

ON THE WINGS OF A CLOUD

Chapter 3 Motions of the Earth



R N PODAR SCHOOL
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ACKNOWLEDGEMENT

‘Education is the kindling of a flame, not the filling of a vessel.’ –

Socrates

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PREFACE

From the beginning of history, mankind has been fascinated by the Earth, Moon, Sun, Stars and all the other heavenly bodies. This fascination has only increased with the passage of time and the ability of humans to observe and understand celestial bodies.

As each child gets to know about the wonderful world of Space, he learns about our Solar System consisting of the Sun and the planets revolving around it. He learns that the Sun is a star which is nearest to our planet, the Earth.

Every child is greatly excited when he first begins to see, hear and understand about Space and the celestial bodies. As his curiosity about such things grows, he uses his imagination to understand, know and tell stories about them.

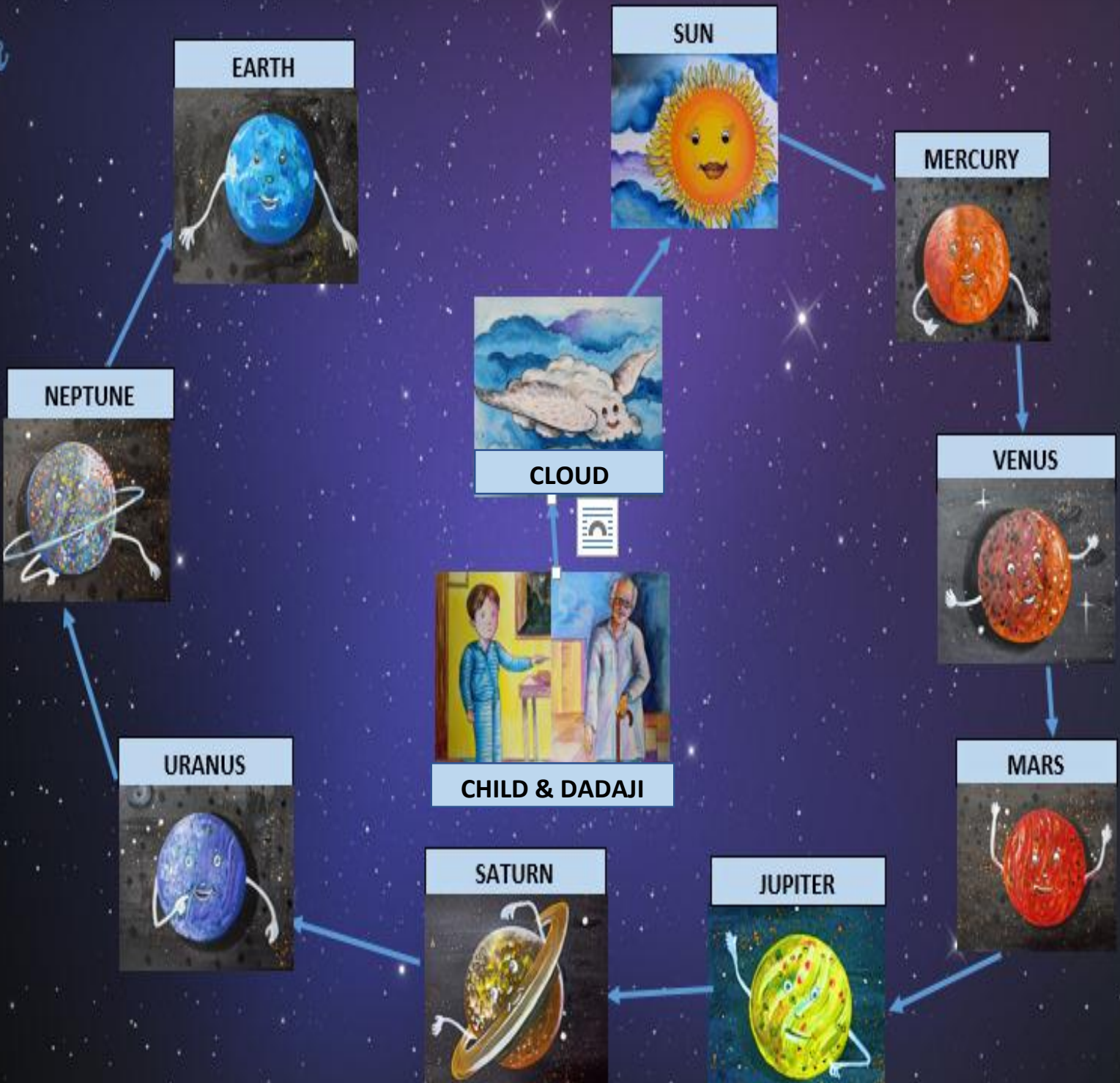
This book is a story of one such young, curious and excited child exploring our Solar System and understanding the various phenomenon associated with it.

DISCLAIMER

This is an imaginary story about a young curious boy wishing to know about the Solar System. The scientific facts about the Solar System have been explained through the use of an imaginary friend, the cloud and his father and grandfather. The scientific and other information has been taken from the sources mentioned in the bibliography.

Any resemblance to any other such story is purely coincidental and unintended. This graphic novel and its contents are a creation of the team of R N Podar School, Santacruz West, Mumbai.

STORYBOARD

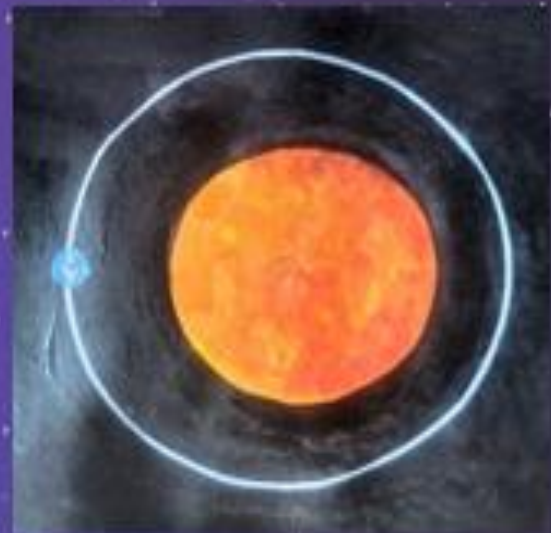


STORYBOARD

MOTIONS OF THE EARTH



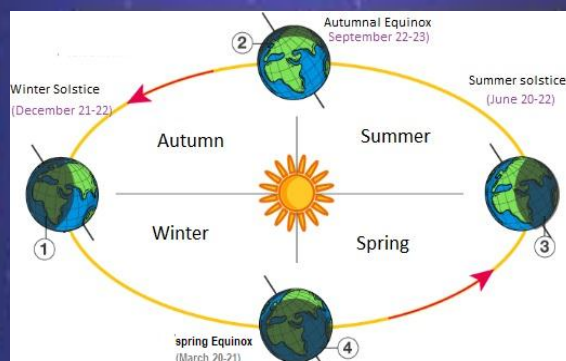
Rotation



Revolution



Day and Night



Seasons



Year and Leap Year

LEARNING OUTCOMES ★

1. Develop the skills of "Inquiry Based Learning" in the students. Inculcate questioning skills and drawing inferences from them.
2. Create a Scientific Temper and develop Logical Reasoning Skills.
3. Gaining knowledge about the Sun and the 8 planets.
4. Get a clear concept of Movements of the Earth- Rotation and Revolution.
5. Comprehending the concept of Rotation causing day and night and Revolution leading to formation of seasons.
6. Understanding the concept of Equinox, Summer and Winter Solstice.
7. Understanding the concepts of Calendar and Leap Year.

Main Characters of the Graphic Novel

1. Sameer: The whole story revolves around the central character Sameer, a child of around 11 years age. He is an inquisitive child who wants to know more about the Solar System and the stars. He likes to question and his imagination knows no bounds.



2. Grandfather: An old, affectionate and patient person who wants to satisfy his grandson by answering all the questions raised by him. He explains the concept of day and night and also how seasons are formed. He believes in experimentation and demonstration to clear his grandson's concepts.



3. Cloud: This is an imaginary friendly and helpful character which tries to fulfil all the wishes appearing in Sameer's dreams. It acts as a vehicle (spaceship) and takes the child wherever he wants to go.



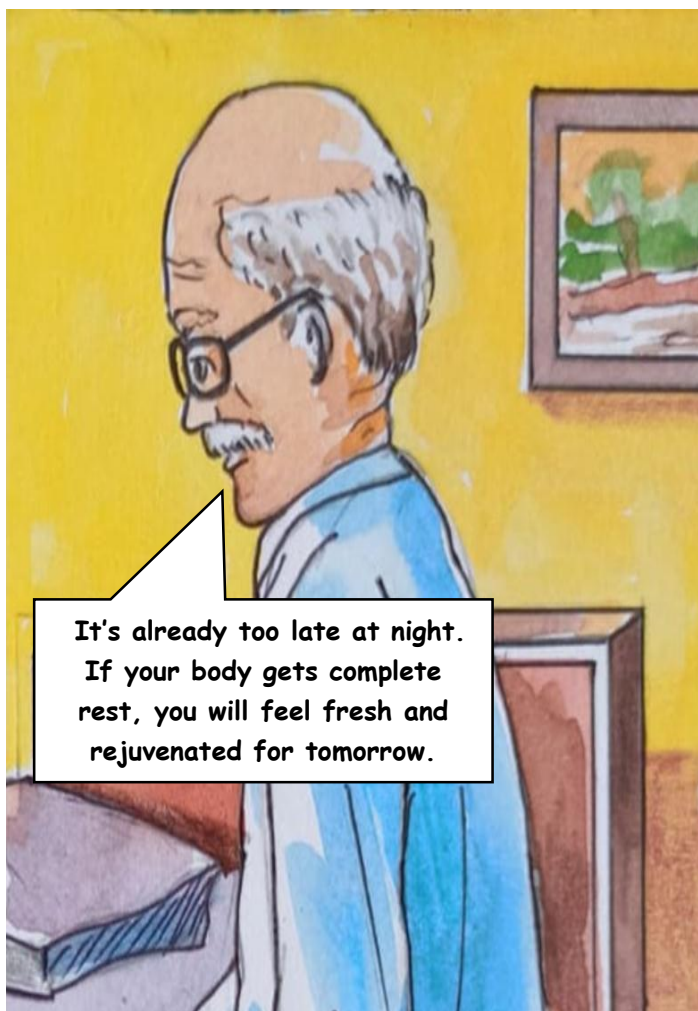
4. Father: A nurturing parent, who believes in explaining the concepts by encouraging the observation and questioning skills of his child. He also guides his son to understand the concept of leap year. He believes in fitness of the body and mind by exercising and healthy eating.



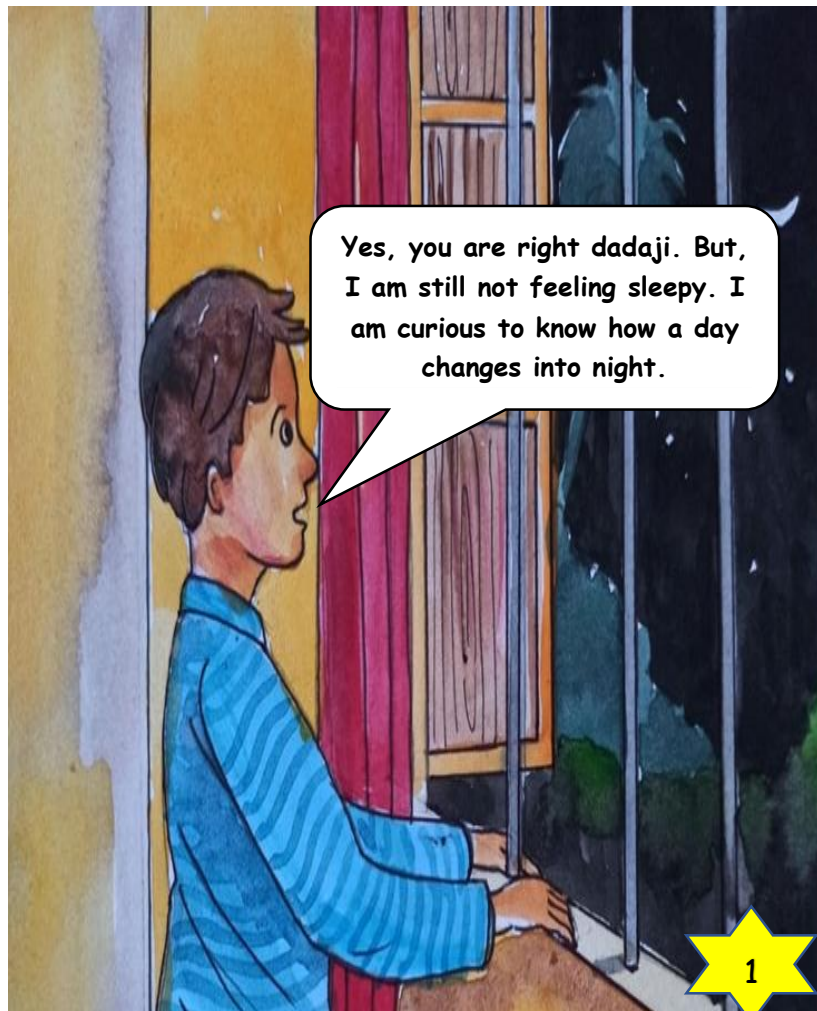


Sameer, it's time to sleep,
my child.

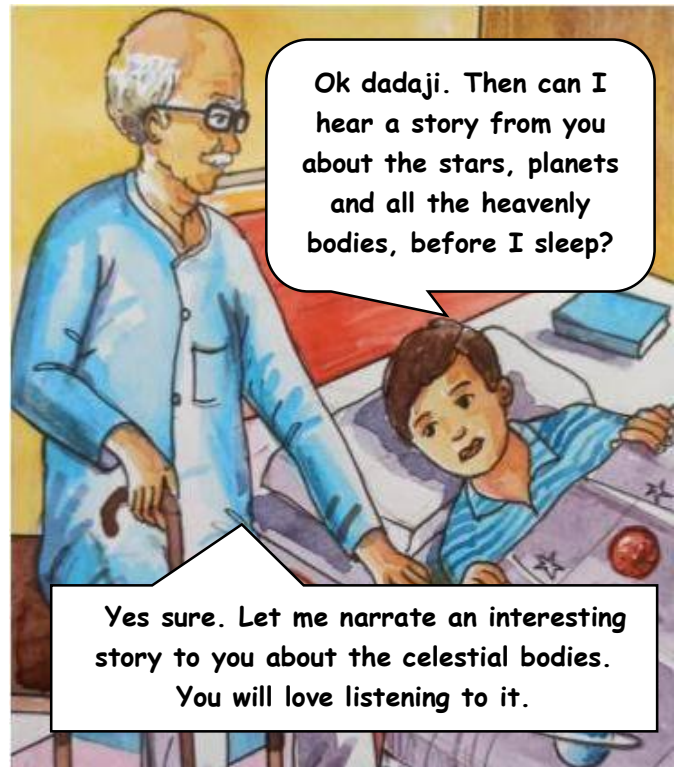
But dadaji, I don't want
to sleep now. I want to
have some fun. Why
can't I go out and play
in the garden?



It's already too late at night.
If your body gets complete
rest, you will feel fresh and
rejuvenated for tomorrow.



Yes, you are right dadaji. But,
I am still not feeling sleepy. I
am curious to know how a day
changes into night.





A young boy with brown hair, wearing blue and white striped pajamas, is riding a large, fluffy white cloud that has a smiling face. He is holding a yellow telescope and looking towards a bright star in the dark night sky. The background shows dark blue clouds and a starry sky.

My Social Science teacher had told us, our Solar System consists of the Sun and the eight planets. Will you please take me to see the Sun?

Of course yes! So on your marks, Get, Set Go!

The boy is now sitting on the same smiling cloud, which is flying over a miniature town with many small houses and green hills in the background. He is looking down at the town with a surprised expression.

Wow! Look at the miniature sized buildings. They look so intricately designed. I can also feel the cool breeze touching my cheeks and gradually flowing into my hair.





However, I will suggest
you not to go there.

But why?



That's because there is no air in
space. It is only a vacuum with
harmful UV and infrared rays.

So you mean to say, I
cannot breathe in space?



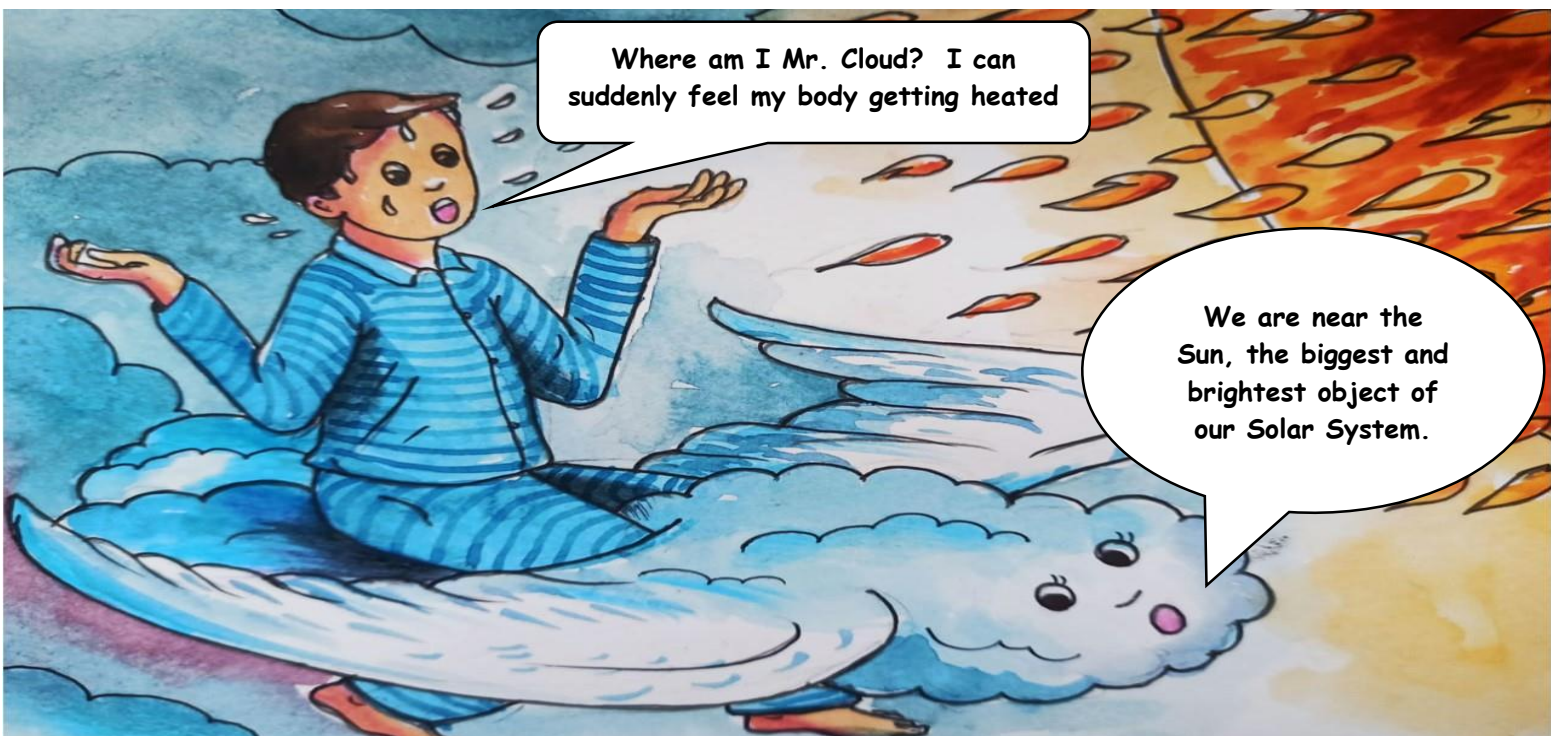
Yes, no one can breathe in
space. We better not go there!



But you promised to take
me there for a quick ride
to our universe.

