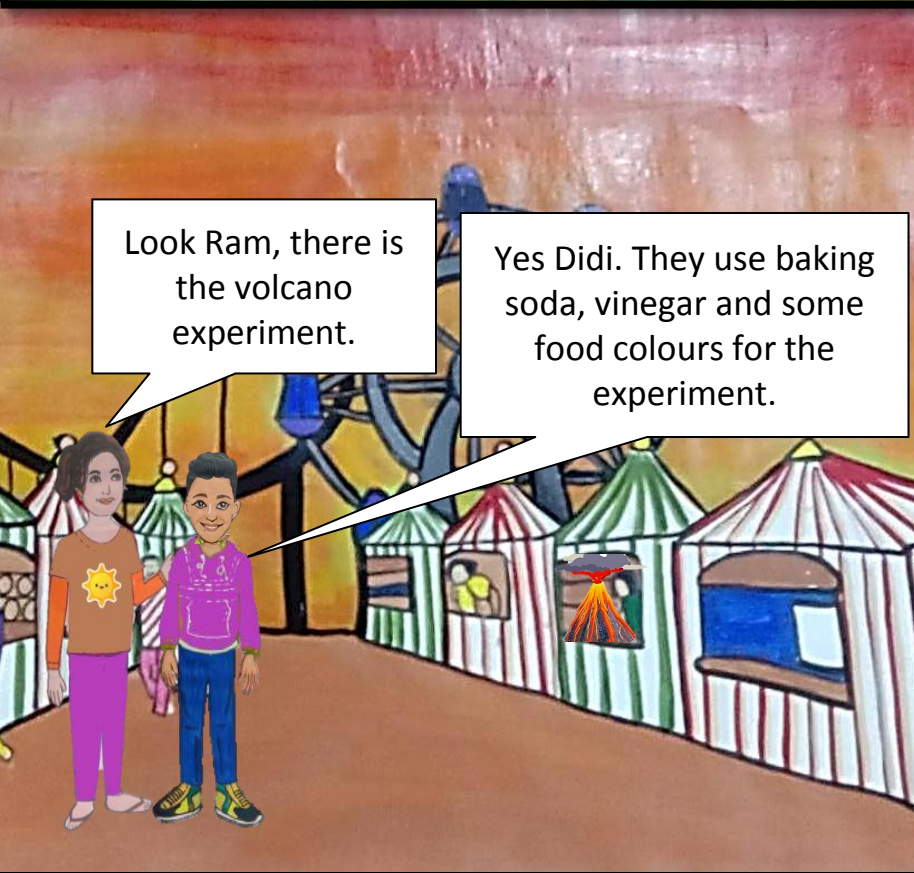
The family goes back home.

