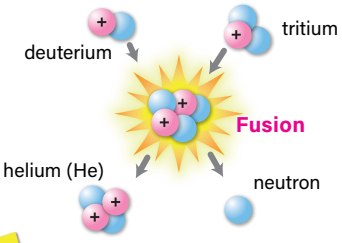
National Institutes for Quantum Science and Technology
ITER Japan Domestic Agency
fusion.qst.go.jp/ITER/

ITER paper crafts can be downloaded from the website

Sustainable Energy
What is Fusion?

Fusion—the source of power for the stars in the universe, including the Sun—is the process by which hydrogen nuclei collide at incredible speeds and "fuse" into heavier atoms, releasing tremendous amounts of energy in the process. On Earth, however, fusion reactions are most easily replicated by fusing isotopes of hydrogen (deuterium and tritium) at high temperatures.



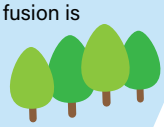
The 4 tenets of fusion

POINT 01 — Virtually inexhaustible fuel resources

The fusion fuel, deuterium and lithium, are readily extracted from sea water and provide a secure source of energy. The fuel is considered to be inexhaustible.

POINT 02 — Environmentally friendly

Fusion doesn't emit carbon dioxide or other greenhouse gases into the atmosphere and doesn't produce high-level radioactive waste. All waste generated by fusion is low-level and can be safely managed.



POINT 03 — Inherently safe

If any disturbance occurs, the plasma cools within seconds and the reaction stops with no risk of a meltdown. Tritium is used as a fuel but the techniques for the safe storage and handling of tritium are well developed, and ITER has been designed with strict safety measures to ensure containment.

POINT 04 — Power generation efficiency

Can generate a lot of electricity with little fuel.

What is"the ITER Project"?

The ITER Project is an ambitious energy project of unprecedented scale and involves more than 30 countries collaborating under the ITER Agreement.
The goal of the ITER Project is to demonstrate the scientific and technological feasibility of fusion energy for peaceful purposes.
Together, the ITER members—China, the EU, India, Japan, South Korea, Russia, and the US—represent more than half of the world's population and more than 85% of the global gross domestic product.

The ITER site (180 hectares in size) in Saint-Paul-les-Durance in southern France, where ITER is being built.

QST-ITER Japan Domestic Agency

The ITER Agreement mandates that the parties, through their respective domestic agencies, procure and deliver approximately 90% of the ITER components to the ITER site. Designated as Japan's domestic agency for the ITER Project,
QST is in charge of manufacturing and delivering commissioned components and equipment, such as the superconducting coils.
QST also serves as a liaison and coordination office for dispatching Japanese personnel to contribute to the ITER Project.

The ITER tokamak

ITER is a doughnut-shaped vacuum chamber, which allows for sufficient temperature, pressure, and confinement time to create a plasma in which fusion can occur.
This superheated plasma, the fuel for the fusion process, is electrically conductive, and can thus be manipulated by electrical or magnetic fields.
Think of iron filings in the presence of a magnet, except in ITER's case, the magnets are giant superconducting coils
that surround, shape, and confine the plasma.

Main specifications of ITER

Plasma Major Radius	6.2 m
Machine Weight	23,000 t
Fusion Power	500 MW

The 3 Goals of ITER

GOAL 01 — Demonstrate a burning (self-heating) plasma

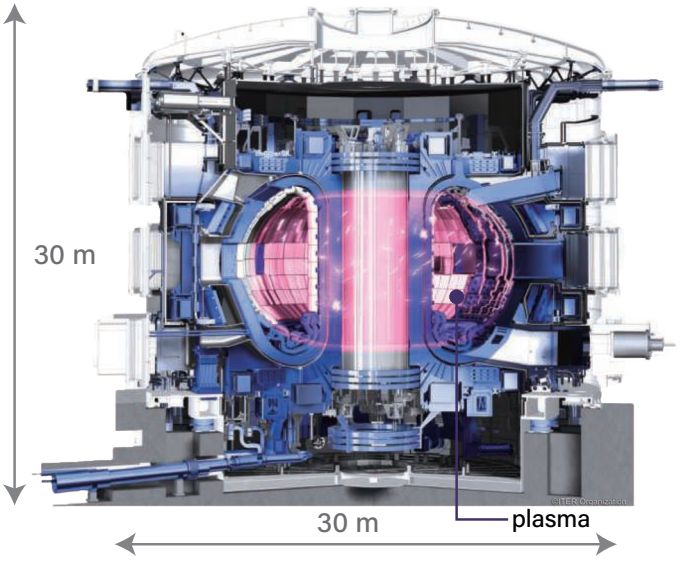
ITER has been designed for high fusion power gain.
For 50 MW of power injected into the ITER machine via the systems that heat the plasma it will produce 500 MW of fusion power for periods of 300 to 500 seconds.
This tenfold return is expressed by Q ≥ 10 (ratio of heating input power to thermal output power).

GOAL 02 — Demonstrate the integrated operation of technologies for a fusion power plant

Scientists can study plasmas under conditions similar to those envisaged in a future power plant and test technologies such as heating, control, diagnostics, cryogenics, and remote maintenance in an integrated way.

GOAL 03 — Recovery of heat energy and tritium breeding tests

Scientists will conduct experiments for extracting heat from the fusion energy generated by burning plasmas.
In later stages of ITER operation, tritium breeding tests will aim to demonstrate the feasibility of producing tritium within the vacuum vessel.



