

Graphic Novel
SCIENCE - Class IX
Chapter 4: Structure of the Atom



VALENCY

(Art Integrated Learning)



DELHI PUBLIC SCHOOL, SEC-45, GURGAON
(Affiliated to C.B.S.E)

ACKNOWLEDGEMENT

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DISCLAIMER

This graphic novel by Delhi Public School, Sector-45, Gurgaon, is designed to provide information, ignite interest and enable joyful learning of the text. 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 any way distorting the basic facts.

PREFACE

“The beauty of a living thing is not the atoms that go into it, but the way those atoms are put together.”

Carl Sagan

Chemistry, the science of atoms, molecules, their properties, structure and composition, has been an intriguing subject for young learners. If knowledge about this subject is presented in the form of a story by referring to real life situations, it will undoubtedly become more engaging and comprehensible.

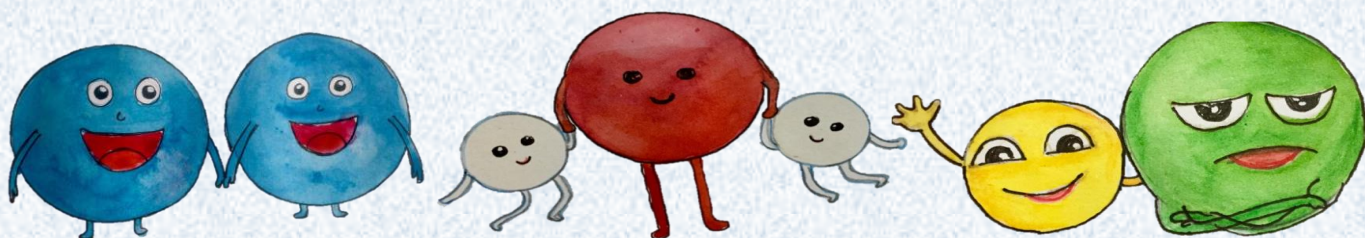
The graphic novel, '**Valency**', is a modest attempt to make the teaching and learning of atoms, molecules and valency a joyful and engrossing experience. The novel, written in a simple way, skilfully integrates an interesting storyline with vivid graphics and scientific knowledge about chemistry to enable the students to visualise the structure of an atom and the changes it undergoes. The protagonist in the novel, Chiranjeev, is so fascinated by the world of atoms and molecules that at night, he dreams of visiting a fantasy world of elements with his friends, where they see atoms and molecules moving about freely.

This novel, with all its colourful illustrations, interesting puzzles, thought provoking riddles, aims to ignite curiosity and inquisitiveness among the students by empowering them to comprehend the core concepts of the subject and develop a liking for the subject, chemistry.

We, at DPS Sector 45, Gurgaon, hope that this humble effort on our part will go a long way in providing opportunities to students to express their ideas, share their opinions in lively classroom discussions and in the process make both teaching and learning chemistry an enjoyable and enriching experience.

LEARNING OUTCOMES

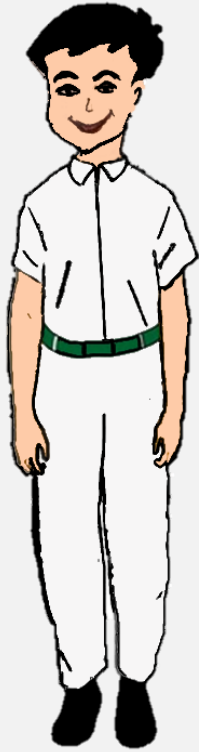
1. To acquire knowledge and sound understanding of composition of atoms and sub atomic particles of an atom.
2. To become familiar with the concept of electronic configuration.
3. To be able to understand Duplet and Octet rule.
4. To identify noble gas elements with the help of electronic configuration.
5. To gain clarity about the concept of valency and thereby apply the concept virtually through illustrations and images.
6. To be able to think beyond textbook content.
7. To appreciate new concepts of chemistry and develop a liking for the subject.



CHARACTERS



Ms. Madhu Sharma
Teacher



Chiranjeev
Student



Adira
Student



Bhumika
Student



Mr. Subramaniam
Chiranjeev's Father

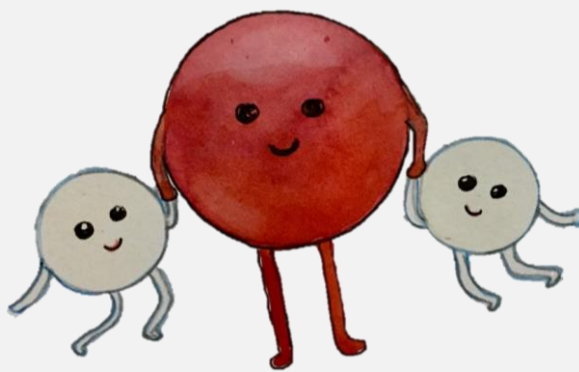


Mrs. Subramaniam
Chiranjeev's Mother

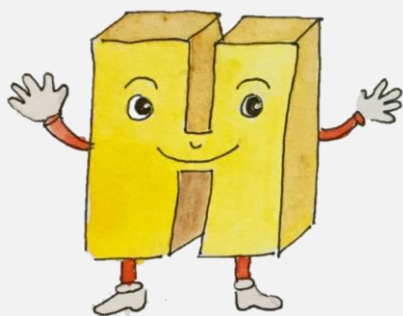
CHARACTERS



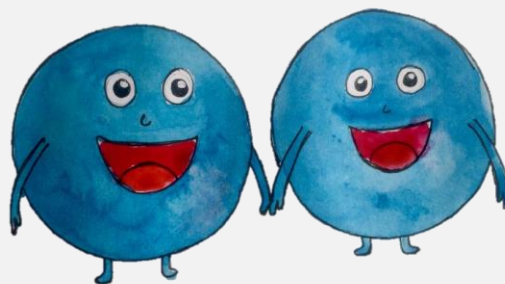
Neon atom (Ne)



Water molecule (H_2O)



Hydrogen atom (H)



Oxygen molecule (O_2)

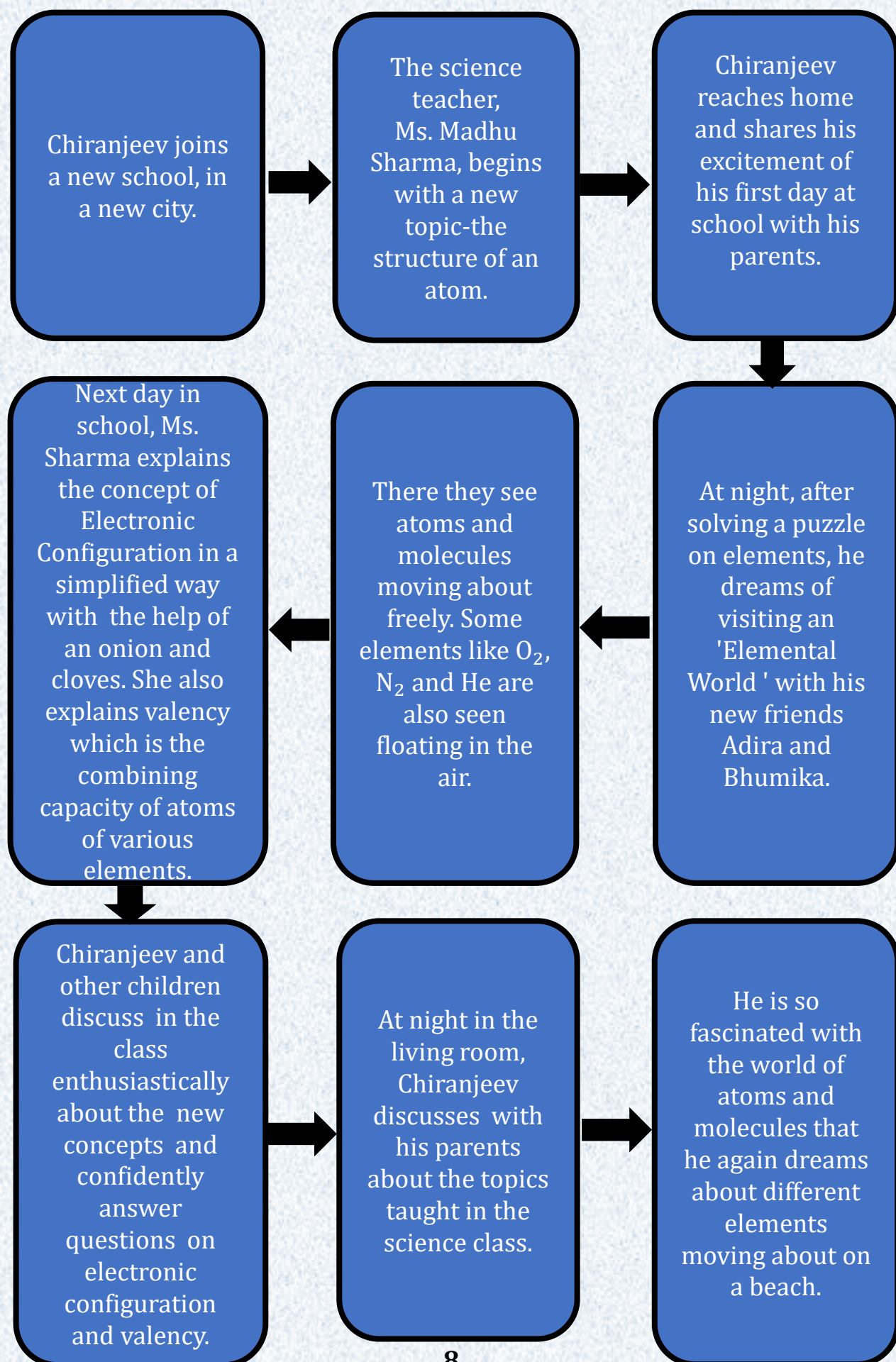


Helium atom (He)

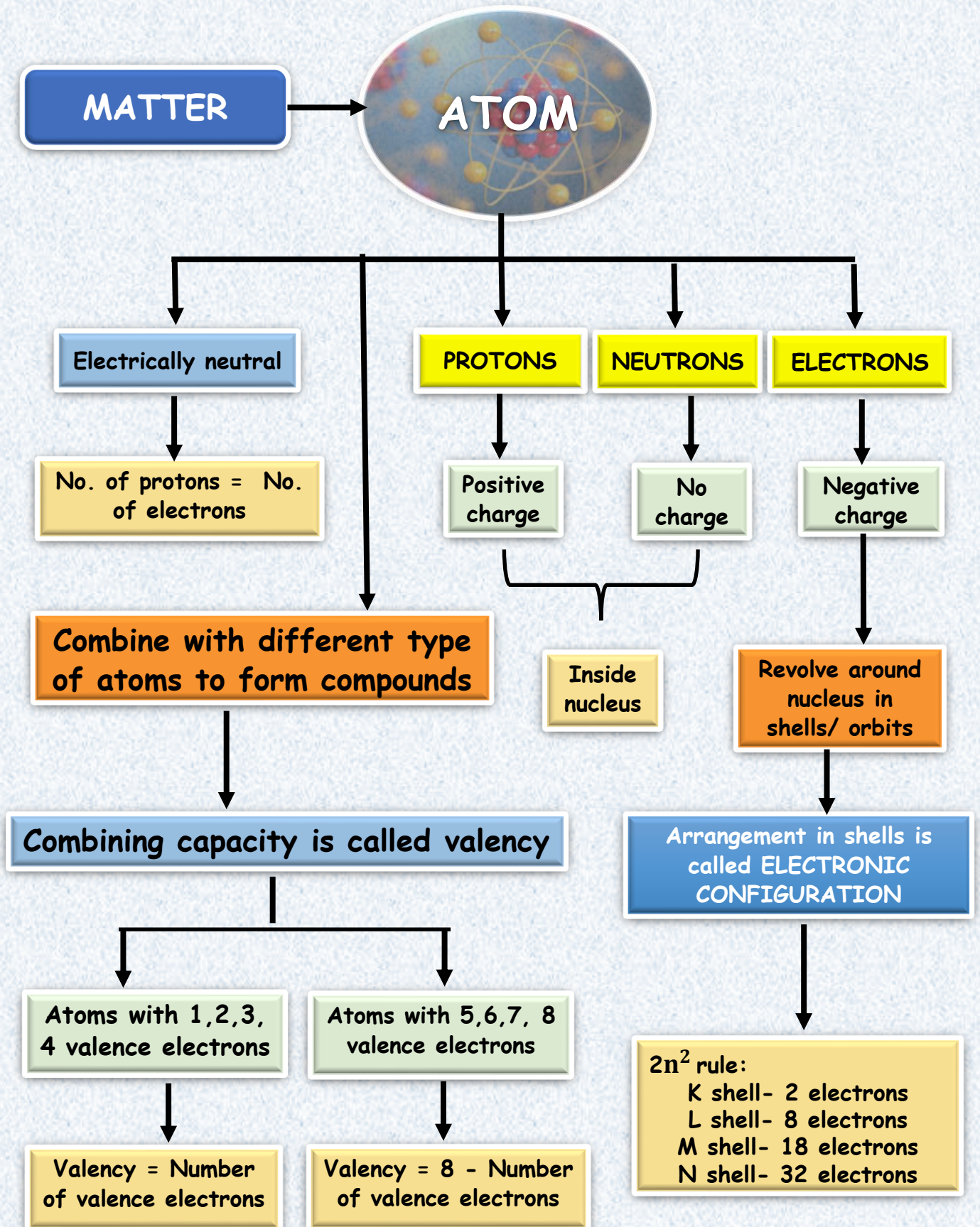


Sodium Chloride
molecule (NaCl)

STORY BOARD



THE CONCEPT



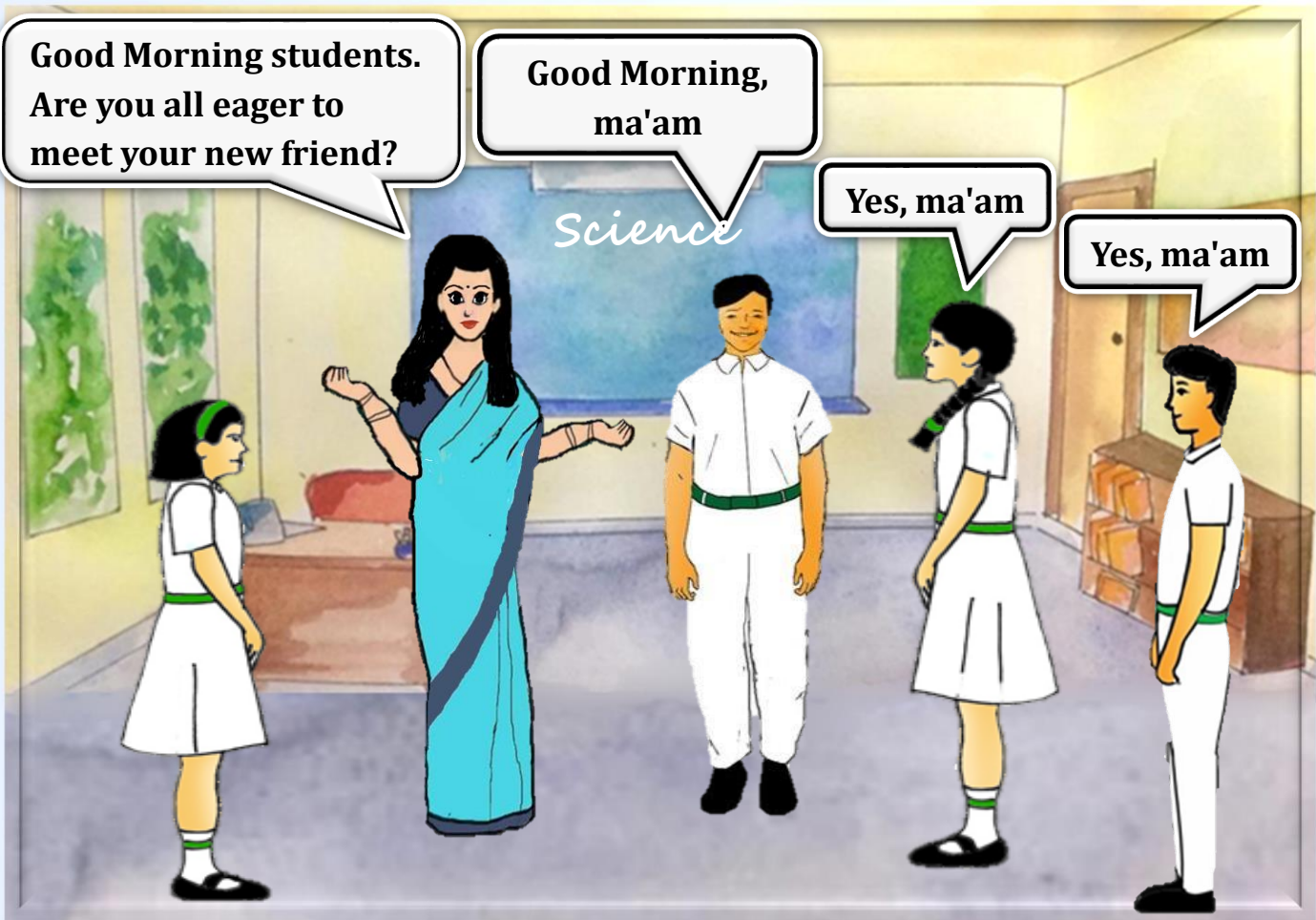
Ms. Madhu Sharma, the science teacher enters the class and greets the students.

**Good Morning students.
Are you all eager to
meet your new friend?**

**Good Morning,
ma'am**

Yes, ma'am

Yes, ma'am



**Children ,meet your new
classmate Chiranjeev.**

Hello, friends



**Chiranjeev, please introduce
yourself to the class.**



My name is Chiranjeev and I'm very happy to be with you all in this new school, in the new city.

