

THINAIR
BRANDS

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Parker, Colorado USA

MADE IN CHINA
WARNING: Choking Hazard

If at any time in the future you should need to dispose of this product please note that waste electrical products should not be disposed of with household waste. Please recycle where facilities exist. Check with your local authority or retailer for recycling advice. (Waste Electrical and Electronic Equipment Directive)

COLORS AND CONTENTS MAY VARY



Dr.STEM
Toys

8+
S T
E M

AMAZING SOLAR SYSTEM PROJECTOR



Educational Experiment Manual

Dr. Stem Toys™ SERIES

Welcome to the AMAZING world of the **Dr. Stem Toys™** series in the 21st century. Our vision in this series is to open door to a world of new possibilities and imagination in our **Dr. Stem Toys™** products, so to educate the future generation to become successful in their own ways. **Dr. Stem Toys™** integrates Science, Technology, Engineering and Mathematics through hands on fun learning activities! **Science** stimulates our curiosity and can increase our creativity. **Technology** focuses on turning theories into reality and empowers inventions. **Engineering** improves hand-eye coordination skills and gives opportunity to connect things together. Whereas **Mathematics** helps to promote problem solving skills. All of these are important life skills for growing and learning in this fast-growing society. **Dr. Stem Toys™** is our modern learning toys preparing and motivating the future generation to adapt skills in problem solving, creativity and imagination through building experiment to enrich intelligence and stimulate the minds to enhance knowledge. Future generation can learn how science is applied to daily life and how things work around us through embracing STEM learning – it is everywhere and everyday connection around us. Everything created in **Dr. Stem Toys™** series will intrigue the mind of **Science, Technology, Engineering and Mathematics** and using imagination to build and explore with endless fun!

Have an amazing future!

WARNING

Adult supervision and assistance is required. This unit is only for use by children aged 8 years and older. Not suitable for children under age 3 years old due to small part(s) and component(s) – CHOKING HAZARD. Read and follow all instructions in the manual before use. This toy contains small parts and functional sharp points on components. Keep away from children under age 3 years. Please retain the information and this manual for future reference. Follow the instruction manual to perform the circuit connection. Instructions for parents are included and have to be observed. Do not lock the motor or other moving parts. Otherwise it may cause overheating. The toy is not to be connected to more than the recommended number of power supplies. Use screwdriver under adult supervision. Keep screwdriver away from children after use.

BATTERY INFORMATION

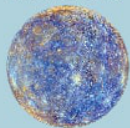
Use 4 x AA size batteries (not included). Remove batteries when not in use. Batteries must be inserted with the correct polarity. Non-rechargeable batteries are not to be recharged. Re-chargeable batteries are only to be charged under adult supervision. Re-chargeable batteries are to be removed from the toy before being charged. Different types of batteries or new and used batteries are not to be mixed. Only batteries of the same or equivalent types are to be used. Exhausted batteries are to be removed from the toy. The supply terminals are not to be short-circuited. Do not dispose of the batteries in fire. Do not mix old and new batteries. Do not mix alkaline, carbon zinc and re-chargeable batteries.

Introduction

Our Solar System

Our home is planet Earth, which is a part of the solar system and the fifth largest of planets. The sun is located at the center with 8 planets revolving around it and Earth is the third planet from the sun. The sun rises and falls every day we see is actually stationary. It is actually our Earth that is moving. Below is a list of fun facts of the eight planets, listing from "the closest" to "the furthest" away from the sun.

(1) Mercury



Size ranking: 8th (the smallest) / Mass ranking: 8th (the lightest)

Mercury is a rocky planet, with a thin atmosphere. It has no moon. Mercury has been known since ancient times because it can be seen in the sky as a star. Though it is the closest planet to the sun, it is only the second hottest. Venus is the hottest because it has a thick atmosphere full of greenhouse gas, while Mercury has a thin atmosphere that does not trap heat well.

(2) Venus



Size ranking: 6th / Mass ranking: 6th

Venus is a rocky planet, with a thick atmosphere. It has no moon. Venus has been known since ancient times because it can be seen in the sky as a star. Though it is further away from the sun than Mercury, Venus is hotter. This is because it has a thick atmosphere full of greenhouse gas that traps heat very well. Venus is the only planet whose rotation is in the reverse direction: That is, if you are on Venus, you will see the sun rises from the west to the east. (The cause of this rotation direction is not clear)

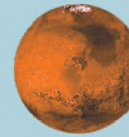
(3) Earth



Size ranking: 5th / Mass ranking: 5th

The Earth is the planet that we live on. It is also the only planet to have life forms in our solar system. The Earth is a rocky planet, but with a large body of water covers around 70% of Earth's surface. It has a moon.

(4) Mars



Size ranking: 7th / Mass ranking: 7th

Mars is a rocky planet, with a thin atmosphere. It has 2 moons. There are signs that, there were water on Mars in the past. Now the water mostly exists in the form of icy dirt and thin clouds. Mars has been known since ancient times because it can be seen in the sky as a star. One day on Mars lasts 24.6 hours, which is just a bit longer than a day on Earth! Mars is further away from the sun than the Earth, and is colder. Among all the planets in the solar system, Mars has a temperature range that is the closest to that of the Earth, from around 20 degrees Celsius to -153 degrees Celsius. This leads to the speculation that, in the future Mars could be a planet for human to build bases to stay on.

(5) Jupiter



Size ranking: 1st (the largest) / Mass ranking: 1st (the heaviest)

Jupiter is the biggest planet in our solar system. It is mainly composed of gases. Therefore it is called a gas giant. The color stripe patterns on its surface are caused by clouds and gases of different chemical compositions. As of 2018, Jupiter is known to have 79 moons. Jupiter has been known since ancient times because it can be seen in the sky as a star. Jupiter has a relatively high rotational speed and one day on it is just 10 hours!

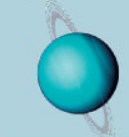
(6) Saturn



Size ranking: 2nd / Mass ranking: 2nd

A remarkable feature of Saturn is its very apparent ring. The ring is made of chunks of ice and rock orbiting around. Saturn is mainly composed of gases. Therefore it is called a gas giant. Saturn is known to have at least 50 moons. There could be more but will need to be confirmed by the mainstream scientific community. Saturn has been known since ancient times because it can be seen in the sky as a star. Saturn has a relatively high rotational speed and one day on it is just 10.7 hours!

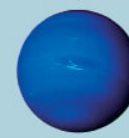
(7) Uranus



Size ranking: 3rd / Mass ranking: 4th

Uranus is mainly composed of water, methane and ammonia, but in an icy form because of the extremely low temperature there. Therefore it is called an ice giant. The methane of its atmosphere makes Uranus blue. Uranus also has a ring, but it looks fainter and not as apparent as Saturn's ring. Remarkably, Uranus is the only planet whose rotational axis is parallel to the revolution plane. This makes it like rotating sideways. Uranus was discovered in 1781. It is now known to have 27 moons.

