

WARNING! Not suitable for children under 3 years. Its small parts or components make it a choking hazard. Please retain this information.



Solar Educational Kit

Solar Lehrbausatz

Solar Educational Kit:

Now you can experiment with solar energy the energy source of the future . Our solar educational kit is designed to let you build your own solar models. This kit comes complete with :

- 1.Solar cell module
- 2.Solar energy booklet explaining the whys and hows of solar energy.
- 3.Small DC Motor
- 4.Screws and nuts
- 5.Wire with motor clips
6. Coloured spinner discs
7. Paper aeroplane and bird models.
- 8.Plastic turntables with 4 sizes, 5/8", 1", 1½" and 2"
- 9.Plastic fan-spinner

The solar cell modules, when placed in direct sunlight or close to incandescent light bulbs, generate power similar to batteries. Discover for yourself how to harness the energy of light and employ it in countless practical applications. Solar energy uses are limited only by your imagination.

NOTE: For easy start of motor, turn the motor spin by hand for some time before use.

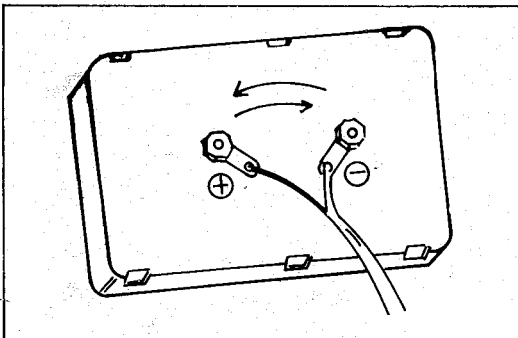
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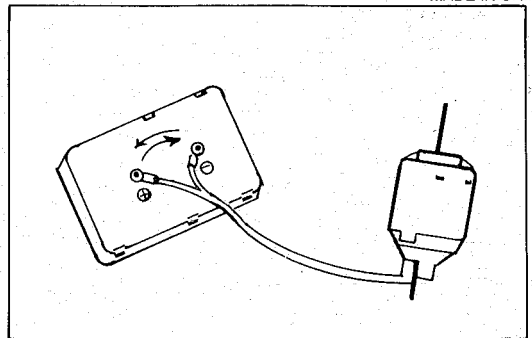
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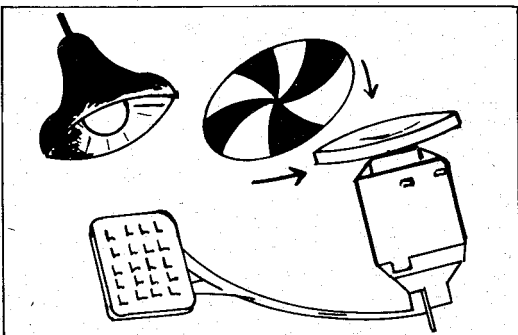
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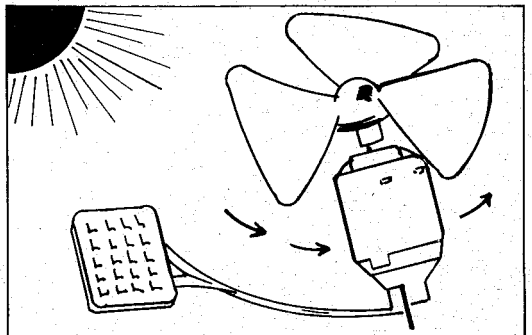
1 Connect the solar cell and wire with screws and nuts.