Welcome Chiranjeev!

Welcome Chiranjeev!

Now children, it's time to start today's class.

Chiranjeev, do you like science?

Oh, Yes ma'am! Science is my favourite subject.

That's great Chiranjeev! Now, let me ask you a simple question. What is matter?

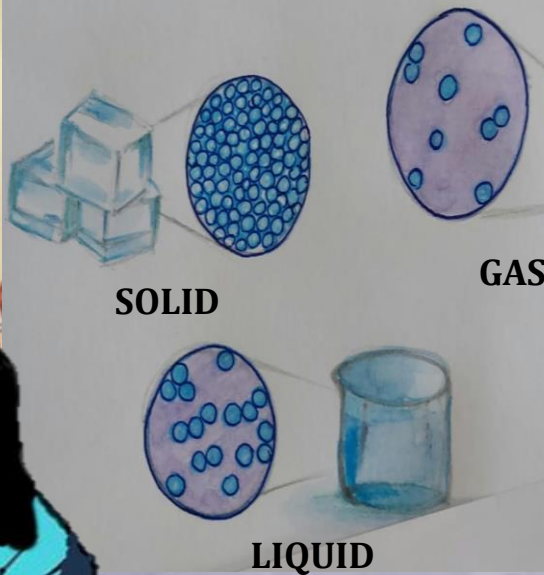
Ma'am, matter is anything that has mass and occupies space.

GOOD

INTERPARTICLE ARRANGEMENT IN MATTER

SOLID, LIQUID AND GAS

How can we classify matter?



Ma'am, matter is classified into solid, liquid and gas.

Do you know what is matter made up of?

Yes, ma'am... all matter is made up of tiny particles called atoms.

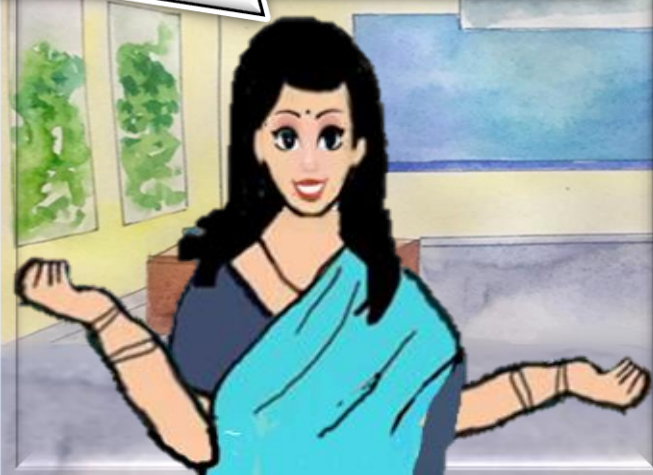
Very good, Chiranjeev. I am impressed!

Do you think all matter is made up of only one kind of atoms?

No, ma'am.

Yes, ma'am.

Adira. you're correct. Well tried!



Different kinds of matter are made up of different kinds of atoms.



Can we see these atoms?



No Chiranjeev, atoms are so small that they cannot be seen even with the most powerful microscope.



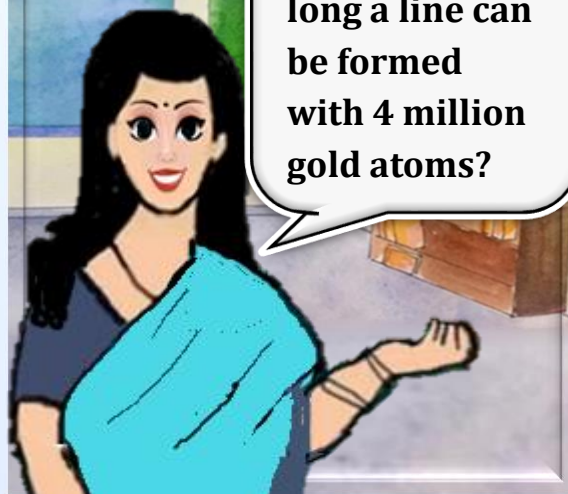
Ma'am, how small are they?



Imagine 4 million gold atoms arranged end to end.

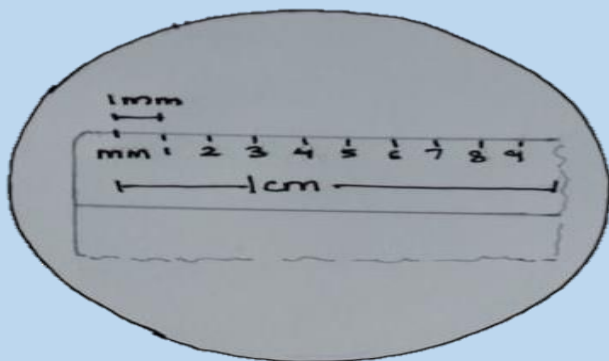


Can anyone guess how long a line can be formed with 4 million gold atoms?



Ma'am, may
be 10 cm?

Ma'am, can it
be 5 cm?



No children,
the atoms are
so small that
4 million gold
atoms will
form a line of
only 1 mm.

Ma'am, can matter
be made of same
kind of atoms?

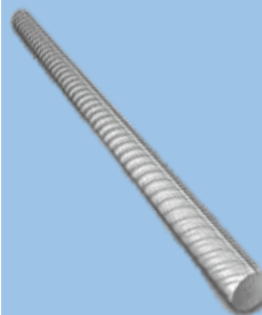
Yes Adira.

A substance
which is made up
of only one kind
of atoms is called
an element.

Ma'am, can you please give us
some examples of elements?

Well, there are only 118 different kinds of elements known to us.

For example -
Gold, Iron,
Aluminium,
Copper etc



IRON



GOLD

Think of atoms like the letters of the alphabet. Thousands of words can be formed from just 26 letters.

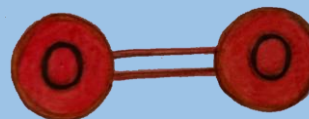


Similarly millions of different kinds of molecules can be made from only 118 different kinds of atoms.

Ma'am, what are molecules?

A molecule is the smallest particle of an element or a compound that can normally exist independently. In a molecule, two or more atoms are bonded together.

OXYGEN MOLECULE

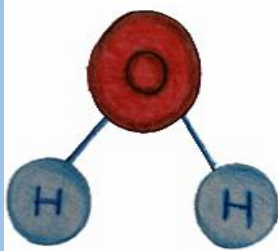


Two atoms of oxygen are bonded together to form a molecule of oxygen.

Ma'am, what is a compound?

It is a substance composed of two or more different kinds of atoms/elements bonded together in a fixed ratio by mass.

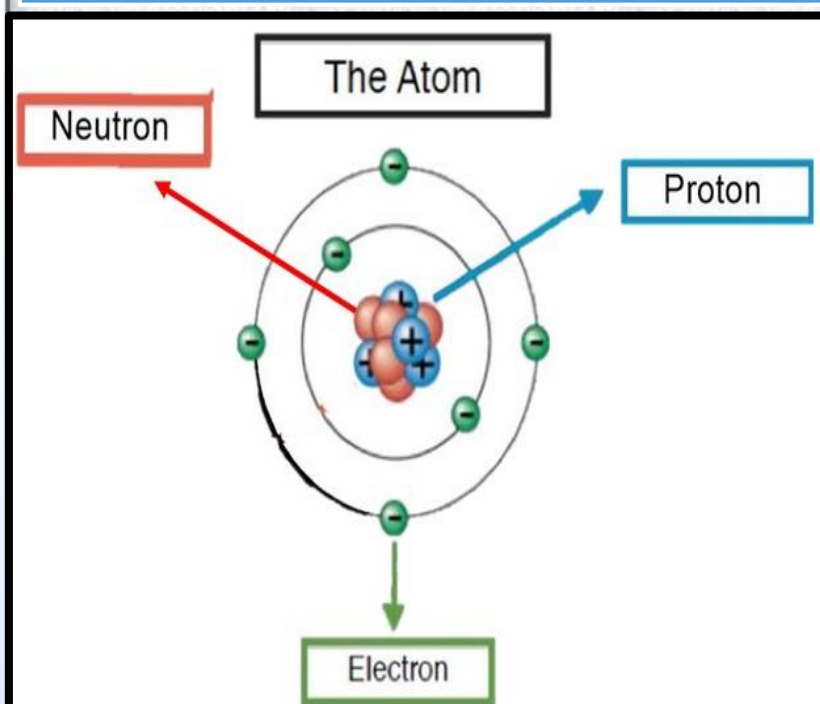
WATER MOLECULE

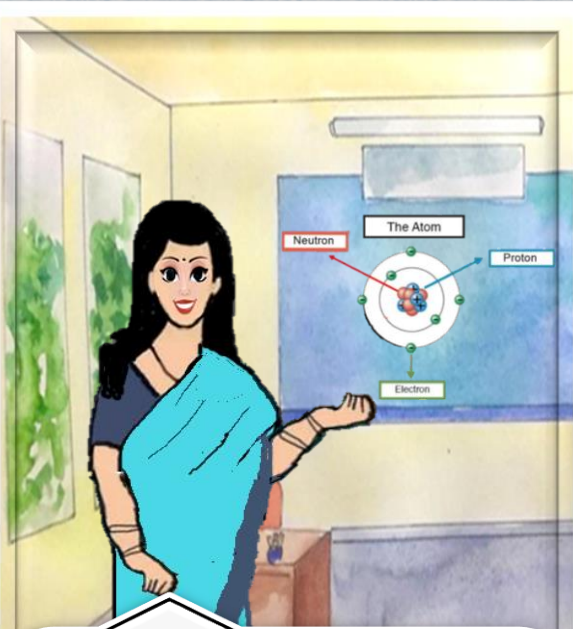


Two atoms of hydrogen combine with an atom of oxygen to form a molecule of water.

Ma'am, you explained that matter is made up of atoms. I would like to know whether an atom is also made up of something.

Ms. Madhu Sharma draws a diagram to visually depict the three fundamental particles inside the atom. The diagram will enable the children to understand the concept better.





Good question Chiranjeev!
An atom is made up of 3 sub atomic particles named as electrons, protons and neutrons.

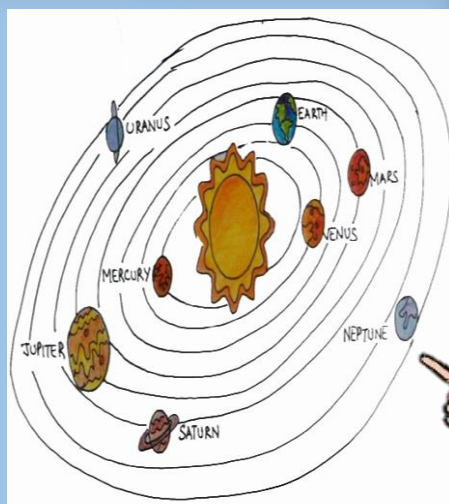


How are the sub atomic particles placed in an atom?



Protons and neutrons are placed in the centre of the atom, inside the nucleus while the electrons revolve around the nucleus in circular orbits or shells.

Ma'am, this looks like the solar system that we had studied.



Yes, indeed! So, students, this is how an atom looks.

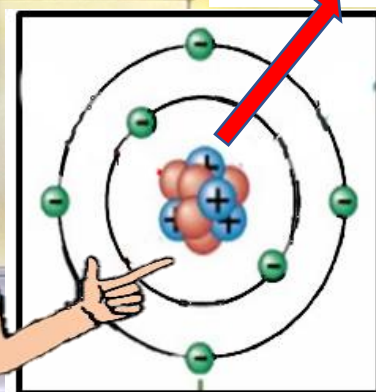


Ma'am, what is a nucleus?

A nucleus is the dense centre of an atom. It is small, heavy and positively charged.



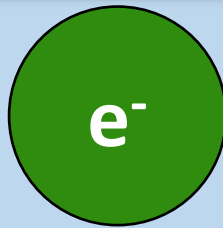
NUCLEUS



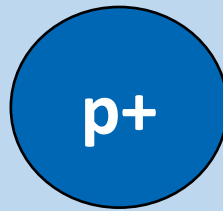
Ma'am, does that mean that protons and neutrons are positively charged?



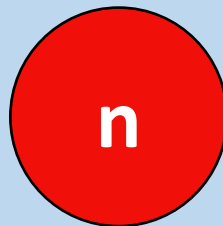
No, Chiranjeev, only protons are positively charged while neutrons, as the name suggests, are neutral. They have no charge.



ELECTRON



PROTON



NEUTRON



Electrons are negatively charged particles.

Ma'am, what about electrons? What charge do they have?



In an atom, the number of protons is equal to the number of electrons. This makes the atom electrically neutral.

Ma'am, is it because they nullify the effect of each other?



Yes, Adira





=



The number of protons which is equal to the number of electrons in a neutral atom is called the atomic number of the element.

Adira and Bhumika, tell me your roll numbers.

My roll number is 1.

Children just as you all have individual roll numbers; elements too have their unique atomic numbers.

Ma'am, which elements have atomic numbers 1 and 6?

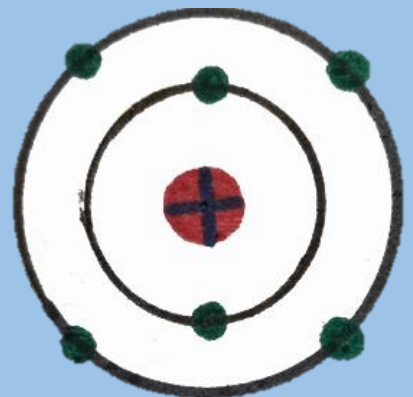
Ma'am, my roll number is 6.

Adira, element Hydrogen has atomic number 1 and 6 is the atomic number of carbon.

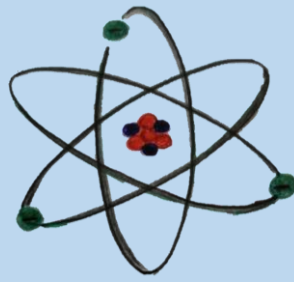
HYDROGEN



CARBON



Though atoms are invisible yet there are so many particles inside it. Simply amazing!

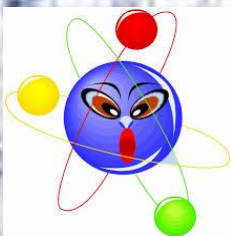


That's right. I am glad that all of you are enjoying the topic.

Thank you for the wonderful class, ma'am.

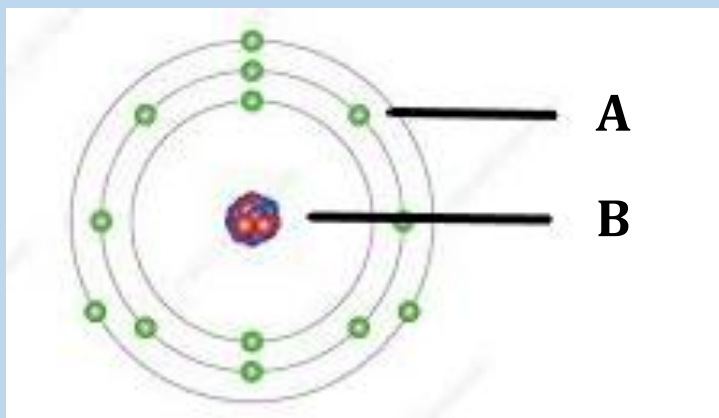
Science

Thank you for the wonderful class, ma'am.



DO YOU KNOW SOMETHING ABOUT ME?

Label the parts in the diagram of aluminium atom given below and answer the questions that follow:



1. Which subatomic particles are present in the centre of the atom? _____
2. Which subatomic particle is negatively charged?

3. Which subatomic particle is positively charged?

4. Name the subatomic particle which is neutral.

5. What is the number of protons present in the aluminium atom? _____

Chiranjeev is at home with his parents, having dinner.

Chiranjeev, how was the first day in your new school?

Wonderful dad! I could answer many questions in Science class.



So, what did you study in your favourite subject?

I studied about matter and what it is made up of..

That's good! Enjoy your studies.



