Operating Instructions

Solar Hydrogen Technology Science Kit
Operating Instructions Solar Hydrogen Technology Science Kit
October 99 model or later.
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1. Notes for the User

The following symbols are used in the operating instructions to indicate dangers and references:

- Dangerous situation (serious injuries possible)
- Danger from heat
- Danger of explosion
- User tips
- No open fire
- Smoking prohibited
- Do not touch

2. Safety

2.1. Introduction and Safety Information

hydro-Genius™ Solar Hydrogen Technology Science Kit is equipped with safety devices.

Nevertheless, improper operation or abuse can lead to dangers for:
- the health of the operator
- the unit itself and other items of property.

All persons involved in the setting up, operation and maintenance of the unit must
- read and precisely follow these operating instructions
- be fully trained for/instructed in their work.
The following symbols and signal words are used in these operating instructions:

**Warning!**
Draws attention to a potentially dangerous situation. Serious injuries can occur if this reference is ignored.

**Important!**
Draws attention to application tips and other useful pieces of information. This is not a reference to dangerous situations. A risk of damage to the product or to the environment might be involved, however.

**2.2. Correct Use**

hydro-Genius™ Solar Hydrogen Technology Science Kit is an experimentation and demonstration model on hydrogen technology and its components. It may only be used for experimentation and demonstration purposes and must be operated in accordance with these operating instructions.

The enclosed experiment instructions describe in the detail the procedure to be followed in the experiments and contain additional safety information. They should be treated as part of these operating instructions.

hydro-Genius™ Science Kit may not be used for:

1. generating electricity for general use, e.g. for operating electrical devices or equipment,
2. generating hydrogen for any other purposes than those described in the experiment instructions,
3. storing or collecting more than minimal amounts of hydrogen (approx. 20 ml).
4. The load measurement box must not be used to measure voltage and current with other than components from the hydro-Genius™ program, particularly no voltage of more than 3V must be connected to the terminals.

For the experiments use only the components of the Science Kit unless otherwise stated in the attached experiment descriptions.

Unauthorised modifications or changes to the components are prohibited for safety reasons. The operating and maintenance conditions laid down in these operating instructions must be observed.
### 2.3. Sources of Danger

<table>
<thead>
<tr>
<th>Source of danger</th>
<th>Possible consequences</th>
<th>Precautions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of hydrogen</td>
<td>Danger of explosion</td>
<td>Avoid handling open fire in the vicinity of the model.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Smoking is strictly prohibited.</td>
</tr>
<tr>
<td>Hot light source</td>
<td>Danger of burning</td>
<td>Do not touch the lamp when in operation or immediately after operation</td>
</tr>
<tr>
<td></td>
<td>Overheating of system</td>
<td>Keep the stipulated distance between the lamp and all surfaces</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Touch the solar module only on the sides not exposed to the light source.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Remove the light source and wait for the solar module to cool down before touching it</td>
</tr>
<tr>
<td>Under very intense illumination the surface of the solar module may become very hot</td>
<td>Danger of skin burns if touched</td>
<td></td>
</tr>
<tr>
<td>Using the load measurement box with foreign components</td>
<td>electric shock</td>
<td>Never operate the load measurement box with others than hydro-Genius™ components. The connected voltage must never exceed 3V.</td>
</tr>
</tbody>
</table>
2.4. Authorised Operators

You may only work with the unit if you
- have read the operating instructions,
- have been instructed on proper handling by the operator,
- have been informed about the potential dangers involved in connection with the unit.

The hydro-Genius™ Solar Hydrogen Technology Science Kit may only be used by trained teaching staff or by pupils and students under the supervision of teaching staff. As the teacher you must ensure proper handling. You are obliged to draw attention to potential dangers. Before starting an experiment, hand out the experiment instructions provided in order to prevent pupils and students from "playing around" with the model.

Take measures to prevent unauthorised persons from installing, using or maintaining the unit. If the hydro-Genius™ Solar Hydrogen Technology Science Kit is passed on to a third party, you must also pass on the operating instructions.

2.5. Workplace

The components of the hydro-Genius™ Solar Hydrogen Technology Science Kit must be assembled and operated on an even, horizontal, stable and solid base.