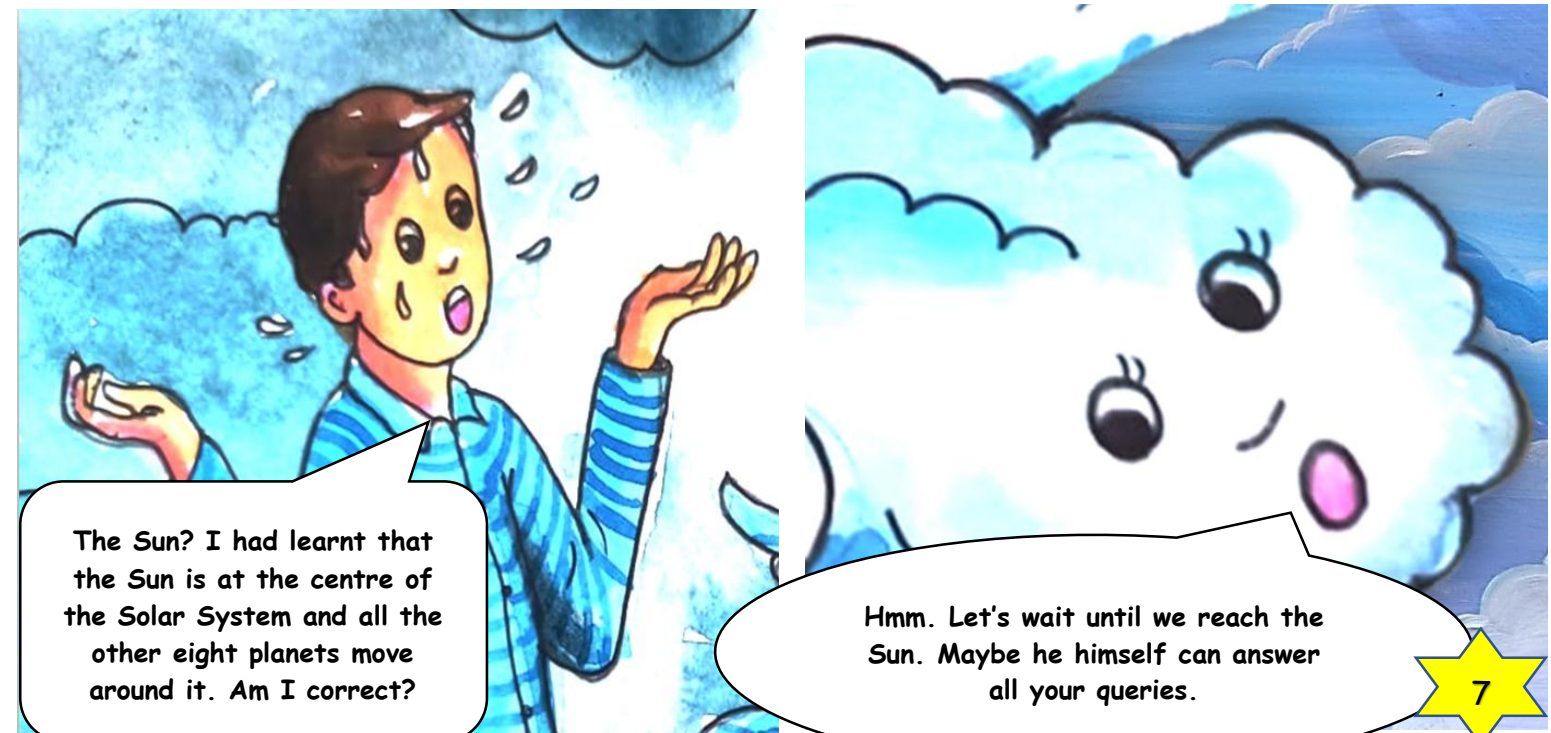


Lovely! I can see the stars, planets and other objects but there are no clouds here.



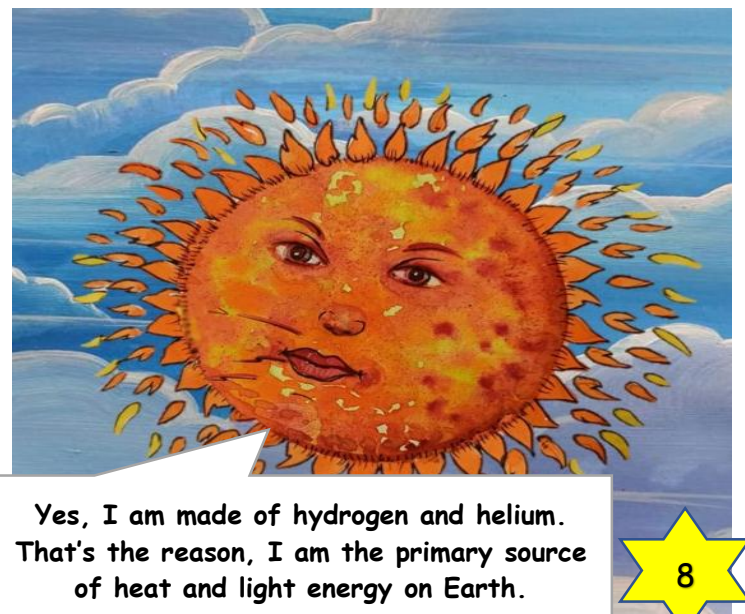
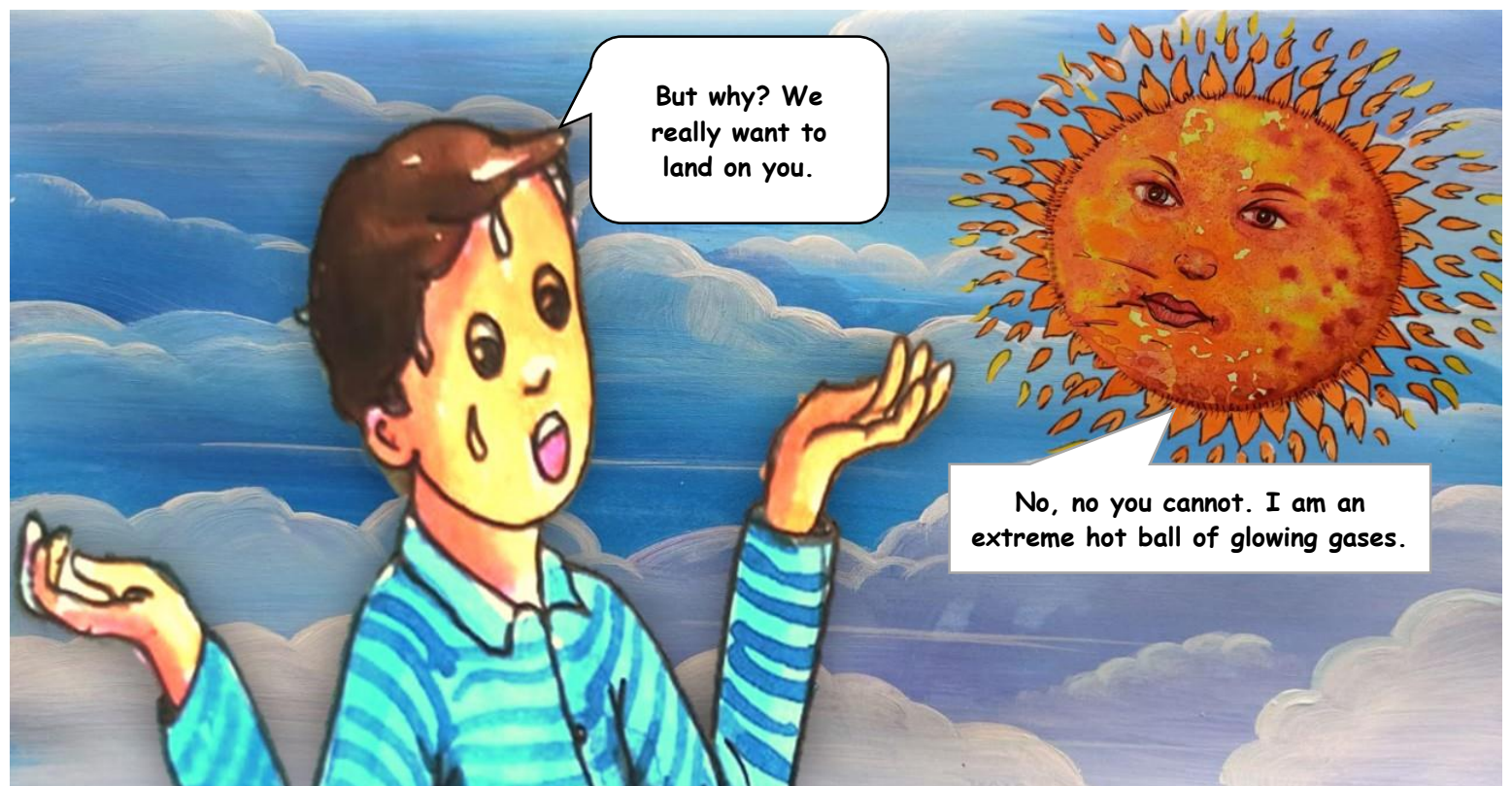
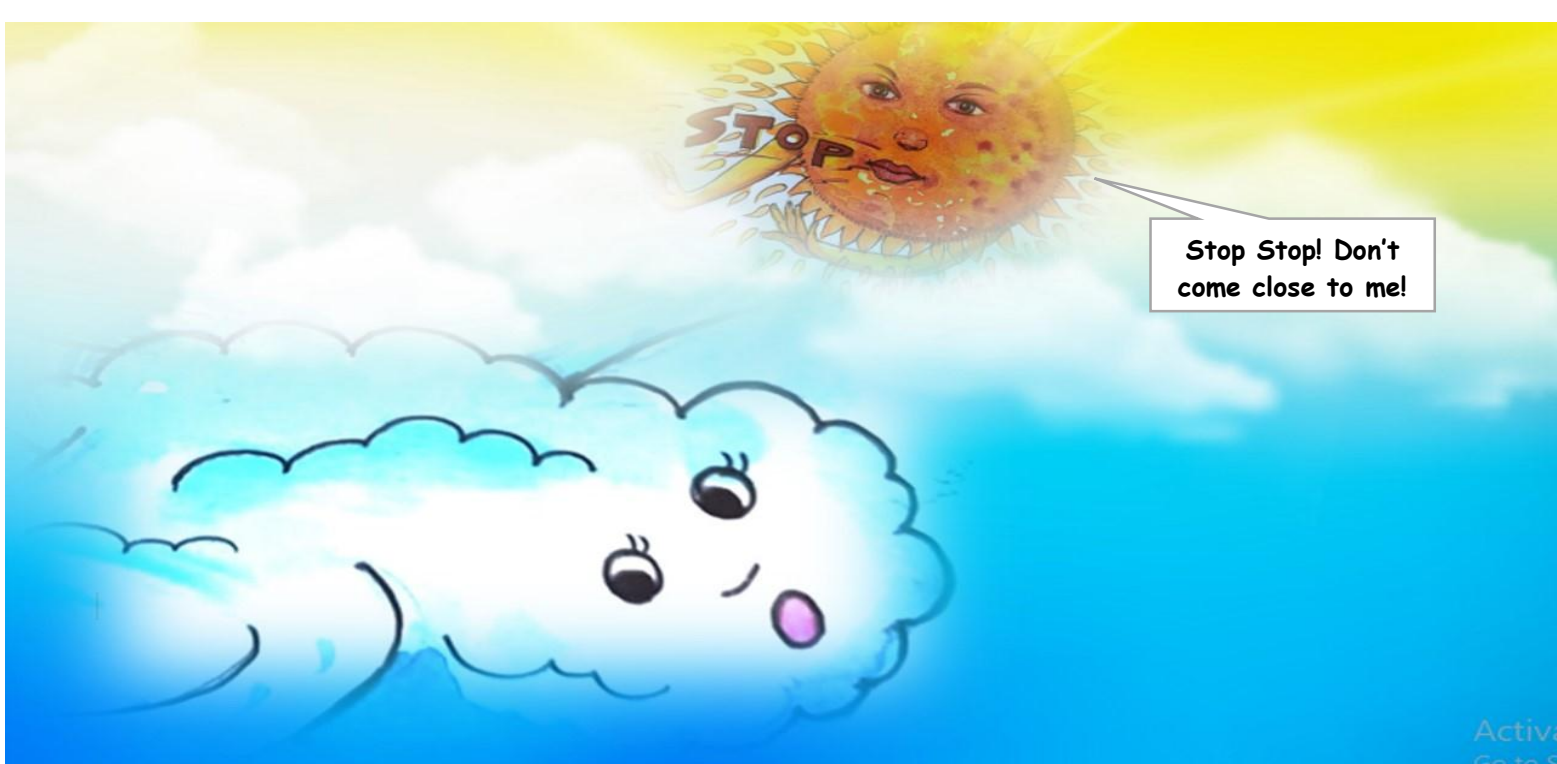
Where am I Mr. Cloud? I can suddenly feel my body getting heated

We are near the Sun, the biggest and brightest object of our Solar System.



The Sun? I had learnt that the Sun is at the centre of the Solar System and all the other eight planets move around it. Am I correct?

Hmm. Let's wait until we reach the Sun. Maybe he himself can answer all your queries.



Yes, light energy is also required by plants for photosynthesis.



Solar geyser



Solar cooker



Solar panel

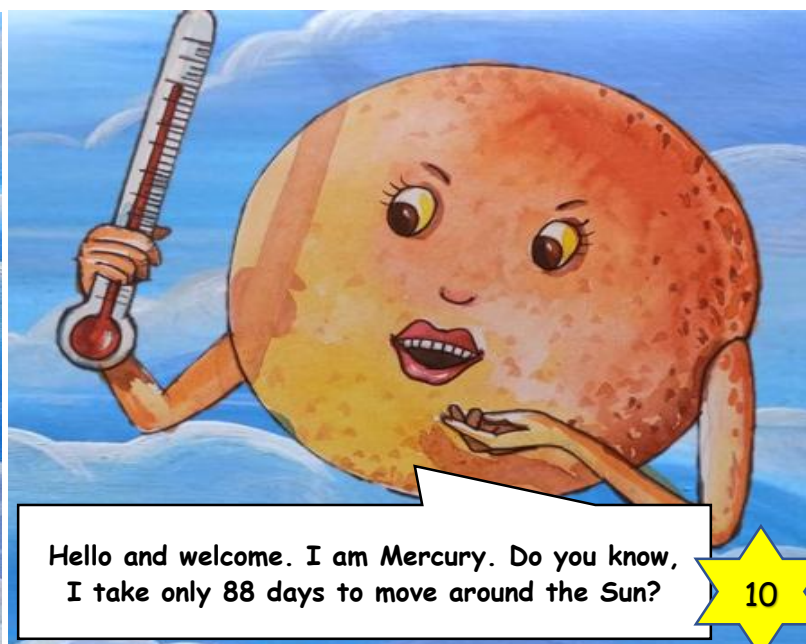
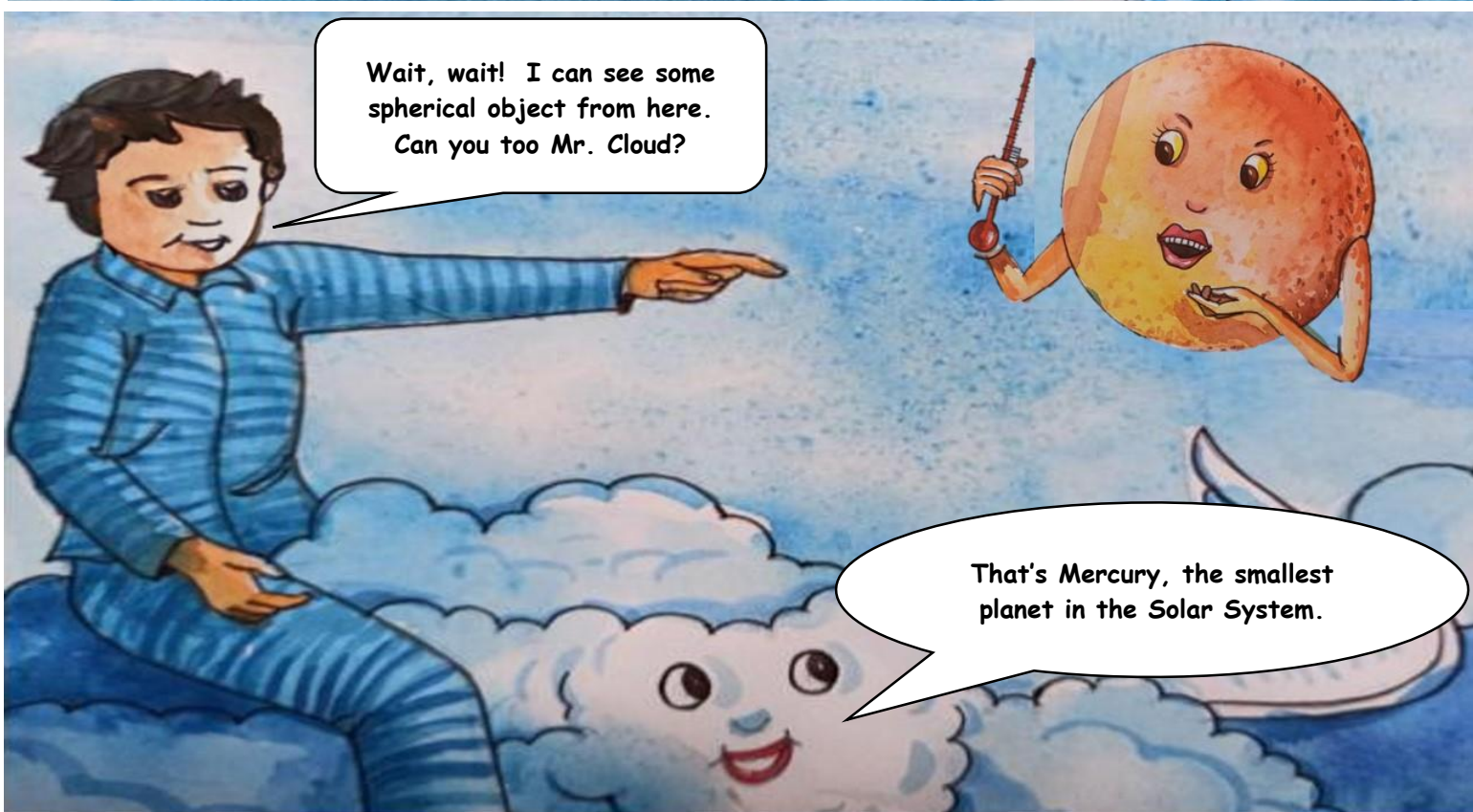
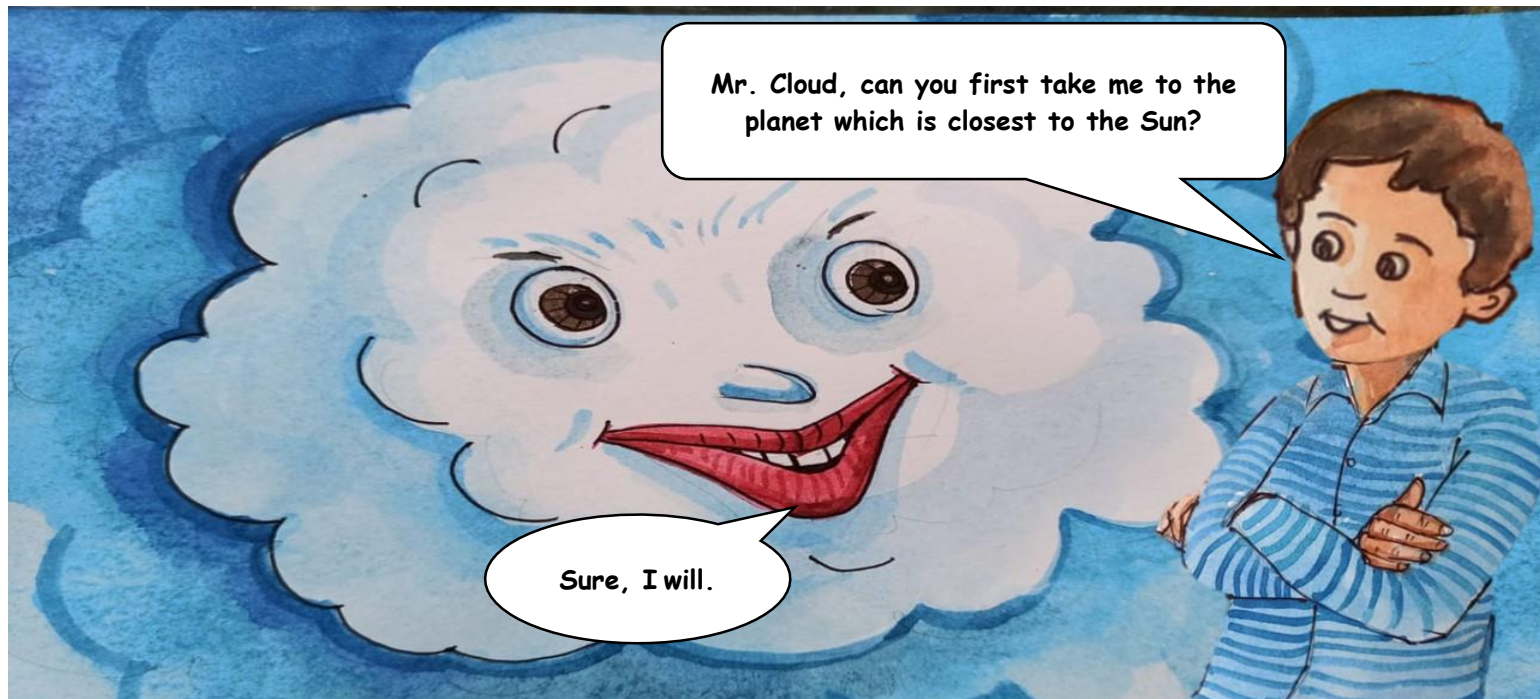
Nowadays solar energy is also widely used. Life has indeed become very simple and easy. Then we also have...