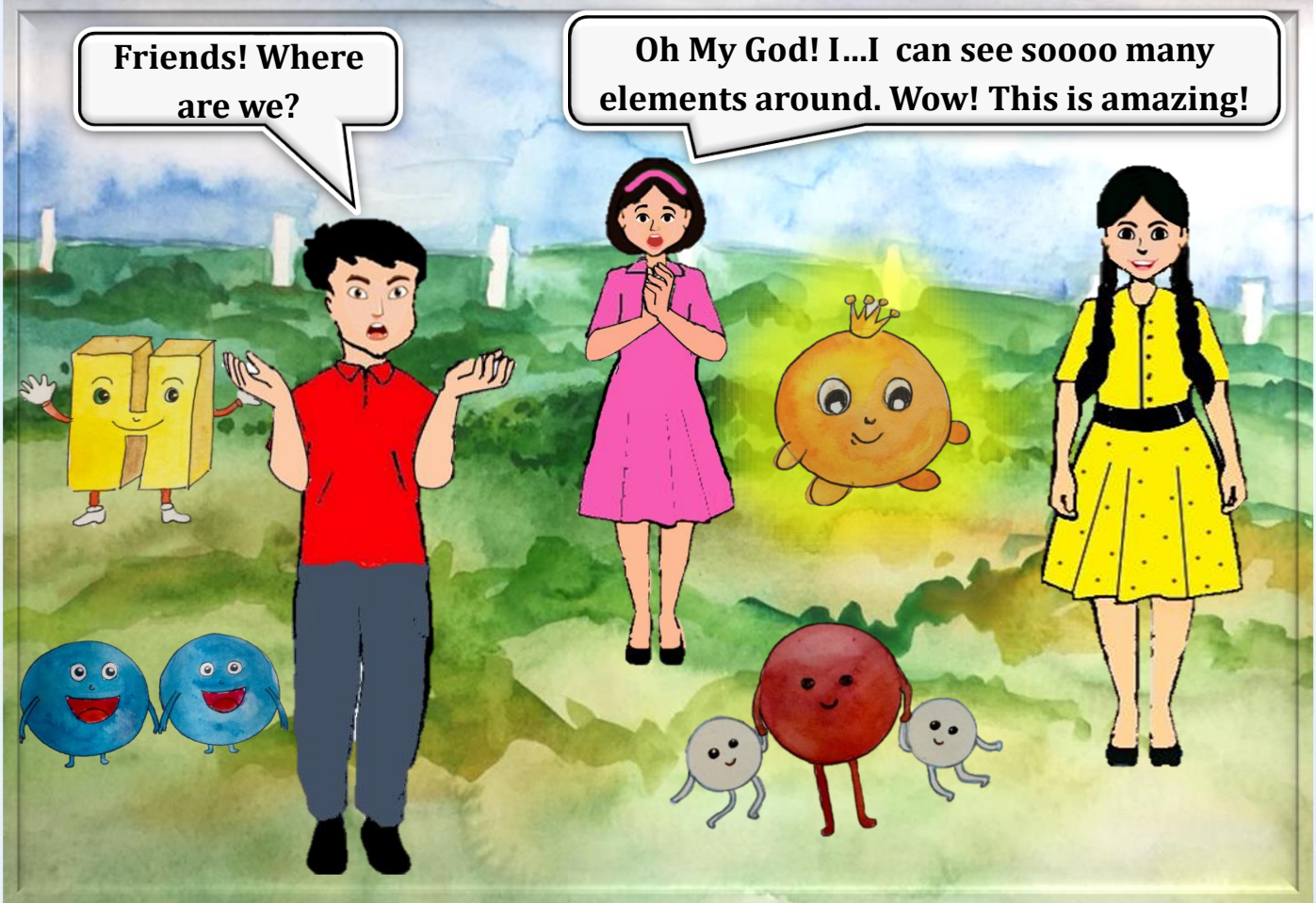
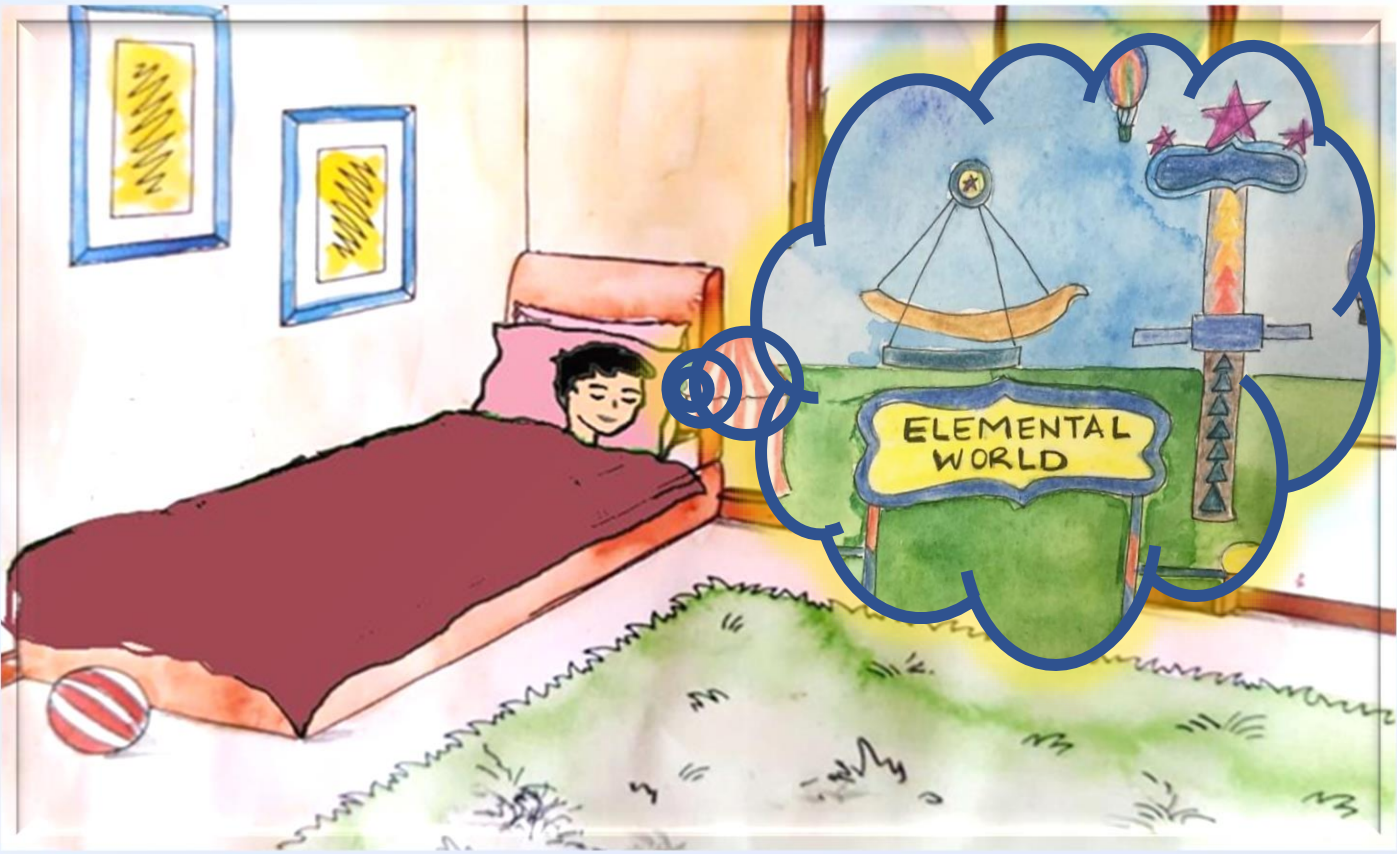
Chiranjeev is in his room and is solving the elemental puzzle game.



WORD SCRAMBLE

1. ONRTOP _ _ _ _ _
2. LUEOECML _ _ _ _ _
3. METRTA _ _ _ _ _
4. LUSCEUN _ _ _ _ _
5. LETMNEE _ _ _ _ _
6. OURNETN _ _ _ _ _
7. OCUDPNOM _ _ _ _ _
8. NCRTLEEO _ _ _ _ _
9. OTAM _ _ _ _
10. LDQIIU _ _ _ _ _

Chiranjeev is asleep, and dreams that he has entered an elemental world along with his friends.



Hey, look- all these elements
have faces and hands like us!!!
Incredible!



Hey Chiranjeev,
look at that
balloon flying
in the sky.

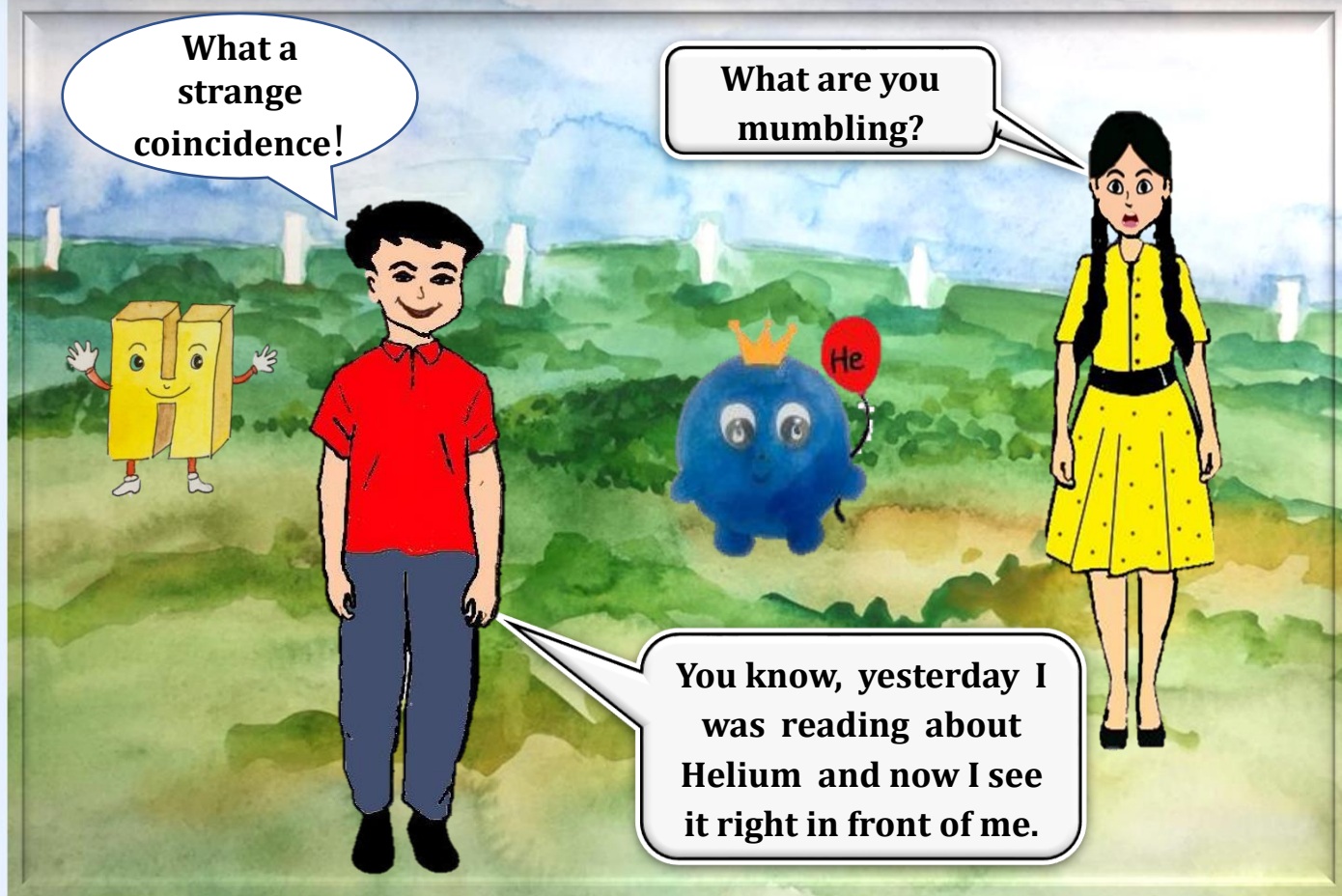


I think it has
Helium in it.



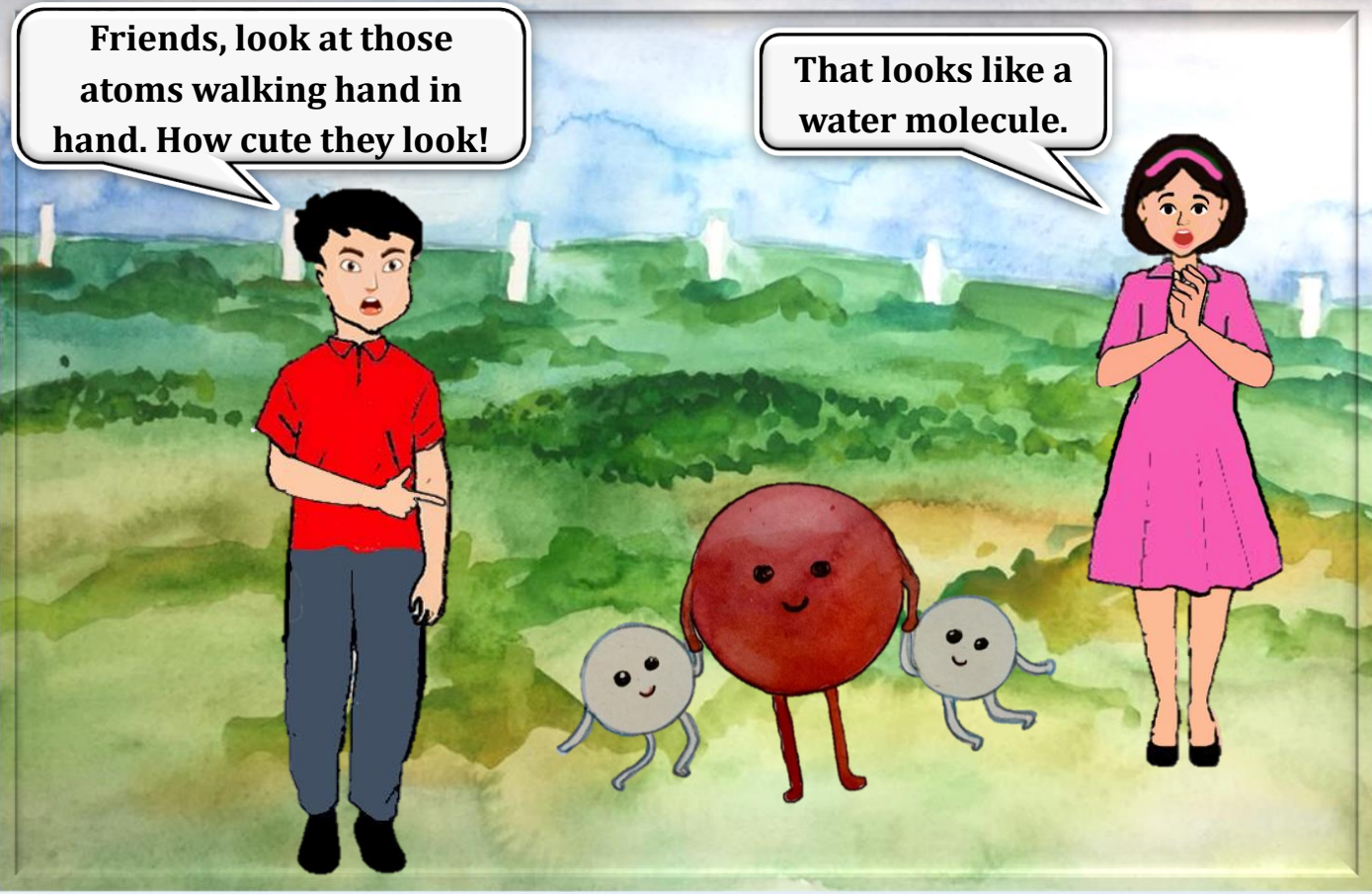
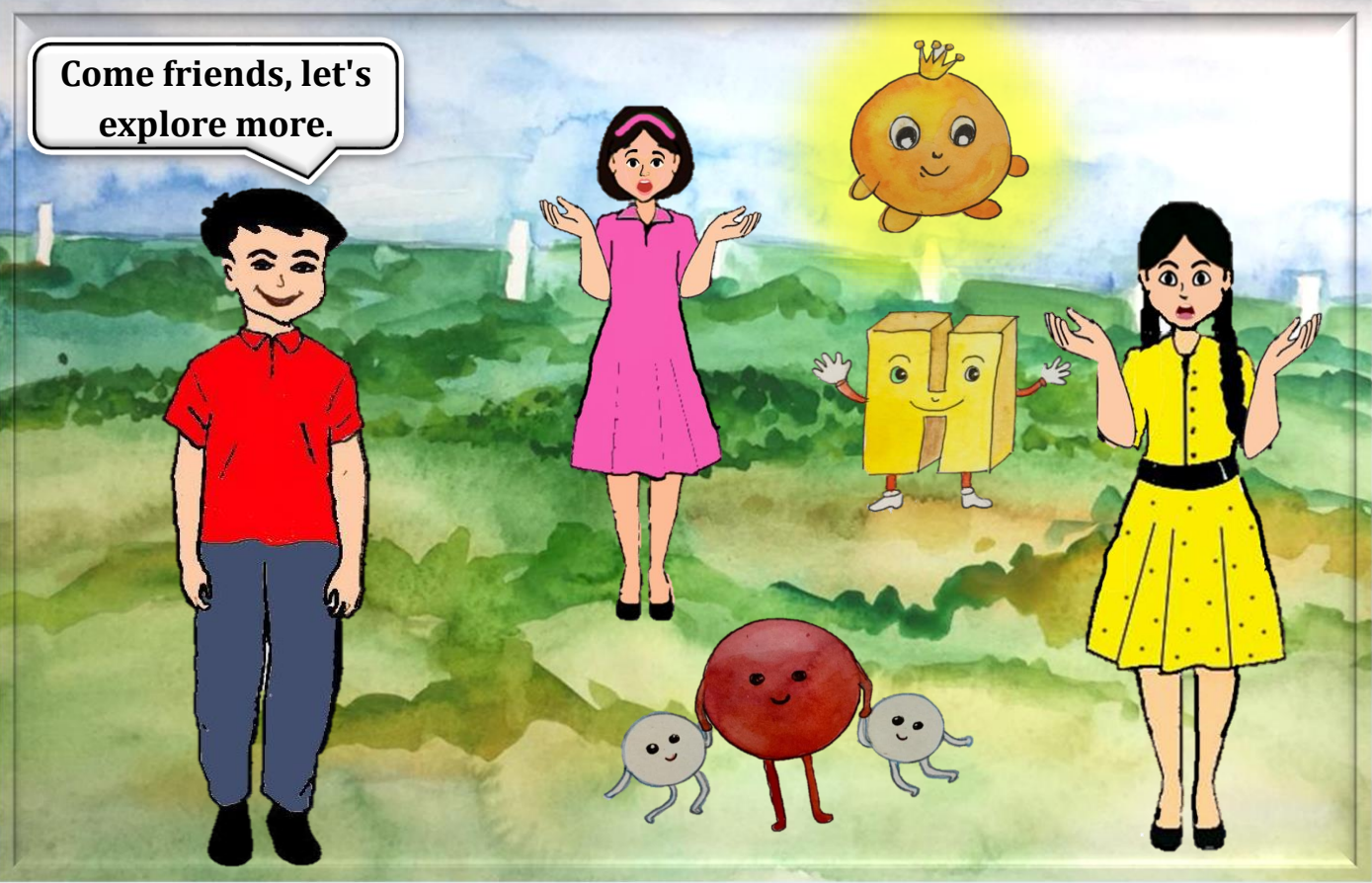
What a
strange
coincidence!