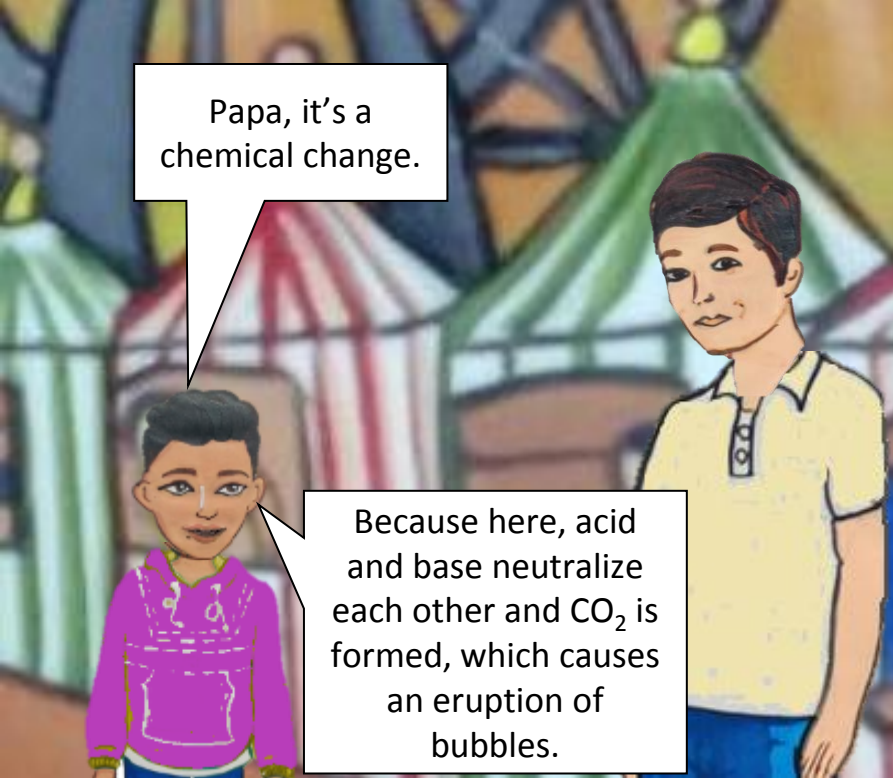




Scene 8

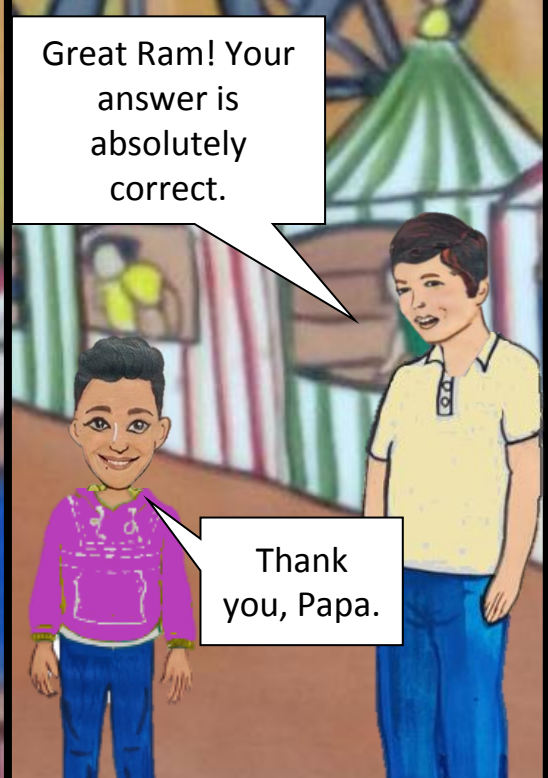






Papa, it's a chemical change.

Because here, acid and base neutralize each other and CO_2 is formed, which causes an eruption of bubbles.