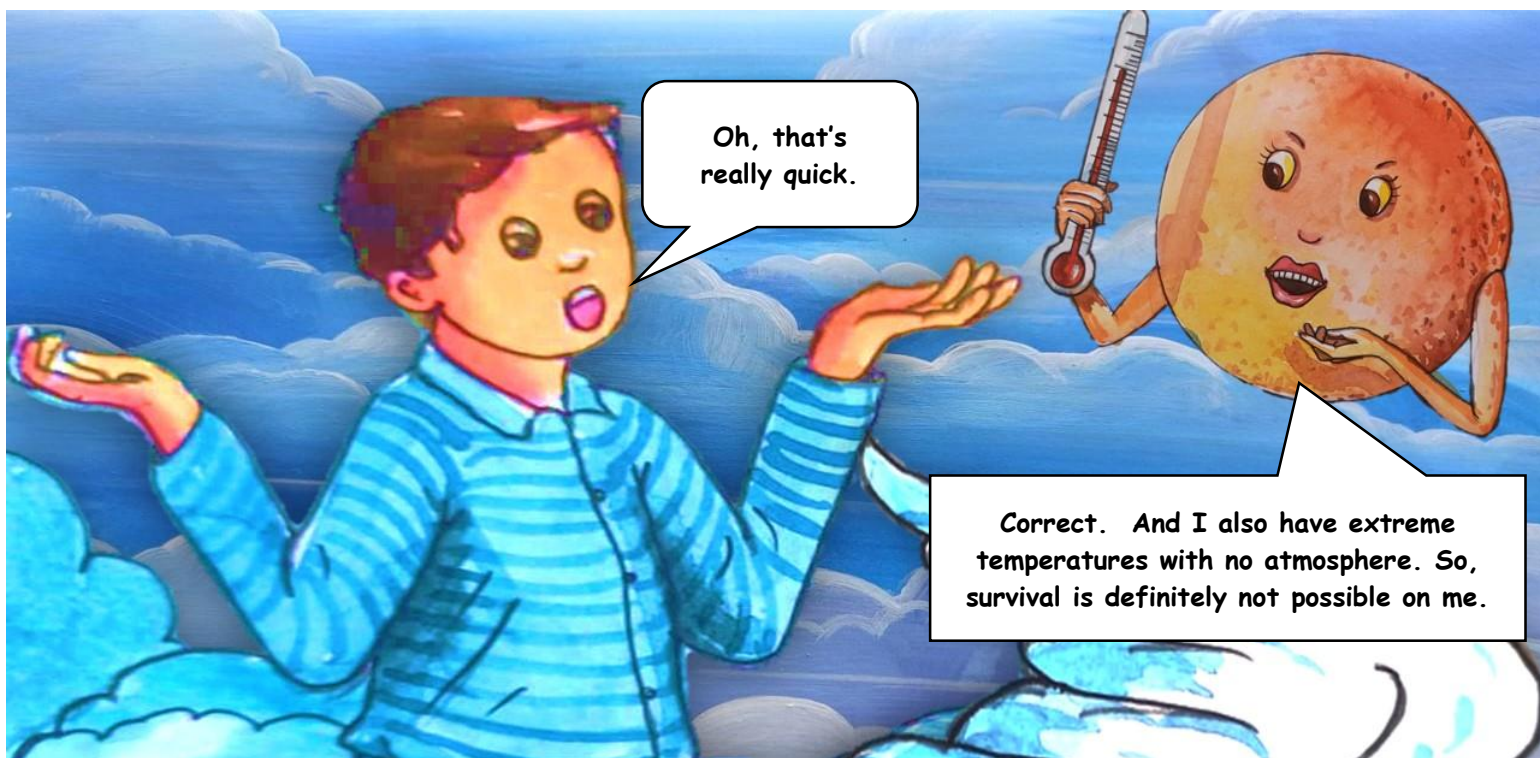
Do you know, earlier all other planets too were hot balls of gases like me?

Oh really? Thank you so much Mr. Sun for sharing such valuable information with me. It was nice talking to you.

BYE BYE

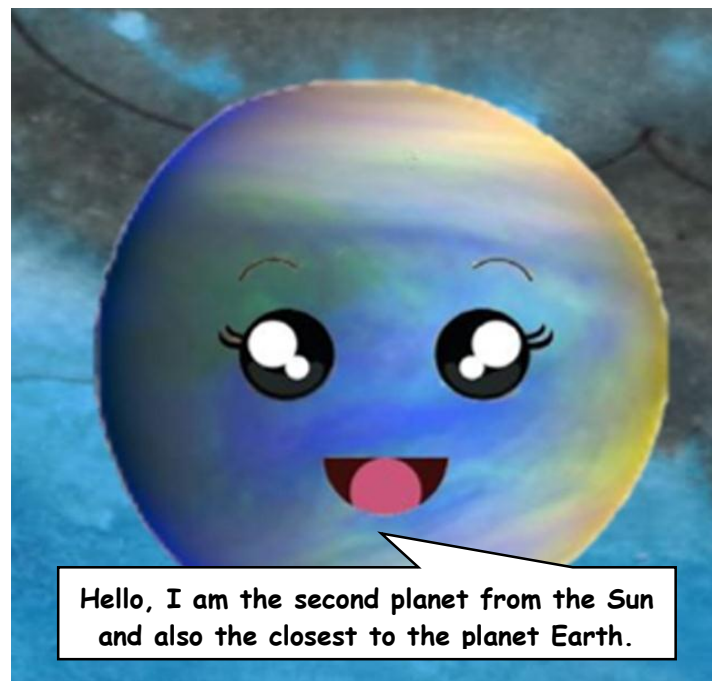
Have a wonderful journey my child and don't forget to visit the other planets. It's going to be super fun!







Venus! I know it is called 'The Twin Planet' of the Earth.

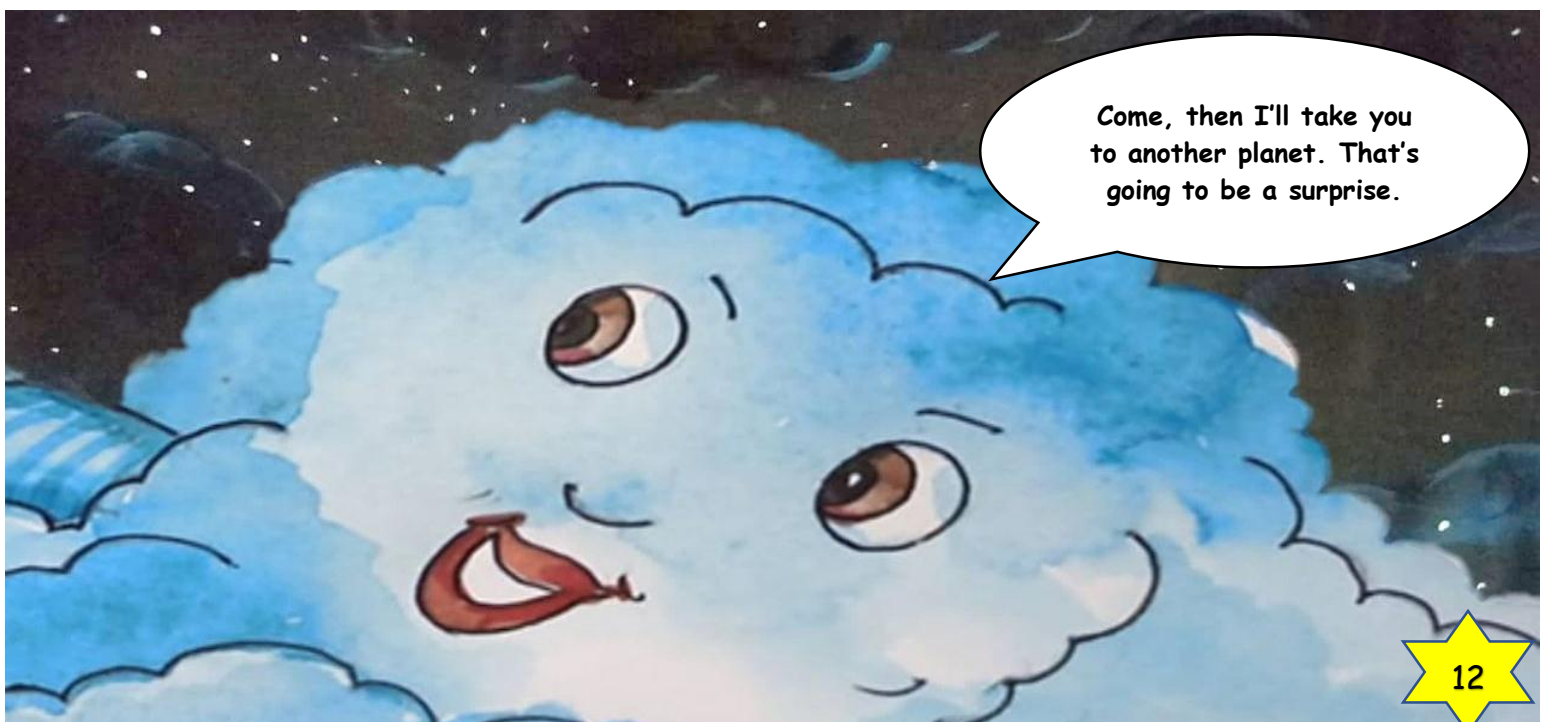


Hello, I am the second planet from the Sun and also the closest to the planet Earth.



Please stay away from me. I am very hot and my atmospheric pressure is very high. Human beings cannot survive on me.

Then what do we do now and where do we go?



Come, then I'll take you to another planet. That's going to be a surprise.



Amazing! I can see Mars, 'The Red Planet' around which Mangalyaan is orbiting. I have seen the movie too.

Hi. I am a terrestrial planet. You will find large contents of iron oxide in my soil, so I am red in colour.



I have heard that you have traces of water too.

Yes, you are right. I have an atmosphere that is very thin and contains only carbon dioxide.

Thank you Mr. Mars, It was wonderful to hear from you.



I am feeling so excited. My next mission will soon be on board.



Oh wow! I can see an unusually enormous planet. I think it is Jupiter.

I am the biggest

Yes, it is. Look, how brightly it shines!



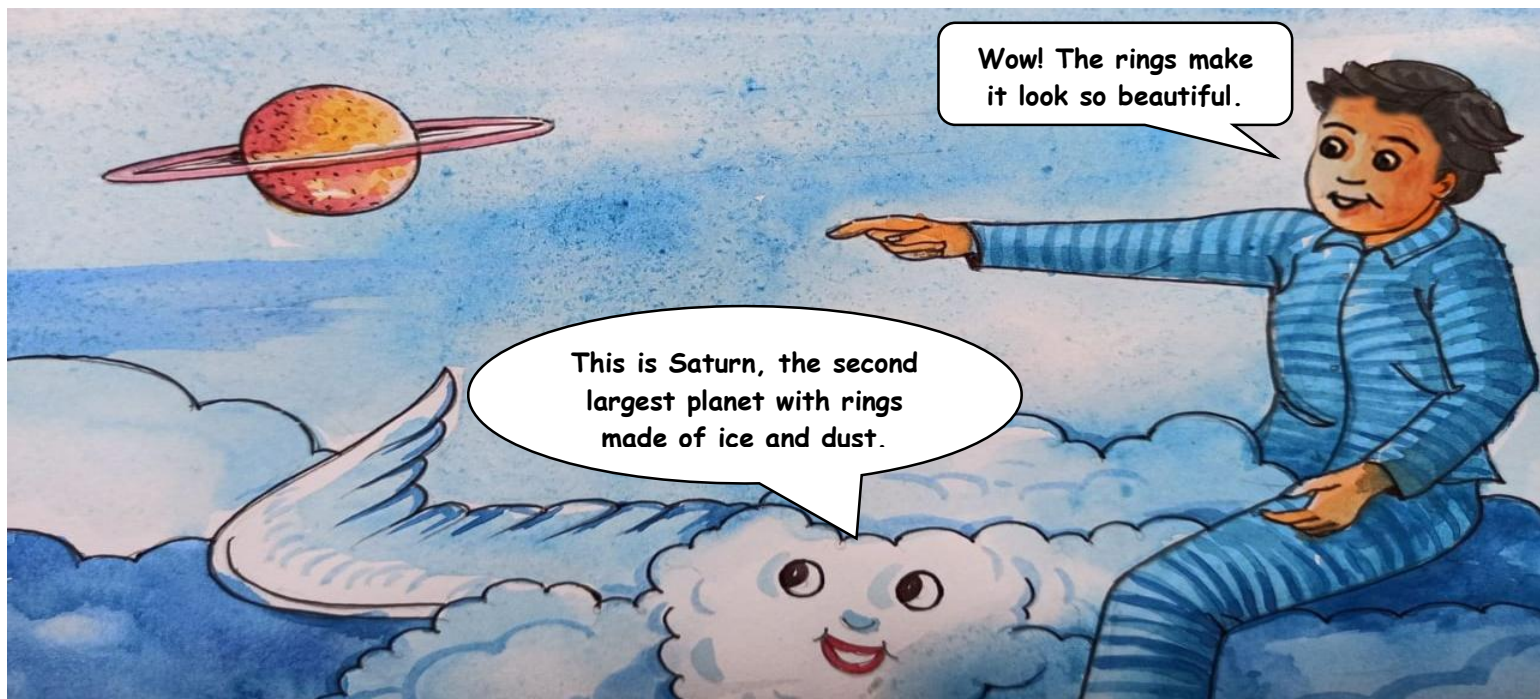
Mr. Jupiter, you look so beautiful. Can I stay with you

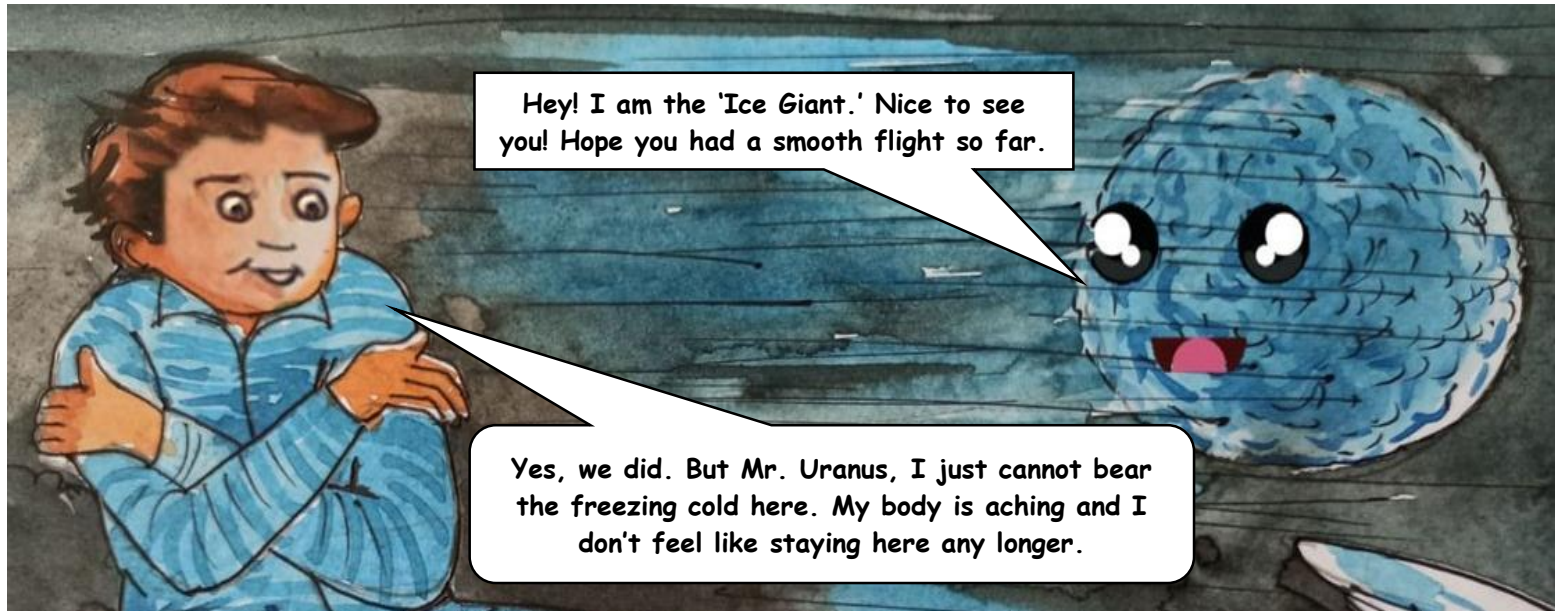
No, my child. My atmosphere is made up of only hydrogen and helium. I do not have any oxygen. You will not be able to breathe here.



Well, then where must we go? Mr. Cloud, can you take me ahead.

Of course yes!

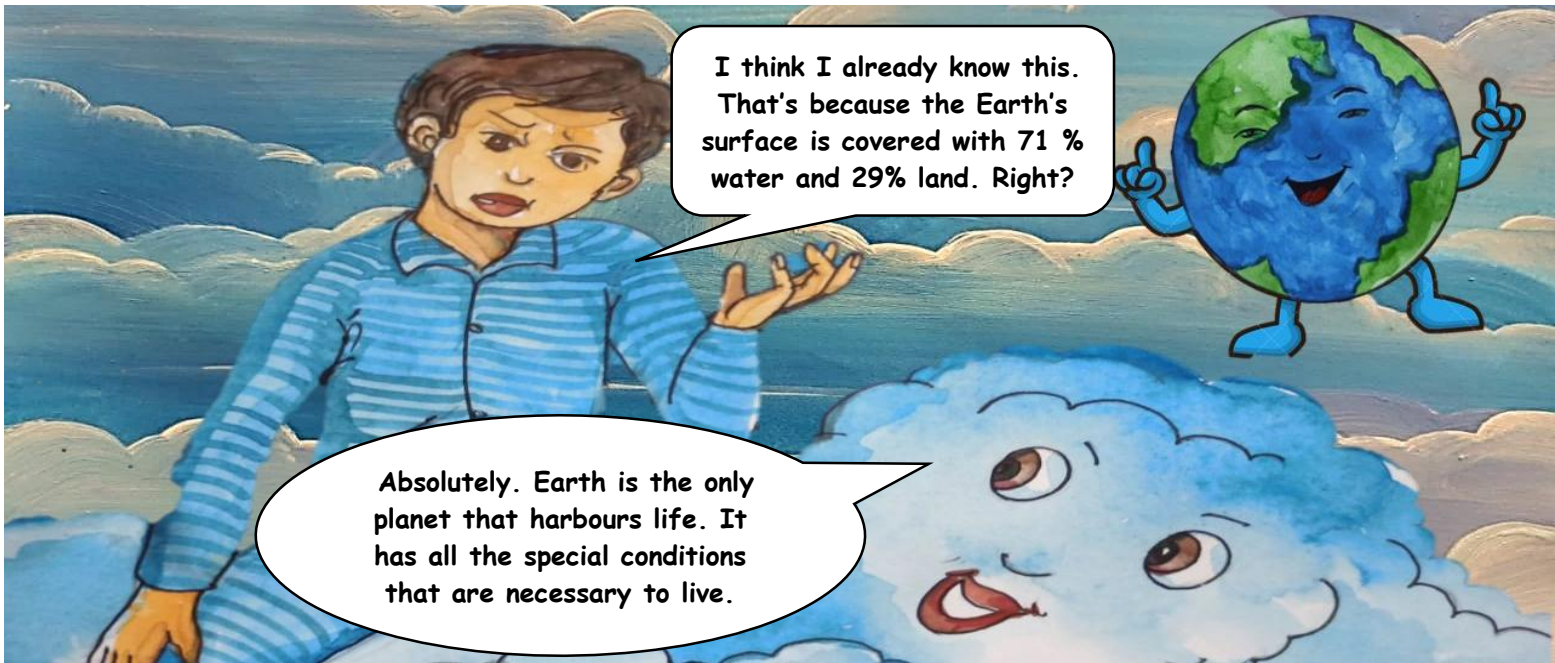






Look, I can now see a blue planet. Mr. Cloud are we close to our planet Earth?

Yes, you guessed it right. Let me tell you what makes Earth appear blue in colour.



I think I already know this. That's because the Earth's surface is covered with 71 % water and 29% land. Right?

Absolutely. Earth is the only planet that harbours life. It has all the special conditions that are necessary to live.



Hmm. And since it is the third planet from the Sun, it is neither too hot nor too cold. The temperature is just right for all living beings to exist.

Wohoo! You are very much right!.



So my child, have you enjoyed your journey into space with me?

Yes, I did. In fact this has been one of the best experience of my life.