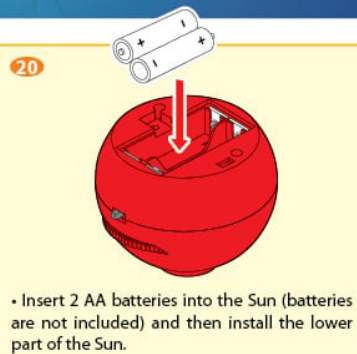
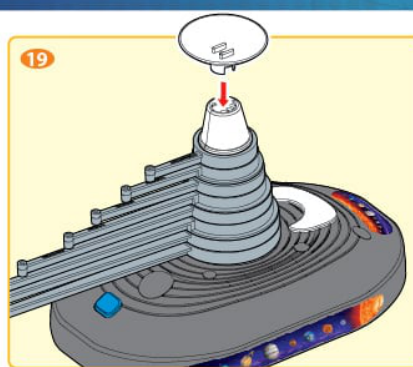
(8) Neptune



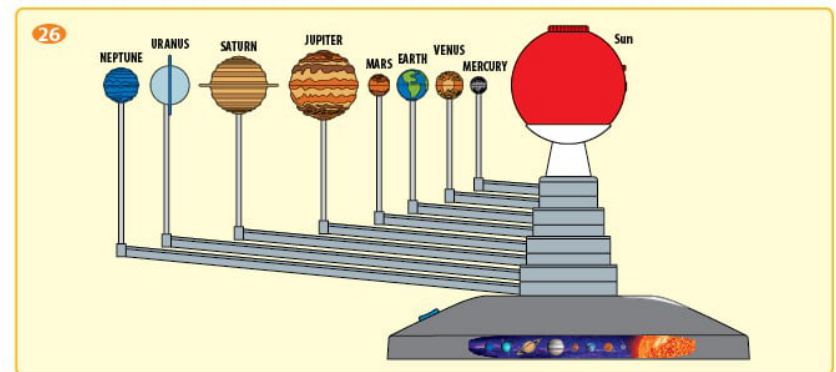
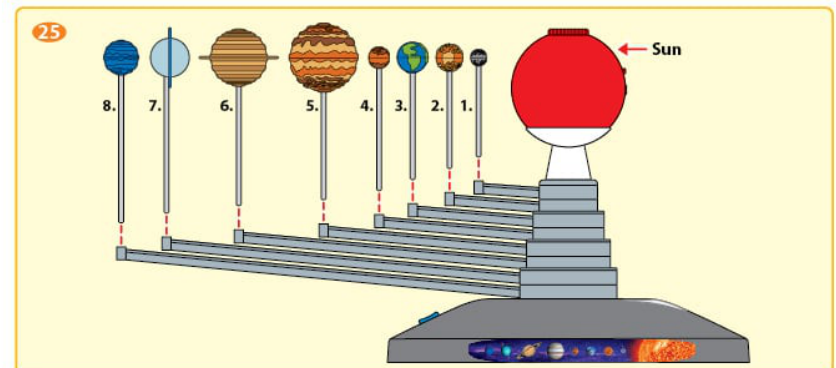
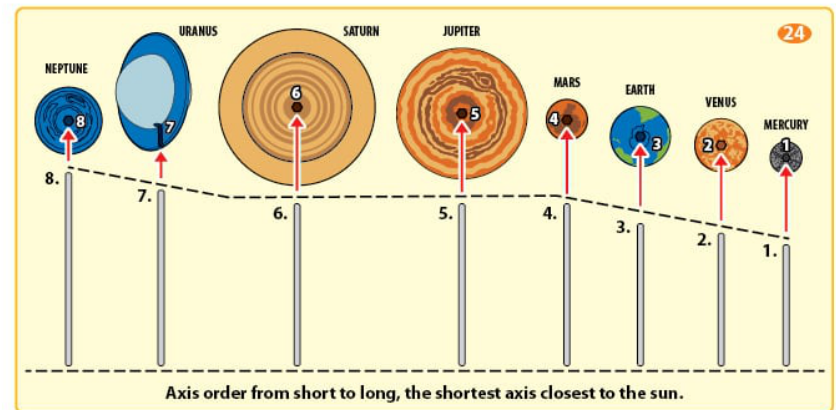
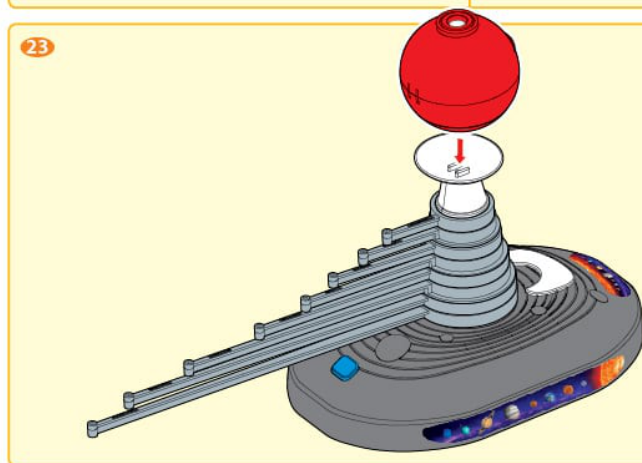
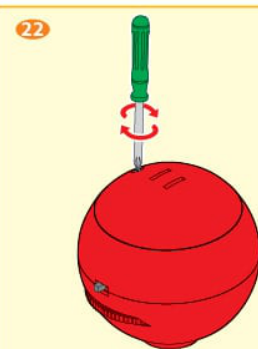
Size ranking: 4th / Mass ranking: 3rd

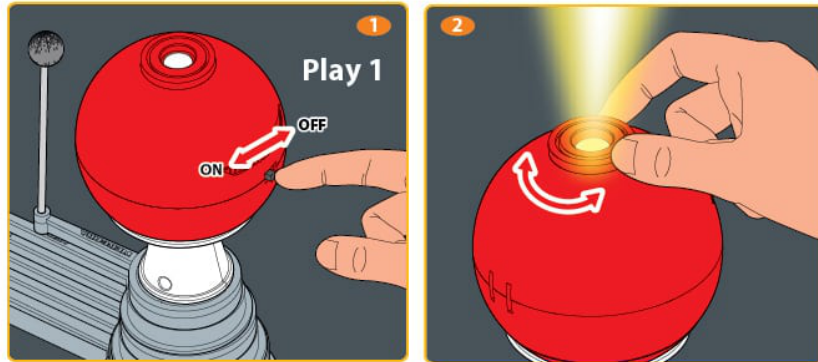
Neptune is mainly composed of water, ammonia and methane, but in an icy form because of the extremely low temperature there. Therefore it is called an ice giant. The methane of its atmosphere makes Neptune blue. Since it is the furthest planet away from the sun, it has the longest revolution cycle. It takes 164.8 earth years to revolve around once. Neptune was discovered in 1846. It is currently known to have 13 moons.