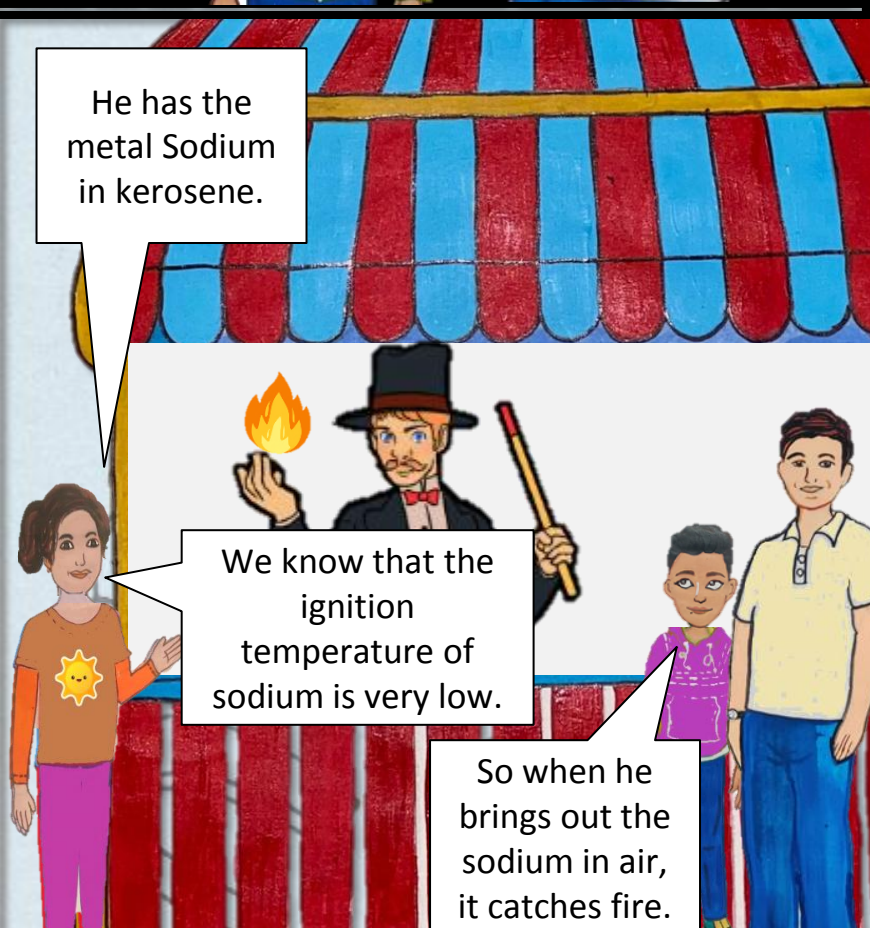
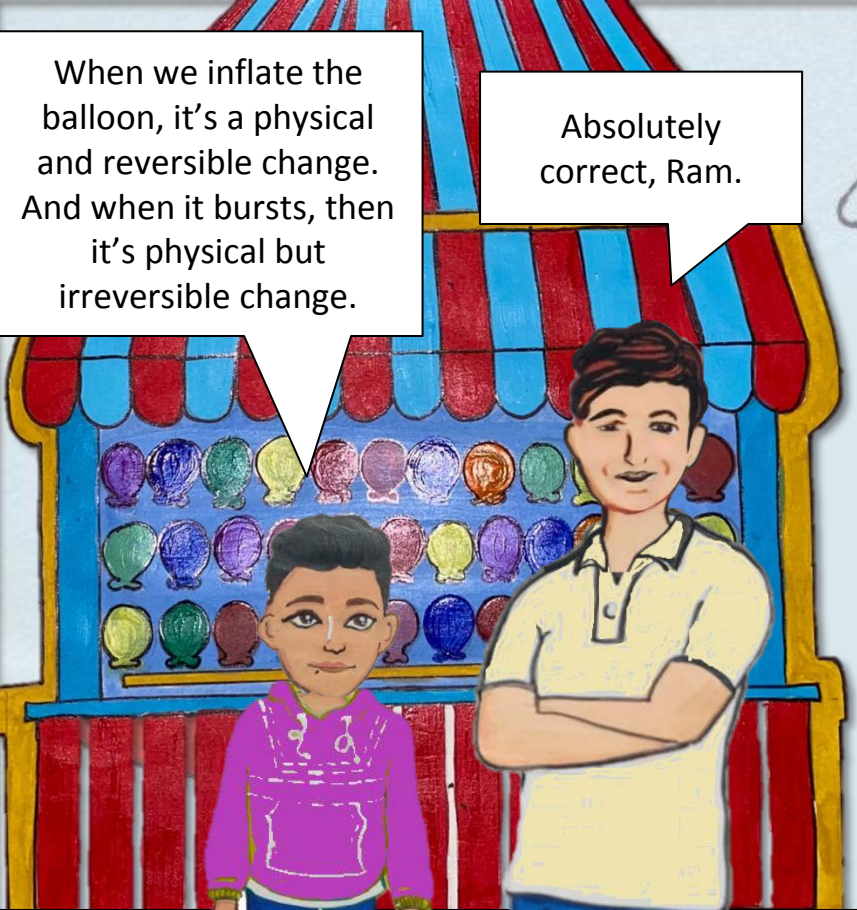
Great Ram! Your answer is absolutely correct.