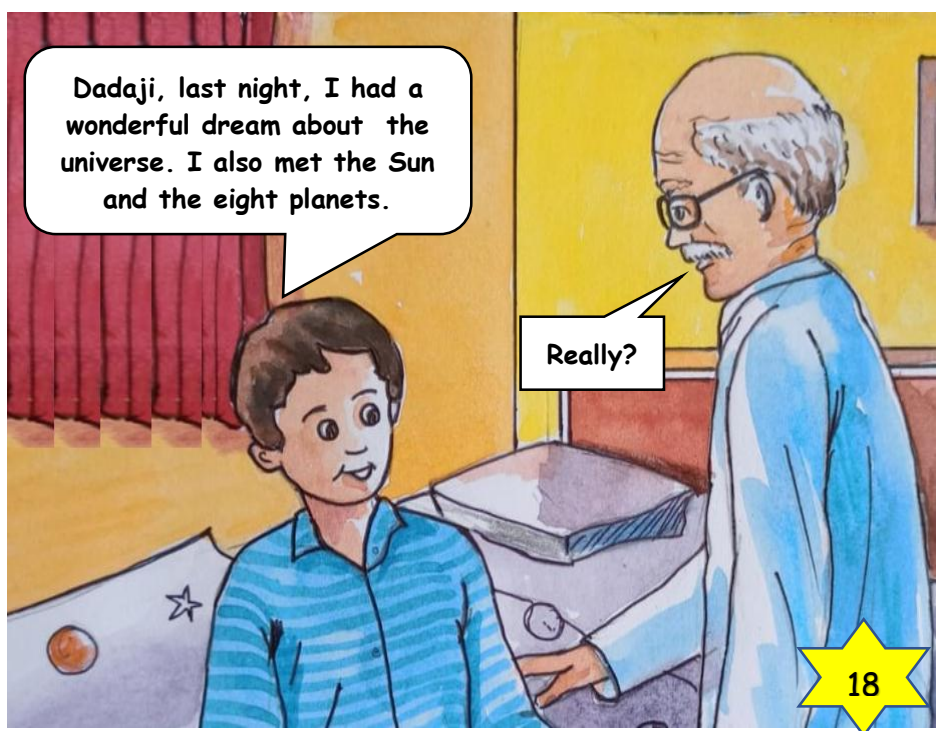


Mr. Cloud, thank you so much for.....

Sameer, wake up my child! Whom are you thinking? There is nobody in the room.

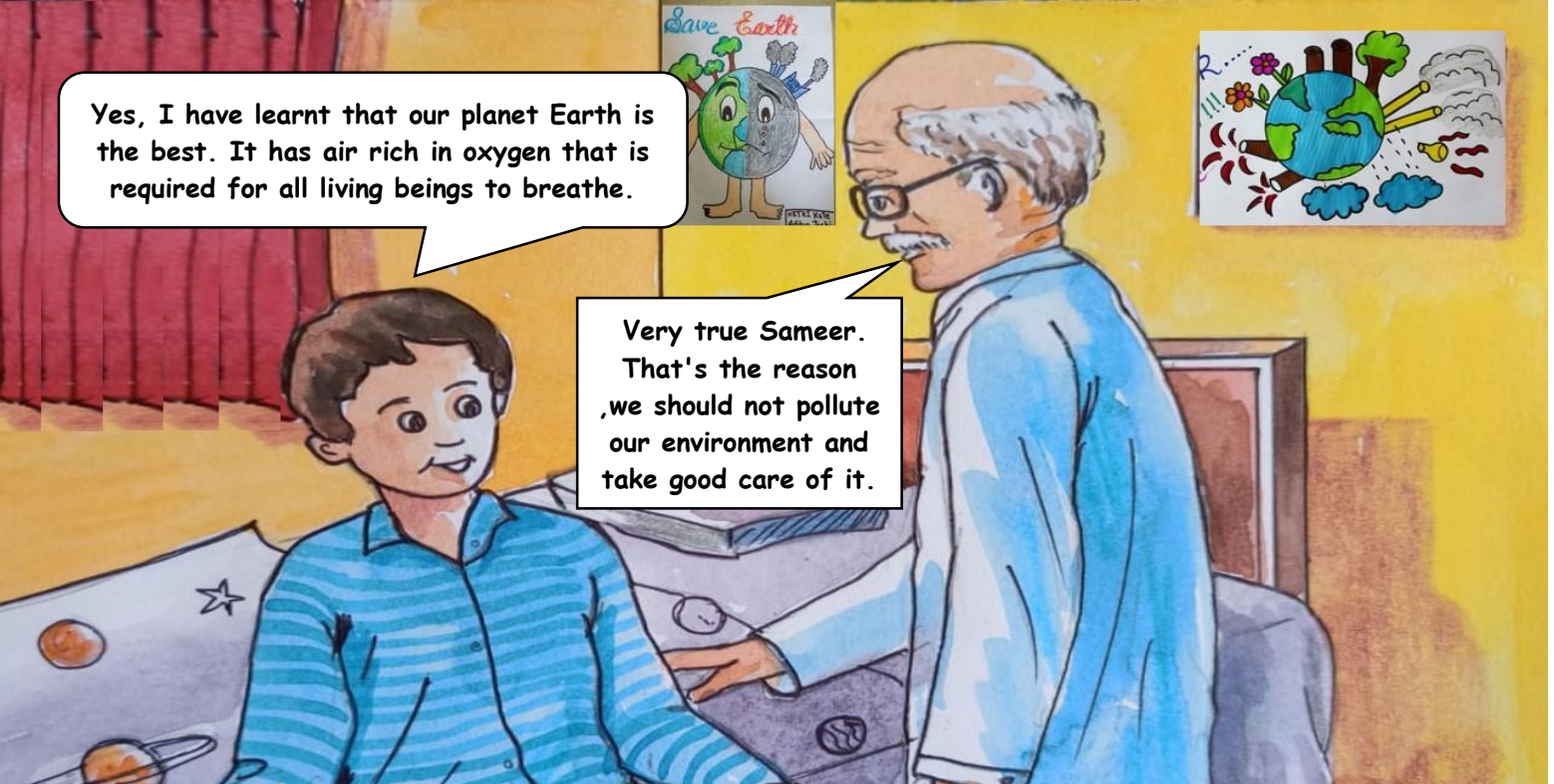


Oh, I think I was dreaming.



Dadaji, last night, I had a wonderful dream about the universe. I also met the Sun and the eight planets.

Really?



Yes, I have learnt that our planet Earth is the best. It has air rich in oxygen that is required for all living beings to breathe.

Very true Sameer. That's the reason we should not pollute our environment and take good care of it.

Yes Dadaji. I even remember the poster that I had once made in school on 'Save My Mother Earth.' But, I don't remember where I have kept it now.

Ha Ha! How can you be so forgetful? It's right there hung on the wall.

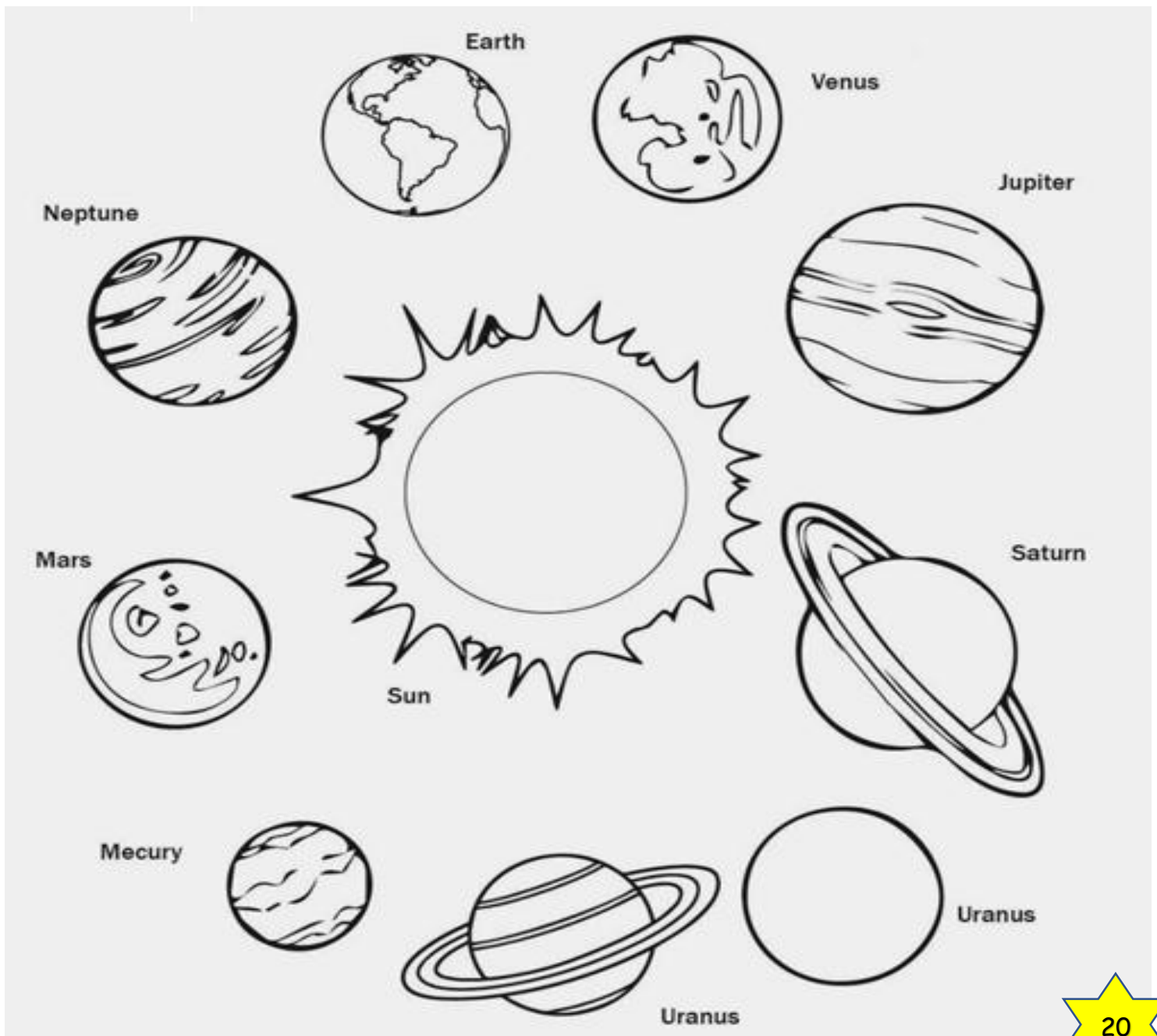
Sameer, from tomorrow onwards join me for a morning walk. It will not only boost your energy but also help you to stay alert.

Ha Ha dadaji! I will surely accompany you.

Worksheet 1

Read aloud and follow the instructions given.

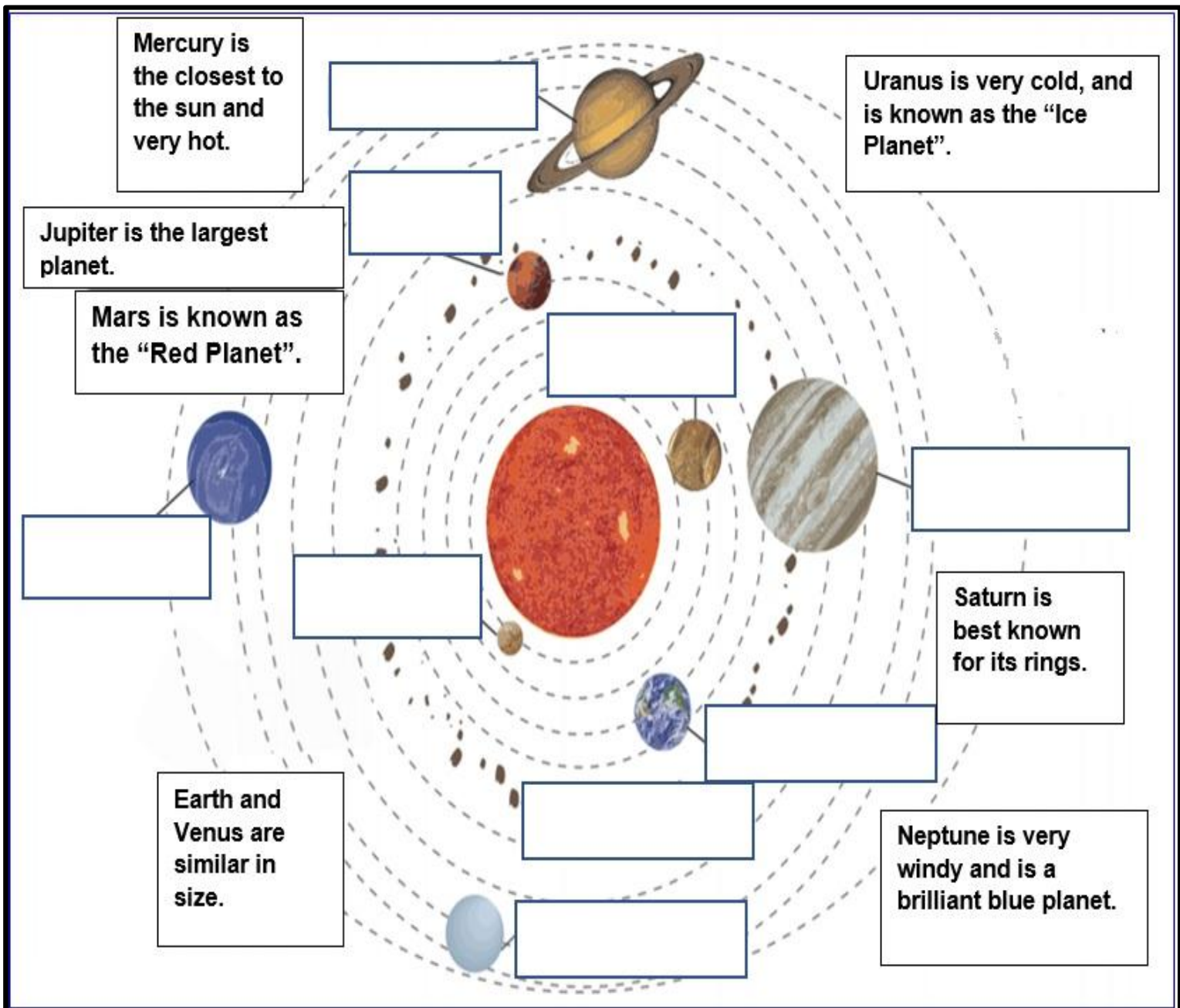
Imagine you are in space,
All is dark but the Sun burns bright,
And the planets show up in the light.
Use your crayons and with your imagination
Colour them up in their own light.



Worksheet 2

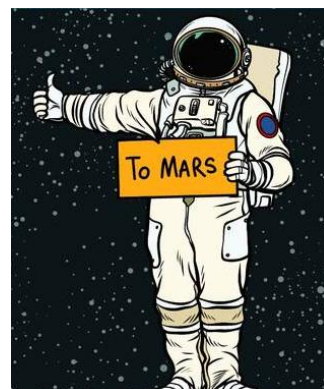
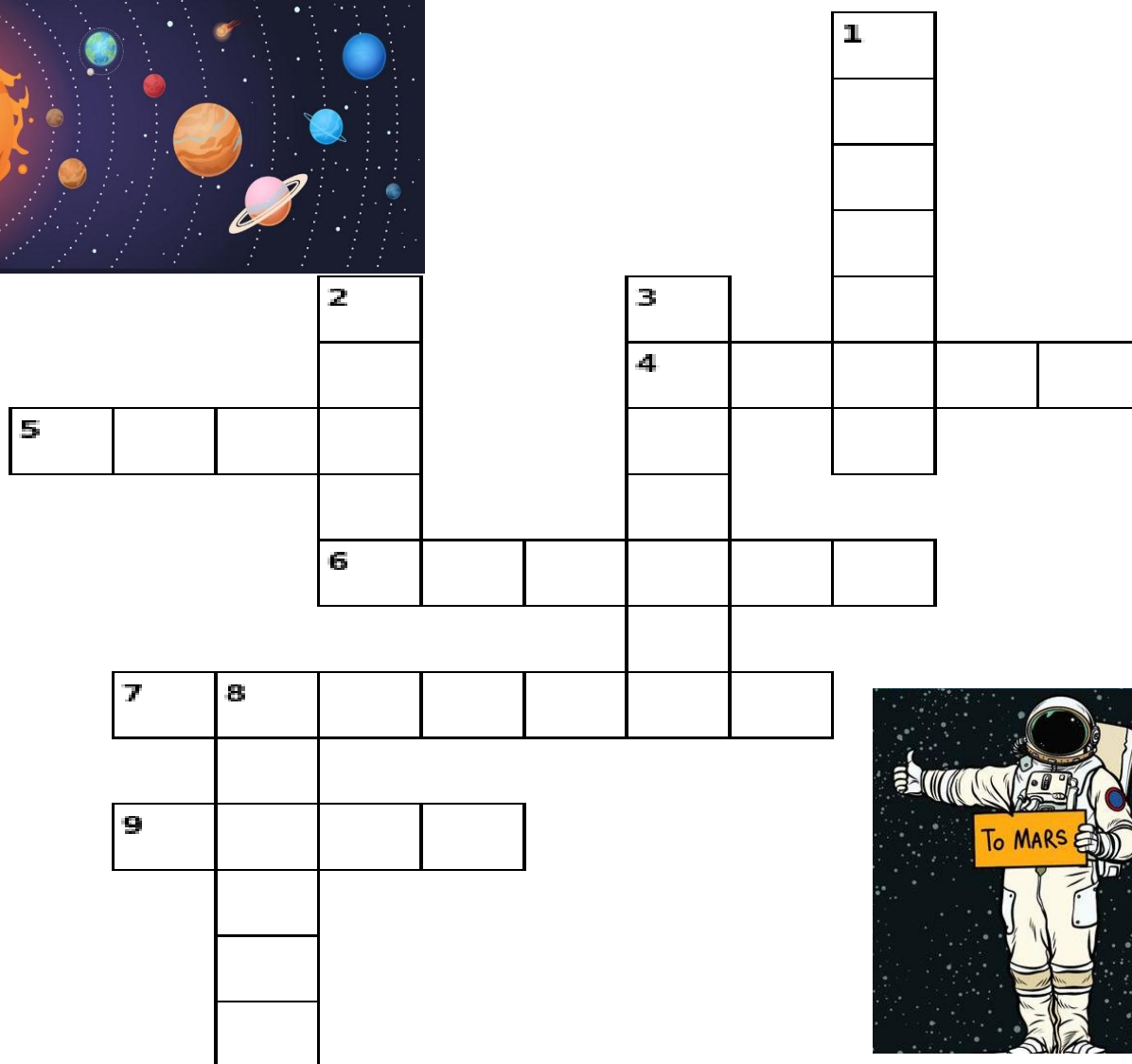
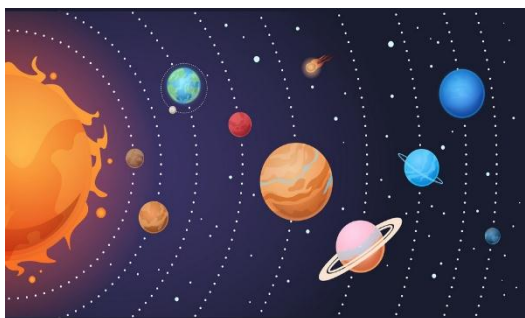
Explore Our Solar System

Our solar system consists 8 planets. Directions: Label the 8 planets. Use the hints to help!!



Worksheet 3

Complete the crossword using the clues given below.



Across

Down

- 4 Third planet from the Sun.
- 5 Neil Armstrong was the first person to land here.
- 6 Famous for its rings.
- 7 Largest planet in the solar system.
- 9 Is often called the "Red Planet".

- 1 Nearest planet to the Sun.
- 2 Second nearest planet from the Sun.
- 3 Eighth planet from the Sun.
- 8 Seventh planet from the Sun.

Dadaji and Sameer are in the park for a morning walk.

Dadaji, I have a question. Can I ask?

Yes sure, please go ahead.

I'd like to know why we see certain things in the sky during the day but not at night.

I'll tell you the logic behind it. During the day, the Moon and the stars are in the sky. However, we cannot see them due to the bright light of the Sun.

Hmm, that's right.

At night, there is no light from the Sun, so the stars and the Moon become visible.

Oh I see! I'd also like to know why we experience day and night.

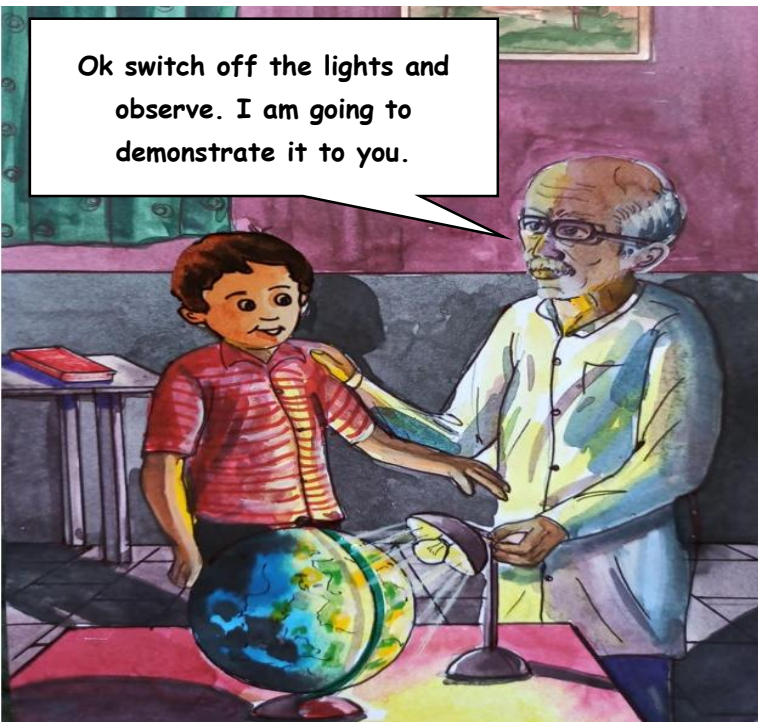
We get day and night because the Earth spins on its own axis. This is called rotation.