Interesting Fact: It has been a long time that, astronomers classified that there were 9 planets in our solar system. In 2006, the classification was changed and Pluto (the ex-9th planet) was no longer classified as a planet. Pluto is a small star whose mass is only 1/6 of the mass of our moon. So that in the current classification there are only 8 planets in our solar system.

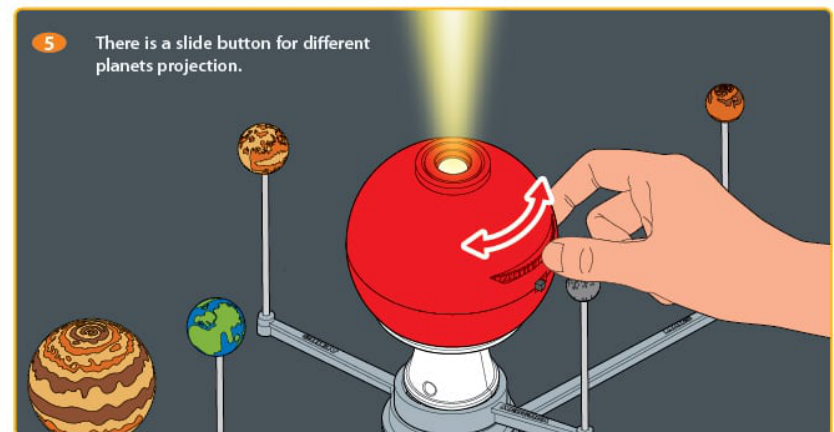
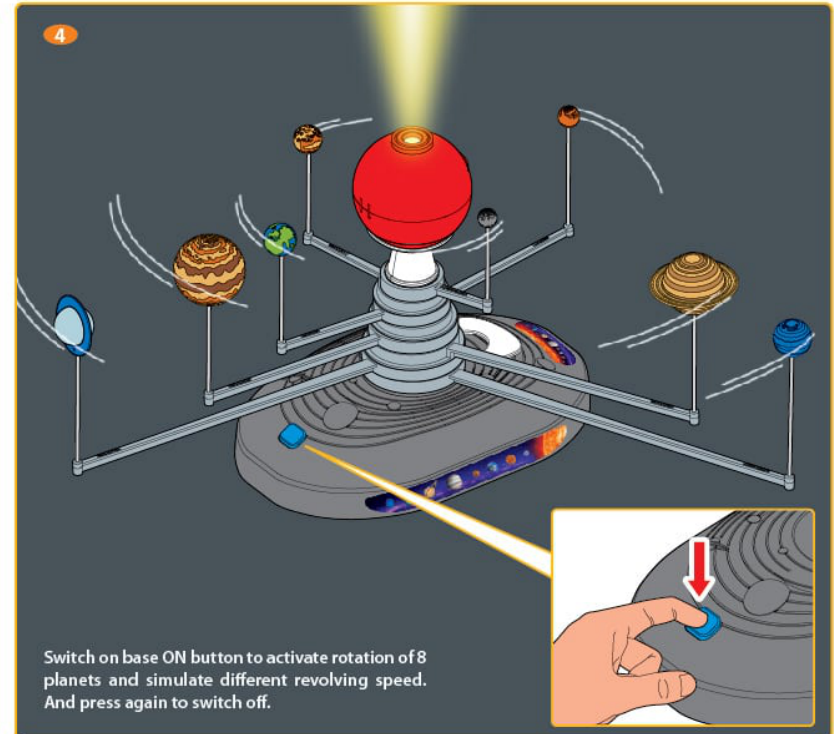
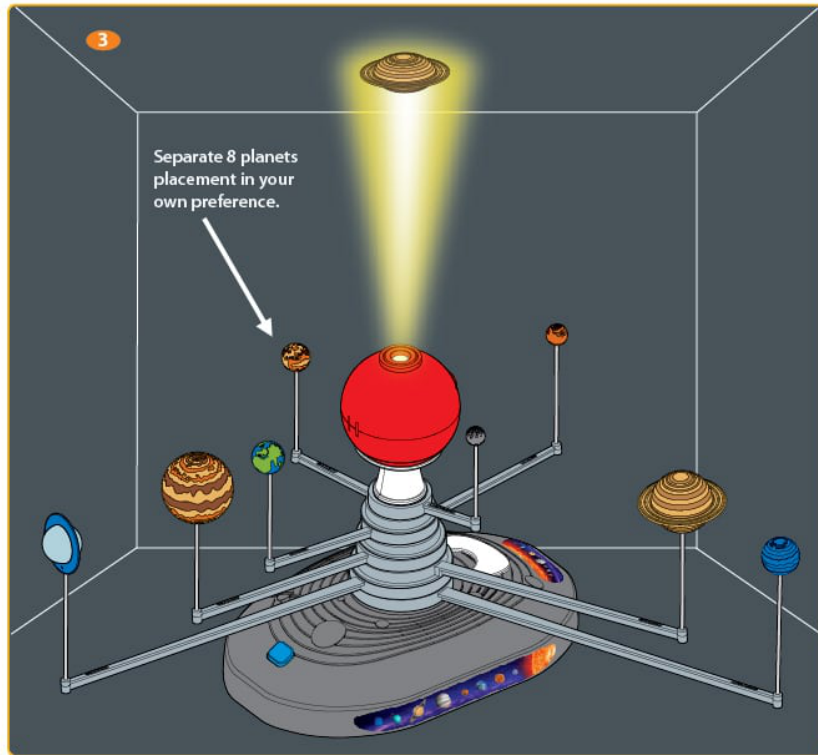