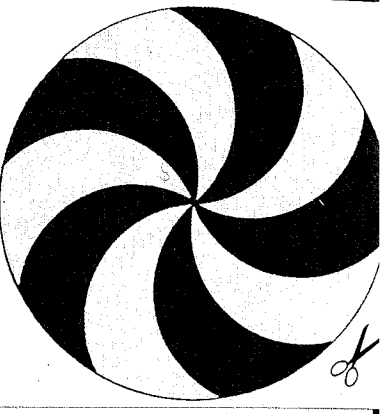
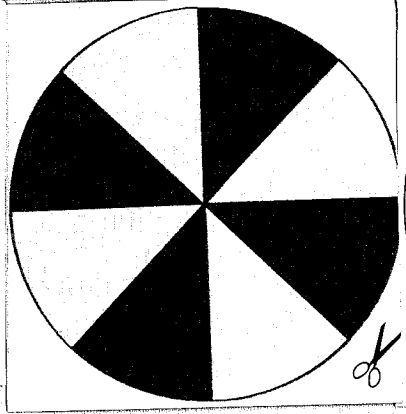
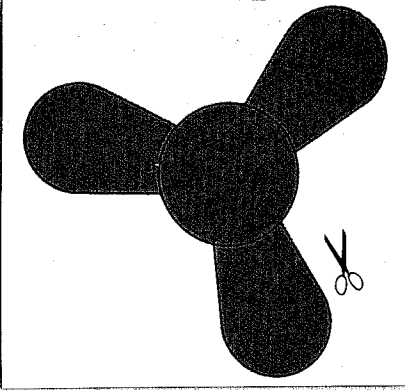
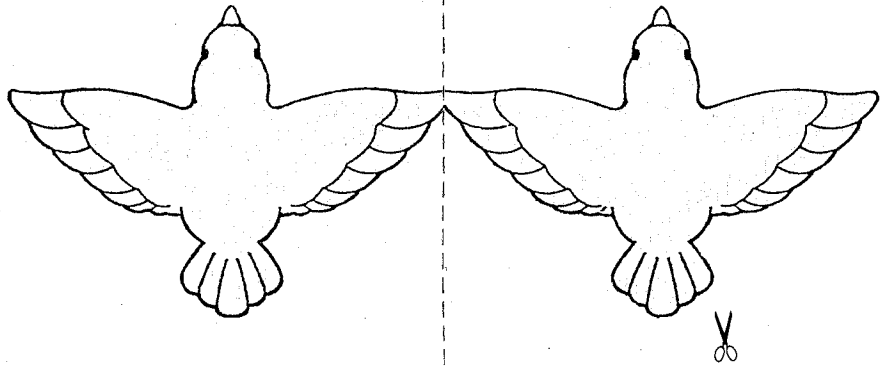
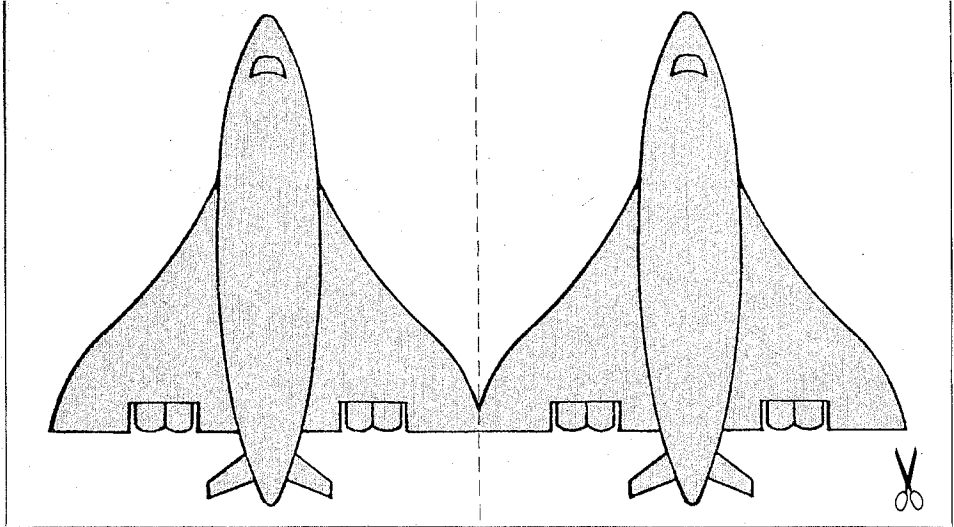
2 Polarity is changeable by swapping with 2 screws.



3 Put the yellow plastic turntables on the motor shaft, then stick the coloured spinner discs on or paper aeroplane models there, to build your own solar model kit.



4 You can also put the fan-spinner there to build your own solar fan.



SOLAR ENERGY

BOOKLET EXPLAINING THE WHYS AND HOWS OF SOLAR ENERGY

HARNESS
THE
POWER
OF
THE SUN

Powered by the Sun ...

Congratulations, you have just purchased a very unique solar powered model. In the age of rising energy costs, the idea of a free and virtually limitless energy source seems too good to be true. For years scientists have experimented with various methods of capturing the abundant energy radiated from our sun. Today, although far from perfected, solar technology has been advanced to a point where we have learned how to harness and utilize the sun's power. Time, research and money will bring to the market place new products that will be energy savers needed by the entire world. Your Solar model is designed to demonstrate the potential of solar energy. We hope that you will enjoy and educate others regarding this energy source of the future.