A working height of 75 - 85 cm is recommended for experimentation purposes.

The model needs approx. 1.0 m x 0.5 m of space.

The ambient temperature should be between 10°C and 35°C. We therefore recommend that you only operate the model inside the building in order to protect it from the weather.

2.6. Protective Equipment

All people present during experiments must wear protective goggles.
3. Technical Information and Data

3.1. Contents of the package

Solar module, mounted in plastic housing
PEM-Electrolyser with storage cylinders, 2 overflow pipe for storage cylinders
PEM Fuel Cell
Load Measurement Box
2 red cables, 2 black cables
2 silicone tubes Ø 4-6 mm, approx. 40 cm length
2 silicone tubes Ø 4-6 mm, approx. 20 cm length
3 Tubing stoppers
Stop watch
1 replacement bulb

Documentation: Operation Instruction
Experiment instructions
Illustrated set-up/packaging instructions
Scale of angles/connection diagram for Load Measurement Box

For transport reasons, heliocentris delivers the hydro-Genius™ Science Kit in partially dismantled form. For repacking after operation see the drawing in section 3.5 and inside the box.

3.2. Necessary Expendables

Distilled water.

The load measurement box requires two 9 V 6LR61-batteries as power supply.

The stop watch requires a round cell battery AG 3, LR 41 or L 736 as power supply.

Both batteries are included in the initial delivery

3.3. Available Additional Accessories

Dismountable Fuel Cell Extension Kit (heliocentris order No. 353),
With 2 different oxygen/air inlets and 2 membranes with different catalyst surfaces, plug-in resistance.
Allows experiments that give a detailed insight into fuel cell’s process parameters and how they work.
3.4. Basic Functions

This Science Kit is a miniature solar-hydrogen plant which has been specially designed for teaching purposes. The components are identical to those used in solar-hydrogen off-grid power-supply plants.

And this is how the hydro-Genius™ Solar Hydrogen Science Kit works:

1. The solar module converts light into current.
2. This current splits water into hydrogen and oxygen in the electrolyser.
3. The gases may be stored in the storage cylinders of the electrolyser.
4. The hydrogen and oxygen are fed into the fuel cell, where they are converted directly into current.
5. The current drives the electric motor or the bulb.
3.5. Overview

1 Solar Module
1a Housing
1b Solar cells
1c Tip jack: positive terminal
1d Tip jack: negative terminal

2 Electrolyser
2a Electrolysis cell
2b Hydrogen storage cylinder
2c Hydrogen storage overflow pipe
2d Hydrogen gas outlet
2e Oxygen storage cylinder
2f Oxygen storage overflow pipe
2g Oxygen gas outlet
2h Tip jack: positive terminal
2j Tip jack: negative terminal
2k Protective diode

3 Fuel Cell
3a Housing
3b Hydrogen gas inlet
3c Hydrogen gas outlet
3d Oxygen gas inlet
3e Oxygen gas outlet
3f Tip jack: positive terminal
3g Tip jack: negative terminal
4 Load Measurement Box

4a ON/OFF switch
4b Ammeter display
4c Tip jack: positive terminal for Load/Am-meter
4d Tip jack: negative terminal for Load/Am-meter
4e Voltmeter display
4f Tip jack: positive terminal for Voltmeter
4g Tip jack: negative terminal for Voltmeter
4h Rotary switch Resistances/Loads
4i Lamp
4k Coloured Disk for Motor

Circuit Diagram for Load Measurement Box
Repacking the Science Kit after operation

- **Load-Measurement-Box**
  - 1 red cable
  - 1 black cable

- **Dismantable Fuel Cell Extension Kit**

- **Short tubes**
  - Tube stoppers

- **Fuel Cell**

- **Long tubes**

- **Overflow pipes**

- **Stop watch**

- **Solar Module**
  - 1 red cable
  - 1 black cable

- **Electrolyser**
### 3.6. Technical Data

**Solar module**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions (length x width x height)</td>
<td>70 mm x 120 mm x 52 mm</td>
</tr>
<tr>
<td>Terminal voltage</td>
<td>3.0 V</td>
</tr>
<tr>
<td>Short circuit current</td>
<td>245 mA</td>
</tr>
<tr>
<td>Maximum Power Point:</td>
<td></td>
</tr>
<tr>
<td>Voltage</td>
<td>2.4 V</td>
</tr>
<tr>
<td>Current</td>
<td>200 mA</td>
</tr>
<tr>
<td>Power</td>
<td>0.48 Watt</td>
</tr>
</tbody>
</table>