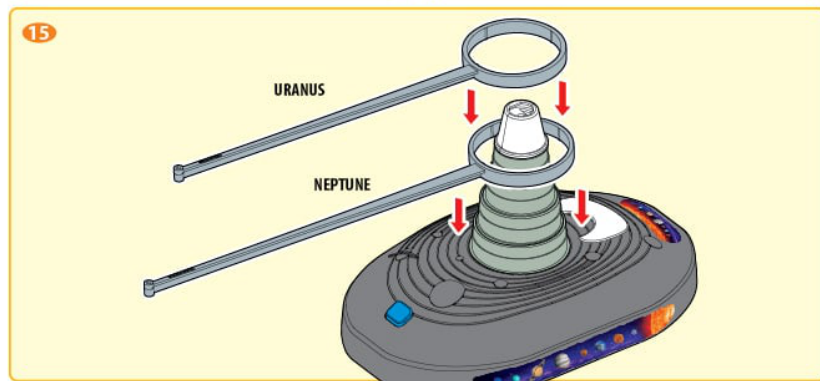
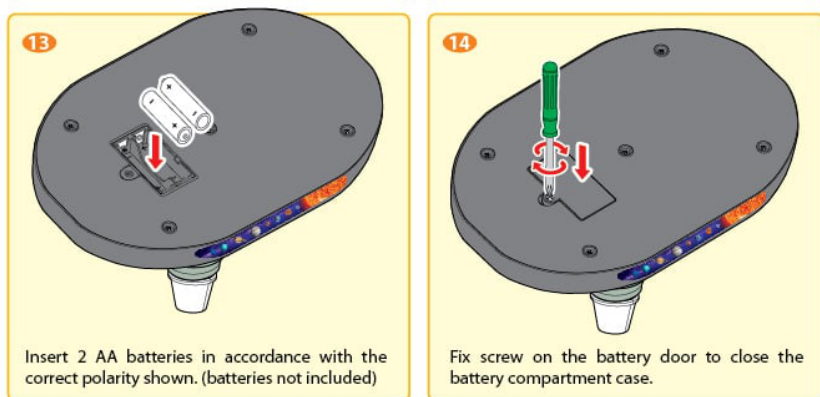
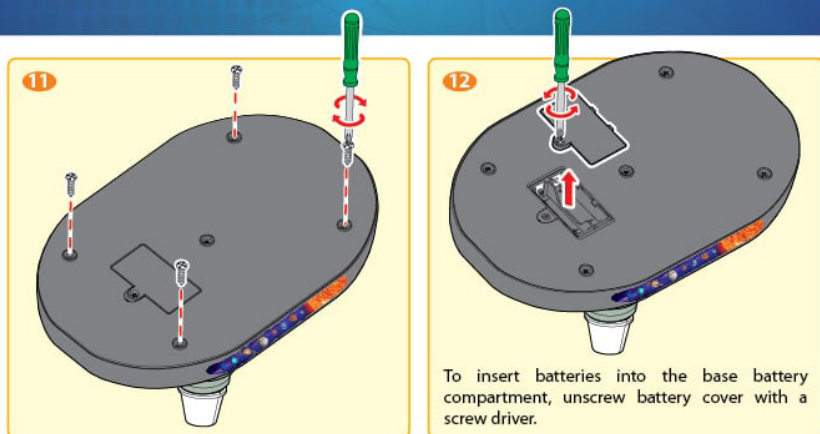
Tips: If the lid is not closed properly, push forward of the buckle into the battery compartment.



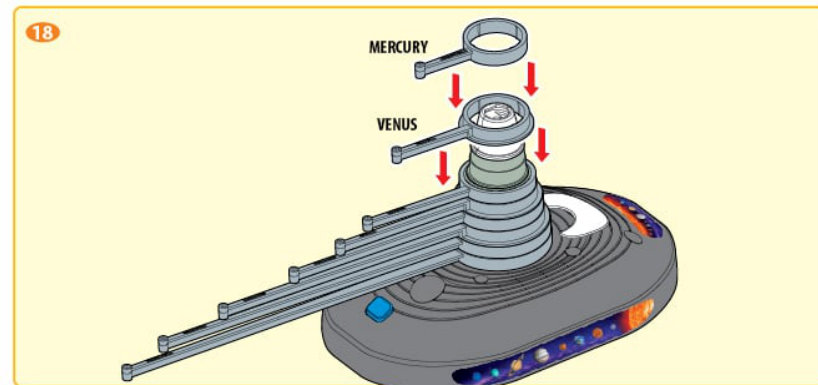
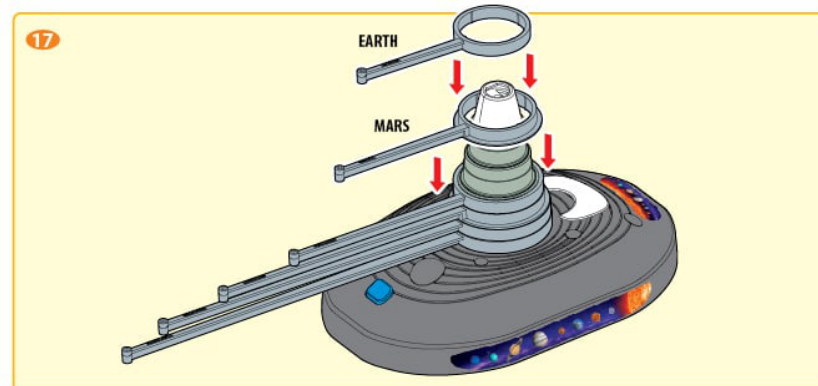
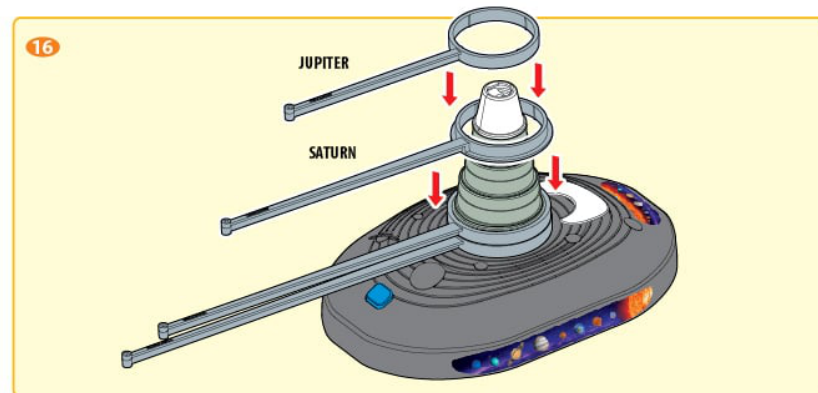


To start 8 planets projection, switch on the ON button at Sun, you can adjust the projection angle (Project on the wall or ceiling) and focus by fingertips.