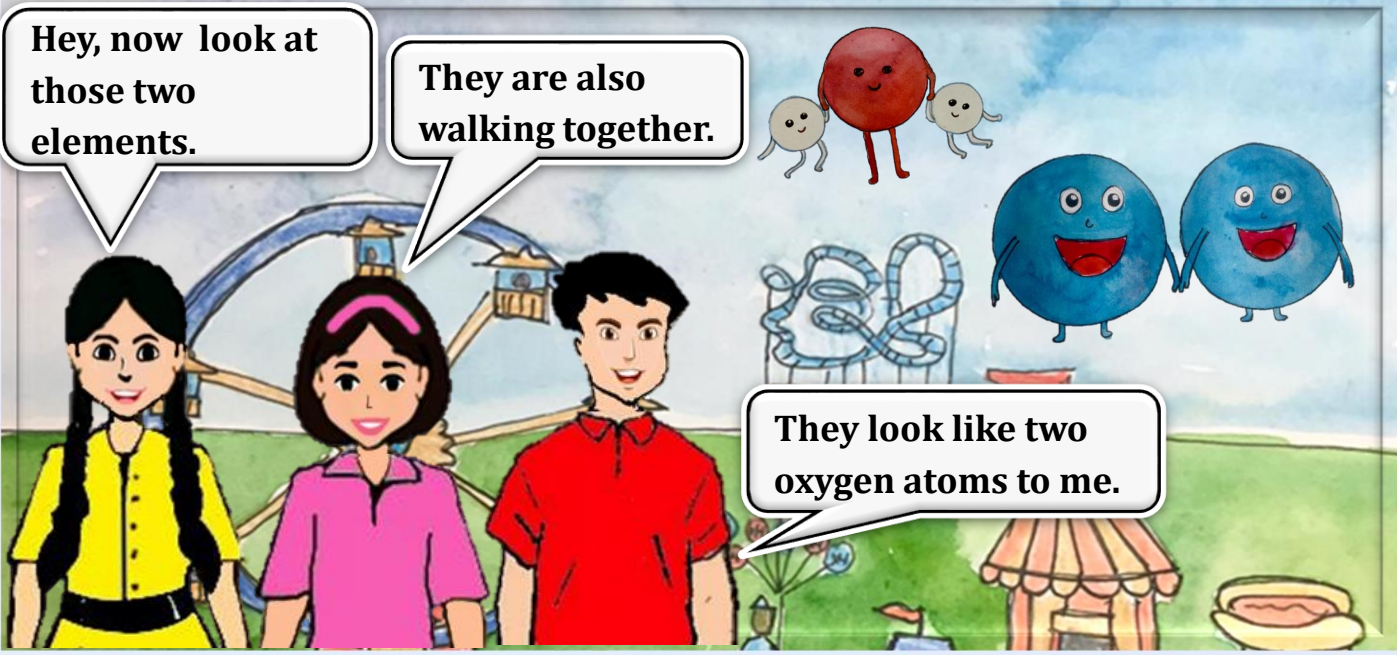
What are you
mumbling?



You know, yesterday I
was reading about
Helium and now I see
it right in front of me.

The curious kids move around the strange place and are thrilled to find different elements in every nook and corner.





Hey, now look at those two elements.

They are also walking together.

They look like two oxygen atoms to me.



Friends, don't miss that one!

You mean the one in front of us ?- looks pretty unfriendly.

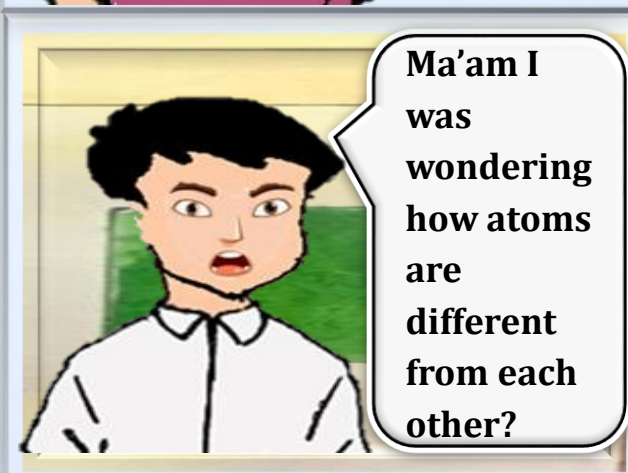
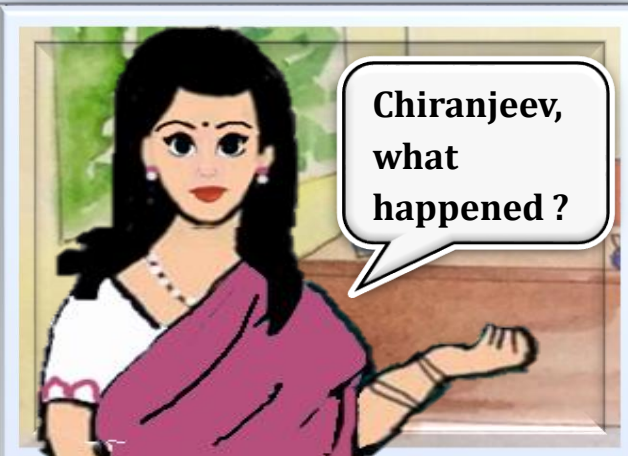
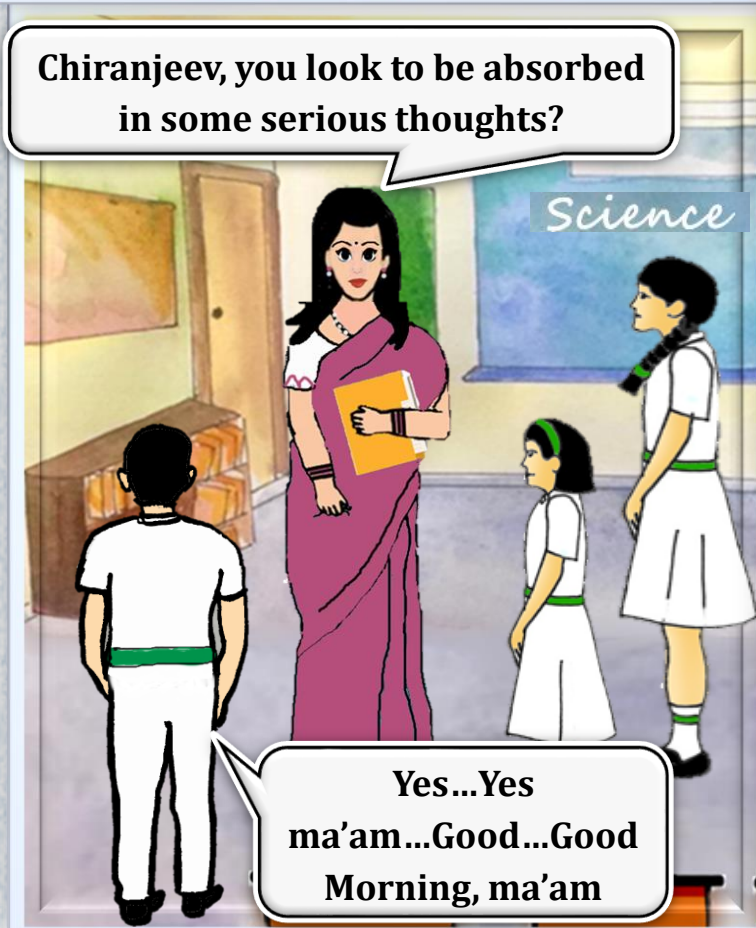
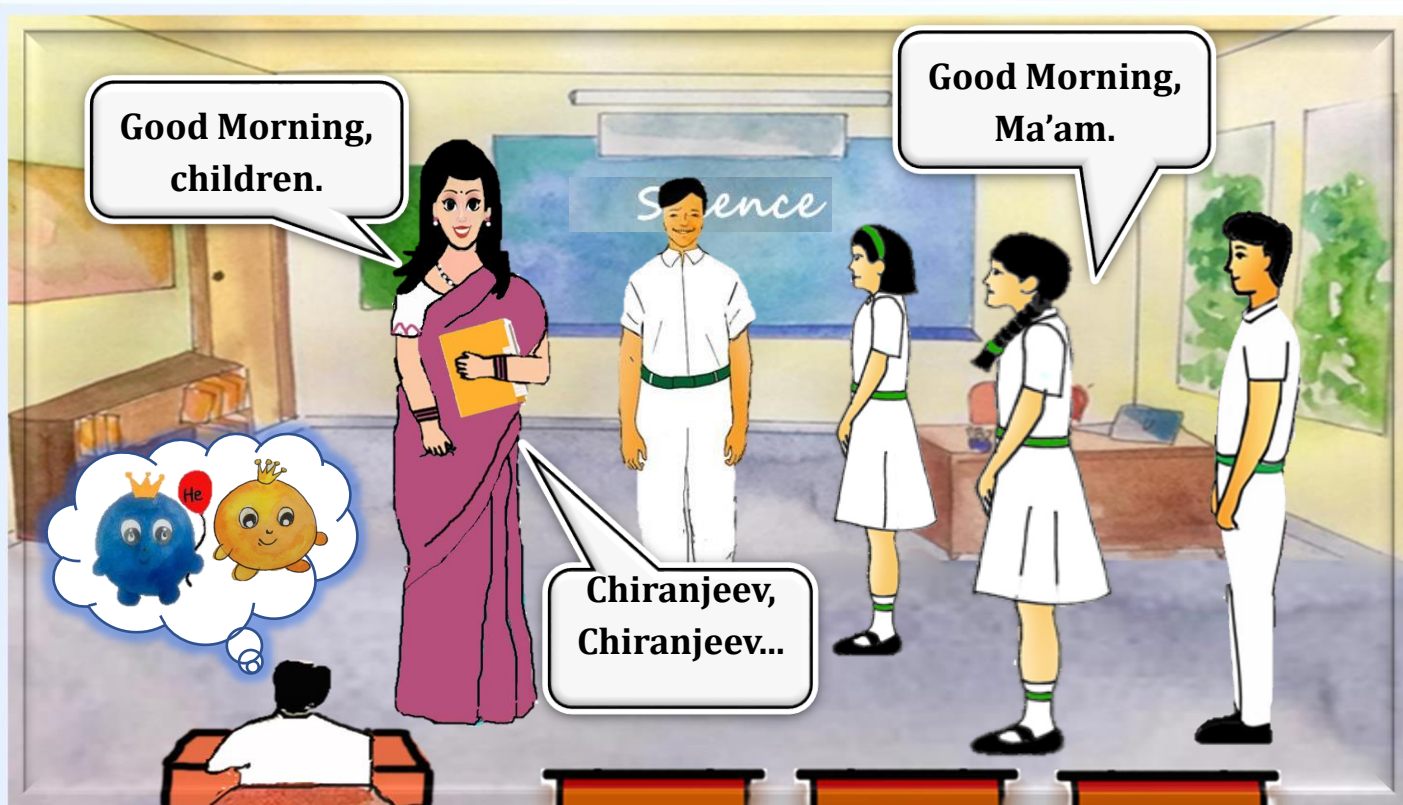
Well, that's Neon- see it is glowing!

Chiranjeev is in his room, fast asleep. He hears his mother's voice calling his name.



Chiranjeev, wake up, it's time to go to school.

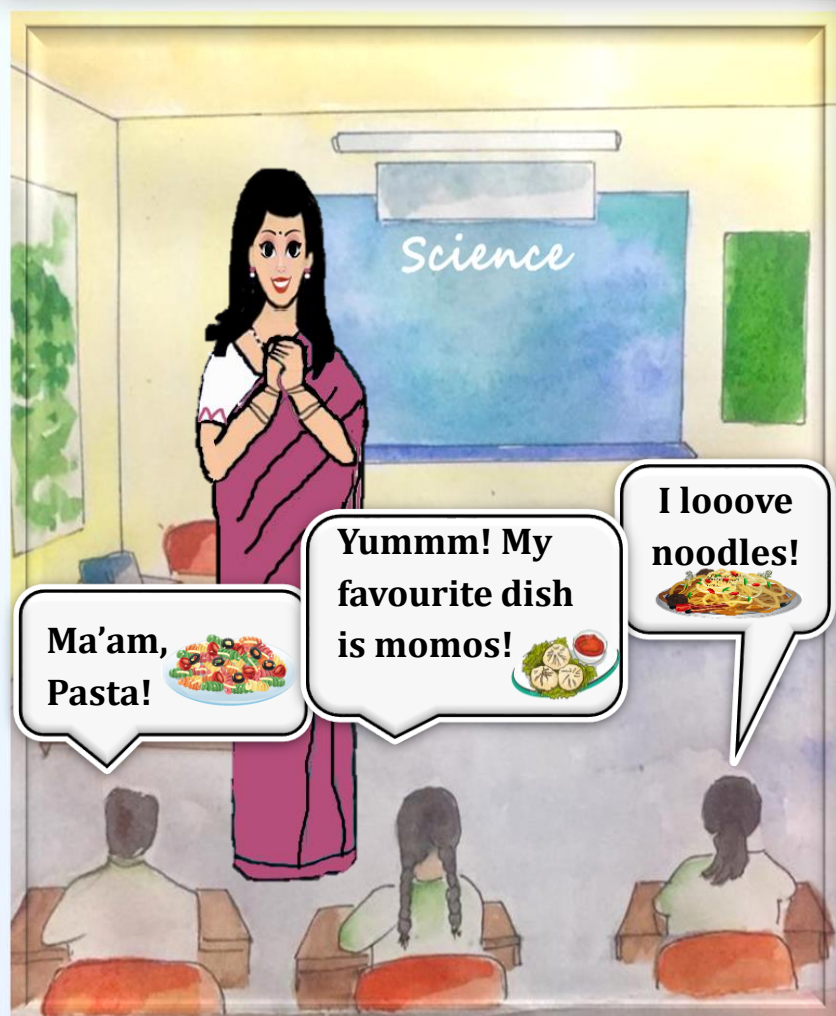
Chiranjeev reaches school and is sitting in his classroom. He is still lost in his dream of the previous night. All the children stand and wish Ms. Sharma but Chiranjeev, lost in his thoughts, is still sitting.



All the children are very excited and are engaged in an animated conversation.



Children, before I begin with a new topic, I would like to know about your favourite dish.



Just as all of you have different choices and each choice is unique, similarly, atoms of different elements are also unique.



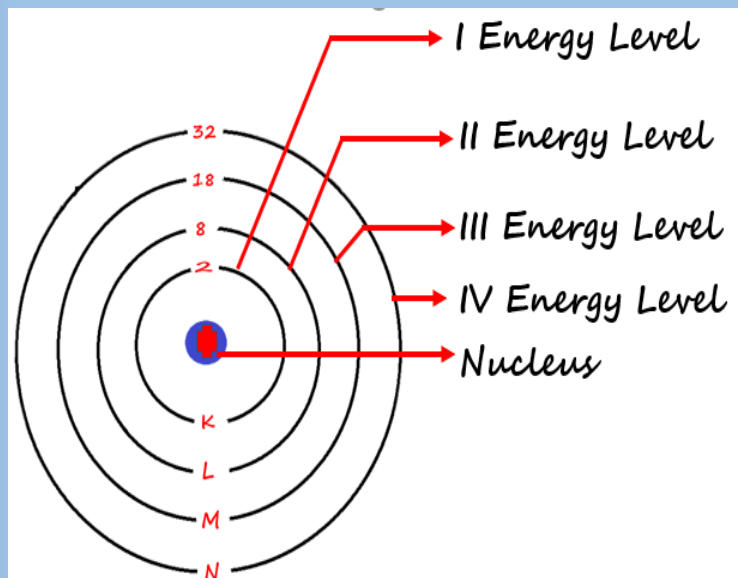
Ms. Sharma gives a demonstration - She slices an onion horizontally and places a few cloves in different rings.

Children, the rings of the onion are like the shells in an atom and the cloves are like the electrons.

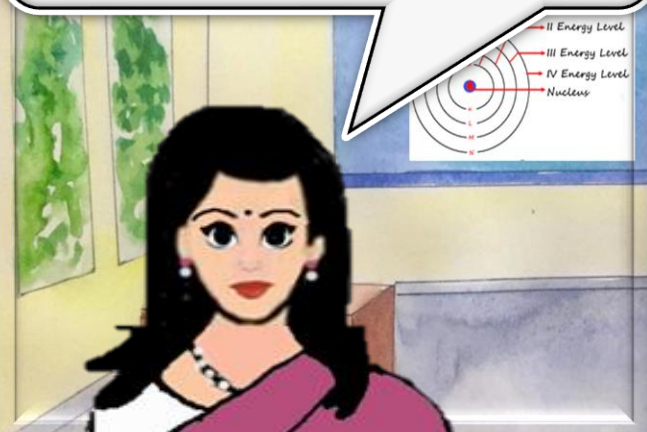


Ms. Sharma draws the structure of an atom on the board. When she completes her drawing, she explains the structure.