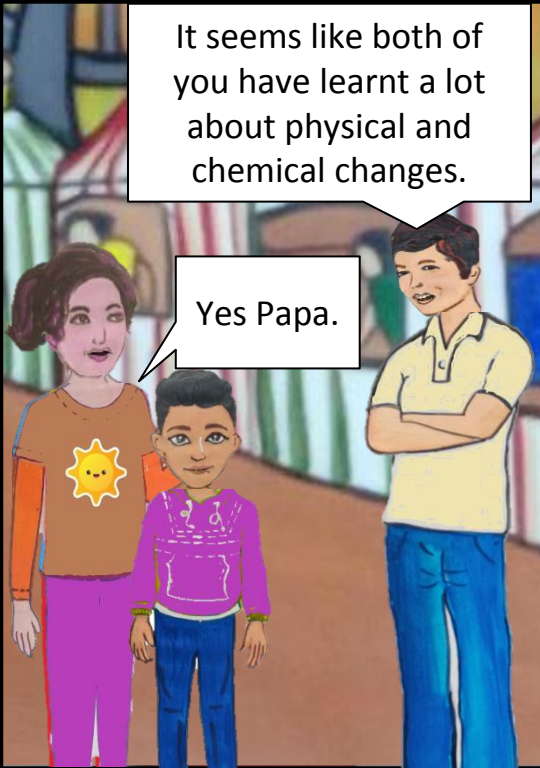
Thank you, Papa.



Look children, there is the "shooting balloon" stall.

Let's go there Papa.



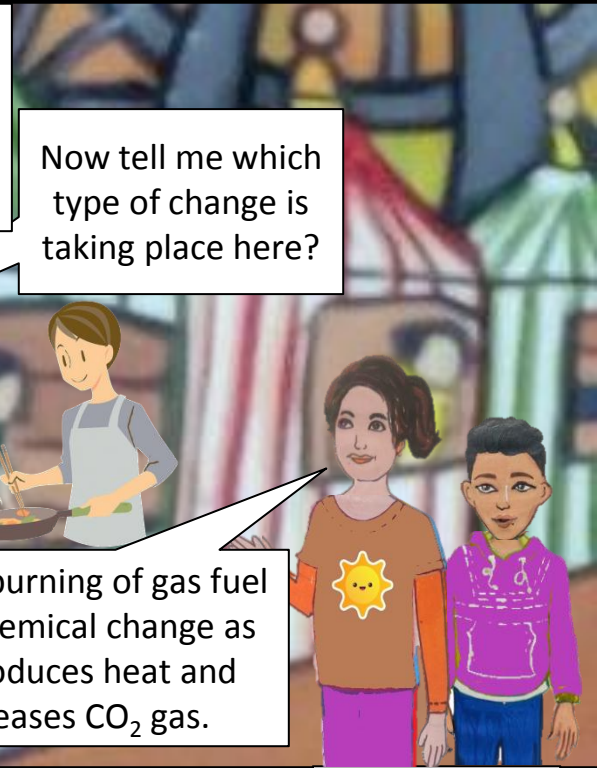


It seems like both of you have learnt a lot about physical and chemical changes.

Yes Papa.



Look at that stall. The person is cooking "chaat" on a gas stove.

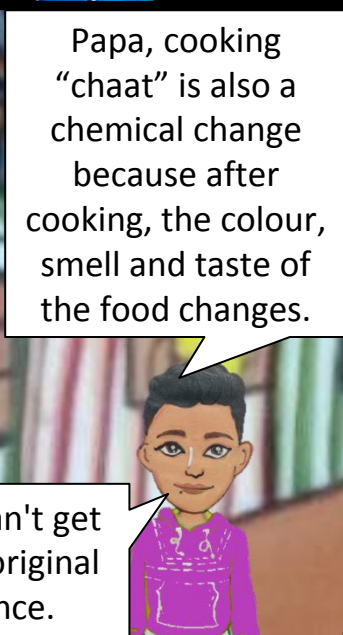


Now tell me which type of change is taking place here?