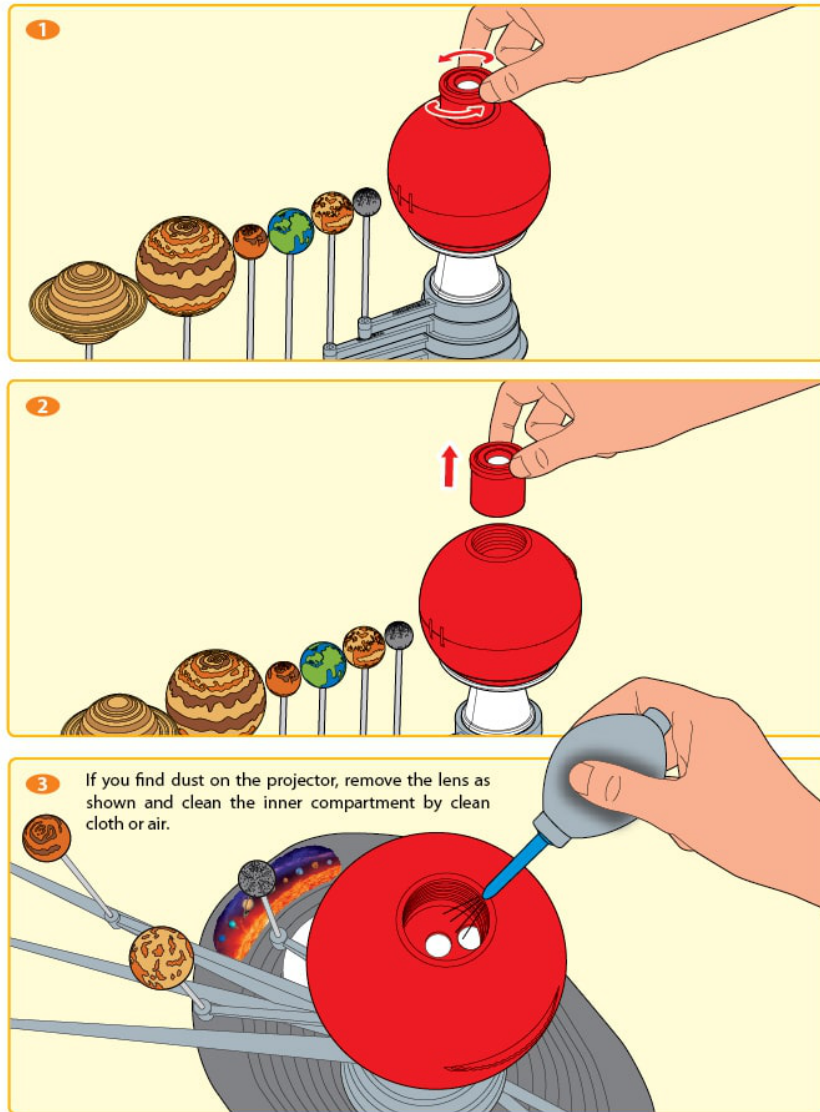


P.5



P.6

How To Clean

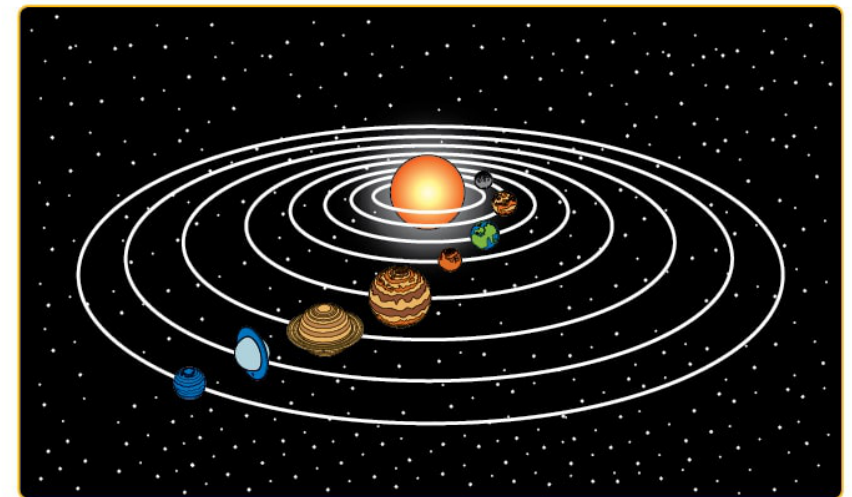


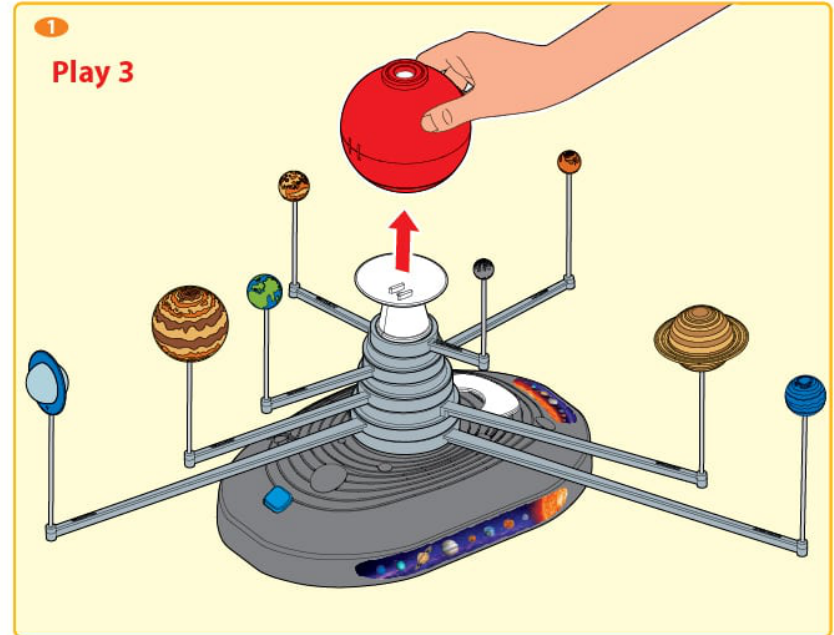
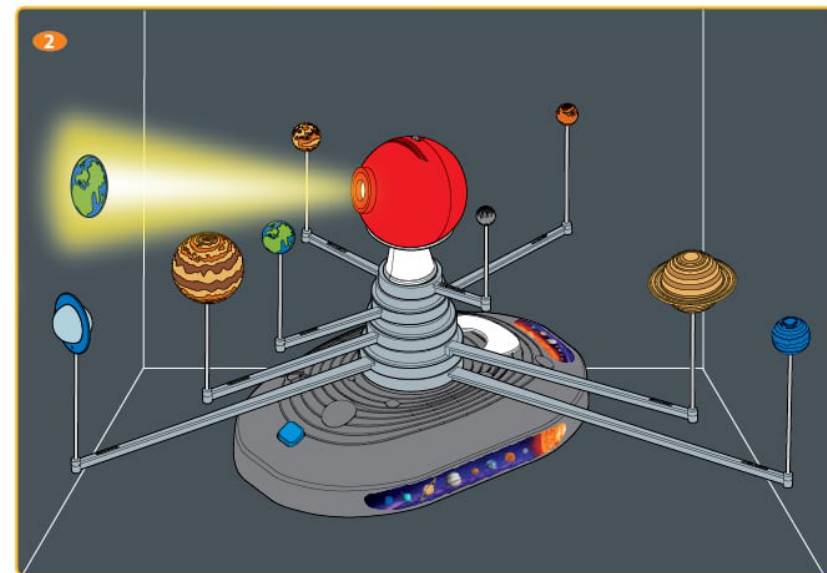
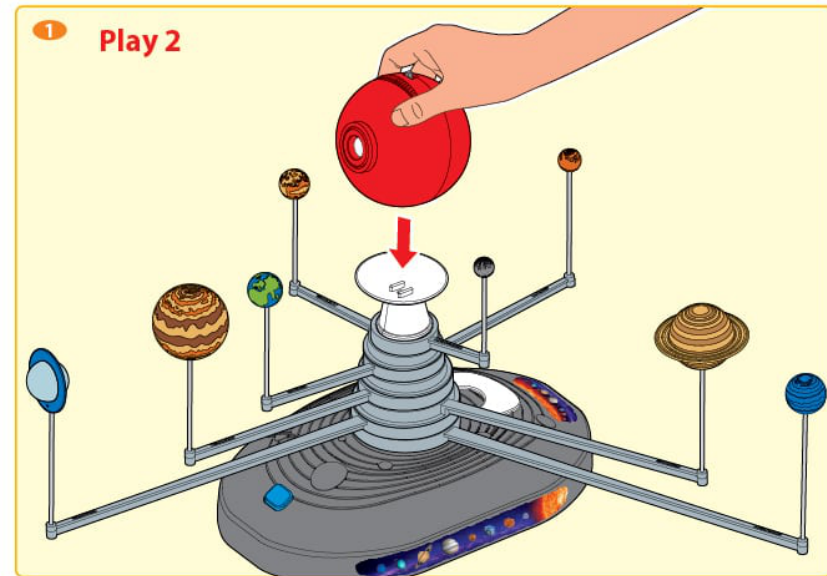
Educational Hints