Output data under standard conditions (all data at 1000 W/m² and 25°C)

**Electrolyser**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions (length x width x height)</td>
<td>85 mm x 190 mm x 90 mm</td>
</tr>
<tr>
<td>Consumption of distilled water</td>
<td>1 ml/10 h at 300 mA electrolysis current</td>
</tr>
<tr>
<td>Amount of water carried from oxygen to hydrogen side</td>
<td>1 ml/ h at 500 mA electrolysis current</td>
</tr>
<tr>
<td>Storage volume of hydrogen and oxygen</td>
<td>10 ml each</td>
</tr>
<tr>
<td>Normal/Operating voltage</td>
<td>1.4 – 1.8 V</td>
</tr>
<tr>
<td>Current</td>
<td>0 - 500 mA</td>
</tr>
<tr>
<td>Hydrogen production</td>
<td>max. 3.5 ml / min</td>
</tr>
</tbody>
</table>

**Fuel cell**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions (length x width x height)</td>
<td>85 mm x 70 mm x 70 mm</td>
</tr>
<tr>
<td>Voltage</td>
<td>0.4 – 1.0 V</td>
</tr>
<tr>
<td>Current</td>
<td>max. 1000 mA</td>
</tr>
<tr>
<td>Consumption of hydrogen</td>
<td>max 7 ml/ min at 1000 mA current</td>
</tr>
</tbody>
</table>

**Load measurement box**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions (length x width x height)</td>
<td>190 mm x 110 mm x 85 mm</td>
</tr>
<tr>
<td>Operation voltage of motor</td>
<td>0.2 – 3 V</td>
</tr>
<tr>
<td>Current drain of motor with coloured disk</td>
<td>10 – 15 mA</td>
</tr>
<tr>
<td>Operating voltage of lamp</td>
<td>0.6 – 1.5 V</td>
</tr>
<tr>
<td>Current drain of lamp</td>
<td>0 – 80 mA</td>
</tr>
<tr>
<td>Operating voltage of display units</td>
<td>9 V</td>
</tr>
</tbody>
</table>

**Climatic conditions**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient temperature</td>
<td>10 - 35 °C</td>
</tr>
<tr>
<td>Transport and storage temperature</td>
<td>10 - 35 °C protect against frost!</td>
</tr>
</tbody>
</table>
4. Transport and Storage

The Solar Hydrogen Technology Science Kit is delivered partially dismantled in a plastic storage container. The container protects the components from damage.

Please contact the manufacturer in the event of any transport damage.

Use only the storage container for transporting the Science Kit. The electrolyser must never be filled with water during transport.

Protect the storage container against falling, vibrations and the influence of weather.

Store the components in their designated compartments in the original container. The electrolyser must be emptied of water before storage.

The electrolyser must be refilled with distilled water before the unit is restarted.

5. Installation and Assembly

The hydro-Genius™ Solar Hydrogen Technology Science Kit is supplied complete with illustrated assembly instructions for starting up. Please hand these out to the pupils to ensure that they set the unit up properly.

The following sections contain written assembly instructions.

Some of the experiment instructions contain further of set-up advice. Please follow these instructions.

5.1. Solar Module

The solar module is set up perpendicular/at right angles to the workplace surface. The light source should illuminate the solar module perpendicularly.

Enclosed with the Science Kit is a printed scale of angles, which you can use to set up the solar module at specific angles to the light source.

See experiment instructions for further information.
5.2. Electrolyser

Assembling the gas storage cylinders

Insert the overflow pipes (2c and 2f) into the stoppers at the top of the storage cylinders (2b and 2e) and press them in tightly.

**Tip:**
Moistening the pipe ends with distilled water makes them easier to insert.

Push the two 40 cm tubes onto the gas outlets (2d and 2g) of the storage cylinders. These tubes conduct the gases from the electrolyser to the fuel cell.

**Filling with distilled water**

Before the Science Kit can be started up, the electrolyser must be filled with approx. 50 ml of distilled water.