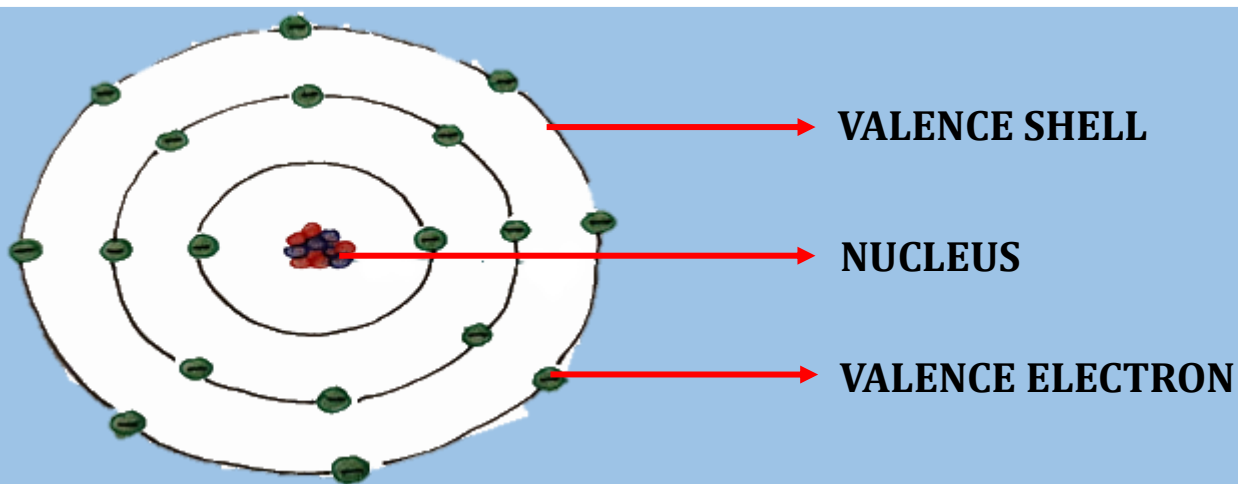
Atoms of different elements have different number of shells. These shells are named as K,L,M,N shells.



The arrangement of electrons in the shells of an atom is known as its **ELECTRONIC CONFIGURATION**.



The outer most shell or the last shell of an atom is known as the **VALENCE SHELL** and the electrons present in the valence shell are called **VALENCE ELECTRONS**.



Ma'am, are there fixed number of electrons in each shell?

Good question Adira! Yes, there are fixed number of electrons. Let me explain.



The number of electrons present in a shell is based on the formula $2n^2$, where n is the shell number. K,L,M,N shells are given numbers as 1,2,3,4 respectively.



Now who will tell me how many electrons can be accommodated in the K shell?

Ma'am, may I?

Yes
Chiranjeev,
go ahead.

2 electrons,
ma'am.

Correct
answer,
Chiranjeev.

Before we proceed further,
tell me, how many electrons
can be accommodated in the
L, M and N shells?

Ma'am, I think 8 electrons
in the L shell can be
accommodated.

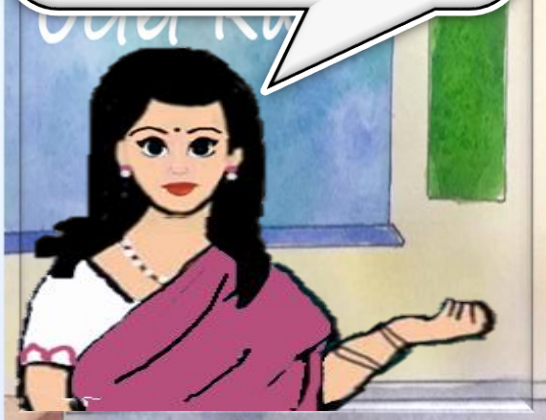
Correct, Adira.

18 electrons in M shell and
32 electrons in N shell.

Here, I would
like to
introduce one
more rule for
filling of
electrons, that
is octet rule.

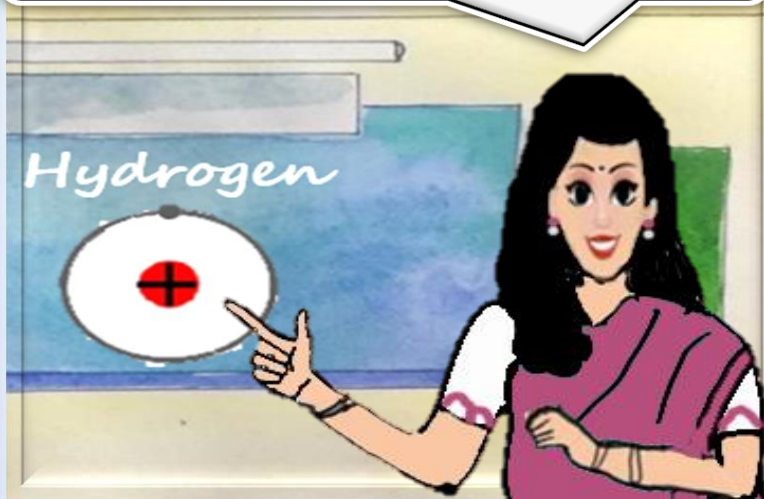
Excellent Bhumika! Really
appreciate!

According to this, filling of the next shell starts only once previous shell is filled with eight electrons except K shell.



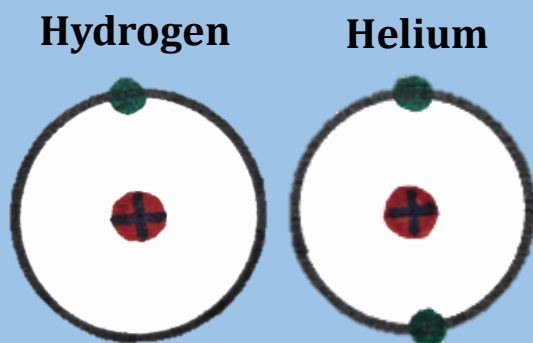
Ms. Sharma draws the structure of Hydrogen on the board.

Children, Hydrogen has only one electron which is present in the K shell.



Ms. Sharma draws the structure of Helium on the board.

Children, Helium has two electrons which are present in the K shell. This shell cannot accommodate more than two electrons.



This is how we write electronic configuration of an element. Tell me the electronic configuration of an element having 6 electrons.



2 in K shell and 4 in L shell Ma'am



Excellent, Adira.

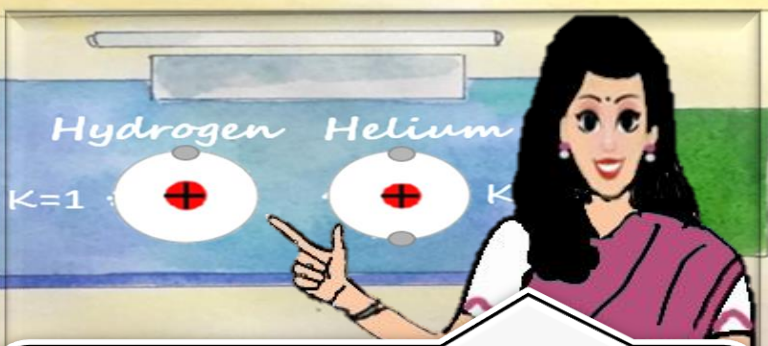
Most of the elements are unstable except the elements whose outermost shell is completely filled.

ELEMENT	SYMBOL	ATOMIC NUMBER	ELECTRONIC CONFIGURATION				VALENCY
			K	L	M	N	
Hydrogen	H	1	1				1
Helium	He	2	2				0
Lithium	Li	3	2	1			1
Beryllium	Be	4	2	2			2
Boron	B	5	2	3			3
Carbon	C	6	2	4			4
Nitrogen	N	7	2	5			3
Oxygen	O	8	2	6			2
Fluorine	F	9	2	7			1
Neon	Ne	10	2	8			0
Sodium	Na	11	2	8	1		1
Magnesium	Mg	12	2	8	2		2
Aluminium	Al	13	2	8	3		3
Silicon	Si	14	2	8	4		4
Phosphorus	P	15	2	8	5		3
Sulphur	S	16	2	8	6		2
Chlorine	Cl	17	2	8	7		1
Argon	Ar	18	2	8	8		0
Potassium	K	19	2	8	8	1	1
Calcium	Ca	20	2	8	8	2	2

Ma'am, how do atoms attain stability?

Adira, every element tries to attain stability by gaining, losing or sharing electrons so that it can have a stable configuration.

Ms. Sharma writes the configuration of Hydrogen and Helium on the blackboard.



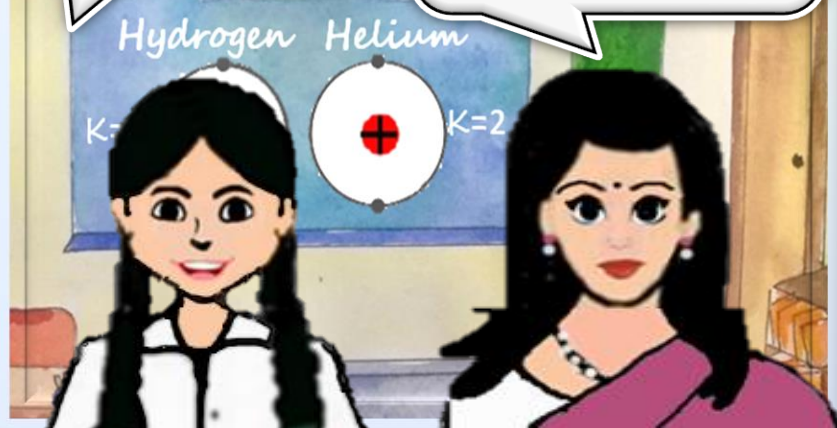
Hydrogen having only 1 electron in its valence K shell, tries to be stable by gaining or sharing an electron with other atoms. This is called duplet rule.

Helium has 2 electrons in the K shell which is its maximum capacity. Hence it is stable.

Ma'am, is the duplet rule followed by other atoms also?

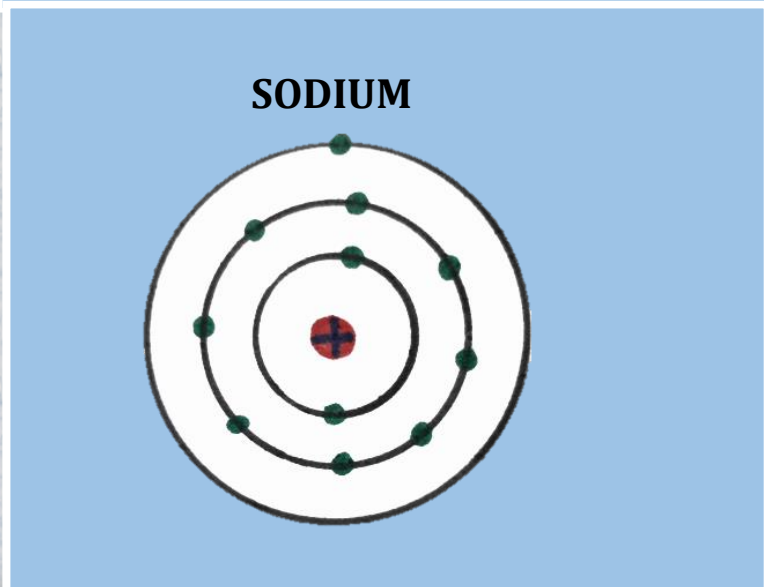
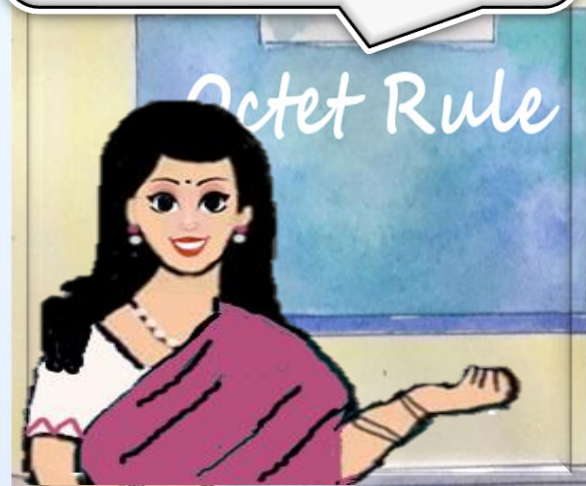
No Bhumika, it is applicable only for Hydrogen and Helium.

Ma'am, is there any other rule followed by other atoms?



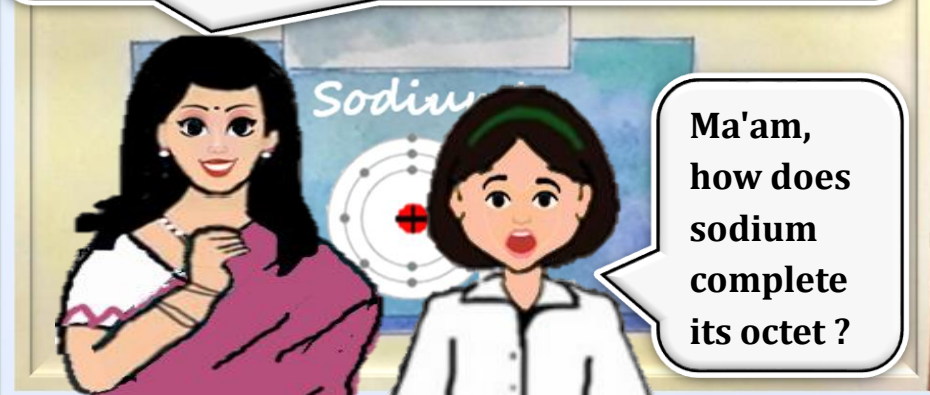
Yes Adira, I have already explained that atoms of all other elements follow the octet rule.

Ms. Sharma draws the structure of Sodium atom on the board



Students like you can see in the diagram, Sodium has 2 electrons in the K shell, 8 electrons in the L shell and only 1 electron in its valence M shell.

Who would like to answer Adira's question?



Ma'am, how does sodium complete its octet?



Ma'am, it will gain 7 electrons.



Yes Chiranjeev! You are absolutely correct. It will be easier for Sodium to lose its one electron than to gain 7 electrons.



No ma'am, I think it will lose one electron.



Ms. Sharma draws the structure of Chlorine atom on the board

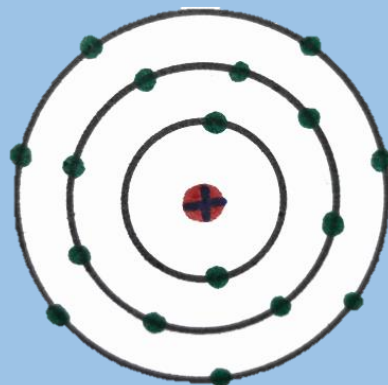
How does Chlorine complete its octet?

Ma'am, it will be easier for it to gain one electron.



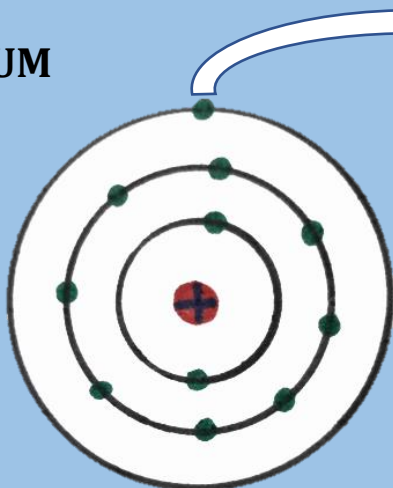
Superb Bhumika!

CHLORINE

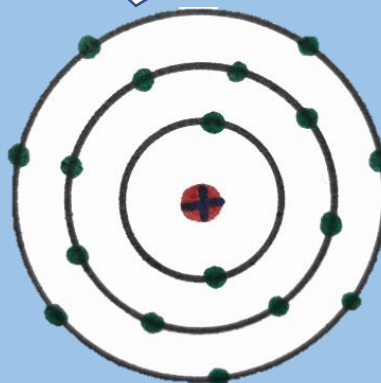


Ms. Sharma draws the transfer of electron from sodium atom to chlorine atom on the board

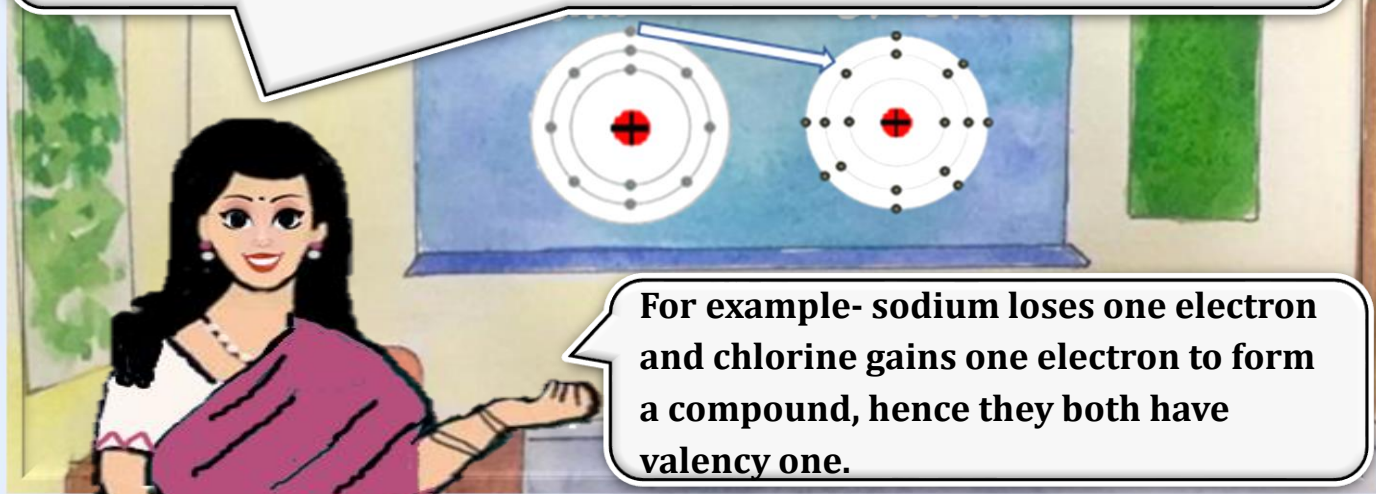
SODIUM



CHLORINE

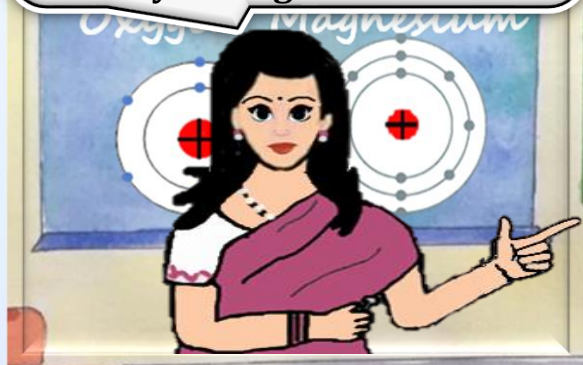


When Sodium and Chlorine combine with each other, chlorine gains the electron given by sodium. Thus, both attain stability. This combining capacity of both the elements to form a compound is called valency.