- In our solar system, all planets revolve around the sun in the same direction, and their revolving planes are on the same plane. Their orbits are all nearly circular.
- The Amazing Solar System Projector is a simulation only. Because of mechanical limitation, it can simulate to have 4 different revolving speeds. In fact, in reality all the planets revolve around the sun at different speeds.
- The time for their revolution varies from 87.7 earth days (Mercury) to 164.8 earth years (Neptune). And for our Earth, the time is of course 1 year. Scientifically speaking, it is 365.25 days. That is, not exactly 365 days, but 0.25 days more.
- In order to make up for the extra 0.25 days lost in counting a year, every fourth year we need to add one day into our calendar. So every fourth year it becomes 366 days, which is called a "leap year". That additional day is added into February. That is, on February 29th in a leap year. For example, year 2000, 2004, 2008, are leap years. They all have a February 29th in them.
- The Amazing Solar System Projector is a simulation, and the sizes and distances of the sun and planets are not on scale. This is because the scale ratio is so huge that is not practical. In fact, even in science museums, you will not find any solar system model that follows the scale. Here is an example to show you why: If you want to build a model on scale, and the diameter of the sun model is made to be 10cm, then, you need to place Neptune at a distance more than 300 meter away from the sun! [For comparison: The length of a standard football field is 100 meter only.]

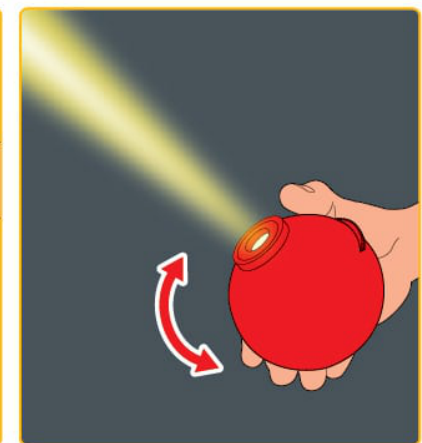
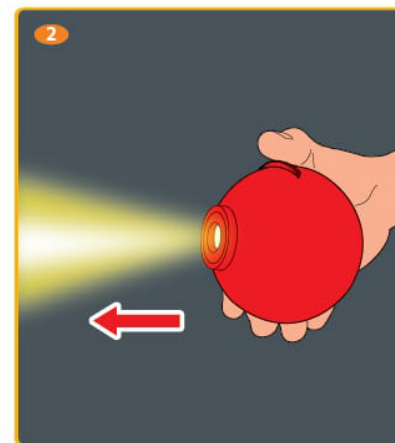


Why are the 8 planets all orbiting around the sun in the same plane?

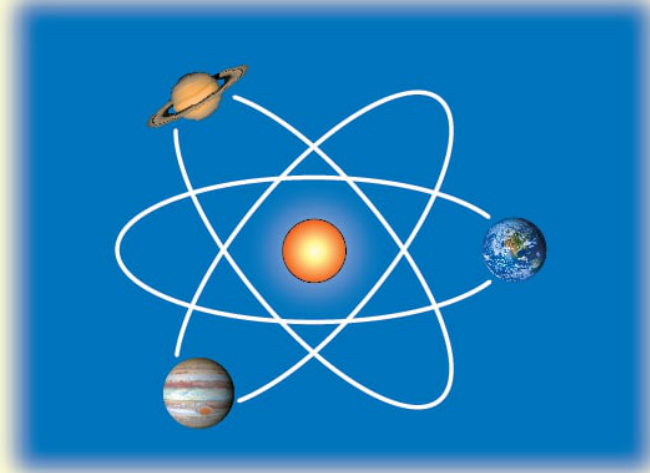




You are free to take out the portable projector (SUN) and bring it everywhere for exploring the Universe.

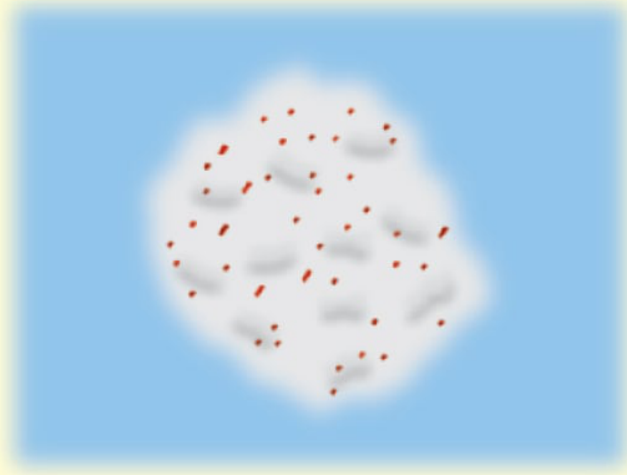


Why aren't they orbiting in planes of different directions, for example, like this?