**Caution:** the PEM electrolyser may only be filled with distilled water. If you use any other liquids (e.g. containing electrolytes), this could destroy the electrolyser.

Use a wash bottle to simplify this operation.
Pour distilled water through the bore-holes in both stoppers.

For normal use in class and for operation up to a maximum of 1 hour, fill both storage cylinders up to the 0 ml marks (see Fig. a)).

Since a small amount of water is transported from the oxygen to the hydrogen side during electrolysis (approx. 1 ml/h at an electrolysis current of 500 mA), for longer use (continuous operation) the two storage cylinders must be filled to different levels (see Fig. b)).
5.3. **Fuel Cell**

The fuel cell is delivered ready assembled.

5.4. **Load Measurement Box**

The load measurement box is delivered ready assembled.

5.5. **Assembling and Starting up the Solar Hydrogen plant**

1. Make sure that all components of the Science Kit are standing on a horizontal and stable base.

2. Use laboratory cables ("banana plugs") to make the connection between the power source (solar module or power-supply unit) and the electrolyser:
   - Positive terminal of the solar module (1c) to the positive terminal of the electrolyser (2h)
   - Negative terminal of the solar module (1d) to the negative terminal of the electrolyser (2j)

3. Connect the hydrogen gas outlet (2d) of the electrolyser and the hydrogen gas inlet of the fuel cell (3b) using one of the enclosed tubes. Repeat for the oxygen side.

4. Illuminate the solar module sufficiently or use the power-supply to set a current of between 150 mA and 350 mA.

5. You should now observe a distinct development of gas in the electrolyser. Oxygen forms in one of the half-cells, hydrogen in the other.

6. Use laboratory cables ("banana plugs") to make the following connection:
Positive terminal of the fuel cell (3f) to the positive terminal of the load measurement box (4c)
Negative terminal of the fuel cell (3g) to the negative terminal of the load measurement box
(4d).

7. Turn the ON/OFF switch of the load measurement box to the “ON” position. Adjust the rotary
switch (4h) to the “MOTOR” position.

8. After a maximum of 10 – 20 minutes the fuel cell should be sufficiently supplied with gas to be
able drive the electric motor.

The hydro-Genius™ Science Kit is supplied with illustrated assembly instruction to guide you when
starting up the system and making the necessary cable and tubing connections.

The enclosed experiment instructions contain further instructions for experiments using the Science
Kit. Follow these instructions to carry out your experiments safely and reliably.

6. Operation of the hydro-Genius™ Solar Hydrogen Technology Science Kit

6.1. Using the right Operation Media

The solar module can be operated using various light sources:

1. Sunlight
2. Halogen lamp with reflector, up to 150 watts
3. Filament lamp with reflector, up to 150 watts

The light source must ensure that the surface of the solar cells is evenly illuminated. For safe and
reliable experiments, we recommend the heliocentris 120 W accessory filament lamp.

The electrolyser can be operated with the following power sources:

1. Solar Module: The enclosed solar module is perfectly adjusted to the electrolyser and offers the
greatest operational safety.

2. Power-supply unit: The current must be limited to a maximum of 0.5 amps. Otherwise the
electrolyser will be destroyed.

Caution: The electrolyser current must never exceed 0.5 amps.
Otherwise the electrolyser may be destroyed.
hydro-Genius™ Solar Hydrogen Technology Science Kit

Make sure that the power sources are connected correctly, i.e. connect the positive terminal of the power source to the positive terminal of the electrolyser and the negative terminal of the power source to the negative terminal of the electrolyser.

The electrolyser is equipped with a protective diode which short-circuits the power source if polarity is reversed. At currents above 0.5 amps, reversed polarity can lead to the destruction of the protective diode.

Use only the enclosed electrolyser as the source of hydrogen and oxygen for the fuel cell.

The fuel cell will supply its full output of electrical energy approx. 10 minutes after the electrolyser is started up.

For further information see the enclosed experiment instructions.

6.2. Operating the Stop Watch

Tear out the white insulation strip before first use of the stop watch.

1. Press the “H” and “M” keys simultaneously; the display shows “0:00”. An alarm tone also sounds until you release the keys.