QST
National Institutes for Quantum Science and Technology

1/300 scale model

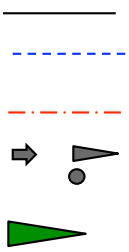
How to assemble ITER paper model

ITER JAPAN
ITER Japan Domestic Agency

Things to prepare （No glue or tape needed）
- Thick printing paper（Thickness 0.2mm and over recommended*）
- Box cutter・scissors（Please handle with care）
- A cutting mat（or card board）
- Something sharp-pointed e.g. used ball point pen etc. (This is for making deep creases in folding lines to make it easier to fold)
- A ruler

ITER paper model can be downloaded from ITER Japan Website: www.fusion.qst.go.jp/ITER/

Line and mark

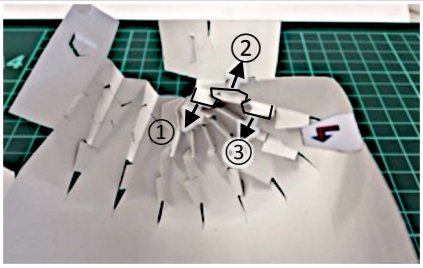


Cutting line
Mountain fold line
Valley fold line
Insertion & Hooking slit
Cut-off
（Please match the color for insertion & hooking slit）

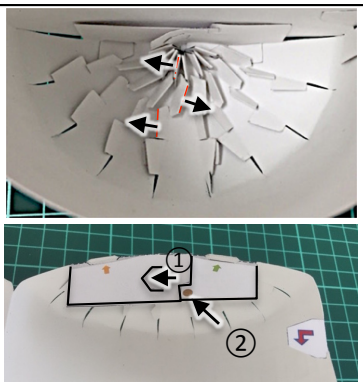
①Print out on thick printing paper
②Cut out along the cutting lines by box cutter or scissors.
③Put ruler along the fold line(mountain or valley) then trace along the line using a used ball point pen, etc.
④Assemble the 3 parts as shown below.
⑤That's all for completion. If you want to know the name of facilities, please attach the facilities explanation card to the front part.
（Underlined explanations are important: key to success!）
- Target ：12 years and up（difficulty: ★★★(high)）
- Time required：1～2hours for adults

1. Assembling ITER main body

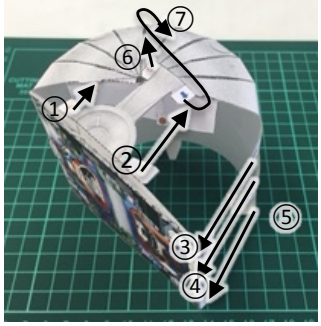
Fold along the fold line after making trace line firmly using used ball point pen, etc.



From inside, 3 folding parts should be folded alternately as shown in the photo ①、②、③. Repeat this for rest of the part. Make a dome shape referring the front photo.

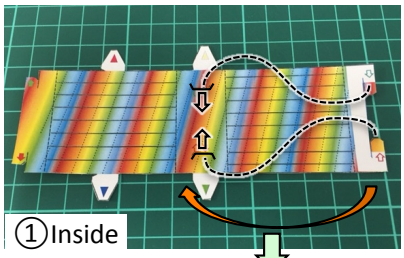


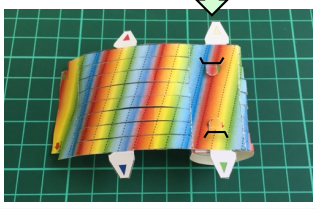
After making dome shape, insert part ① to its slot and fix it by hooking slit②.



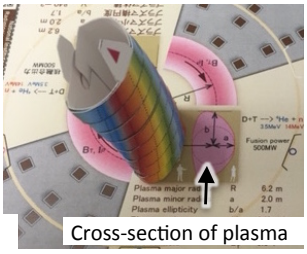
Put the part into the corresponding slot in order from ①to ⑦. For ③④, slide lower to fix in place after insertion. For ⑤fix it by hooking slit.

2. Assembling Plasma

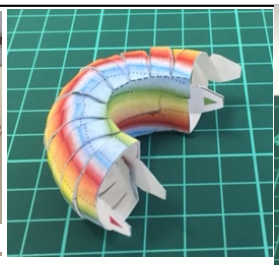




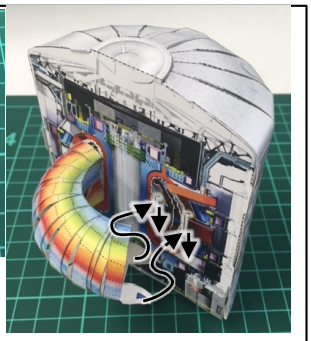
Put ① into the slot from inside. Put ② into the slot from outside



Make vertically long shape referring to the cross-sectional figure on the base.（It might be easier if you use ball point pen, etc.）

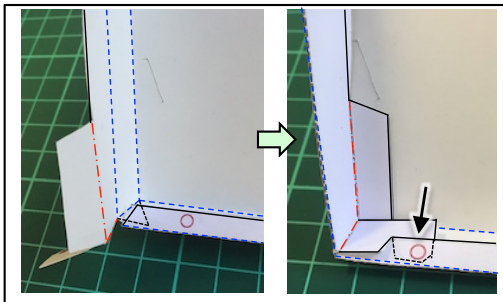


Expand evenly, forming a semi-circle. Shape the plasma so that the inside and outside comes out alternatively.



Insert this into the main body then slide lower to fix in place.

3. Assembling the base and final installation



Fold along the folding line. After that, put the hooking slit into folded part as above photo to fix in place (4 positions)

（Above） Fix the ITER main body into the base, then slightly shift it in the right direction(4 positions). You can choose the English version by fixing it onto the opposite side of the base.
（Right） You can put an LED light inside the plasma part after completion.
Please try various ideas and have fun with it!!