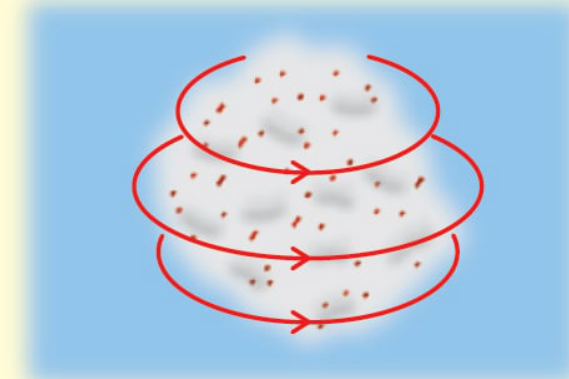


This is a natural phenomenon. Below is a simple explanation:

At the beginning, when our solar system was formed 4.6 billion years ago, it was a nebula - a spinning, swirling cloud of materials.

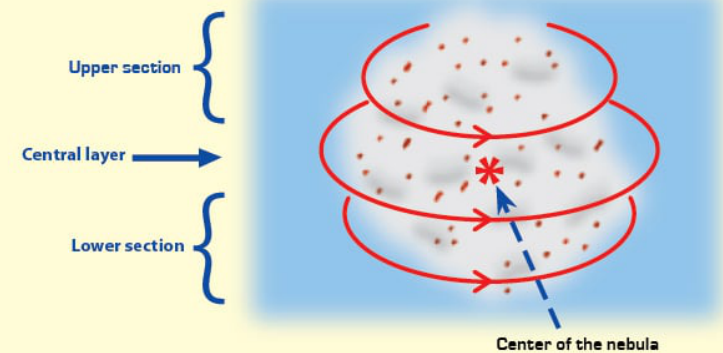


Because it was a single nebula, all the materials of it spun in one direction.



Matters in the nebula tended to clump together because of gravitation. They smashed into one another, forming larger and larger objects. For those clumps that were massive enough, their gravity would shape them into spheres, becoming planets or moons. Others became asteroids, meteoroids, or asteroid belt around planets. This is how the planetary objects and stars formed.

Now, let us consider what happened at the central layer of the early spinning nebula.
(We will talk about the "upper" and "lower" section later)



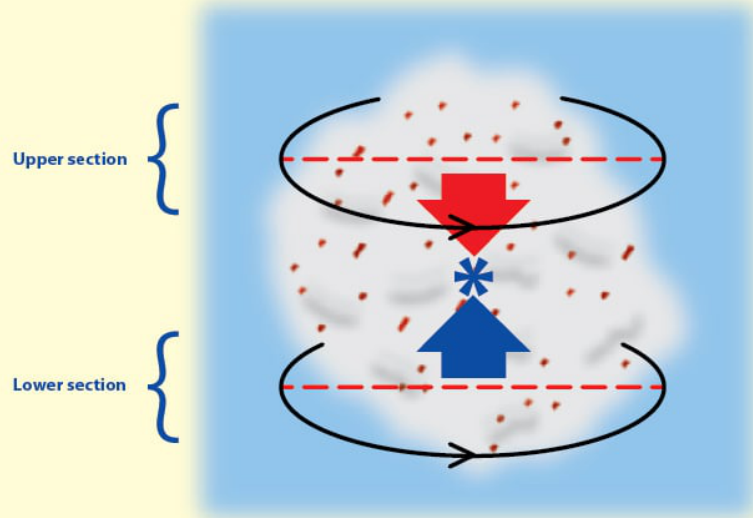
The early nebula contained lots of matters, and the resultant gravitational force of all these matters was at the center of the nebula. In simple, all the matters were experiencing gravitation, attracting them towards the center of the nebula. Naturally, for matters that were spinning too fast, the "centrifugal force" would be too large and overcame the gravitation, and lead them to fly away from the spinning nebula.

And for the matters whose speeds were just right that, their "centrifugal force" were not too powerful that lead them to fly away, but just enough to cancel out the gravitational force, then they just kept on spinning in their orbits!

For matters that were spinning too slowly, they would gradually be sucked into the center of the nebula, forming the very massive sun.

So, to put it simple: matters that were spinning too fast would fly out of the nebula eventually, as the gravitational force could not retain them from the "centrifugal force". And for the materials there were spinning too slowly, they would gradually be sucked into the center of the nebula and became part of it. Only matters whose speed were just right would remain in their orbit. So, as time passed, they became the 8 planets at the center layer eventually.

And then, let's consider what happened at the "upper" and "lower" section.



Because the resultant gravitation was at the center of the nebula, matters spinning at the "upper" and "lower" section would gradually be pulled towards the central layer. They could not stay at the "upper" or "lower" section forever, because the gravitation force from the center was pulling them in.

During the course, materials from the "upper" section collided with materials from the "lower" section. As time passed, the materials from both sections kept on bumping into each other. The up and down motion tended to cancel out in the crushing and clumping. In the end, all the remained materials stay at the center layer.

And as a result, all the 8 planets orbit on the same plane, which is what we see in our solar system now!

The Earth - the planet that we live on

Rise and fall of the sun in a day:

The sun rises and falls every day. However, it does not move actually. It is our Earth's self-rotation that causes the apparent rise and fall of the sun. Earth rotates eastward. So the sun appears to be rising from the East. The rotation cycle is 24 hours, thus it is 24 hours a day.



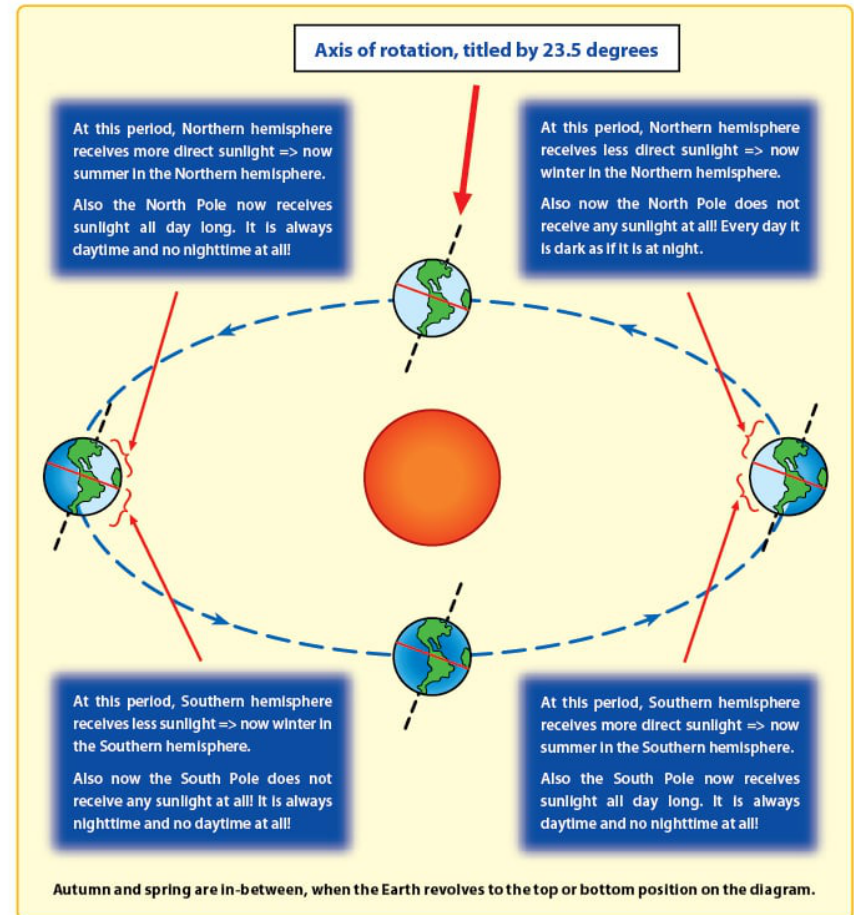
The 4 seasons:

Why are there 4 different seasons? Actually this is caused by the different amount of sunlight falls onto the different regions of the Earth.