2. Press the “S/S” key to start the stop watch. Press “S/S” again to stop.

The stop watch can also be used as timer. It counts down to zero from a preselected time and sounds an alarm to indicate that the time has expired:

1. Press the “H” and “M” keys simultaneously; the display shows “0:00”. An alarm tone also sounds until you release the keys.

2. Press “H” to set the hours and “M” to set the minutes.

3. Press “S/S” to start. The colon starts flashing. The alarm sounds when the preselected time has expired. Press “S/S” to stop the alarm.

If the numbers on the display are no longer properly visible, the round cell battery must be replaced. Proceed according to section 7.3.
6.3. **Safety Precautions for Operation**

1. The teacher is responsible for ensuring that pupils and other persons only operate the model under supervision and after receiving instruction.

2. When carrying out experiments with the hydro-Genius™ Solar Hydrogen Technology Science Kit, be sure to follow the enclosed experiment instructions.

3. If the light source heats up the solar module too much, remove the light source and do not touch the solar module until it has cooled down sufficiently.

4. If appropriate follow the safety instructions in the operation manual of the light source. It is especially important to keep the stipulate minimum distance from the lamp.

6.4. **Recommended Modes of Operation**

Make sure that the electrolyser does not dry out during operation.

Regular operation is good for the fuel cell. If possible, the equipment should be used for several hours every 3-4 weeks. The more frequently the fuel cell is used, the more efficient it is. The membrane can dry out if it not used for a long time. The model will then take longer to start up.

In order to ensure that measured data of the fuel cell (e.g. for the characteristic curve) correspond to the data indicated in the experimental operating instructions, the fuel cell should be in operation for some time before the measurements are made.

The electrolyser allows in principle two different modes of operation:

1. Storage mode

2. Continuous operation

In storage mode make sure that both gas storage cylinders are filled with distilled water up to exactly the 0 ml mark before the experiment is started.

In continuous operation, the oxygen side should be filled to the 0 ml mark, but the hydrogen side only to the 10 ml mark, a small measurable volume of water is transported from the oxygen to the hydrogen side since during electrolysis. When the water-level on the hydrogen side approaches the 0 ml mark, the surplus water must be siphoned out with a pipette or syringe after removing the stopper. About the same volume must be added on the oxygen side.

For operation using oxygen from the ambient air, disconnect the oxygen tube from the fuel cell.
6.5. Improper Modes of Operation

1. The solar module must not be heated above 60°C by the radiation/light source.

2. The solar module must not be illuminated with focused (directed) light.

3. Avoid pinching the rubber gas tubing, because this can lead to positive pressure, causing the rubber tubes to jump off and leading to an acute risk of injury.

4. The gas outlets of the fuel cell and all other tubes may only be sealed when strictly following the experiment instructions.

5. The gas storage cylinders of the electrolyser must be filled with distilled water at least to the top of the electrolyser.

6. The maximum operating voltage indicated in section 3.6 must never be exceeded.

7. Do not under any circumstances connect the fuel cell to an external power source (e.g. laboratory power-supply unit or solar module). A forced current flow from outside can immediately lead to the destruction of the fuel cell.

8. If other objects than the installed disk are connected to the motor axle on the load measurement box, heliocentris assumes no liability for any damage thus caused.

9. The bulb of the lamp in the load measurement box must not be operated at voltages exceeding 1.5 V and especially not using the enclosed solar module.
6.6. Possible Malfunctions

(Minor faults which you can remedy yourself)

Electrolyser is not producing any gas
Is the electric connection between the solar module and the electrolyser correct (see section 5.5)?

Electrolyser is producing too little gas (less than one gas bubble every 4 seconds)
Illuminate the solar module better with the lamp (Caution, danger of burning!)

The Ammeter is indicating no current
Check that the fuel cell and the electrical load are connected correctly (see section 5.5)
Is the ON/OFF switch of the load measurement box set to “ON”?
Is the rotary switch of the load measurement box set to one of the positions “LAMP”, “MOTOR”, “SHORT CIRCUIT” or a resistance smaller than 50Ω?
Check that the stoppers at the electrolyser and the rubber tubes leading to the fuel cell are tight and impervious.
If gas bubbles can be observed in the electrolyser, a rubber tube to the fuel cell might be leaky.
The fuel cell might have dried up if the Science Kit has not been in operation for more than 2 months. In this case, use a wash bottle to introduce a few drops of distilled water into the oxygen inlet.
Continuous operation may lead to surplus water in the fuel cell. It can be poured out through the gas nozzles on request.