Papa, burning of gas fuel is a chemical change as it produces heat and releases CO_2 gas.



So what about cooking "chaat"?



Papa, cooking "chaat" is also a chemical change because after cooking, the colour, smell and taste of the food changes.

And we can't get back the original substance.



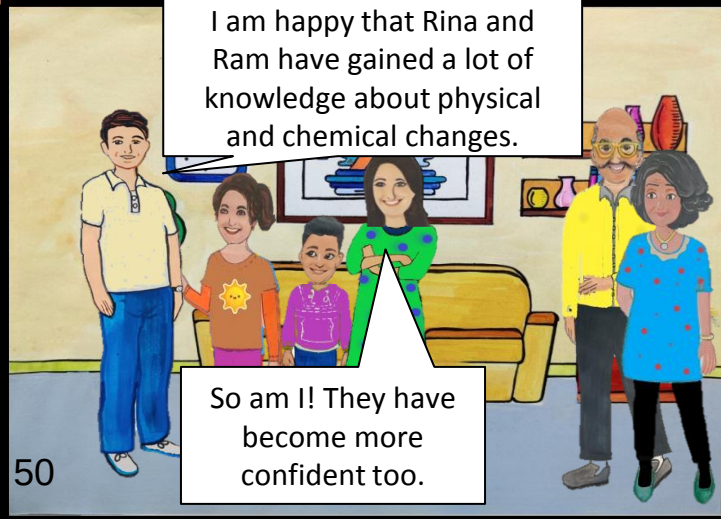
Great. I am impressed.



Papa, let's go home. We are tired of visiting so many stalls.

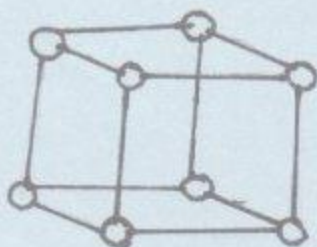
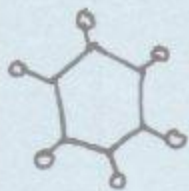
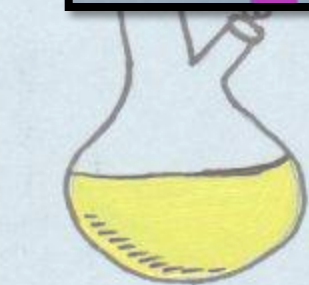


Okay children. Let's go back home



I am happy that Rina and Ram have gained a lot of knowledge about physical and chemical changes.

So am I! They have become more confident too.



EXERCISE

Q1. Find the incorrect statement from the following in relation to a chemical reaction:

- A. Heat may be given out but never absorbed
- B. Sound may be produced
- C. A colour change may take place
- D. A gas may be evolved

Q2. Properties of substances like size, shape, colour, state of a substance are _____ properties.

- A. chemical properties
- B. mental properties
- C. physical properties
- D. physico-chemical properties

Q3. Rusting of iron is a

- A. Physical change
- B. Chemical change
- C. both A and B
- D. none of these

Q4. Iron starts rusting when exposed to:

- A. Oxygen and water
- B. soil and rain
- C. breeze and sunlight
- D. salt water and clouds

Q5. The process of coating a layer of Zinc over iron is known as:

- A. aluminisation
- B. galvanization
- C. fertilisation
- D. ironing

Q6. Which of the following is a chemical change?

- A. Germination of seeds
- B. Cutting a piece of paper
- C. Bursting of fire crackers
- D. Both A and C

Q7. Which of the following is not a clue that could indicate the occurrence of a chemical change?