Here are some basic facts you need to know first:

- The Northern hemisphere is always in the opposite season to the Southern hemisphere. For example, when it is winter in the US (on Northern hemisphere), it is summer in Australia (on southern hemisphere). And vice versa.
- The rotational axis of the Earth is tilted by 23.5 degrees. Therefore when the Earth revolves around the sun, there will be different amount of sunlight falls onto it at different time.

Below diagram shows you how summer and winter are formed in related to the Earth's orbiting position:

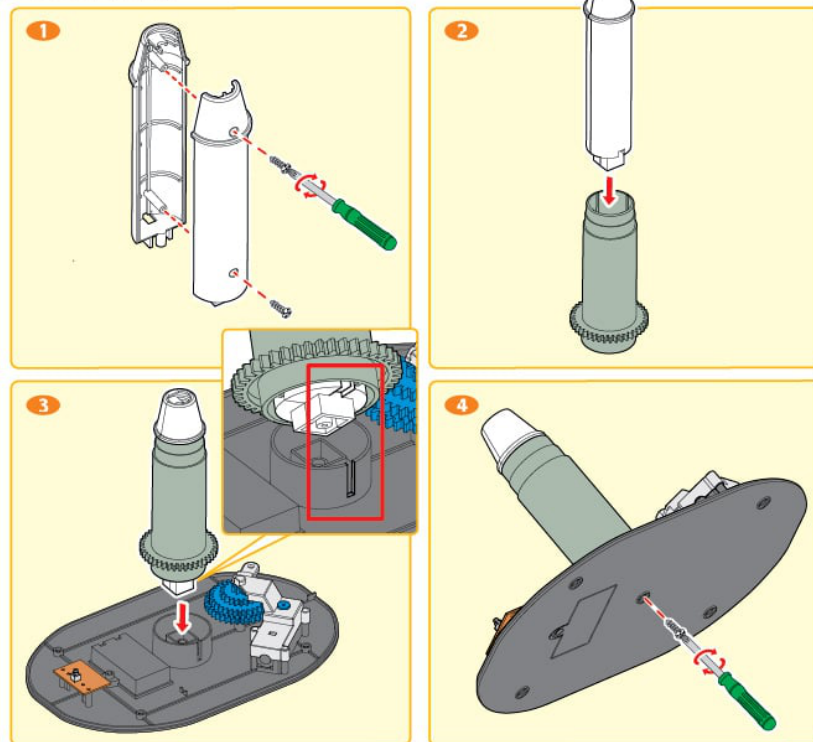


Enjoy Exploring
the Amazing Solar System Projector!

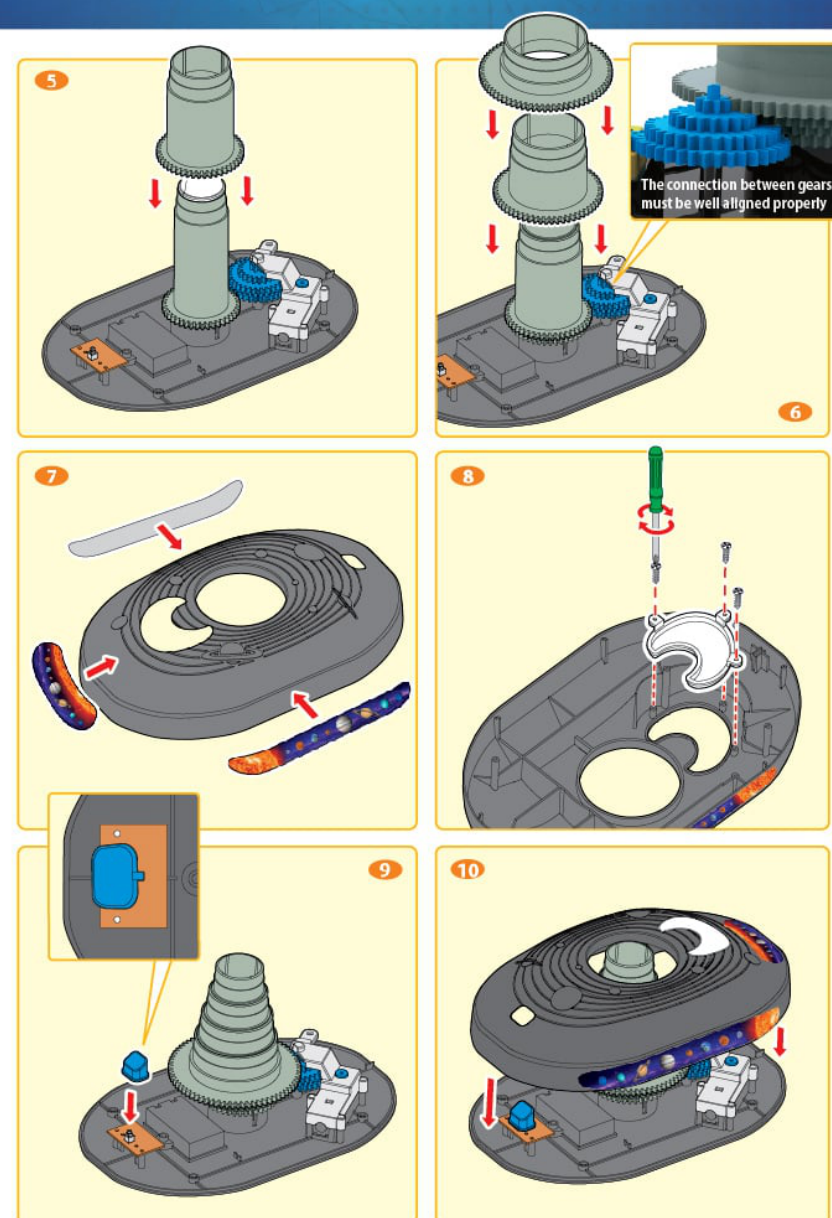
Parts List



Assembling



P.3



P.4