Components:

1. Main Rotor x1
2. Tail Rotor x1
3. Stand x1
4. Body Left x1
5. Body Right x1
6. Landing Skid x2
7. Tail Fin x1
8. Tail Boom x1
9. Window x5
10. Solar Panel x1
11. Motor x1
12. Support Tube x1

Fig. 1

Assembling your Solar Helicopter

1. Attach the two landing skids (6) to the stand (3). (Fig. 2)

Fig. 2

2. Attach the tail fin (7) and the tail rotor (2) to the tail boom (8) as shown in Fig. 3.

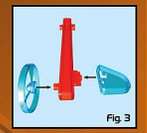

Fig. 3

3. Attach the tail boom (8) and the stand assembled in step 1 to the body left (4), see Fig. 4.

Fig. 4

4. Install the motor (11) and its wire inside the body left (4) as shown in Fig. 5. Make sure the small slot of the socket is facing towards you.

Fig. 5

5. Attach the front window (9) to the body left (4), see Fig. 6.

Fig. 6

6. Combine the left and right part of the main body as shown in Fig. 7.

Fig. 7

7. Attach the four side windows (9), each marked with "L" or "R", to the left and right side of the main body, see Fig. 8.

Fig. 8

Fig. 9

8. Insert round side of the support tube (12) to the motor and insert the main rotor (1) to the support tube, as shown in Fig. 9.

Fig. 10

9. Plug the solar panel (10) to the socket at the rear part of the main body, see Fig. 10.

10. You are done! Check your helicopter by illuminating the solar panel with bright sunlight or a bright lamp. The stronger the light the faster the rotor will spin! Refer to the section "What kind of light is required?" on page 3 to find out whether it will work under other type of light source.

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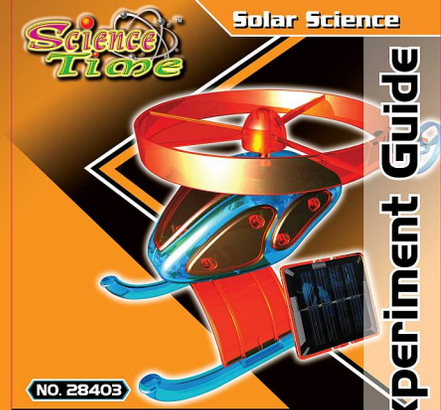
Science Time

Solar Science



NO. 28403

Solar Helicopter

Experiment Guide

WARNING!

NOT SUITABLE FOR CHILDREN UNDER 36 MONTHS BECAUSE OF SMALL PART(S) - CHOKING HAZARD.

Packaging materials are not toys. Please remove all packaging and packing tags/wires before giving this toy to your child.

CAUTION!

Not suitable for children under 3 years – This toy contains a functional sharp point of connecting wires – for use under the direct supervision of an adult. Take extra care during unpacking and use. Please take note: As an extra precaution check this toy regularly for signs of wear or damage. Read the instructions carefully before use, then follow them and keep them for reference.

Warning!

Do not short-circuit the battery terminals, which may cause overheating. The wires are not to be inserted into socket outlets.

IMPORTANT: Keep these instructions. DO NOT DISCARD.

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)

Introduction

The Solar Science series demonstrate the use of solar energy in our daily lives. You will see sunlight provides the energy to drive different models like cars and boat. However, you need to have patience in building these models and follow the instructions step by step to make them work. Most important of all, they need to be illuminated with either strong sunlight or closely under a bright lamp. Your hard work will be compensated when you see your models finally work without batteries!

All these models make use of solar cells to provide the necessary power. Sunlight falling on the solar cells is converted into electric current. This current drives the motors to provide the mechanical power of movement or provide electricity to the radio or music box circuit boards. In commercial applications a large number of solar cells are connected together to provide enough electricity to power demanding devices like solar vehicle or street light. A rechargeable battery is often used to store the electricity in daytime and release the current at night or when required.

What kind of light is required?