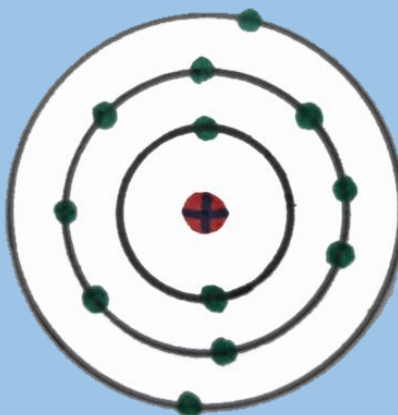


Ms Sharma draws structure of Magnesium and Oxygen on the board.

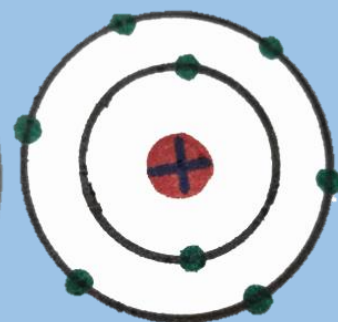
Let us discuss few more examples to find valency. Adira, can you guess the valency of Magnesium?



MAGNESIUM



OXYGEN



Ma'am, it will lose 2 electrons. So, valency is 2.



Adira! Very good.



Bhumika, what is the valency of Oxygen?



Ma'am it will be 2 as it will be easier for it to gain two electrons to attain stability.

Brilliant!!!
Bhumika.

Will there be a gain or loss of electrons if one oxygen atom combines with another to form a molecule?

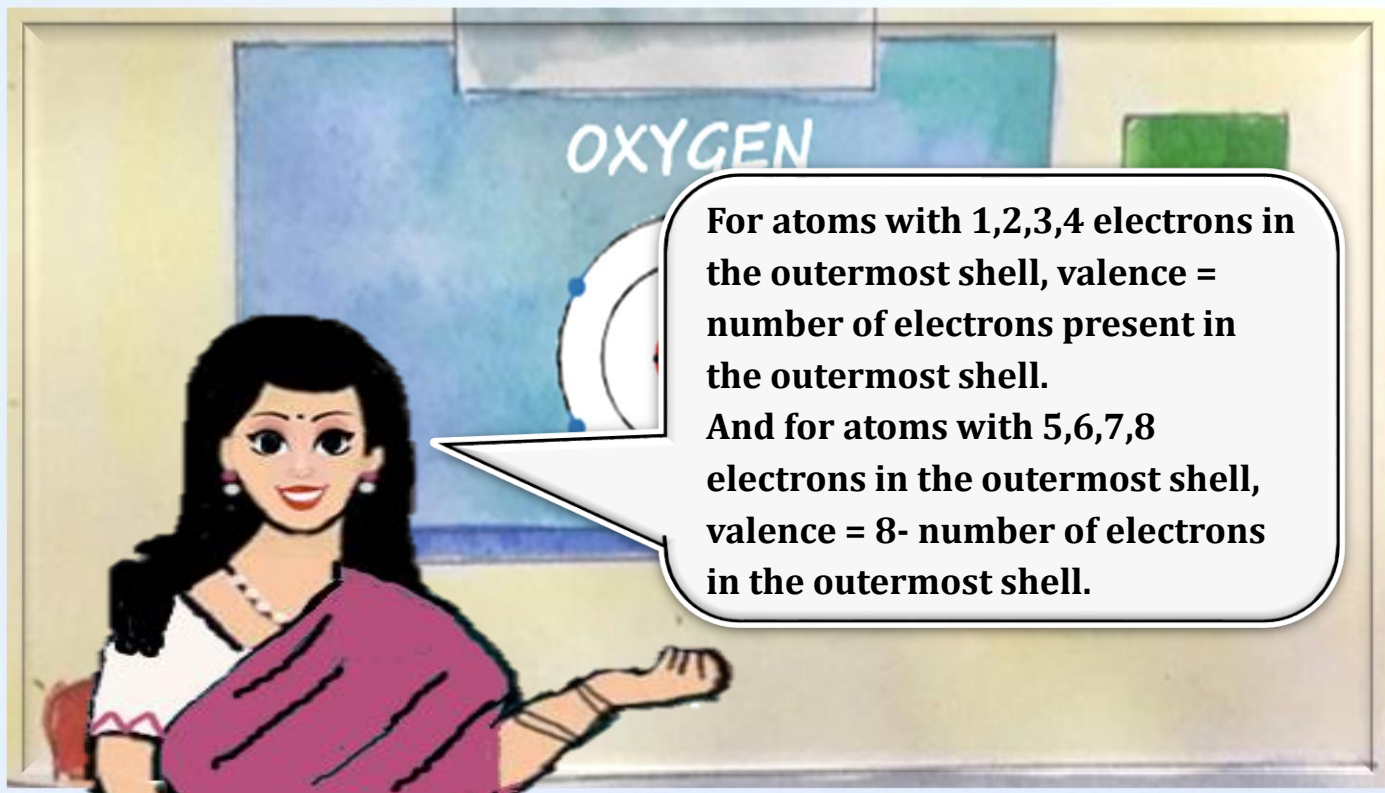
I think oxygen atoms will share the two electrons.

Therefore, we can also define valency as the number of electrons gained, lost or shared to attain a stable electronic configuration.

Excellent Chiranjeev. Yes, they will be sharing two electrons

Ma'am, how do we calculate valency for so many elements?

It's very simple Chiranjeev. Let me explain.

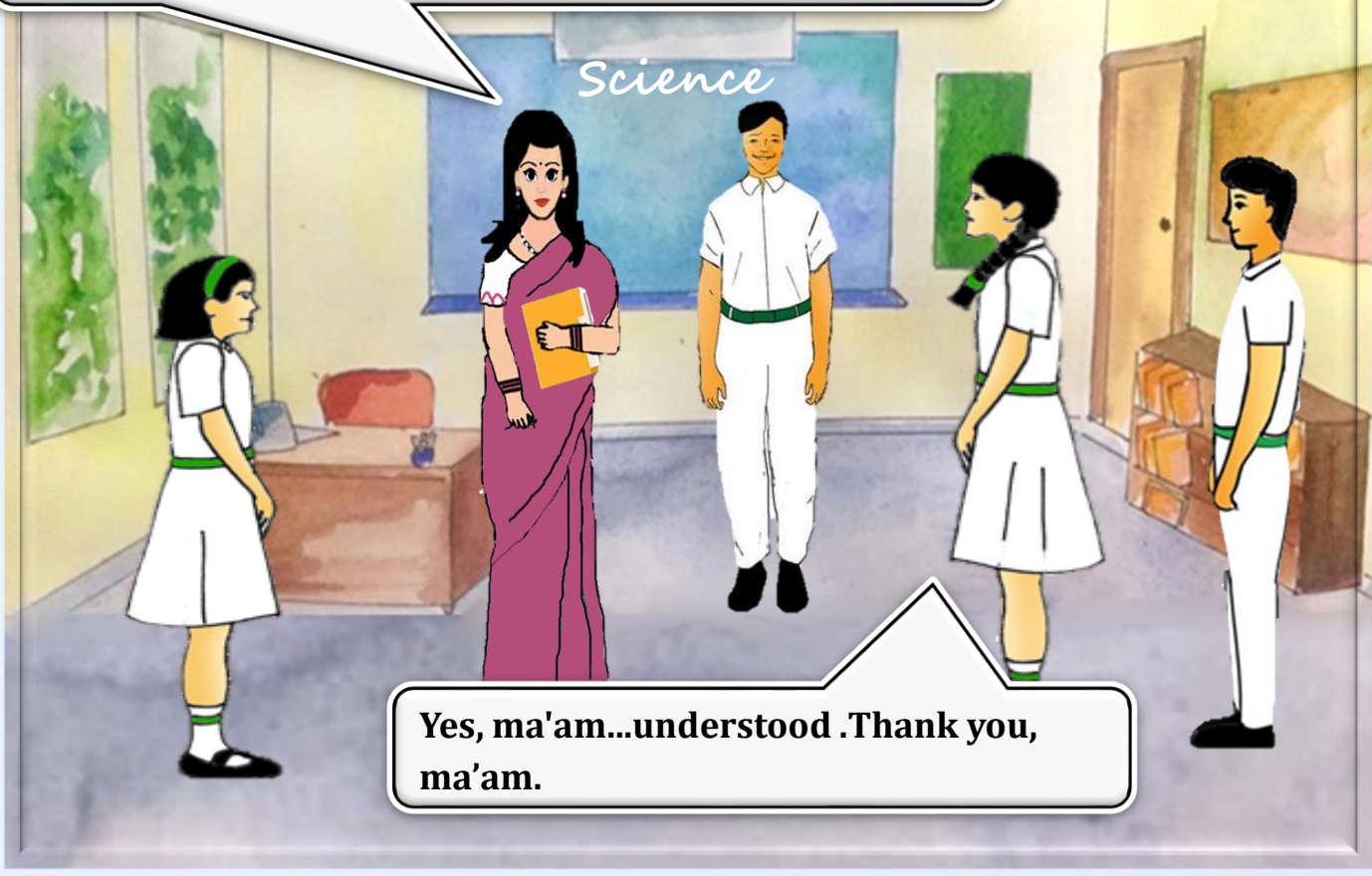


For atoms with 1,2,3,4 electrons in the outermost shell, valence = number of electrons present in the outermost shell.

And for atoms with 5,6,7,8 electrons in the outermost shell, valence = $8 - \text{number of electrons in the outermost shell}$.

Note: Valence = Valency

Okay children, that's all for today. Hope all have understood the topic well. Do revise it at home.



Yes, ma'am...understood .Thank you, ma'am.

WHO AM I?

1. I am an atom with 7 protons.

- a) How will you arrange my electrons in different shells? _____
- b) How many electrons are there in my valence shell? _____
- c) Can you identify my name? _____

2. I am an atom with atomic number 16.

- a) How many valence electrons do I have?

- b) What will be my valency? _____
- c) What is my name? _____

3. I am an atom with 10 electrons.

- a) How many shells do I have ? _____
- b) What will be my valency ? _____
- c) What is special about me ? _____

WORD SEARCH

FIND THE WORDS IN THE PUZZLE.

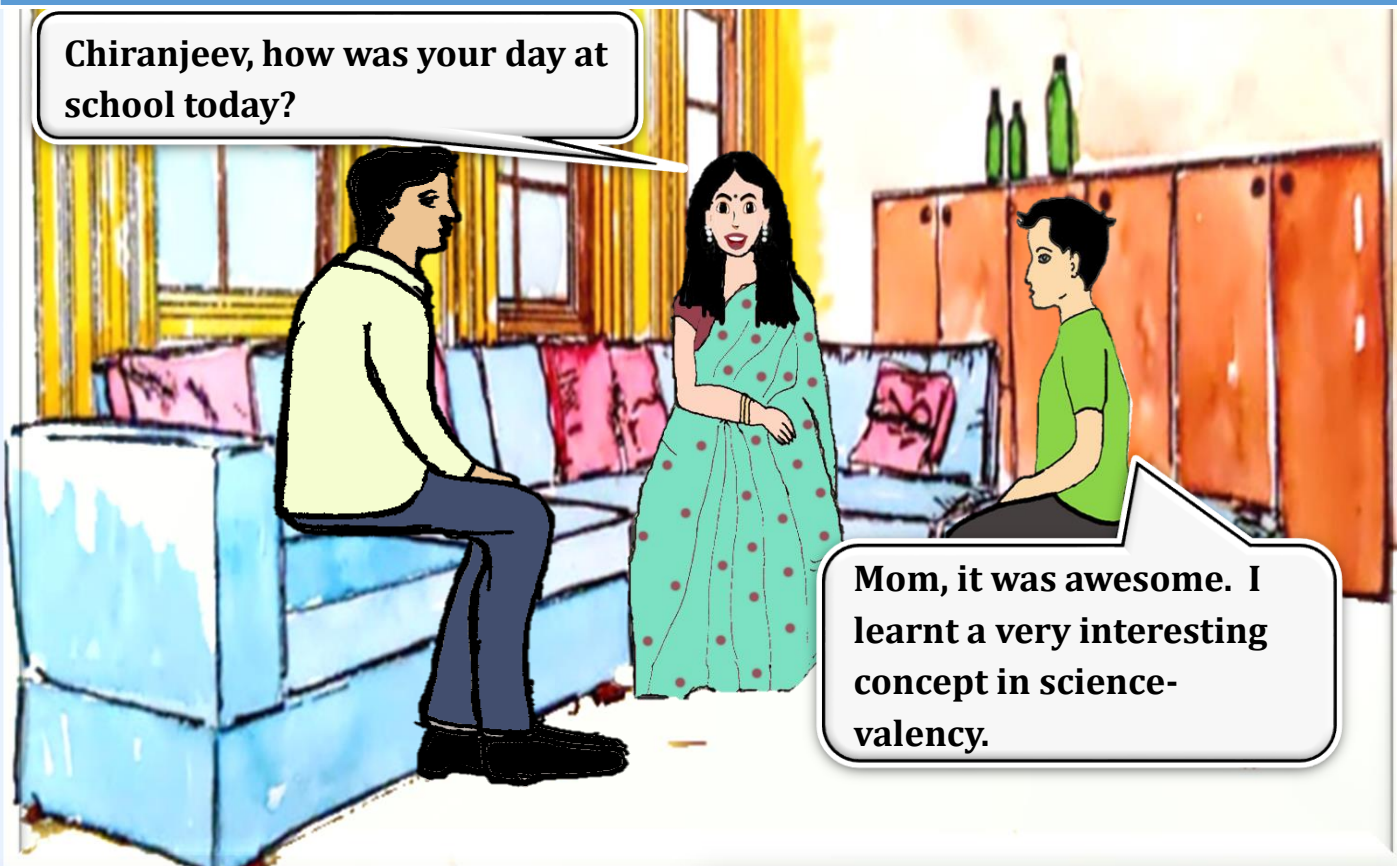
F	D	Y	K	F	Y	Y	E	G	P	F	I
H	D	F	T	P	J	U	Y	S	B	A	U
J	Y	B	W	N	O	S	L	N	D	L	S
K	C	D	O	D	O	O	O	J	M	O	W
S	W	E	R	A	E	R	A	S	H	J	T
H	N	N	T	O	T	M	T	U	M	C	W
I	E	K	A	C	G	Y	S	U	U	I	Y
V	A	L	E	N	C	E	S	H	E	L	L
H	E	L	I	U	M	S	N	U	E	N	E
V	E	L	B	C	A	E	O	A	Y	L	Y
W	I	E	P	M	O	F	C	Y	G	D	L
R	I	F	I	D	R	T	O	O	S	K	V

SEARCH THE WORDS WITH THE GIVEN CLUES:

VALENCY OF OXYGEN	OUTER MOST SHELL OF AN ATOM	SUB-ATOMIC PARTICLE WITH NO CHARGE	A NOBLE ELEMENT
SUB-ATOMIC PARTICLE WITH NEGATIVE CHARGE	A GAS FILLED IN BALLOONS	MAXIMUM CAPACITY OF THIS SHELL IS 32 ELECTRONS	ELEMENT WITH SYMBOL H

Chiranjeev with his parents in the living room.

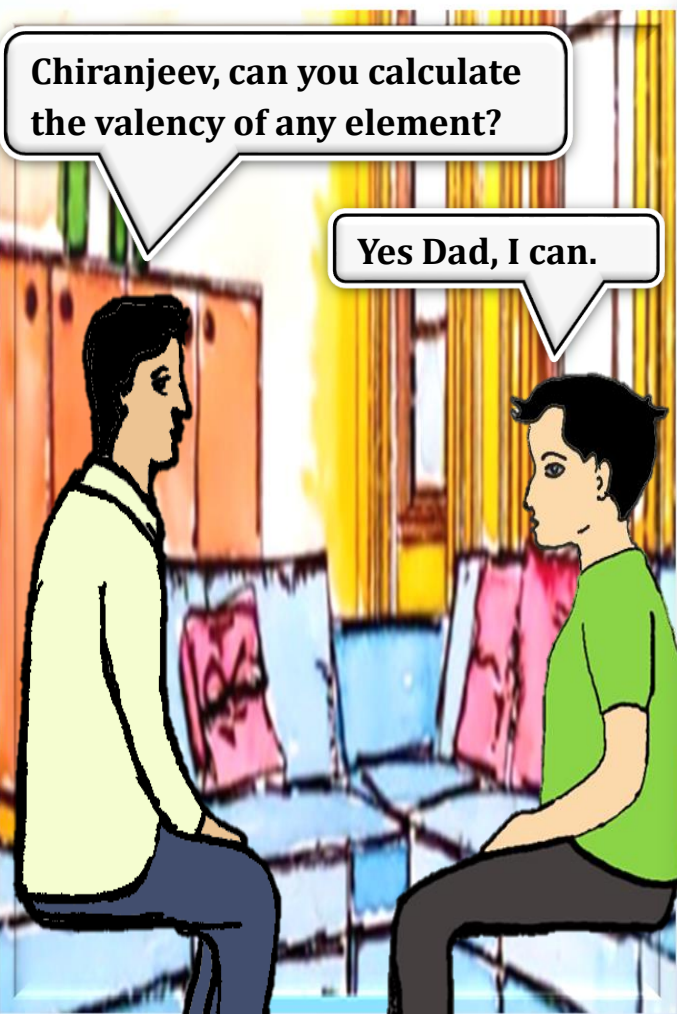
Chiranjeev, how was your day at school today?