Rotation?



Come, let's go home. I will help you understand the concept of rotation with the help of a globe.

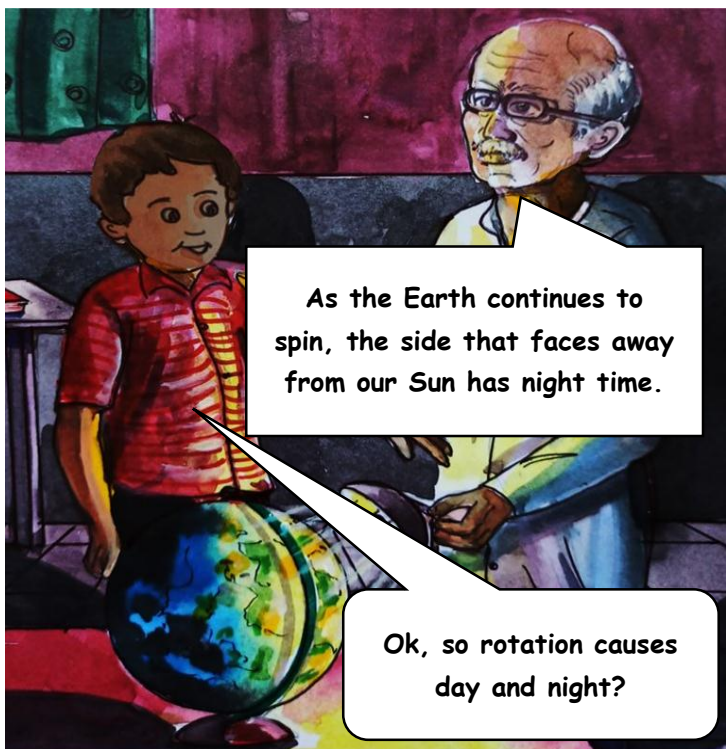
Yes, I am so excited to know more about this.



Ok switch off the lights and observe. I am going to demonstrate it to you.



See, one side of the globe is lit up and the other side is dark. The side of Earth that faces the Sun has daylight.



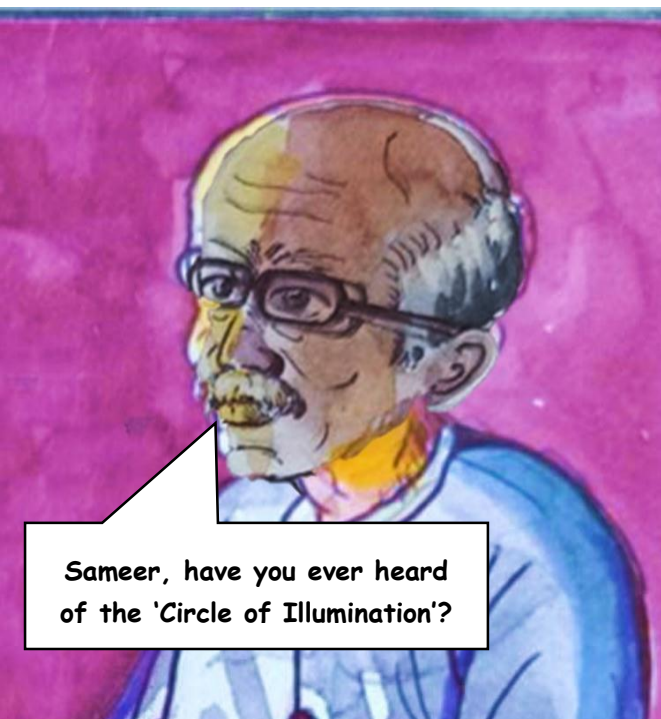
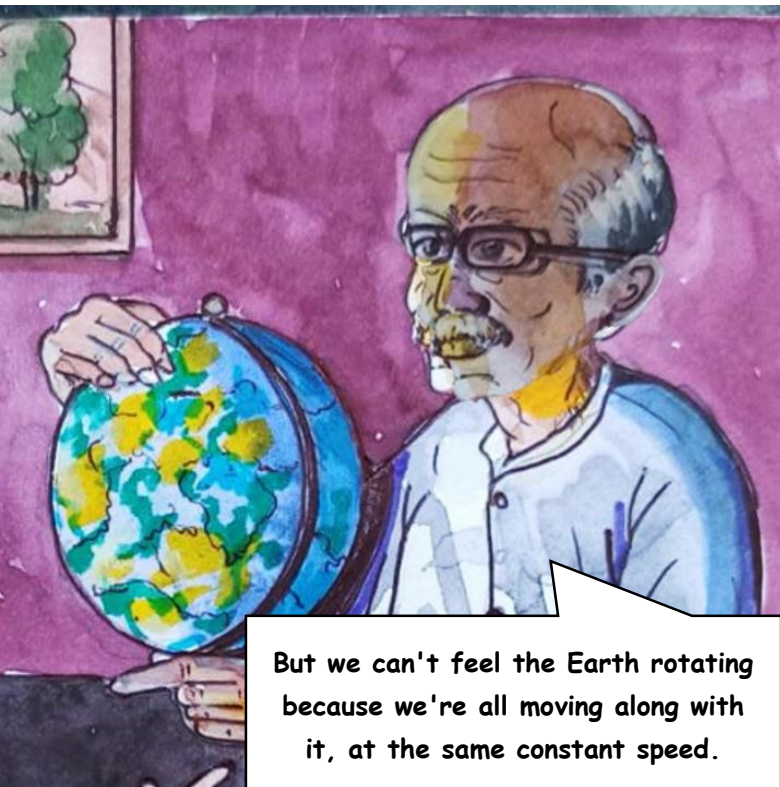
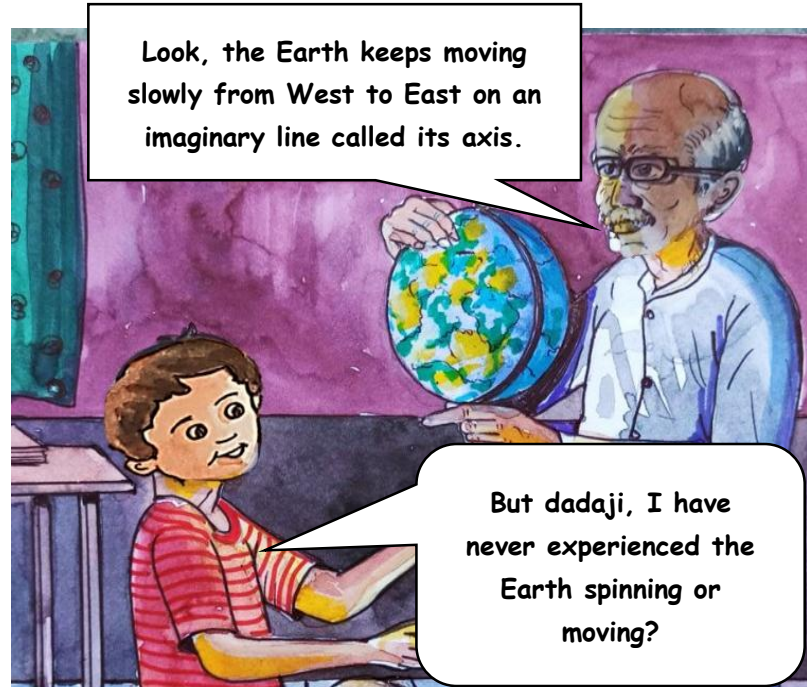
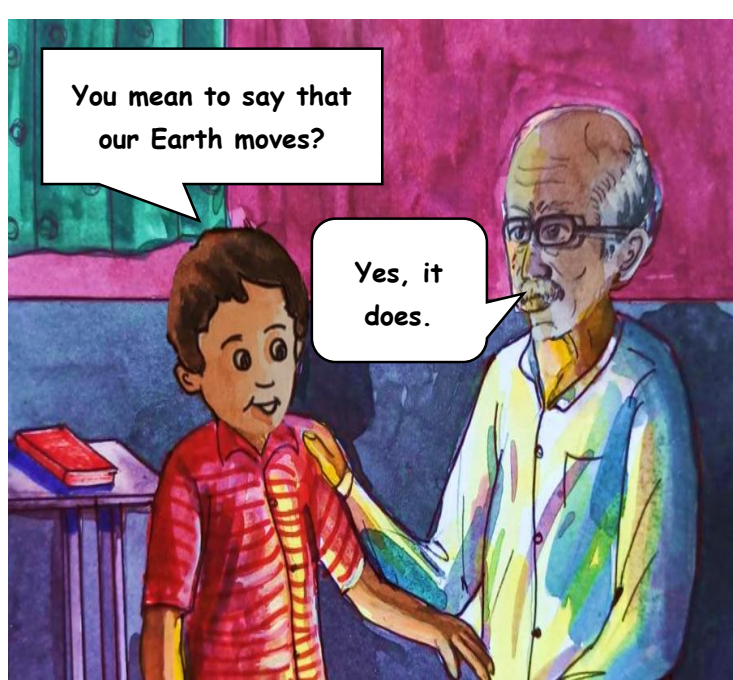
As the Earth continues to spin, the side that faces away from our Sun has night time.

Ok, so rotation causes day and night?

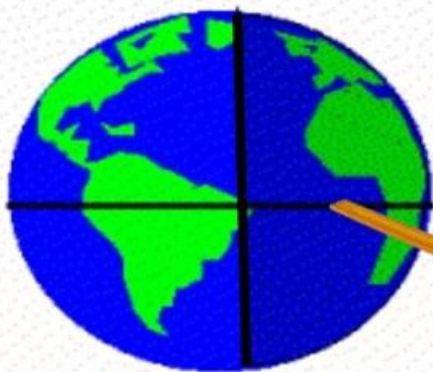


But then why don't we have continuous day or night?

This would happen if our Earth was stationary and not moving.



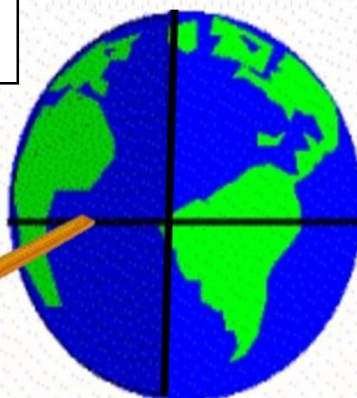
Circle of Illumination



The circle that divides the day from night on the globe is called 'The Circle of Illumination.'

In short, this circle cuts our spherical Earth into lighted and dark halves.

Circle of Illumination



Hmm, so many new terms to learn!

Now, will you tell me how many hours are there in a day?

Very simple, 24 hours.

Correct, the Earth takes exactly 24 hours to complete one rotation around its axis. This period of rotation is called the 'Earth Day'.



So that is why when there is day in India, Aunt Leena has night in the USA.



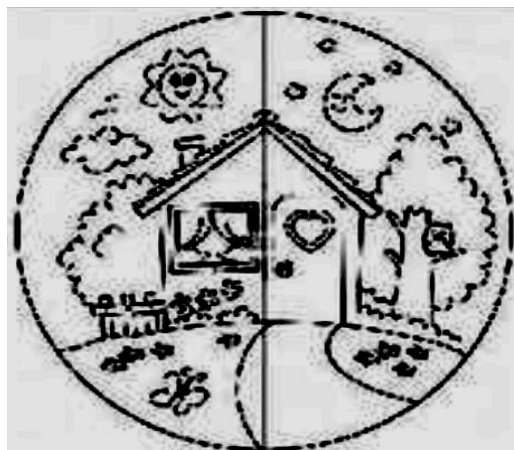
Worksheet 4

Day and Night

Word Bank

Moon, Stars, Clouds, Sun

What can you see during the day?



What can you see at night?

Look, read and complete.

Word Bank

Moon, stars, Sun, day, Earth

a. The _____ shines during the _____.



b. The _____ goes around the sun.

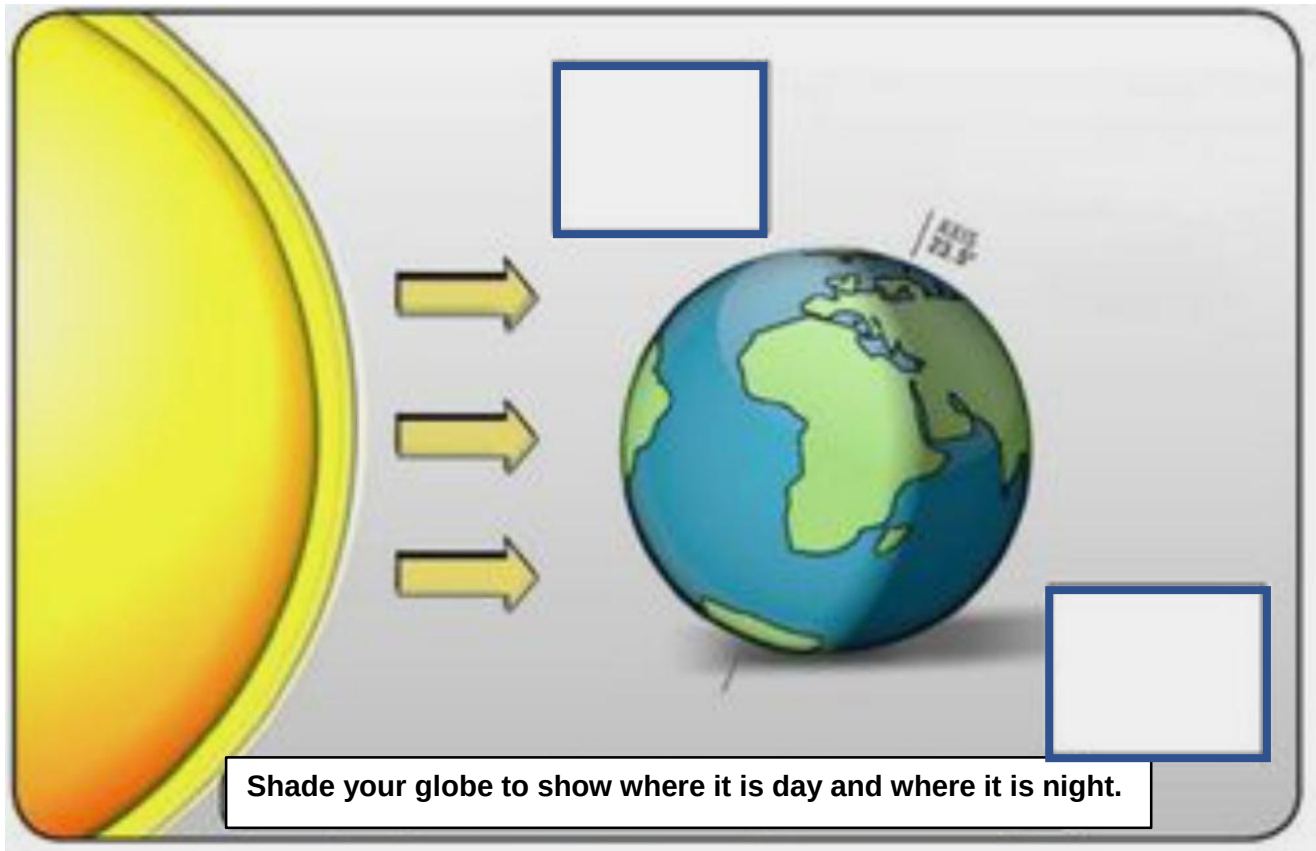


c. At night we can see the _____ and _____.



Worksheet 5

Colour the given pictures and answer the following questions.



Our planet spins or _____ from _____ to _____
_____. It takes _____ hours for one spin, we call
this one _____.

revolves

West

24

day

Day here

The Earth
receives light
from the Sun.

Night here

As Earth
shadows the
Sun.

rotates

East

48

Sameer and dad spend time together.

Hi Sameer, where had you been the whole day? I did not see you at all.

Dad, I was with dadaji in his room. I was trying to understand a few concepts that I did not know earlier.

Oh that's great! You seem to be deeply engrossed in something. What are you writing?

Dadaji explained to me a new concept about day and night. I am penning down my experience in my diary so that I can share it with my friends too.

Wonderful! Do you know writing a diary helps us to keep our thoughts organized? You will now never forget what dadaji has explained to you.

Dad, can I accompany you for a walk in the garden tomorrow morning?

Of course yes! But what made you think so?

10:50

I thought just as I have gained some valuable information from dadaji, spending some quality time with you will also help me to learn new things.

Hmm. You have become a mature boy Sameer! I am proud of you!

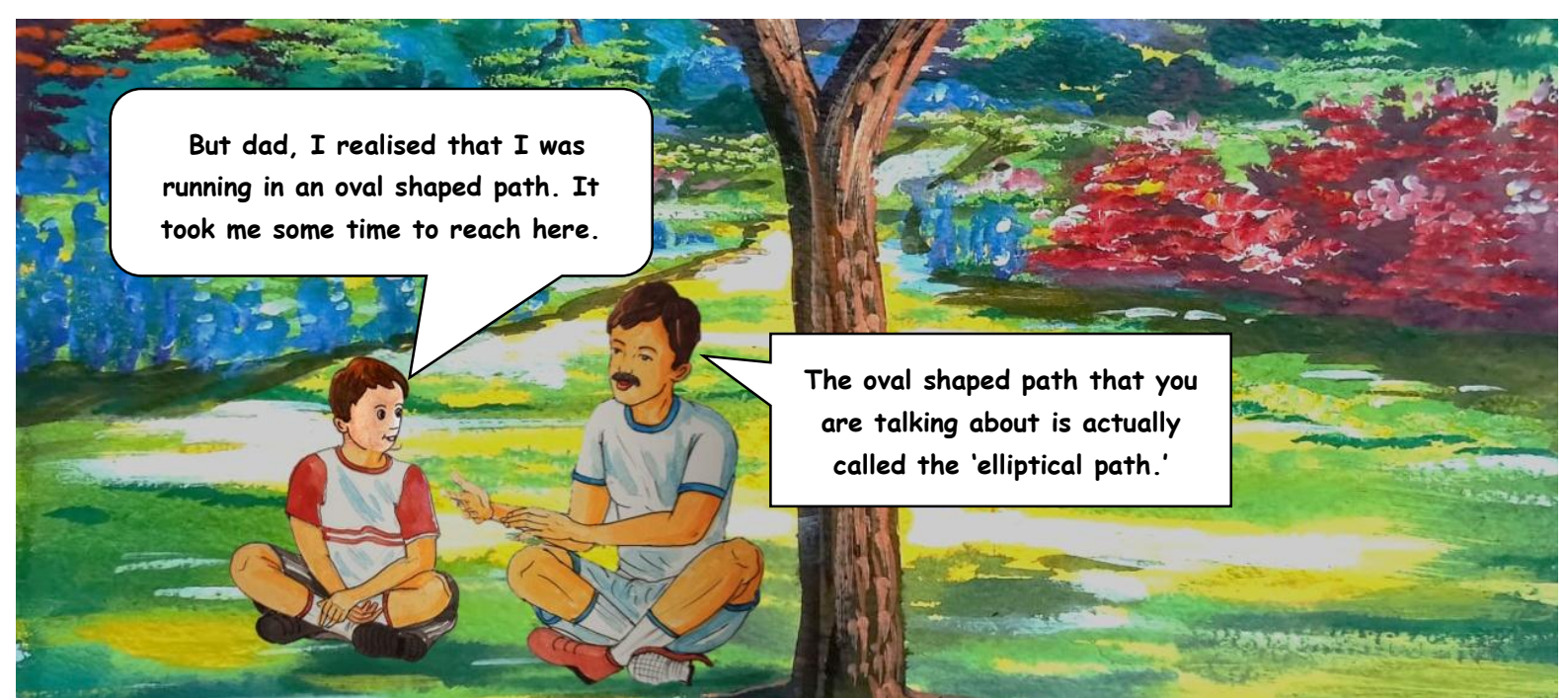
Next morning, Sameer and his dad are in the garden for a morning walk.

Come on, Sameer. After completing our walk, you run towards your right and take one full round of the garden and I'll start from the left.

Yes, nice idea. Let's see who reaches first.

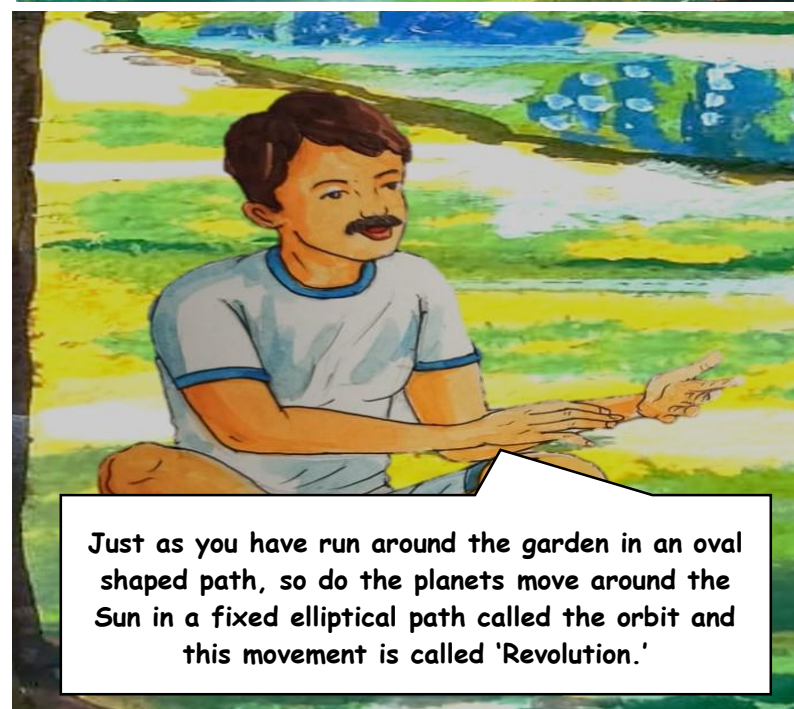
Fantastic!