Space Age Technology

Your Solar model is powered by means of a tiny disc which actually converts light into electricity. This disc, more commonly referred to as a photovoltaic (photo meaning light and voltaic meaning producing electricity) or solar cell, is the result of the extensive research and development which went into the space program. Scientists originally developed photovoltaic cells as a means of recharging batteries and powering various systems contained in spacecraft. These tiny cells have contributed greatly to the success of the space program.

Research and development of solar cells increased on a fairly large scale. Cost was not the big factor ... weight was the big factor, even the critical factor. Every additional ounce put into orbit had to be carefully considered. The efficiency

of solar cells increased and manufacturing techniques improved. Solar cells become lighter and less expensive. In many cases, batteries could be eliminated completely and solar cells used to supply all the electrical power required to operate the equipment aboard satellites. This research has helped to open the door to the unlimited potential for applying solar technology to industry and to our private lives.

Care and Maintenance of Solar Cells

Though it may be hard to believe, these lightweight solar cells never wear out or require any maintenance. Do not drop or abuse the solar cell or solar cell module, as the material it is made from is similar to glass and will break. We are not responsible for solar cells which are damaged due to

mishandling. The motor provided with your Solar model requires no maintenance and its operation should exceed the models lifetime.

To clean, a simple blowing with your breath removes dust and most foreign objects. We recommend wiping with a soft cloth and glass cleaner.

How Do Solar Cells Work?

Most of the solar cells in volume production today are made with silicon. This plentiful natural resource makes up more than one fourth of the earth's crust and is the chief component of ordinary sand. The silicon used in the production of solar cells must be purified to a very high degree. A large part of the cost of solar cell production results from the painstaking task of removing all but the slightest traces of impurities in order to produce the highest quality silicon.

To make the solar cell which powers your Solar model, we start with a thin disc of almost pure silicon crystal. When the silicon crystal is being formed, a small amount of boron is added. The boron gives the crystal structure a unique characteristic. It actually has a positive electrical

charge. Since this part of the solar cell has a positive charge it is referred to as "P" type silicon and it forms the base of the cell.

Next, a very thin layer of silicon crystal is formed over the disc of "P" type silicon. However, instead of adding boron, this time a small amount of phosphorous is added to the mixture. The phosphorous provides a negative charge and thus is referred to as "N" type silicon.

The two halves of the solar cell, one "P" type silicon and the other "N" type silicon, cancel each other out to produce a neutral cell.

When sunshine penetrates to the junction of the "N" type and "P" type silicon cell layers it creates a flow of electrons throughout the crystal structure. The crystal structure of silicon contains empty areas which will accept electrons. As one electron moves to fill a hole, it creates another hole. It is this flow of electrons which produces electricity.

The Power in Light

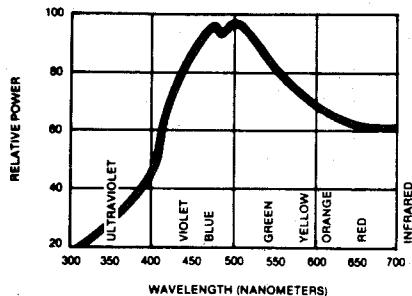


FIGURE 1

Sunlight contains many colors of light. Color and the relative power in each color of light is determined by the measure of the wavelength. Figure 1 plots the relationship between wavelengths and color along the spectral distribution of ordinary daylight.

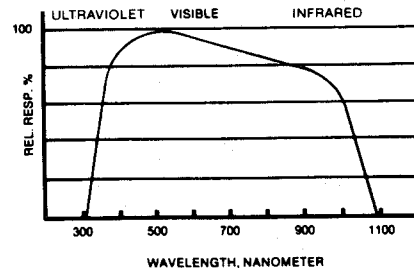


FIGURE 2

The relative response of a typical silicon solar cell across the light spectrum is represented in figure 2. As we can see from this chart, silicon solar cells have a high response over a broad range of wavelengths.

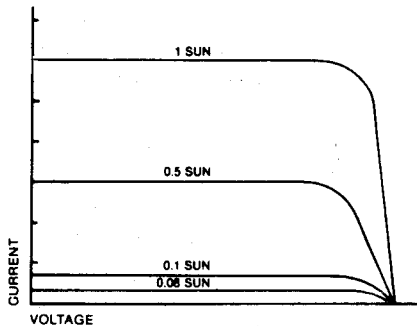


FIGURE 3

In most circumstances, solar cells are not exposed to maximum levels of sunlight. Figure 3 shows the resulting output of a solar cell when exposed to maximum and lesser amounts of sunlight. Notice that the terminal voltage is not significantly effected by the amount of light.