The best light source for these models are strong bright sunlight, you can take them outdoors on a sunny day or place them near the window where there is sunlight. **Caution! When playing outdoors, be careful and wear suitable protective clothing and hat to protect yourself from the sun's ultraviolet radiation. Do not put the toy under sunlight for more than 10 minutes.**

Alternatively, these models will also work under a bright lamp of at least 60 watts. **Warning! Adult supervision required. Do not put the model too close to the light bulb and/or for more than 2 minutes. Be very careful not to touch the bulb or you will get burnt! For safety reasons, put the solar panel and the model at a distance of at least 10cm from the light.** You may need to push the moving part slightly (except for solar radio) to start the models when the illumination is weak. Try putting the model at different distance from the lamp, what happens? The model will move slower (or sound weaker in case of a radio model) and eventually stop working when you move it further and further away from the light because less light is falling on the solar cell. You can experiment with different types of light source to see which is the most efficient. As you will find out, those energy saving lamps and fluorescent tubes are not bright enough to power these models.

Sunlight

Sunlight through the window

Lamp

The sun and solar energy

The sun is 150 million kilometers from the earth and is 4 to 5 billion years old. The temperature of the sun ranges from 6000 degrees Celsius at its surface to more than 6.5 million degrees Celsius at its center. That's HOT! It takes about 8 minutes for this energy to reach the earth. The sun itself is a star made up of mostly hydrogen and helium gas and it radiates an enormous amount of energy every day.

The sun is the ultimate source of all energy on earth. Without it the lives on earth would not exist, there will not be any fossil fuel (e.g. coal and oil) for us to use, which comes from the decaying plants hundreds of millions of years ago. We use the sun's energy everyday in many different ways. When we hang our laundry outside to dry in the sun, we are using the heat from the sun to do the work. Plants use sunlight to produce food. Animals eat plants for food.

330 Million Terawatt hours (3300000000000000000000 watt-hour!) of equivalent energy from the sun hits the earth every year. That's 30 times more energy from the sun in a single year than all the energy stored in the earth. If we can use more solar energy, which is clean and practically inexhaustible, we will be less dependent on fossil fuels. Burning fossil fuels produce greenhouse gas and other pollutants which are harmful to our environment. There are two ways to convert solar energy into electricity: Solar thermal electricity and Solar Cells. The former use the suns heat to boil water and drive a turbine to generate electricity. The latter convert sunlight directly into electricity.

Solar Cells or Photovoltaic Energy

Solar cells are also called photovoltaic cells - or PV cells for short. They can be found on many small appliances, like watches, calculators, and even on spacecraft. They were first developed in the 1950s to provide power for the satellites in space. They are made of silicon, a special type of melted sand.

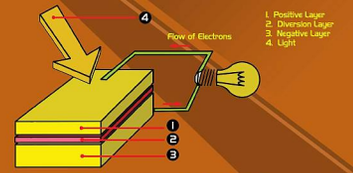
Photovoltaic systems are solar systems that produce electricity directly from sunlight. The term "photo" comes from the Greek "phos," meaning light. "Voltaic" is named for Alessandro Volta (1745-1827), a pioneer in the study of electricity for whom the term "volt" was named. Photovoltaics, then, means "light electricity." Photovoltaic systems produce clean, reliable electricity without consuming any fossil fuels. There is no fuel, steam or thermodynamics involved. They are being used in a wide variety of applications, from providing power for watches, highway signs, and space stations, to providing for a household's electrical needs. The industry has been growing steadily at a rate of at least 25% per year for the past 20 years. It is estimated that by the year 2020, more than 30 millions household will be powered by solar electricity

Most photovoltaic cells are made from a crystalline substance called silicon, one of the Earth's most common materials. Solar cells are typically made by slicing a large crystal of silicon into thin wafers and putting two separate wafers with different electrical properties together, along with wires to enable electrons to travel between layers. When sunlight hits the wafers, electrons naturally travel from one layer to the other through the wire because of the different properties of each layer, resulting in the release of electricity.

These individual solar cells are arranged together in a PV module and the modules are grouped together in an array. Some of the arrays are set on special tracking devices to follow sunlight all day long.

The electrical energy from solar cells can then be used directly. It can be used in a home for lights and appliances. It can be used in a business. Solar energy can be stored in batteries to light a roadside billboard at night. Or the energy can be stored in a battery for an emergency roadside cellular telephone when no telephone wires are around.

Some experimental cars also use PV cells. They convert sunlight directly into energy to power electric motors on the car.



Basic Structure of a Solar Cell