Yipee! Dad I reached before you.



But dad, I realised that I was running in an oval shaped path. It took me some time to reach here.

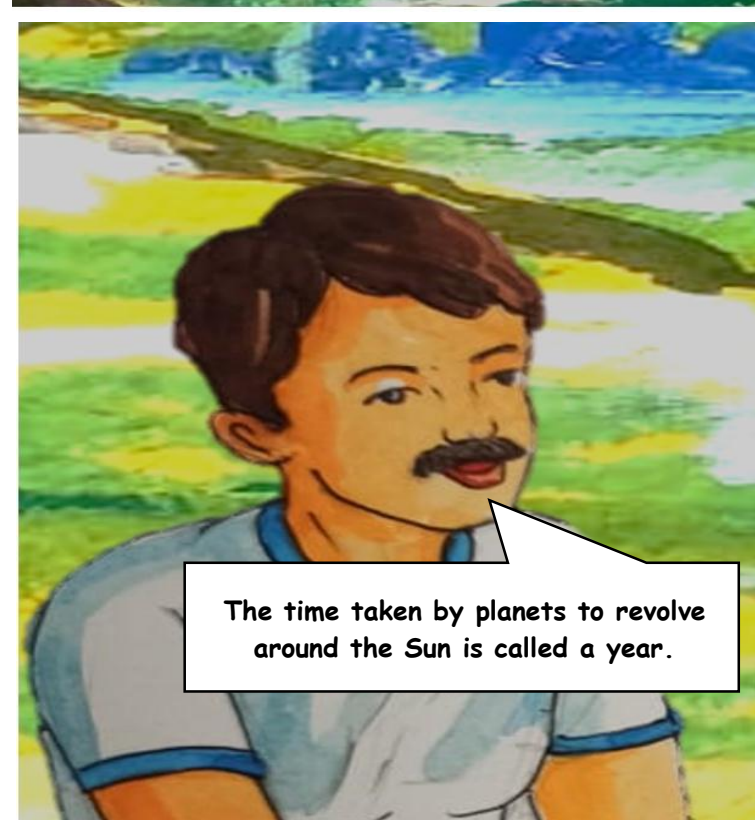
The oval shaped path that you are talking about is actually called the 'elliptical path.'



Just as you have run around the garden in an oval shaped path, so do the planets move around the Sun in a fixed elliptical path called the orbit and this movement is called 'Revolution.'



Yes, I have learnt that the Earth takes 365 days and 6 hours to revolve around the Sun.



The time taken by planets to revolve around the Sun is called a year.



Ok, so now I understand why Mercury has the shortest year.

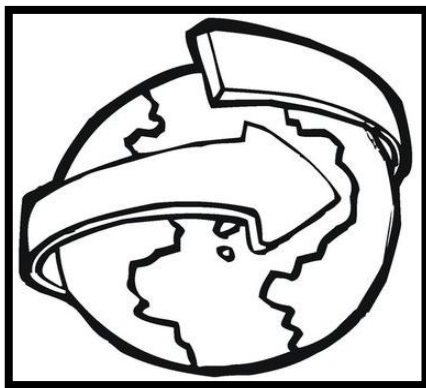
So Sameer how about another diary entry?

Ha ha! Of course

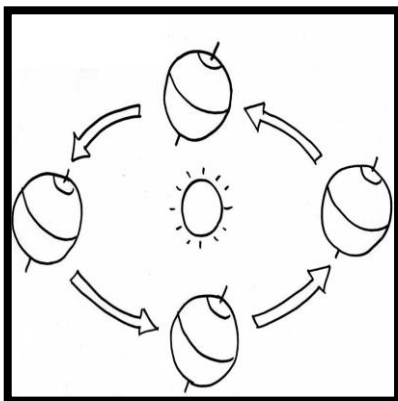
Worksheet 6

Earth's Rotation and Revolution

Colour the illustrations and cut around the dotted lines. Then proceed to glue the left side of the foldable (under the illustrations of Rotation and Revolution in a journal). Cut along the dotted lines between the questions. Inside the flap, answer the three questions regarding the Earth's rotation and revolution.



- What does the illustration depict?
.....
- How long does it take?
.....
- What does it cause?
.....



- What does the illustration depict?
.....
- How long does it take?
.....
- What does it cause?
.....

Worksheet 7

Movements of Planets

Look at the figure below and answer the following questions.

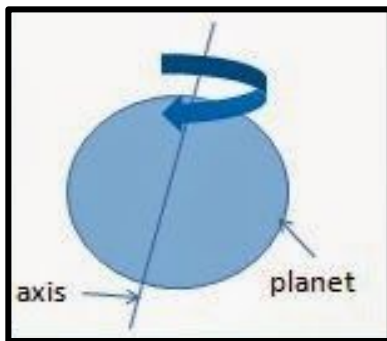


Figure A

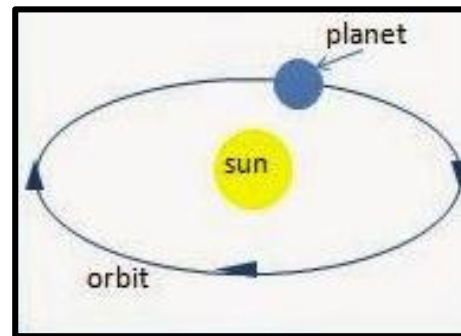


Figure B

a. What kind of movement is shown in Figure A- rotation or revolution?

b. What kind of movement is shown in Figure B- rotation or revolution?

c. An imaginary line on which a planet spins, is its _____.

d. An imaginary elliptical path that a planet takes to go around the Sun is it's _____.

e. The Earth rotates completely around its axis once in a _____.

f. The Earth revolves completely on its orbit once in a _____.

Define:

a. Rotation: _____

b. Revolution: _____



Dad, I had also heard my Math teacher saying that 2020 is a leap year. What does that mean?

Come I'll explain this to you over breakfast.

Sameer and his dad spend some time in the 'Garden Club'.

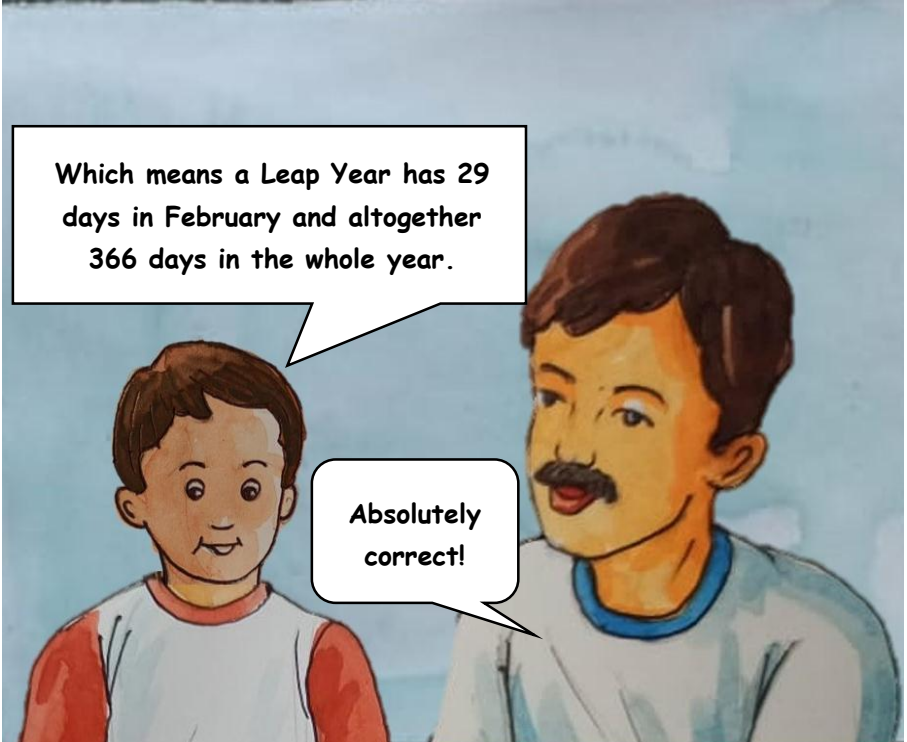
Remember the Earth takes 365 days and 6 hours to complete one revolution.

365 days + 6hrs

The remaining 6 hours that are left get added up every year till we get one full day. This complete day is added in the month of February. That is why 2020 is a Leap Year.

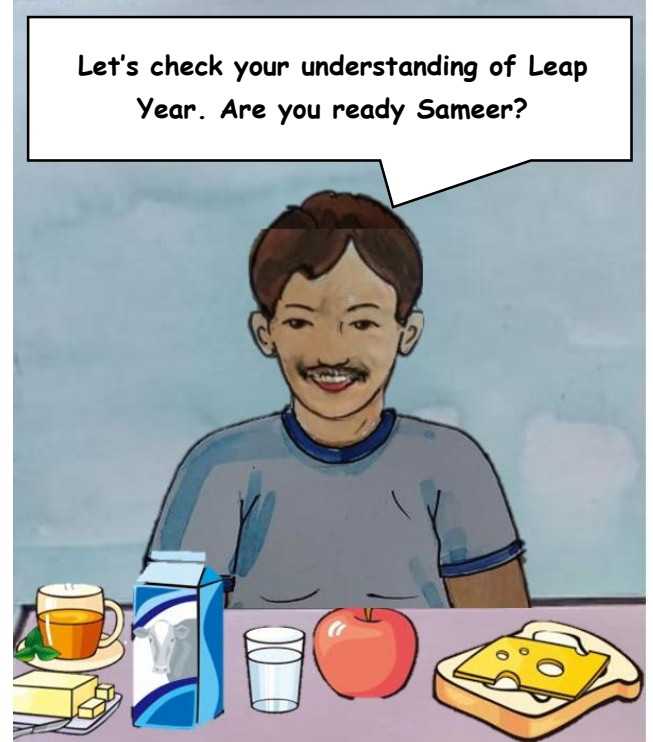
But we have 365 days in a regular year? What happens to the remaining 6 hours?

365 days + 6hrs
365 days + 6hrs
365 days + 6hrs
365 days + 6hrs
1 day → 24 hrs

A boy with brown hair and a red and white shirt is talking to a man with a mustache and a grey shirt. The man is looking at the boy and listening.

Which means a Leap Year has 29 days in February and altogether 366 days in the whole year.

Absolutely correct!

A man with a mustache and a grey shirt is sitting at a table. On the table are a cup of orange juice, a carton of milk, a glass of water, a red apple, and a slice of toast with cheese and a fried egg.

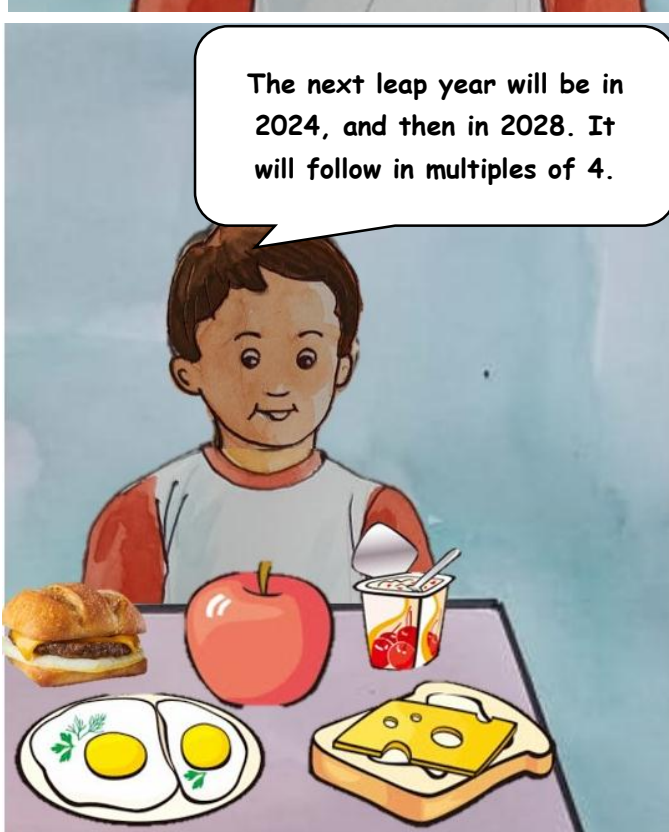
Let's check your understanding of Leap Year. Are you ready Sameer?

A boy with brown hair and a red and white shirt is speaking.

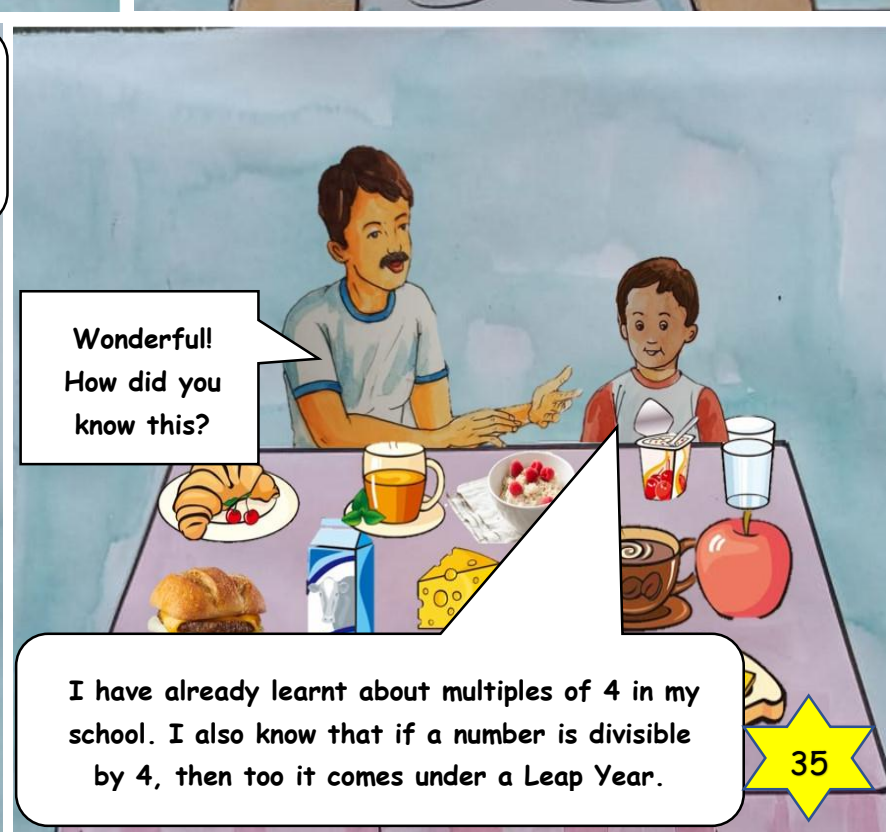
Yes, I am.

A man with a mustache and a grey shirt is speaking.

Now tell me when is the next leap year?

A boy with brown hair and a red and white shirt is sitting at a table. On the table are a hamburger, a red apple, a carton of milk, a glass of water, a slice of toast with cheese, and a fried egg.

The next leap year will be in 2024, and then in 2028. It will follow in multiples of 4.

A man with a mustache and a grey shirt is sitting at a table with a boy. They are both eating breakfast. On the table are a croissant, a hamburger, a carton of milk, a glass of water, a slice of toast with cheese, a fried egg, a bowl of fruit, and a cup of coffee.

Wonderful!
How did you know this?

I have already learnt about multiples of 4 in my school. I also know that if a number is divisible by 4, then too it comes under a Leap Year.



So, now tell me in which year did Neil Armstrong land on the Moon?



1969



Was that a leap year?

No dad, because the last two digits in 1969 are not divisible by 4.



Great! Tell me in which year was Chandrayaan 1, India's first mission to the Moon launched?

In 2008. Dad, that was a leap year because the last two digits are divisible by 4.



You are a genius!



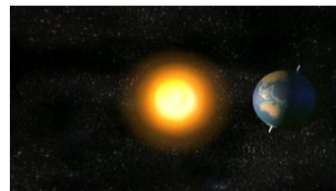
Sameer, let's go home now. Dadaji must be waiting for us.

Worksheet 8

Part A

Choose the correct alternative:

- a. How many days are there in a leap year?
- i. 210
 - ii. 367
 - iii. 365
 - iv. 366
- b. How many days are there in a regular year?
- i. 366
 - ii. 365
 - iii. 364
 - iv. 362
- c. How often are leap years formed?
- i. every 4 years
 - ii. every six months
 - iii. every 365 days
 - iv. every 12 years
- d. A year will be a leap year if it is divisible by ...
- i. 365
 - ii. 400
 - iii. 4
 - iv. 0
- e. In which month do we count a leap day?
- i. April
 - ii. June
 - iii. January
 - iv. February
- f. Why do we need to have a leap year?
- i. because the Sun is getting gradually smaller
 - ii. because the Earth's rotation is slowing down
 - iii. because the Earth takes longer than 365 days to orbit the Sun.
 - iv. because of revolution.



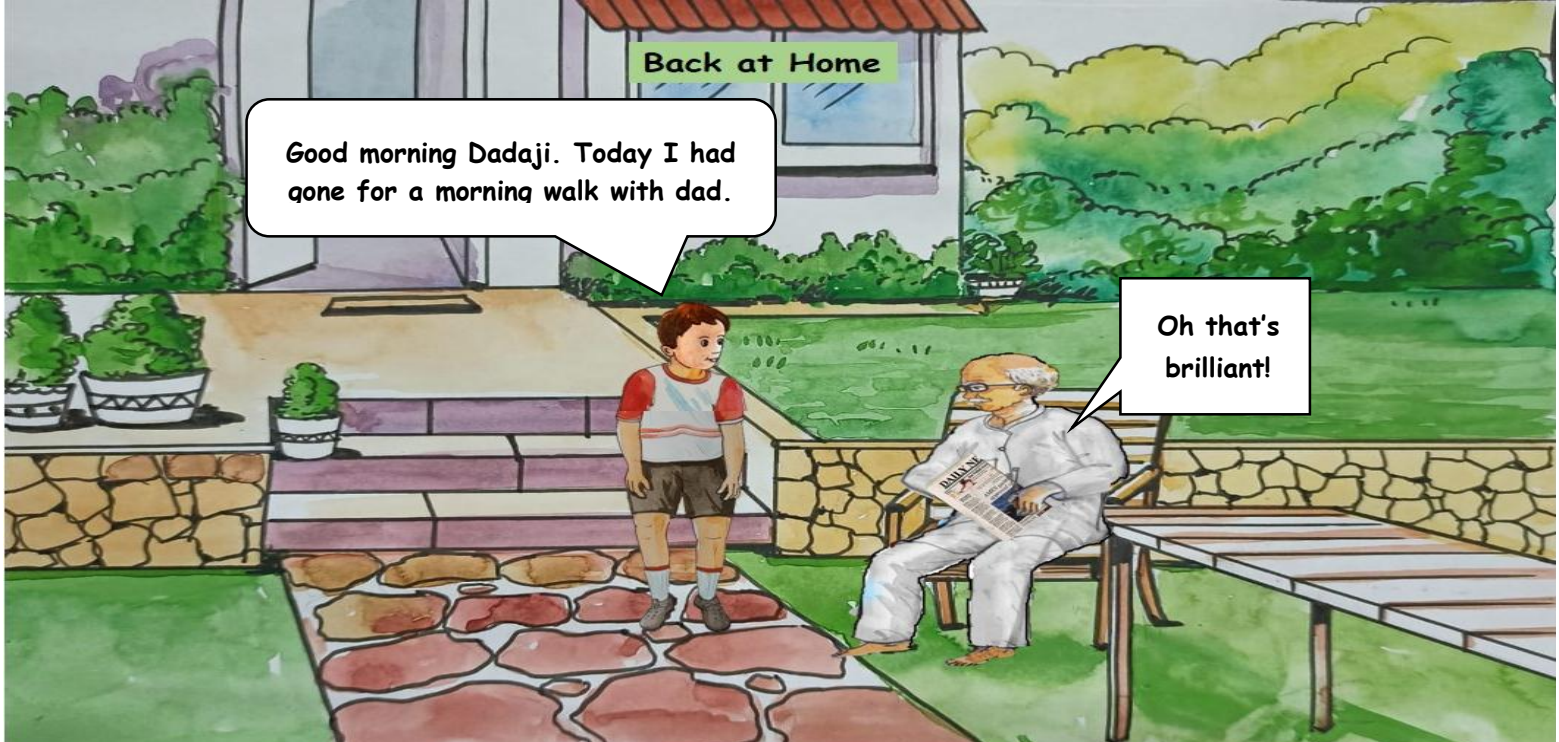
- g. The Sun seems to change its position in the sky because of the
- i. Earth's rotation iii. Earth's orbit
 - ii. Sun's rotation iv. Sun's orbit
- h. How is Sun similar to the stars that can be seen at night?
- i. The Sun has light of its own. iii. The Sun takes light energy from the space
 - ii. The Sun warms some part of the Earth with its light. iv. All of the above
- i. Earth's seasons are caused by the tilt of the _____.
- i. axis iii. hemispheres
 - ii. gravity iv. orbit
- j. If it is summer in the Northern Hemisphere, then it will be _____ in the Southern Hemisphere.
- i. fall iii. summer
 - ii. winter iv. monsoon
- k. The Earth is constantly spinning on its axis, like you might spin a basketball on your finger. It is this spinning of the Earth that causes.
- i. seasons ii. monsoon
 - iii. day and night iii. hail stone

Part B

List the missing leap years.