Mom, it was awesome. I learnt a very interesting concept in science- valency.

Chiranjeev, can you calculate the valency of any element?

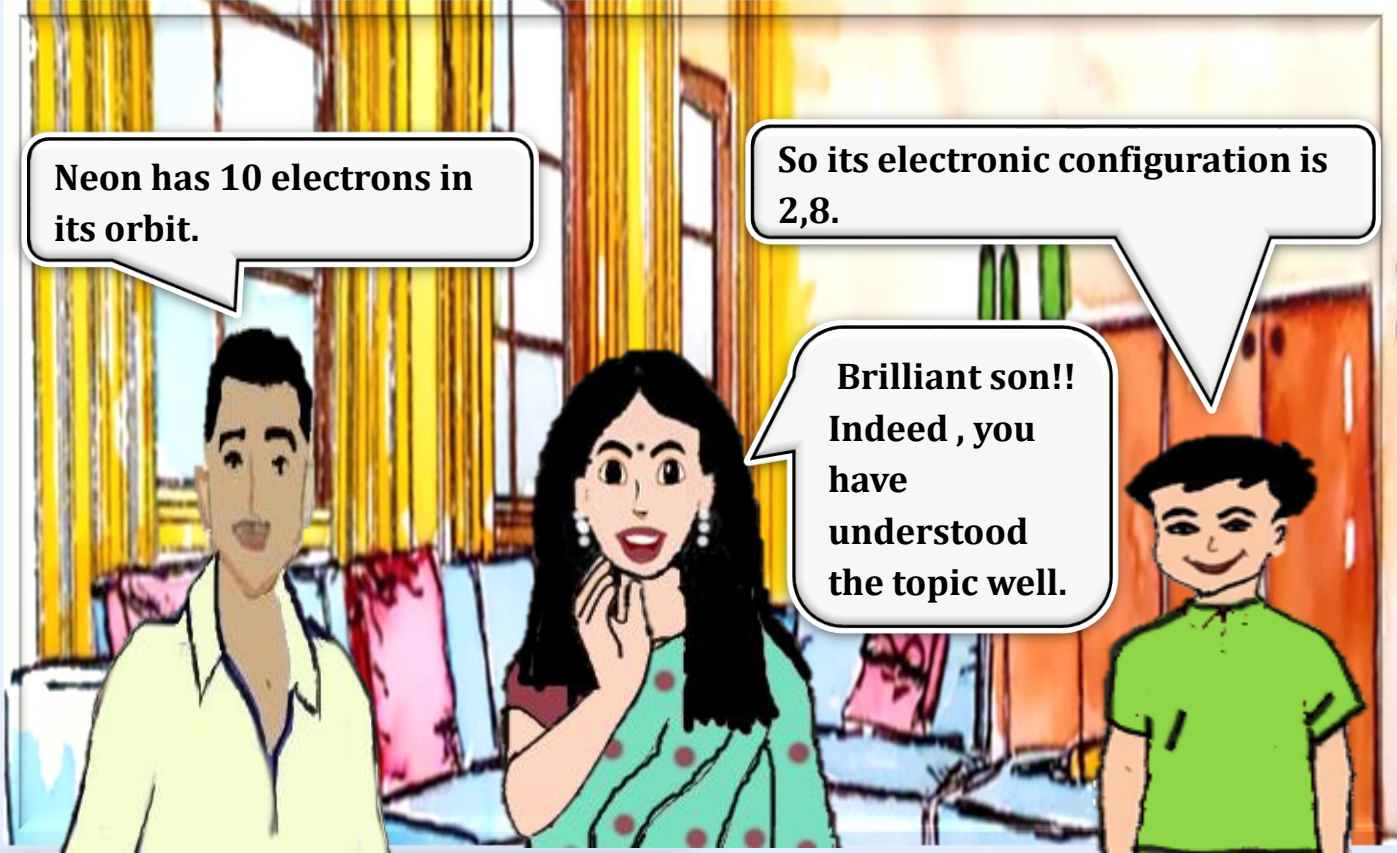
Yes Dad, I can.



Ok son, tell me the valency of Neon.

Dad, for that you need to tell me the number of electrons that Neon has.





Neon has 10 electrons in its orbit.

So its electronic configuration is 2,8.

Brilliant son!!
Indeed, you have understood the topic well.



The valency is $8-8=0$.

Do you know what the elements are called whose valency is 0?



No..no..mamma.

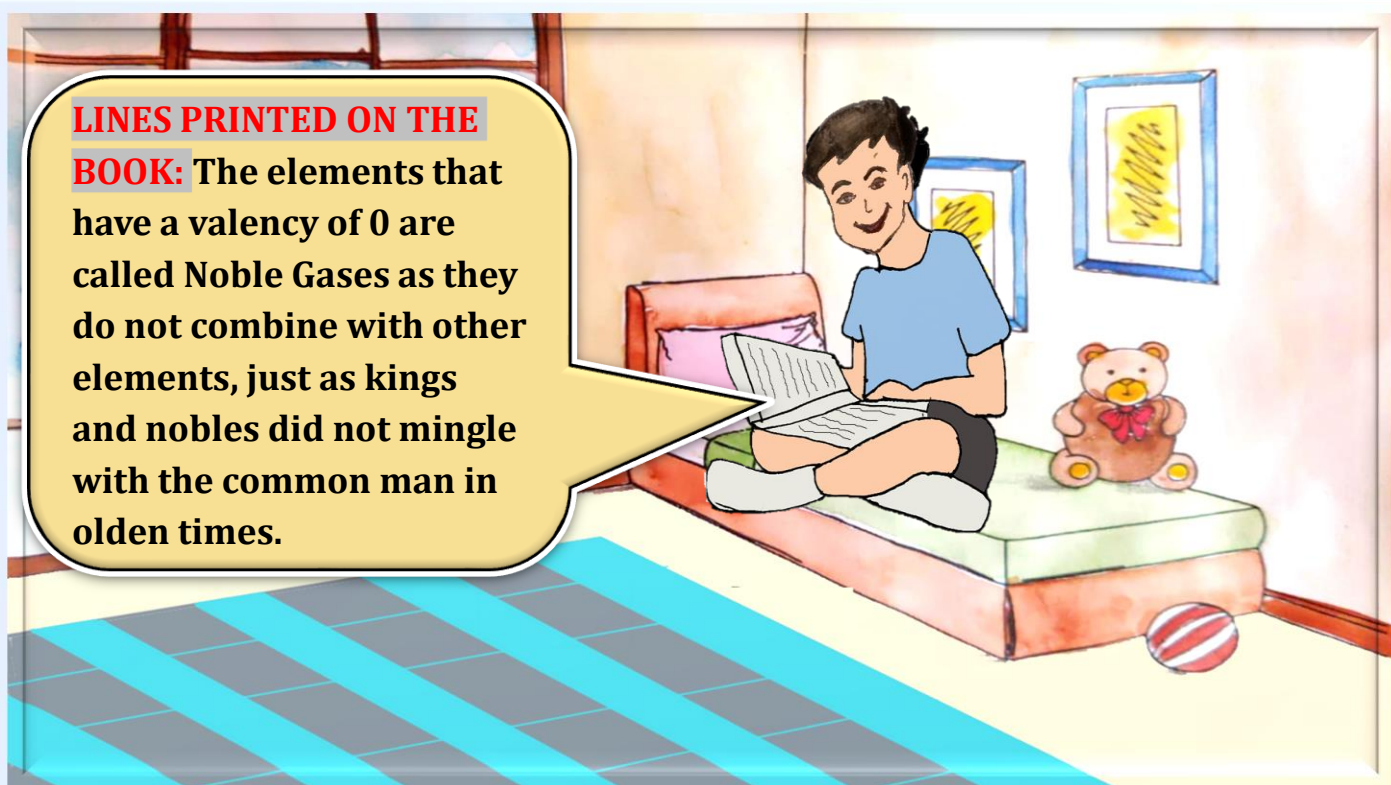


These elements are called Noble gases.

Chiranjeev is sitting on the bed and reading a book about the amazing world of atoms and elements.. He sees an interesting picture of kings and nobles on a page and pauses to read.

LINES PRINTED ON THE

BOOK: The elements that have a valency of 0 are called Noble Gases as they do not combine with other elements, just as kings and nobles did not mingle with the common man in olden times.



Now I understand what mom meant by noble gases. I am going to tell about them to my friends in the class tomorrow.

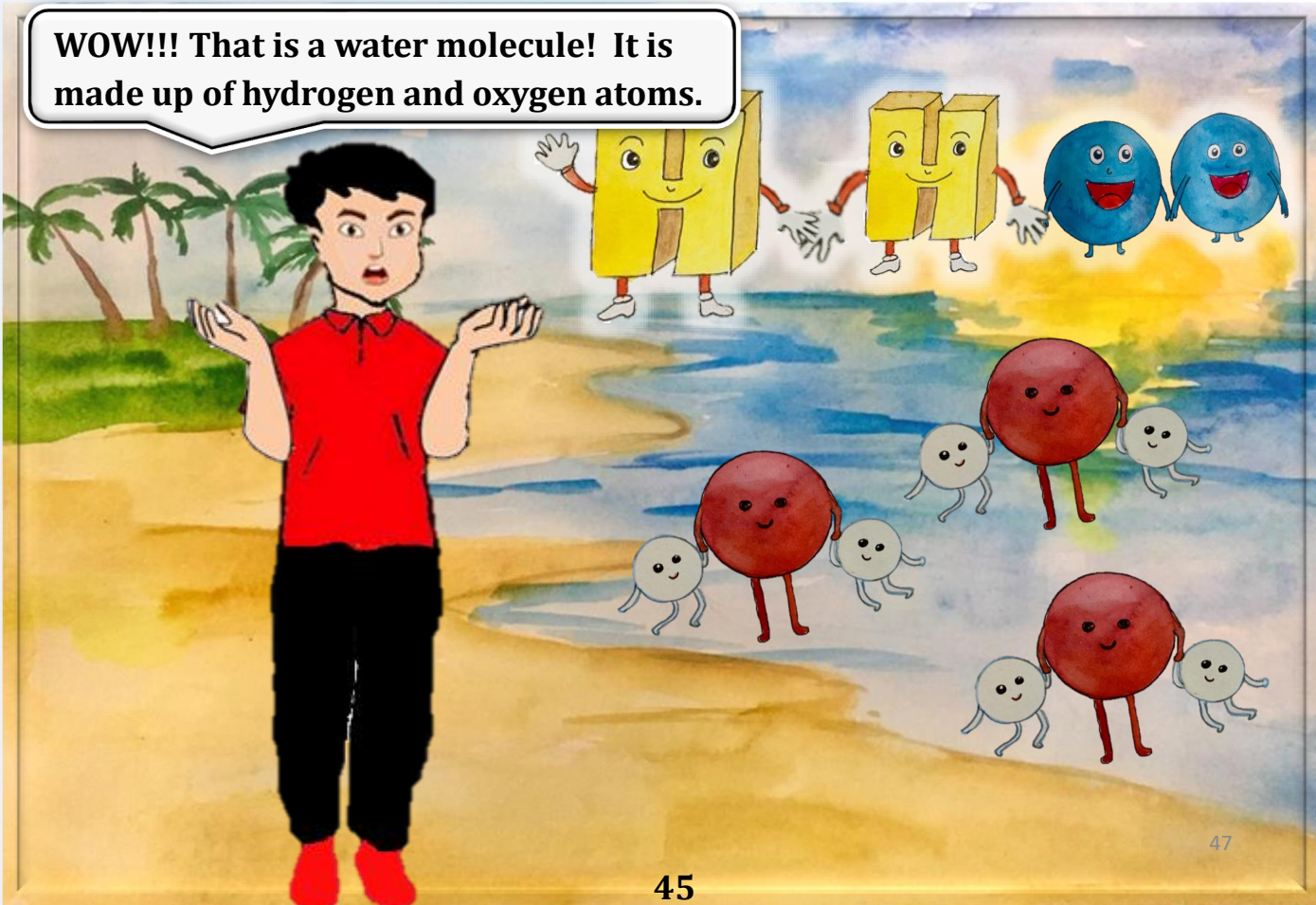


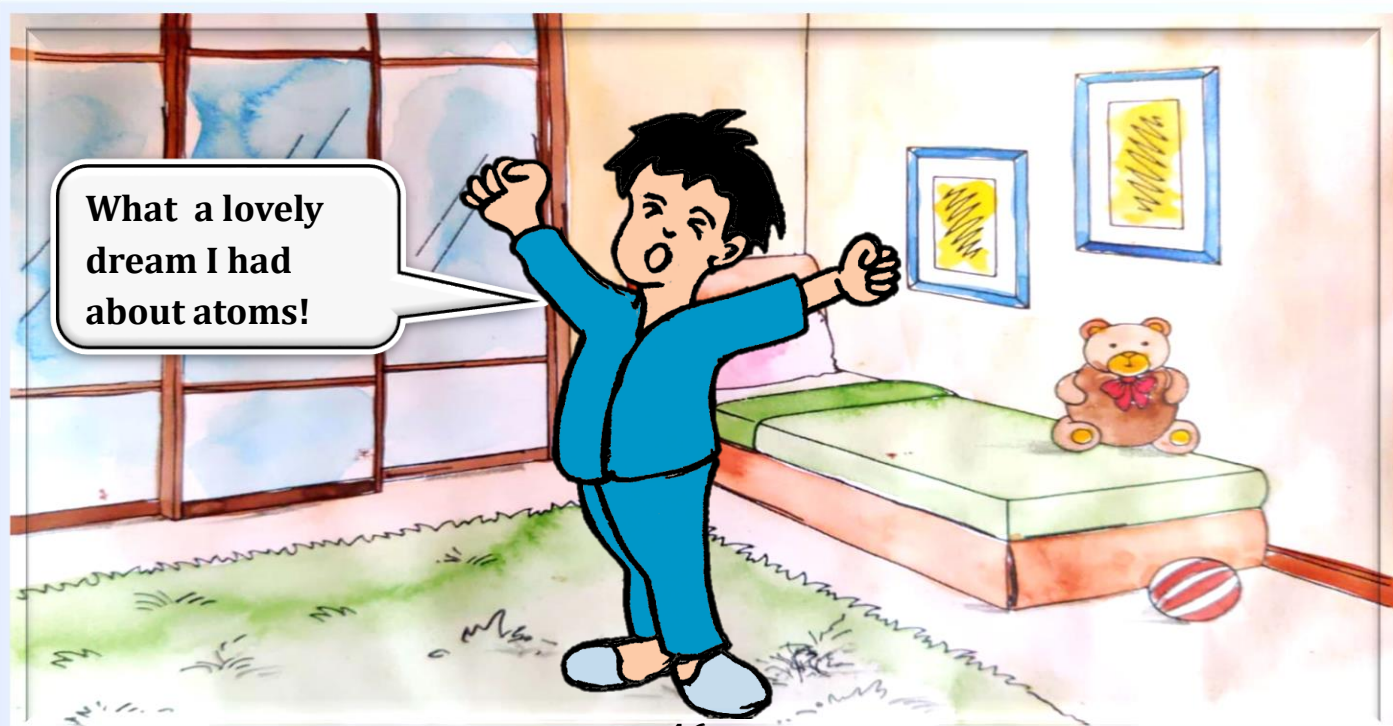
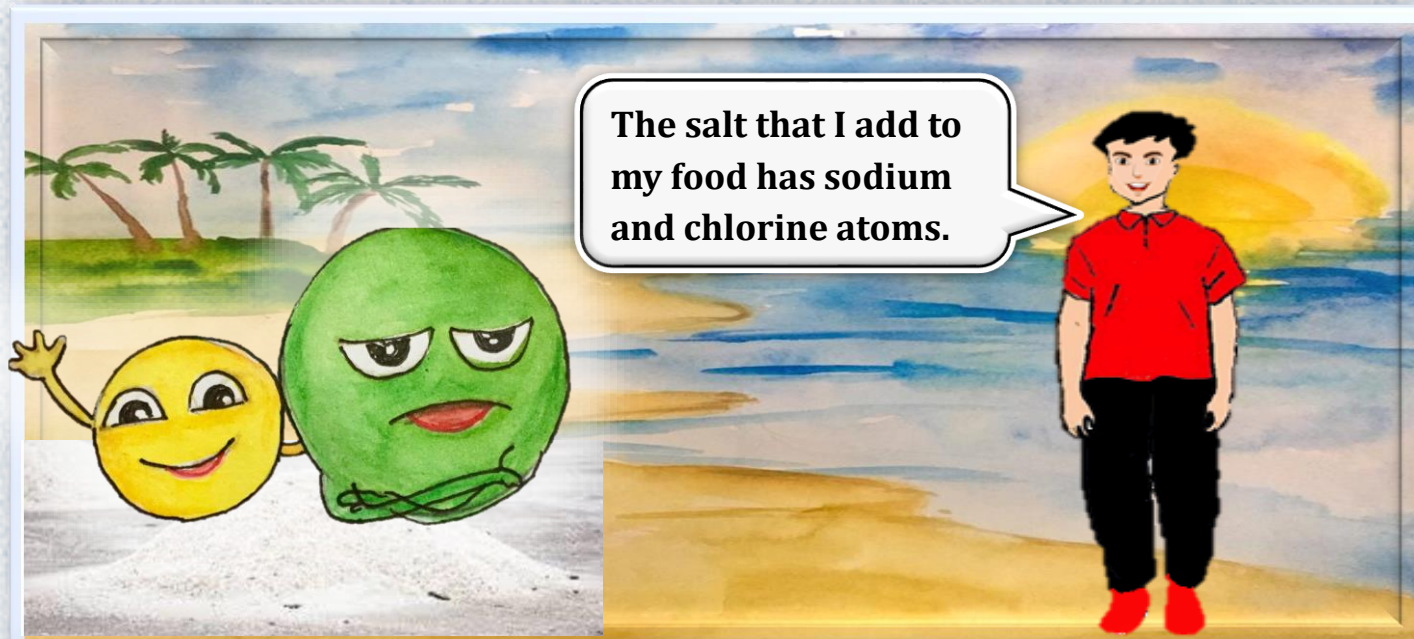
Chiranjeev dreams he is on a sea beach and running about joyfully.