- A. Change in colour
- B. Change in shape
- C. Change in energy
- D. Change in odour

Q2. Fill in the blanks:

- a. For rusting, the presence of _____ and _____ is important.
- b. Rusting can be prevented by _____, _____ and _____ the iron articles.
- c. Burning of anything is a _____ change.
- d. When vinegar reacts with baking soda _____ gas is evolved.
- e. A gas may evolve during a _____ change.
- f. When you add your breakfast cereal into warm milk, it becomes soggy. This is a _____ change.

Q3. True / false:

- a. Pure salt is obtained by the process of crystallization.
- b. Oxygen is an important factor for rusting.
- c. A chemical change can also be called as a chemical reaction.
- d. Chemical changes are temporary in nature.
- e. Sodium is used for the process of galvanization.
- f. Oiling and painting are the methods to prevent rusting.
- g. Formation of manure from leaves is a physical change.

Q4. Unscramble the following words:

A. NOTISAILALSTYCRY

B. ONTINIVALAGZA

C. RUNGSIT

D. ARVIENG

E. ONTIVAEPOAR

ANSWER KEY

Q1. MCQ

1. A. Heat may be given out but never absorbed,
2. C. Physical properties
3. B. Chemical change
4. A. Oxygen and water
5. B. Galvanization
6. D. Both (A) and (C)
7. B. Change in shape

Q2. Fill in the Blanks:

- a. Oxygen and water, b. Painting, Oiling and galvanization,
- c. chemical, d. Carbon dioxide, e. chemical,
- f. Physical Change

Q3. True/False:

- a. True b. True c. True d. False e. False f. True g. False

Q4. Unscramble the following words Answers:

- A. NOTISAILALSTYCRY - Crystallisation
- B. ONTINIVALAGZA - Galvanization
- C. RUNGSIT - Rusting
- D. ARVIENG - Vinegar
- E. ONTIVAEPOAR - Evaporation

PRINCIPAL'S DESK

Human beings learnt to draw even before they learnt to write. This skill has been passed on to us from our ancestors. This is evidence about how well our brain can comprehend visual information. Our learning comes from different sources and all our senses. However, still a majority comes from visual information.

Bringing about innovation in the teaching learning process is the need of the hour. I strongly believe that the initiation of this concept of graphic novels will not only enhance but also sustain the interest of the learners. Since the human brain can process visuals better than mere text, it will help the students comprehend concepts readily. The content created with graphics is indeed more engaging and enhances many aspects of learning including recognition, recall as well as problem solving. This will help the students to develop better analytical and critical thinking skills.

The concept of graphic novel is deemed to be successful because, "The brain processes visual information 60,000 times faster than text."

We are a part of this leap in education with the aim for our students to excel and shine.

Ms. Kanchan Joshi

Principal

Cygnus World School

SUMMARY

This is a story of two curious kids. While observing the changes in daily life, they become curious and wish to explore these changes in depth. As the story progresses, they are able to understand various types of changes with the help of their elders and Dr. O. By only observing the characteristic of some changes and ways to avoid them, they learned to solve some real-life problems.

REFERENCES

Following references / websites and YOUTUBE videos have been referred to during the preparation of this Graphic Novel:

- https://www.nationalgeographic.org/article/changes-matter-physical-vs-chemical-changes/?utm_source=BibblioRCM_Row
- <https://www.youtube.com/watch?v=LZH8DzQTsQY>
- https://www.google.com/search?q=physical+and+chemical+change&client=firefox-b-d&tbm=isch&source=lnms&sa=X&ved=2ahUKEwiVsuCN7qv2AhVwsVYBHSaLDuEQ_AUoAXoECAEQAw&biw=1366&bih=643&dpr=1#imgsrc=dJY93487K1DsIM
- <https://www.google.com/search?client=firefox-b-d&q=questions+on+chemical+and+physical+changes>
- <https://www.learncbse.in/physical-and-chemical-changes-class-7-extra-questions/>