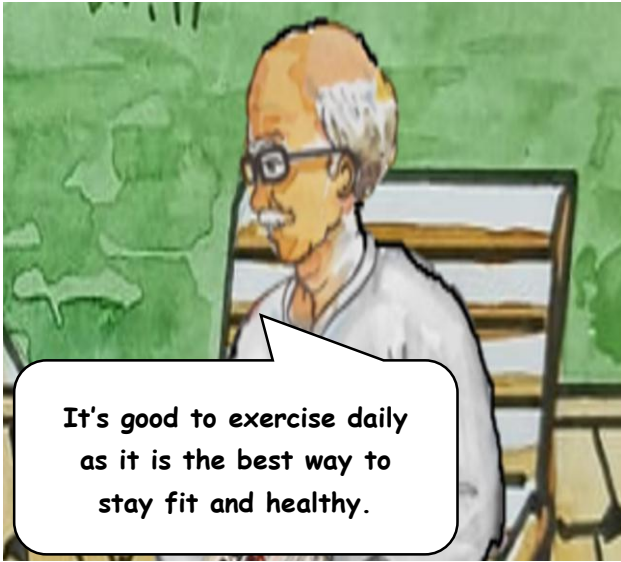
1996 , 2000, 2004 , _____, _____, 2016

_____, 2024, _____, _____, 2036, _____



Good morning Dadaji. Today I had gone for a morning walk with dad.

Oh that's brilliant!



Dadaji, today dad told me about the elliptical path and leap year.

It's good to exercise daily as it is the best way to stay fit and healthy.

Good. This will add on to your further knowledge.



I don't know why I am feeling so hot? Is it because I have come from a walk?

Yes Sameer it's because of the climate. Moreover, you have exercised a lot. We all need to bear the heat till winter sets in.



Summers are so exhausting dadaji.



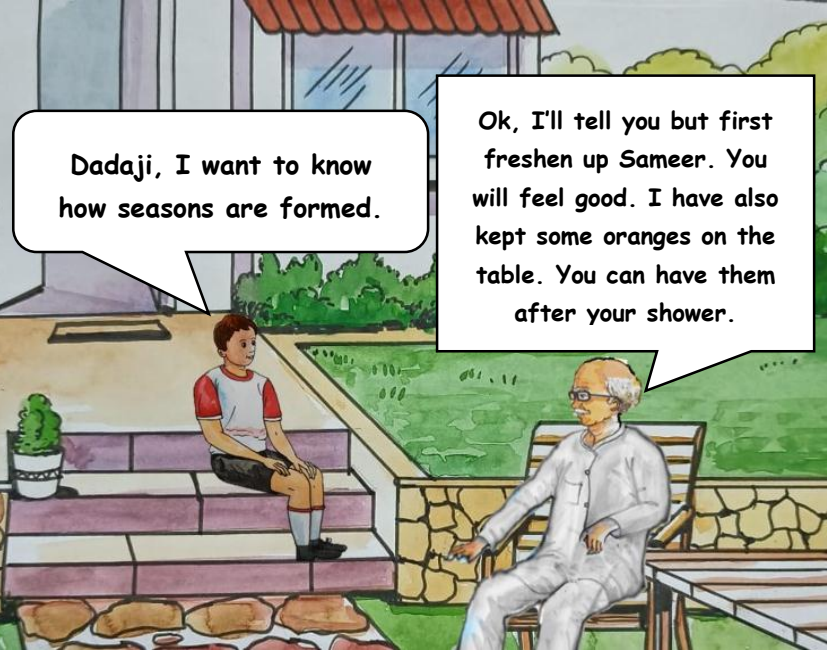
Yes, but don't forget you need to adjust to all kinds of seasons.



Hmm. But, why can't we have winter throughout?



That just cannot be possible.



Dadaji, I want to know how seasons are formed.

Ok, I'll tell you but first freshen up Sameer. You will feel good. I have also kept some oranges on the table. You can have them after your shower.



Oranges are my favourite.



Yes, I know that. That's the reason, I got them for you. Later we can sit to discuss your queries.

Sameer freshens up and joins his dadaji for the discussion.

Do you remember, the Earth rotates on its axis? This axis is not straight, but tilted at an angle of $66\frac{1}{2}$ degree to its orbital plane.

Just like the orange you have in your hand?

Do you mean to say that this orange is responsible for the change in seasons?

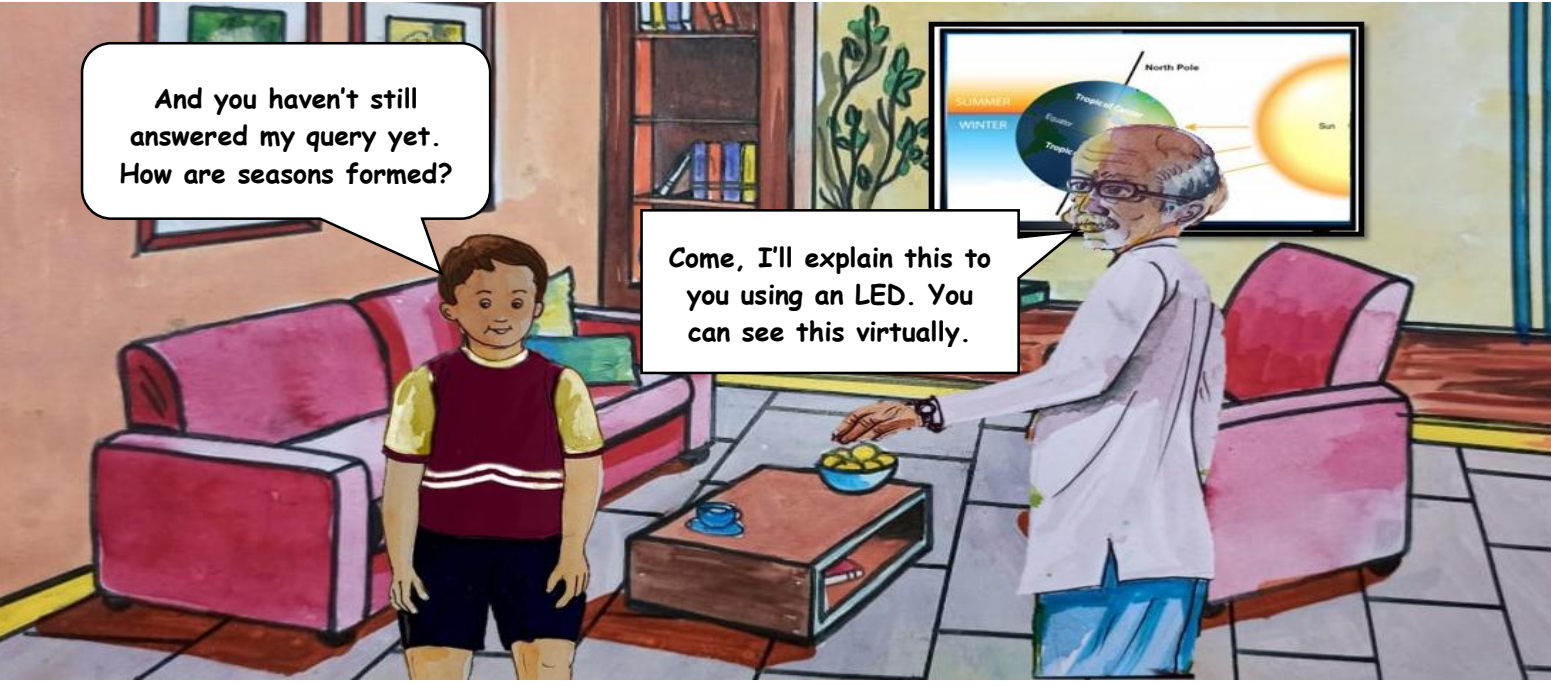
Sameer no jokes please.

Dadaji, every time you introduce me to a new term. What is this orbital plane

The plane passing through the Earth along its orbit is known as the 'Orbital plane'.

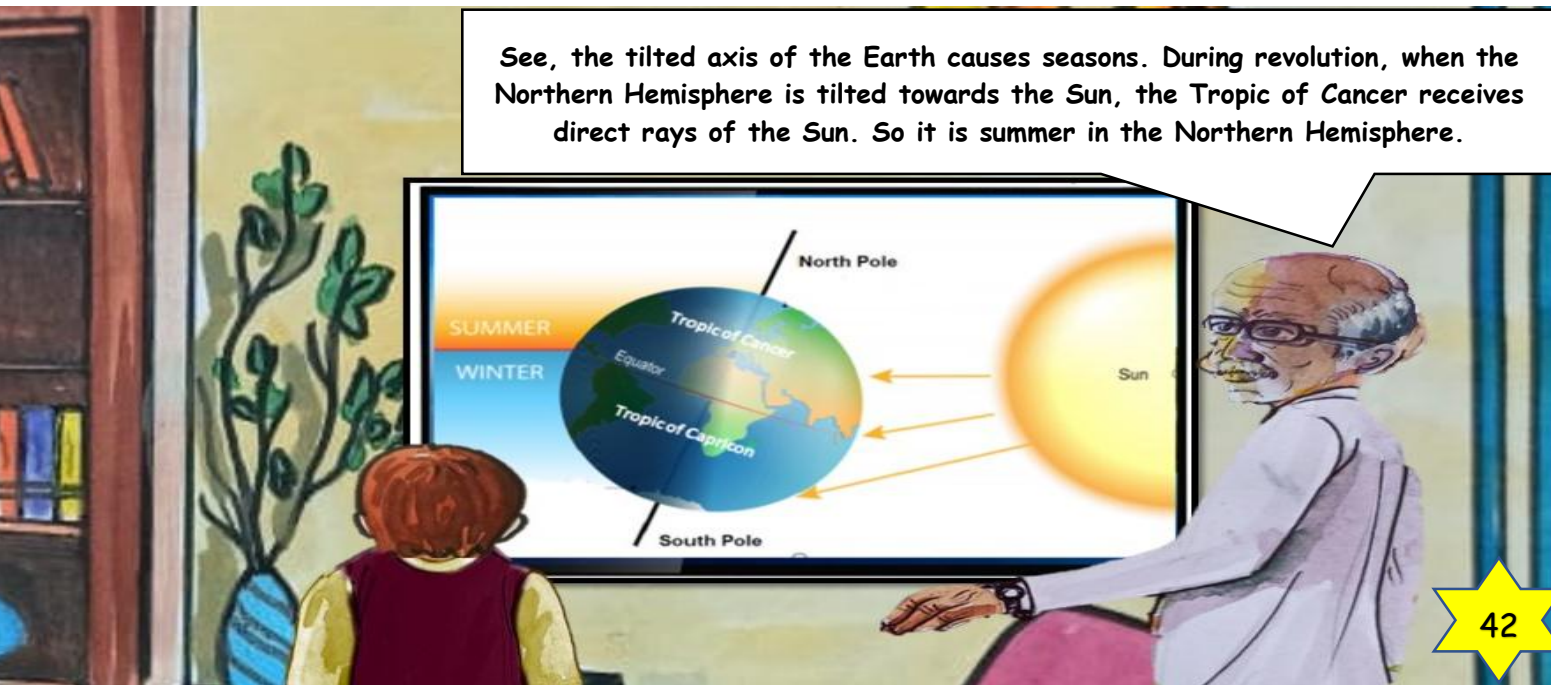


Look, it is a geometric plane which looks like this.



And you haven't still answered my query yet. How are seasons formed?

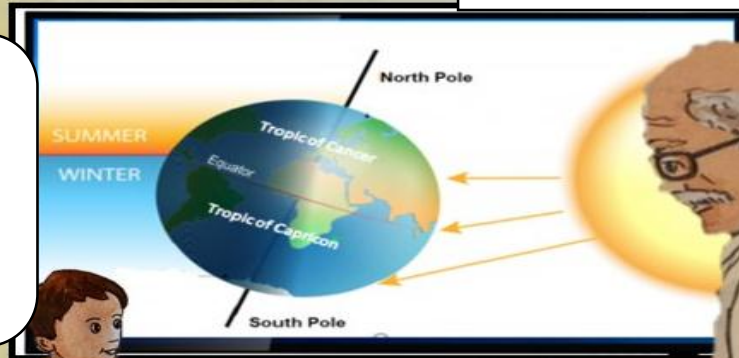
Come, I'll explain this to you using an LED. You can see this virtually.



See, the tilted axis of the Earth causes seasons. During revolution, when the Northern Hemisphere is tilted towards the Sun, the Tropic of Cancer receives direct rays of the Sun. So it is summer in the Northern Hemisphere.

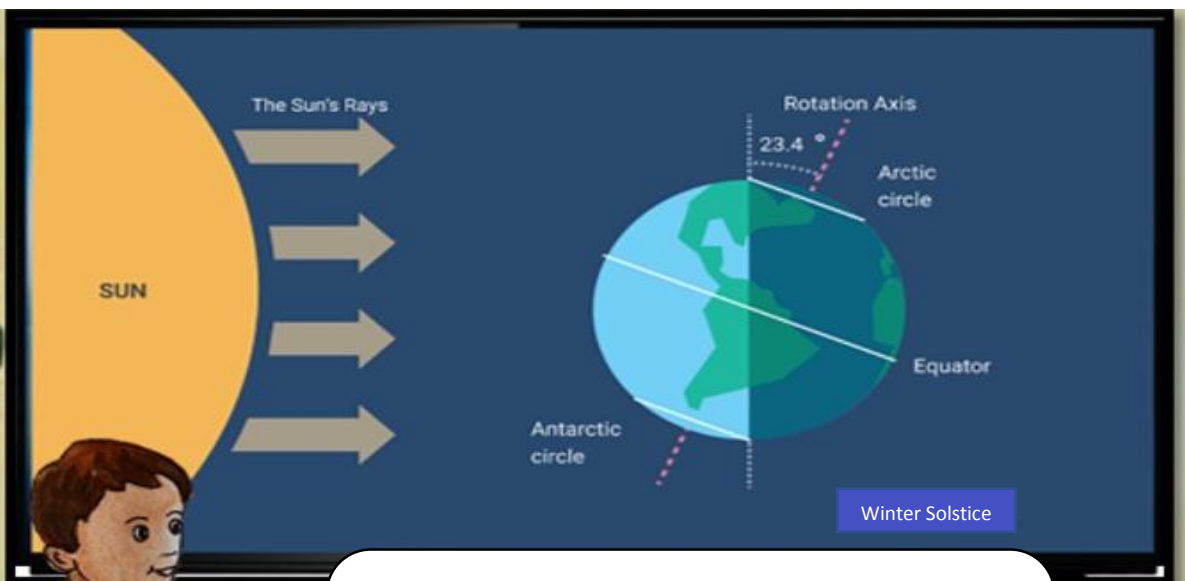
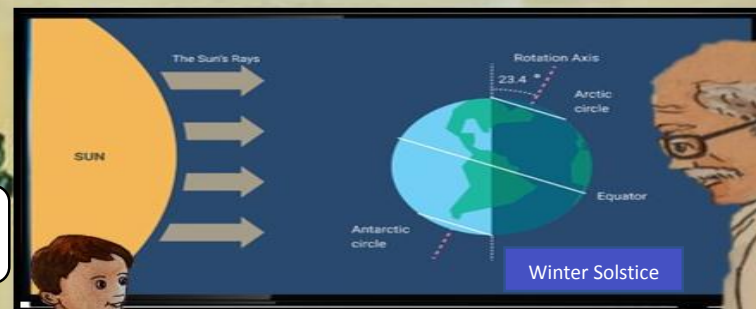
As you know the longest day and the shortest night at these places occur on 21st June. It is winter in the Southern Hemisphere with long nights and short days. This position of the Earth is called the 'Summer Solstice'.

Hmm, so if it is winter in the Southern Hemisphere, the Northern Hemisphere will have the most daylight. It's always vice versa right?



Correct! Now that you have understood the Summer solstice, can you explain the Winter Solstice? You said it is vice versa.

Yes, I will try.



When the Southern Hemisphere tilts towards the Sun, the Tropic of Capricorn receives direct sunlight, it is summer in the southern hemisphere with longer days and shorter nights. This position of the Earth is called Winter Solstice.

Well done!!! That's really great! I have set a task for you.



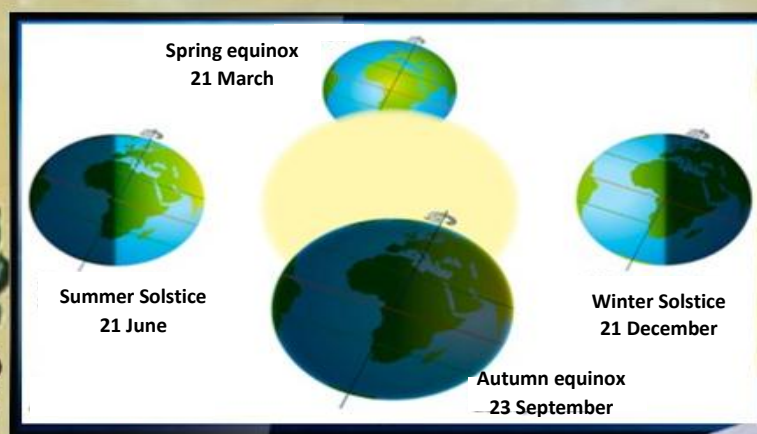
Try solving this worksheet with the help of the picture projected

Worksheet

Fill in the blanks.

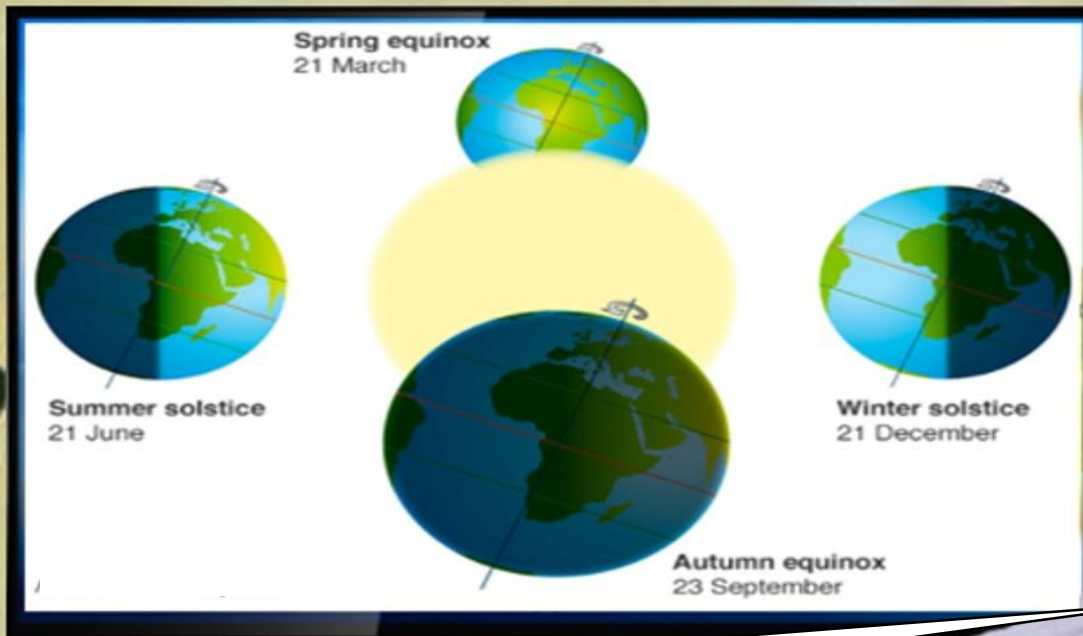
1. The sun rays are falling directly on the _____ (Tropic of Cancer, Tropic of Capricorn, Equator)
2. Days and nights are _____ in both the hemispheres. (Equal, shorter, longer)

Correct!! These days when the Sun rays fall directly on the Equator, i.e. on 23rd September and 21st March are called 'Equinox'.

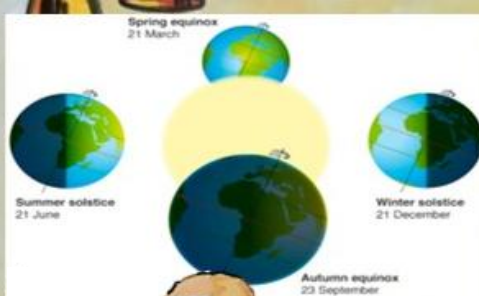


Equinox? Oh, I guessed it correct. It means equal.