In his dream: He sees water molecules (an oxygen atom walking hand in hand with 2 hydrogen atoms) in the sea, sodium chloride molecules (an atom of sodium waltzing with an atom of chlorine) on the beach. He also notices a brightly lit billboard with neon atoms moving around all alone happily.



WOW!!! That is a water molecule! It is made up of hydrogen and oxygen atoms.

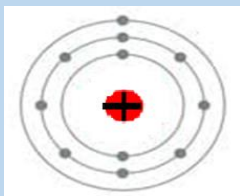




VALENCY VAULT

A Choose the correct option:

1. The electronic configuration of oxygen is
 - a) 2, 4
 - b) 2, 5
 - c) 2, 6
 - d) 2, 7
2. The element with symbol He is
 - a) Hydrogen
 - b) Helium
 - c) Halogen
 - d) Hydrargyrum
3. Total valence electrons present in the atom of chlorine are
 - a) 4
 - b) 5
 - c) 6
 - d) 7
4. The valency of element neon is
 - a) 0
 - b) 1
 - c) 2
 - d) 3
5. The following structure represents the electronic configuration of



- a) Potassium
- b) Aluminium
- c) Sodium
- d) Carbon

VALENCY VAULT

B State whether following statements are true or false:

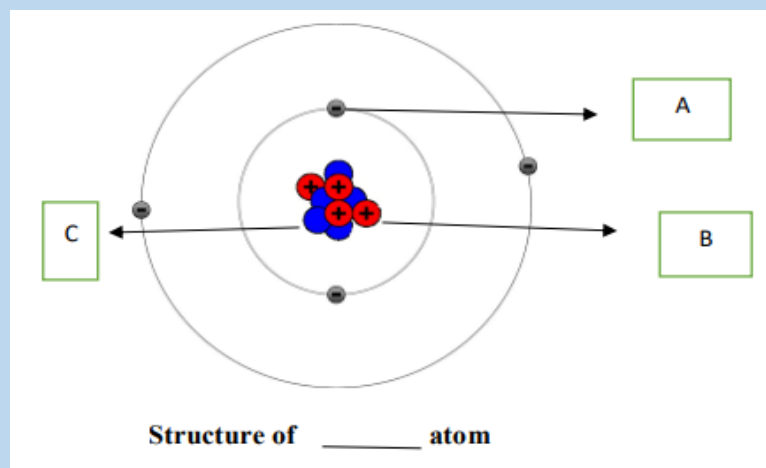
1. The building block of matter is atom.
2. For a hydrogen atom, L shell is the valence shell.
3. There are 2 valence electrons in magnesium atom.
4. Particles are very closely packed in the gaseous state of matter.
5. The nucleus of an atom is positively charged due to the presence of neutrons.

C Fill in the blanks:

1. Filling up of 8 electrons in the valence shell by gaining / losing / sharing electrons is known as the _____ rule.
2. The molecule present in common salt is _____.
3. The element with atomic number 6 is _____.
4. In the $2n^2$ rule, 'n' represents _____.
5. A _____ is the smallest particle of an element or a compound that can normally exist independently.

VALENCY VAULT

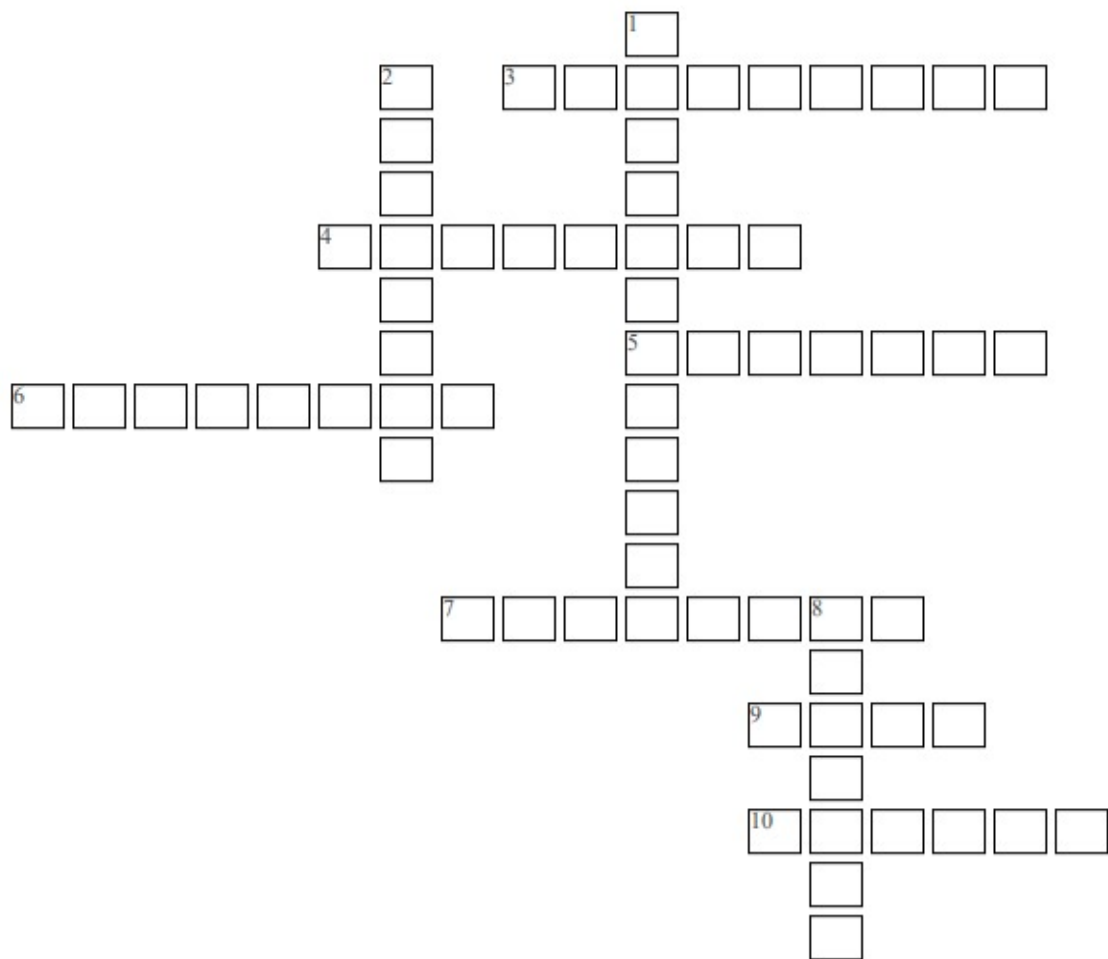
D Label these in the following diagram:



E Write the symbols, atomic number and electronic configuration of these elements:

Element	Symbol	Atomic number	Electronic configuration
Fluorine			
Potassium			
Magnesium			
Silicon			
Argon			

CROSSWORD



ACROSS

3. Element with electronic configuration 2,8,8,1
4. Protons have _____ charge.
5. Centre of the atom
6. Substance in which elements are combined in a fixed ratio
7. Element with atomic number one
9. Gas used to glow billboards
10. _____ is used in gas balloons.

DOWN

1. Total number of protons in an atom
2. Element with 7 valence electrons in the M shell
8. Substance made up of only one kind of atoms

Answers - DO YOU KNOW SOMETHING ABOUT ME?

Labelling A- electron

Labelling B- nucleus

1. Protons And Neutrons
2. Electron
3. Proton
4. Neutron
5. 13

Answers - WORD SCRAMBLE

- | | |
|-------------|-------------|
| 1. PROTON | 6. NEUTRON |
| 2. MOLECULE | 7. COMPOUND |
| 3. MATTER | 8. ELECTRON |
| 4. NUCLEUS | 9. ATOM |
| 5. ELEMENT | 10. LIQUID |

Answers – Who Am I?

1. a) 2, 5
b) 5
c) Nitrogen
- 2 a) 6
b) 2
c) Sulphur
- 3 a) 2
b) 0
c) stable/noble gas

Answers - WORD SEARCH

F	D	Y	K	F	Y	Y	E	G	P	F	I
H	D	F	T	P	J	U	Y	S	B	A	U
J	Y	B	W	N	O	S	L	N	D	L	S
K	C	D	O	D	O	O	O	J	M	O	W
S	W	E	R	A	E	R	A	S	H	J	T
H	N	N	T	O	T	N	T	U	M	C	W
I	E	K	A	C	G	Y	S	U	U	I	Y
V	A	L	E	N	C	E	S	H	E	L	L
H	E	L	I	U	M	S	N	U	E	N	E
V	E	L	B	C	A	E	O	A	Y	L	Y
W	I	E	P	M	O	F	C	Y	G	D	L
R	I	F	I	D	R	T	O	O	S	K	V

Answers - VALENCY VAULT

A Choose the correct option:

1. c – 2,6
2. b – Helium
3. d – 7
4. a – 0
5. c – Sodium

B Is the following statement true or false?

1. True
2. False
3. True
4. False
5. False

Answers - VALENCY VAULT

C Fill in the blanks:

1. Octet Rule
2. Sodium Chloride
3. Carbon
4. Shell number
5. Molecule

D Label these in the following diagram:

A- Electron

B- Proton

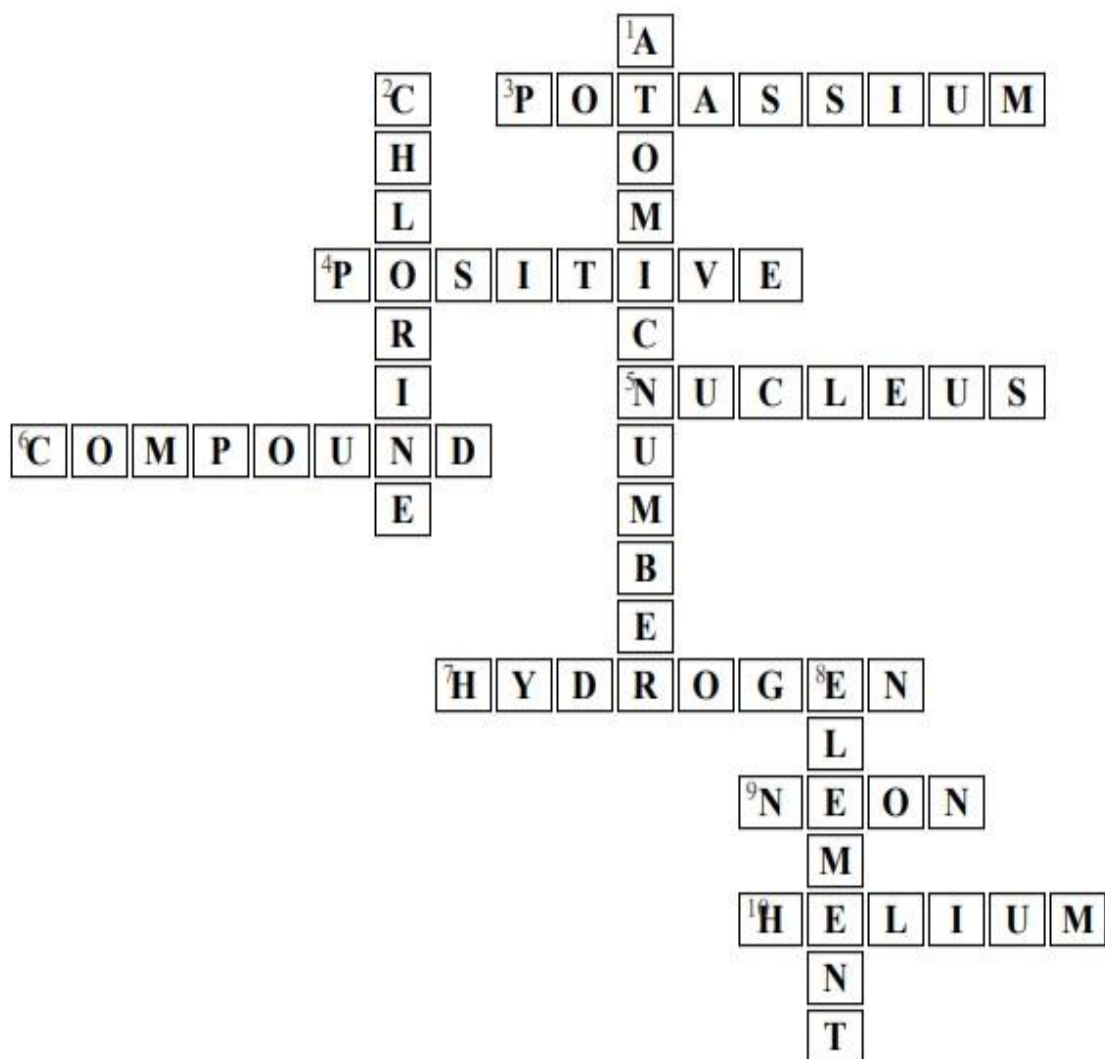
C- Neutron

Structure of **Beryllium** atom

E Write the symbols, atomic number and electronic configuration of these elements:

Element	Symbol	Atomic number	Electronic configuration
Fluorine	F	9	2, 7
Potassium	K	19	2, 8, 8, 1
Magnesium	Mg	12	2, 8, 2
Silicon	Si	14	2, 8, 4
Argon	Ar	18	2, 8, 8

Answers – CROSSWORD



GLOSSARY

ATOM- It is the smallest particle of an element that can take part in a chemical reaction.

COMPOUND- A substance formed by the chemical combination of two or more elements in fixed proportion.

ELECTRON- It is a negatively charged subatomic particle of an atom present outside the nucleus.

ELECTRONIC CONFIGURATION- It is the arrangement of electrons in shells around the nucleus of an atom.

ELEMENT- A substance that cannot be broken down into simpler substance and is made up of only one kind of atoms.

MATTER- It is any substance that has mass and occupies space.

MOLECULE- It is the smallest particle of an element or a compound which can normally exist independently.

NEUTRON- It is a subatomic particle of an atom present inside the nucleus with no charge.

NUCLEUS- A small, heavy, positively charged centre of an atom containing protons and neutrons.

PROTON- It is a positively charged subatomic particle of an atom present inside the nucleus.

SHELLS/ ORBIT- It is the circular path around the nucleus of an atom in which the electrons revolve.

VALENCY- It is the combining capacity of an element.

VALENCE ELECTRON- The electron/s present in the outermost shell of an atom.

VALENCE SHELL- It is the outermost shell of an atom.

BIBLIOGRAPHY

❖ NCERT Science textbook for class IX .

Chapter – Structure of the Atom

IT tools used :

❖ MS PowerPoint

❖ MS Paint

❖ Expression Editor - many-fe.noprod-b.kmt.orange.com

❖ Autodesk Sketchbook version 8.7.1

❖ Freepik.com

Message From Director Principal



The creation of this graphic novel has been a unique experience for all of us. It has, in a sense, involved the 4 Cs, the 21st Century skills : Creativity - since all of us have created these graphic novels, Collaboration- all departments came together to work as a team, Critical thinking- putting our heads together to think of the best ways to engage our learners and of course, Communication - among ourselves

and more importantly, communicating learning outcomes to our audience.

I think the Graphic novel is a great way to break up complex modules and explain them through a story.

My heartfelt gratitude to Ms. Anita Karwal and Mr. Manoj Ahuja, for encouraging the teams to create this content. A debt of gratitude to Mr. Sandeep Sethi, without whose training and patient hand holding, this novel would not have seen the light of day!

Kudos to the teachers for venturing into uncharted waters and reaching their goal!

Aditi Misra
Director Principal
Delhi Public School
Sector 45 Gurgaon

Chiranjeev has joined a new school and is very excited to learn new Chemistry concepts in his science classes. The teacher introduces atoms, molecules, electronic configuration and valency to Chiranjeev and his classmates in an innovative way which the students thoroughly enjoy. Through real life examples and visual illustrations, the students are familiarized with these new concepts. In fact, Chiranjeev becomes so absorbed in his thoughts about electrons, protons and neutrons that he dreams of a magnificent elemental world of Hydrogen , Oxygen, Helium and other elements moving about happily in a park and a sea beach.

This graphic novel is an attempt to make the young learners appreciate, enjoy and understand the basic concepts of Chemistry in an easy and entertaining way.



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