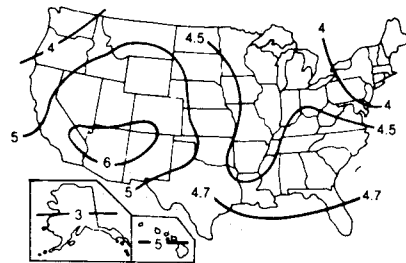
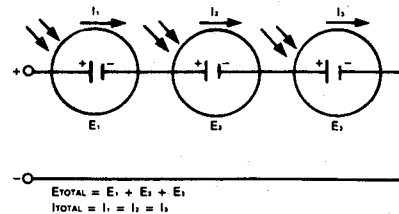


FIGURE 4

The average number of peak sun hours per day varies from one area of the country to another. Figure 4 shows the yearly average peak sun hours and in turn the potential for solar energy applications for different parts of the country.

A: SERIES CONNECTION



B: PARALLEL CONNECTION

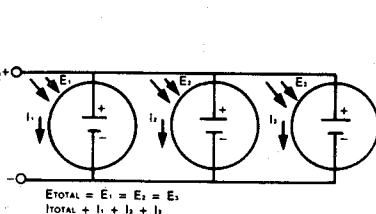


FIGURE 5

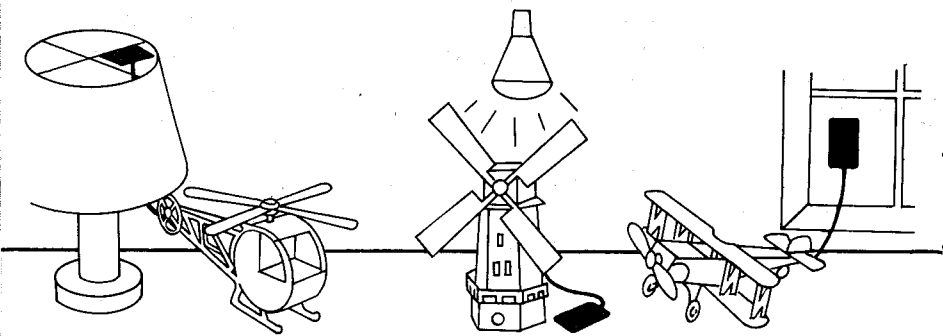
In order to transmit the electricity provided by sunlight activating the "N-P" junction of the solar cell, simply attach a conductor (copper wire) to each half of the cell. The resulting electrical current is determined by the square area of the cell being used at about one-half volt. To vary the amount of current or voltage produced, cells can be connected in series and/or parallel. Figure 5 illustrates that when multiple solar cells are connected in series the voltage (E) is increased, but the current (I) remains constant. Conversely, when multiple solar cells are connected in parallel the result is increased current without altering voltage output.

Operation of the Solar Model

Your model will function best when the solar cell or solar cell module is placed in direct sunlight. For best performance, place in an east, south or west window. In the event you don't have a window facing the sun or you prefer unlimited operation, an artificial light source can be utilized to power your model. The distance from the artificial light source to your model will depend on the wattage of your light source. We recommend using a 150 watt floodlight PAR 38 G.E. outdoor approximately 2 to 3 feet above your model to obtain maximum performance.

Solar Cell Module

If your model comes supplied with an encapsulated solar cell module for remote light pick up, place the solar cell module in a window (with supplied clear suction cup) or inside a table lamp. As you can see you can operate your Solar model day or night. The solar cell is encapsulated in a protective collector lens to prevent damage and comes complete with miniature wire.



lamp

floodlamp

window

Do not subject the solar cell module to an excessive heat location, as it will warp the plastic lens. Remember, it is not heat that makes your model function, it is light. A little experimentation will tell you what setting makes your model work best!

Please handle all models with care.

What Does The Future Hold?

Although the solar cell described in the previous section will provide enough power to operate your Solar model, a more efficient system must be developed in order to produce enough electricity to satisfy average consumer needs.

Some of the concepts currently under study include: solar cell arrays on individual buildings which will be designed to supply all of that building's electrical requirements; massive central systems erected in selected locations which receive abundant sunlight capable of serving an entire distribution system and even central orbiting systems in space which will beam power back to earth and then on to individual users.

Practical applications of solar energy will be plentiful in the years to come. Some uses in the not too distant future include:

electrical power for remote areas; battery recharging for appliances, radios and TV's.

The technology of solar energy is still in the formative stages, however much of what is known today can and is being applied by innovative individuals. Our company, is one company dedicated to advancing the use of solar power and we are leaders in our own particular specialty. Our products are designed to be both educational and entertaining. We feel that with the development of this free, non-polluting energy source ... the future looks bright.