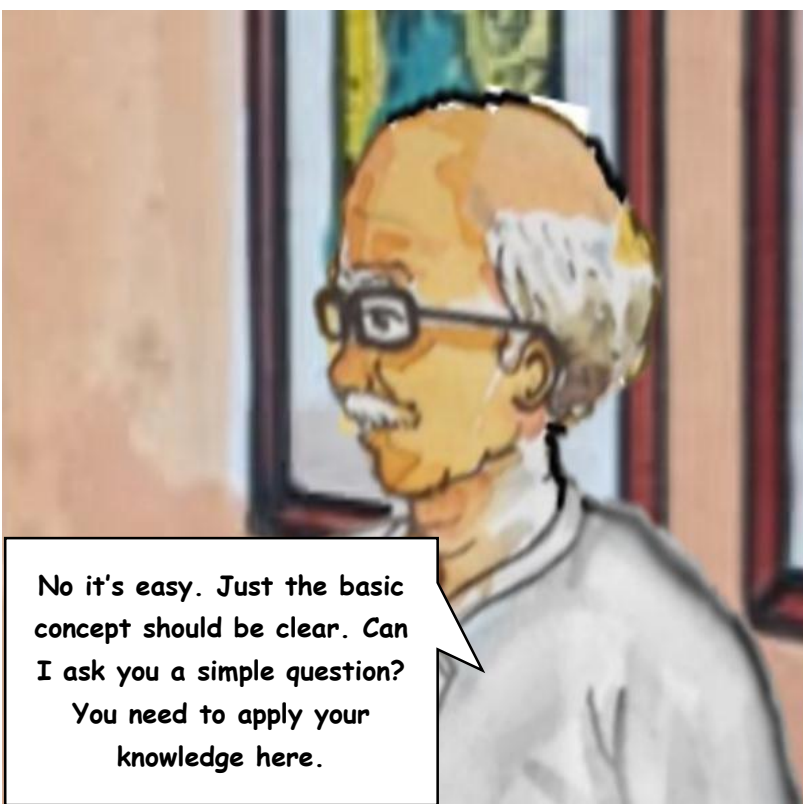
Yes, during these times, the hours of daylight and night are equal.



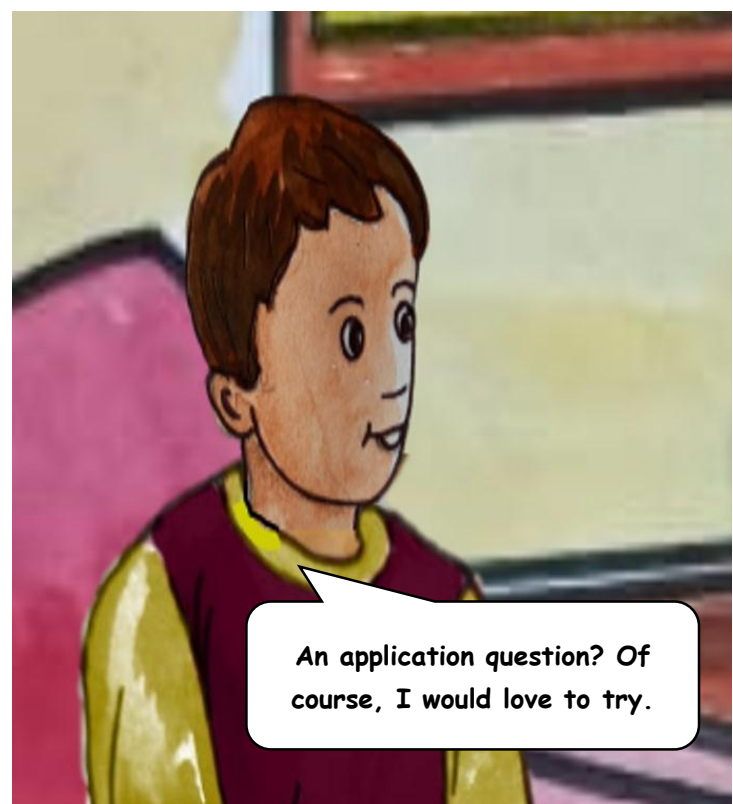
On 23rd September, it is autumn season in the Northern Hemisphere and spring season in the Southern Hemisphere. The opposite is the case on 21st March.



Ha Ha! Sounds like a rigmarole to me!



No it's easy. Just the basic concept should be clear. Can I ask you a simple question? You need to apply your knowledge here.



An application question? Of course, I would love to try.



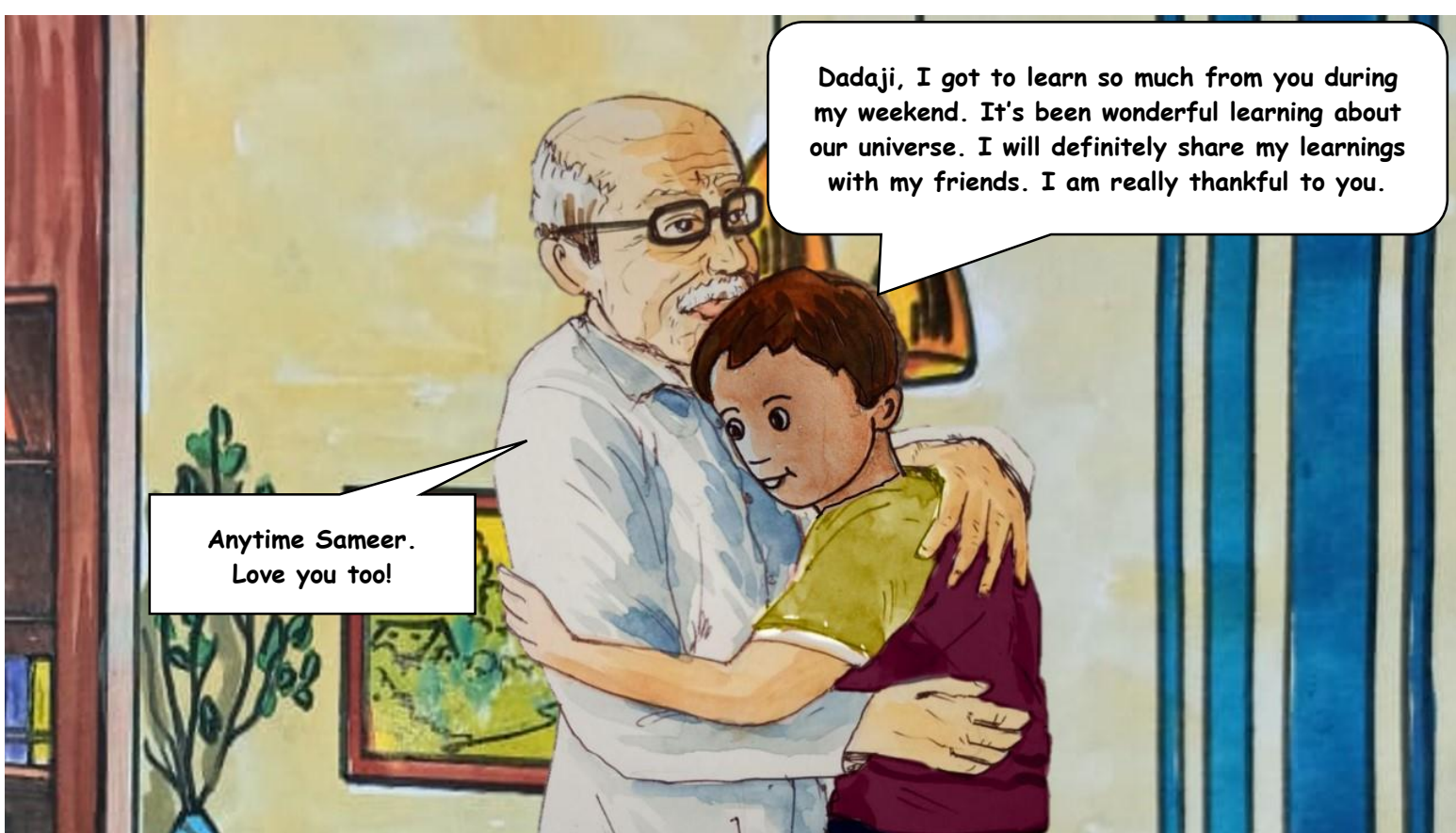
If India is having summer which season is there in Australia?

Winter, as it is in the Southern Hemisphere



Correct! So when we celebrate Christmas in winter, the people living in Australia will be celebrating it in summers.

Yes, December will be summer for them. Oh, this is simply awesome.



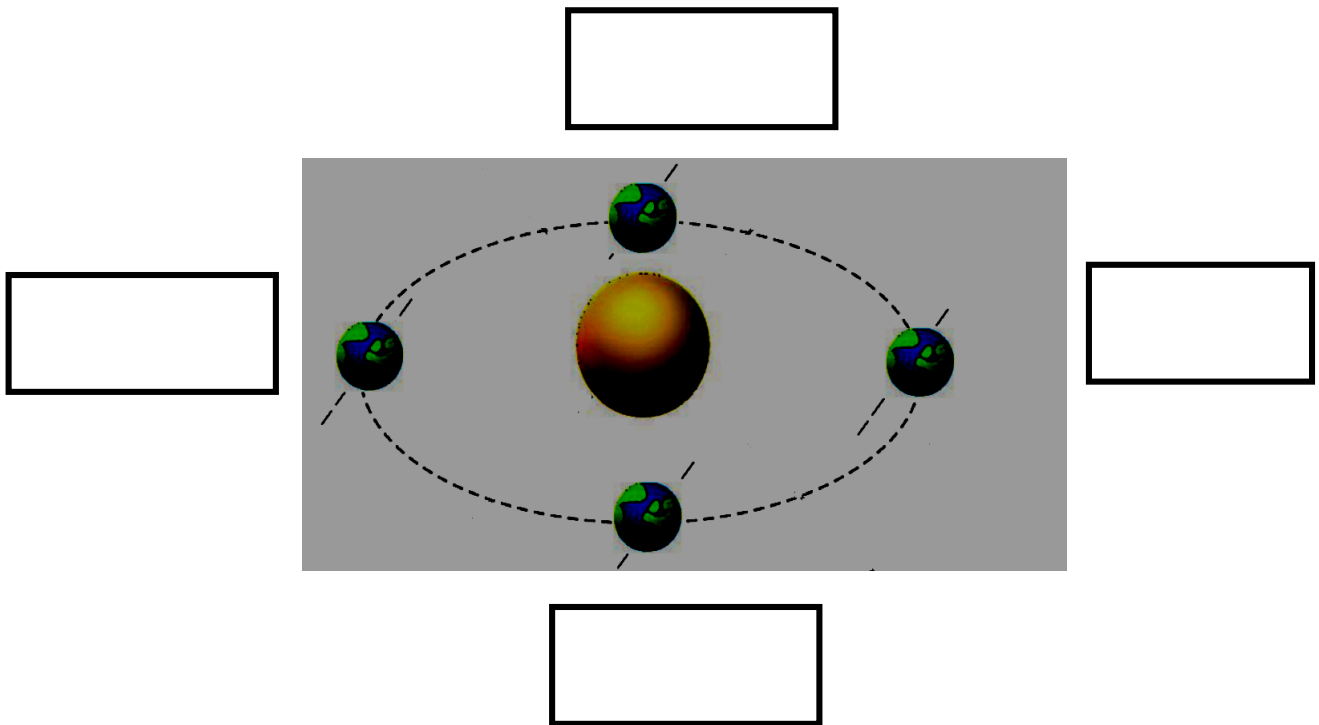
Worksheet 9

Use the following words: day, hours, year, orbits, 365, Hemisphere, Northern, Sun, day

The Earth _____ the Sun once every _____ days. This amount of time is one _____. The Earth spins on its axis once every 24 _____. This is a _____. The Earth orbits the Sun at a tilt. This means at different times of a year some places get more sunlight than others.

When the _____ Hemisphere is tilted towards the _____, it is summer in UK. When the _____ Hemisphere is tilted towards the Sun, it is winter in UK.

Label the seasons in the UK at the four different locations.



Use the following words: earlier, intensity, higher, longer, later, Northern

When the _____ Hemisphere is tilted towards the Sun, it is summer in India. This is because the days are _____. The sun rises _____ and sets _____ than in winter. The light _____ from the Sun in summer is _____.

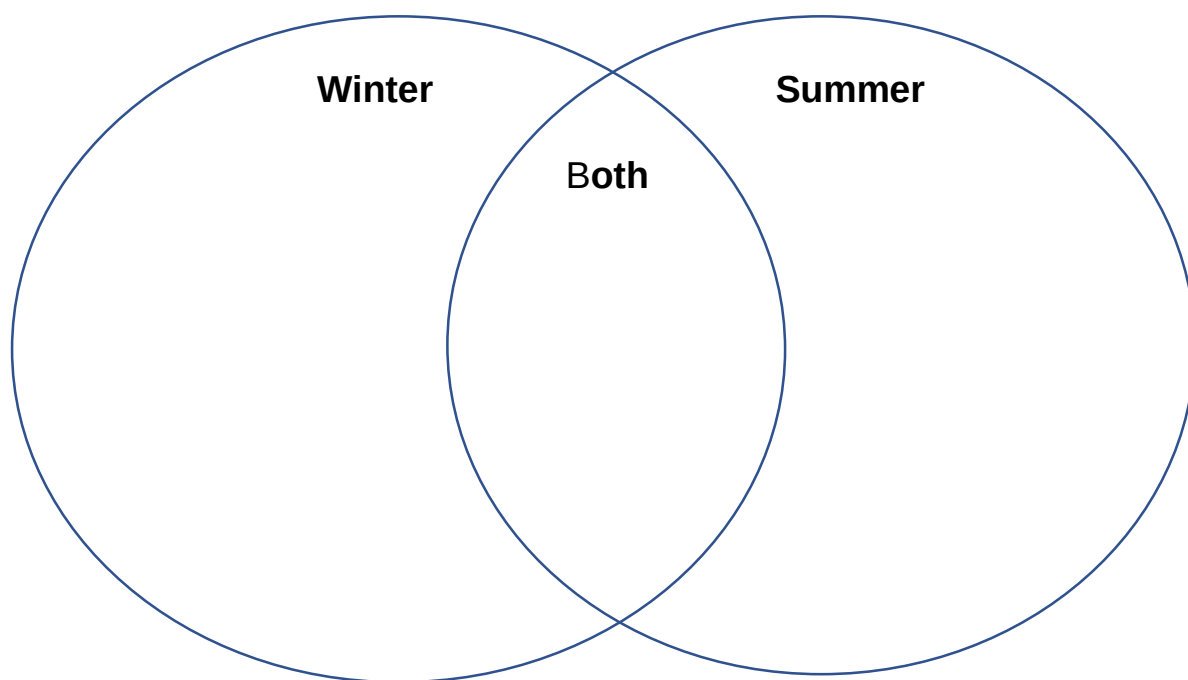
Worksheet 10

Let's compare Winter and Summer

Complete the Venn diagram using the pointers given below to compare and contrast the Seasons.

Pointers

1. Position of the Earth with relation to the Sun
2. Duration of day and night
3. Intensity of light
4. Types of clothes worn
5. Food items



Worksheet 11

Can you think of a word or phrases for each letter in the word **Solstices**. First letter is solved for you.

Summer is over _____

O _____

L _____

S _____

T _____

I _____

C _____

E _____

GLOSSARY

- 1 rejuvenated - to make someone look or feel young and energetic again.
- 2 curious - interested in learning about people or things around you.
- 3 magnanimous - noble and generous in spirit.
- 4 puffy - bloated.
- 5 space - the area which surrounds the planet Earth which is empty.
- 6 vacuum - a space that is completely empty of all substances, including other gases.
- 7 celestial - heavenly.
- 8 queries - to ask questions about something, in order to clarify one's doubts about it.
- 9 glowing - emitting a steady bright light.
- 10 primary source - original or main source.
- 11 solar energy - energy emitted by the Sun.
- 12 photosynthesis - the process by which a plant uses the energy from the light of the sun to produce its own food.
- 13 Mangalyaan - is a space vehicle orbiting Mars since 24 September 2014.
- 14 terrestrial - of or on dry land.
- 15 enormous - extremely large.
- 16 pollute - to make an area usually air, water, or soil, dirty or harmful to people and animals.

- 17 environment - the surroundings or conditions in which a person, animal, or plant lives.
- 18 axis- an imaginary line about which a body rotates.
- 19 rotation - The movement of the Earth on its axis is called rotation.
- 20 elliptical - having an oval shape.
- 21 orbit -the curved path of a celestial object round a star.
- 22 revolution - The movement of the Earth around the Sun in a fixed path or orbit is called revolution.
- 23 Leap year - Leap years have 366 instead of 365 days.
- 24 illumination - brightening up with light.
- 25 Circle of illumination -The circle that divides the day from night on the globe is called 'The Circle of Illumination.
- 26 Orbital plane - The plane formed by the orbit is known as the orbital plane.
- 27 Earth day -The period of one rotation is called earth day.
- 28 engrossed - giving all your attention to something.
- 29 Summer solstice -The position of the Earth when the Northern hemisphere experiences the longest day and shortest night. It falls on 21st June.
- 30 Winter solstice - The position of the Earth when the Southern hemisphere experiences the longest day and shortest night. It falls on 22nd December.
- 31 Equinox - When the whole Earth has equal days and nights. It falls on 21st March and 22nd September.
- 32 rigmarole - a long set of actions or words without any real purpose.

Answer Key

WORKSHEET 1

Colouring by using the child's imagination.

WORKSHEET 2

Students work.

WORKSHEET 3

Across

4. Earth
5. Moon
6. Saturn
7. Jupiter
9. Mars

Down

1. Mercury
2. Venus
3. Neptune
8. Uranus

WORKSHEET 4

During day - clouds and Sun

During night - moon and stars

- Sun, day
- Earth
- Moon, stars

WORKSHEET 5

Day, night

Rotates, west, east, 24, day

WORKSHEET 6

- Rotation
- 24 hours
- Day and night
- Revolution
- 365 days and 6 hours
- Year and seasons

WORKSHEET 7

- a. Rotation
- b. Revolution
- c. Axis
- d. Orbit
- e. Day
- f. Year

Rotation- The movement of the Earth on its axis is called rotation.

Revolution - The movement of the Earth around the Sun in a fixed path or orbit is called revolution.

WORKSHEET 8

Part A

- a. iv) 366
- b. ii) 365
- c. i) every 4 years
- d. iii) 4
- e. iv) February
- f. iii) because the Earth takes longer than 365 days to orbit the Sun.

- g. i) Earth's rotation
- h. i) The Sun has light of its own
- i. i) axis
- j. ii) winter
- k. ii) day and night

WORKSHEET 8

Part B

2008, 2012, 2020, 2028, 2032, 2040

WORKSHEET 9

Orbits, 365, year, hours, day, Northern, Sun, Southern

Summer

Autumn

Winter

Spring

Northern, longer, earlier, later, intensity, higher

WORKSHEET 10

Students work.

WORKSHEET 11

Students work.

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- Mathematics Textbook for class 6 (NCERT.)
- Step Up Math 4 -Textbook for Math CBSE Grade 4 New Edition, 2020.
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- Inhouse Resources.

MESSAGE FROM THE PRINCIPAL



The solar system, the universe and space has always intrigued man and more so young minds. The various space programmes, space missions, sci-fi adventures have fired the imagination of children and spiced up their appetite to explore more about this realm.

Our ingenious team of primary teachers have put together this graphic novel about the celestial bodies, the Solar System and various related concepts in an engaging manner. Through storytelling, the tale explores our galaxy and various concepts of the universe through the eyes of a child. Do join this fantasy journey of exploration 'On the Wings of a Cloud'

The comic book format of the graphic novel has the potential to provide our young readers with a lighter, literary window than their traditional text heavy counterparts. I am sure the young readers will find the vivid illustrations, the lively storyline, and the short burst of dialogues engaging and appealing enough to keep turning the pages till the end.

A huge shout out to my resourceful and artistic team for rising to the challenge and creating this entertaining and informative graphic novel.

SUMMARY OF THE GRAPHIC NOVEL

ON THE WINGS OF A CLOUD

The novel revolves around the central character of a small child named Sameer. He is greatly interested to know more about the Solar System, the stars and the planets. He keeps asking his grandfather various questions, but is never satisfied.

One night, in his dream he sees a big cloud. The cloud promises Sameer that he will take him to a ride of the Universe. Sameer was first confused but later he sits on the cloud and visits the Sun and all the different planets, in his dream. He gets to know about different planets of our Solar System. He realizes that the Earth is the best planet. Earth has air, water and proper temperature and therefore life is only possible on it. Many plants and animals are also found here.

Sameer gets up from his sleep, all excited. He opens up a Pandora's Box of questions. After his grandfather answers all his queries, he now gets to know why stars are not visible during the day, how day and night occur and why there are 24 hours in a day.

On asking, Sameer's father explains to him the concept of revolution, what is a Year and a Leap Year and how a leap year is recognised.

Sameer is excited, happy and ready to share all his learnings with his friends.