All other faults and irregularities can only be remedied by heliocentrinis.

Please notify your dealer in such an event by telephone or by fax.

Many questions can be clarified by phone. A decision can then be still taken on whether the Science Kit or individual parts of it need to be sent in for repair.
6.7. **Closing Down Operation**

1. Switch off the light source (if in operation) and allow the light source and the solar module to cool down sufficiently.

2. Switch the load-measurement box “OFF”.

3. Remove all cables and tubes.

4. Pour the distilled water out of the electrolyser. To do this you must first disconnect the tubes from the outlets. You can now pour the water out through the gas outlets.

5. Store all the components in their designated compartments in the storage container. Check the packaging instruction on the storage container.

6. Store the hydro-Genius™ Solar Hydrogen Technology Science Kit in a safe place that it is protected against unauthorised access.

6.8. **Closing down operation in an emergency**

Proceed as follows in the event of unexpected operating conditions:

**Plastic parts deform because the minimum distance of the lamp has not been adhered to.**

Switch off the lamp.

Allow the model to cool down before you or anyone else touches it.

Proceed as indicated in section 6.7.

**Leaking hydrogen ignites**

Immediately remove the current-supply cable from the electrolyser to stop hydrogen production.

Initiate all necessary fire fighting measures.

Immediately ensure that everyone keeps a safety distance of at least 10 m from the model.

After a waiting period of at least 10 minutes, approach the model with suitable protective clothing (protective goggles!), and close down operation of the model according to section 6.7.

In all the cases specified here, send hydro-Genius™ Science Kit in to the manufacturer to be checked before starting up again.
7. Maintenance and Servicing

7.1. Safety Precautions

Make sure that all rubber tubes and cables are correctly fitted after maintenance work.
Follow the security advice in section 2.

7.2. Cleaning

Use only clear water or a special acrylic glass cleaner to clean the components of the Science Kit.
No liquid must be allowed to enter the components.
Be sure to avoid all contact with solvents.
When cleaning, be careful to not damage the components by using too much force.

7.3. Maintenance

Refilling the Electrolyser with distilled water

If the filling level on the oxygen side of the PEM electrolyser falls below the 10 ml mark, it has to be refilled with distilled water. Proceed as described in section 5.2. If necessary, the filling level on the hydrogen side must be reduced to the 10 ml mark by pouring out water.

Replacement of the batteries inside the Load Measurement Box

If the numbers on the LCD displays are no longer properly visible, the batteries of the load measurement box must be replaced.

Proceed as follows: Remove the four screws on the front cover of the housing. Carefully raise the front cover. Remove the batteries from their compartments.

Place batteries of the same type (9 V energy bar, see section 3.2) into the compartments.

Tighten the four screws to secure the front cover.

Replacement of the battery inside the Stop Watch

If the numbers on the stop watch display are no longer properly visible, the round cell batteries must be replaced. You will find the battery compartment on the back of the stop watch.

Open the cover by pushing in the direction indicated by the arrow and remove the round cell batteries. Insert round cell batteries of the same type (see section 3.2) into the battery compartment, checking correct polarity. The positive terminal "+" should be on top.

Dispose your used batteries in an ecologically responsible way.
8. Warranty and Complaints

The guarantee period for the hydro-Genius™ Solar Hydrogen Technology Science Kit is 6 months.

The guarantee period begins on the day of delivery and only covers faults that occur in the context of proper use through no fault of the operator.

Warranty claims shall be deemed invalid if:

1. the customer caused the damage by maloperation.
2. the equipment has been arbitrarily repaired or manipulated.
3. the customer has neglected his/her duty of supervision, and damage has been caused by third parties.

Your dealer shall be liable for damage caused during delivery to the customer and shall ensure replacement in the event of damage.

The customer shall bear the risk and costs in the event of complaint and the return of the Science Kit for repair, and must ensure proper and safe packaging.

In all cases of questions, please contact your dealer.