» Multi-model Creation

Engino® Engino®

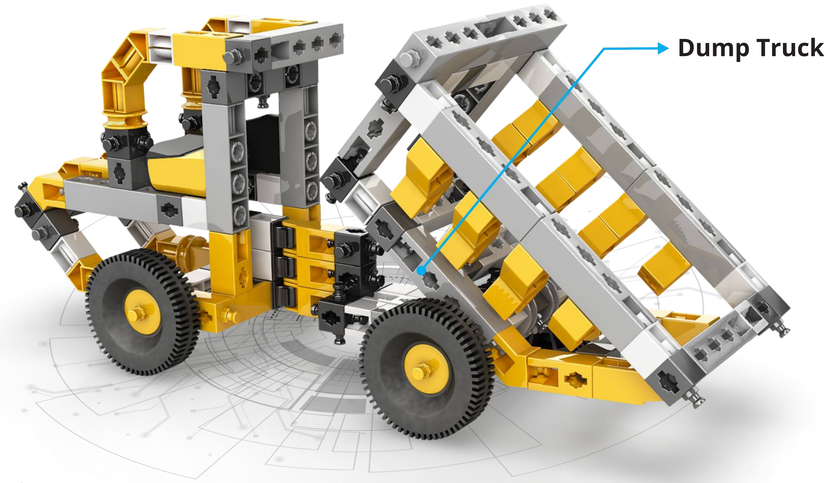
INVENTOR® excavator MECHANICS

7+ Appropriate Ages

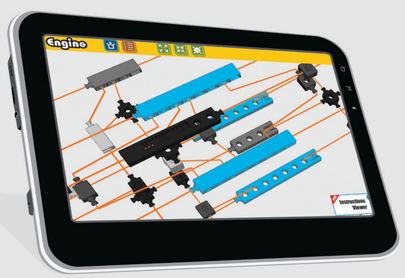
3 Years Warranty

Free 3D Viewer App

Extraction Tool
For easy disassembly of small parts



» More Models Online



A Use your PC or tablet and go to the following link for more models:

www.engino.com/instructions/in40

B Download the app to discover step-by-step instructions in 3D view!

Engino kidCAD (3D Viewer) app:

GET IT ON Google Play | Download on the App Store

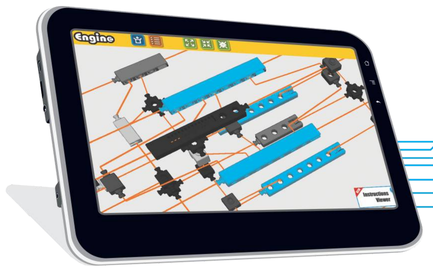
STEM ENABLED

Made in EUROPE

5 BONUS MODELS

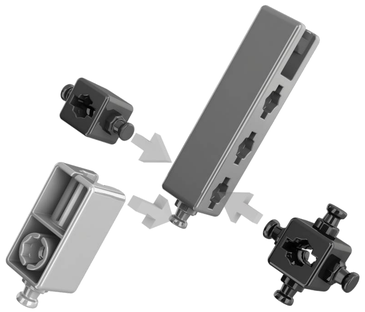
2 models — printed instructions (included)

3 models — online 3D instructions



- 3D INTERACTIVE INSTRUCTIONS
- BUILD
- PLAY
- LEARN
- INVENT

STEM ENABLED

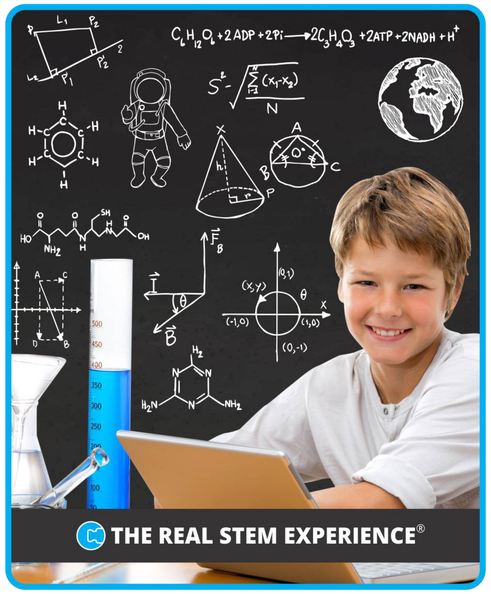


SNAP-FIT SYSTEM

All rights reserved. Photos non-binding. One model can be built at a time. Retain the box for future reference. Colors may vary. WARNING CHOKING HAZARD: Contains small parts. Not suitable for children aged 3 years and under.

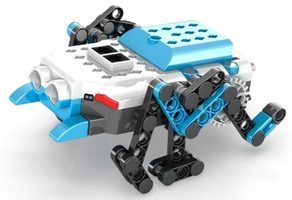
Technology Explained

This new INVENTOR Mechanics range has been developed to inspire children of ages 7-14, to follow STEM careers and develop 21st century skills such as problem solving and critical thinking. The multi-theme approach motivates children to construct a model they can relate to, while the ability to build many different models from the same set enhances creativity and engineering design thinking. INVENTOR Mechanics includes a range of new, highly technical parts that help create fully functional models and learn about various technologies. The top of the range is GINOBOT, a unique robotic vehicle with built-in sensors and Bluetooth which is fully programmable with simple-to-use coding software!



Some more advanced products of INVENTOR range:

IN51



IN90

Visit www.engino.com to find out more details!

Did you know?

Did you know for example that Tractors are big tug vehicles which are used mainly for gathering and moving heavy objects? These machines are commonly called heavy-duty vehicles and are mostly used in earthwork operations such as large constructions and development of public transportation infrastructure. Their functionality is based on applying mechanical advantage of Simple Machines and the usage of hydraulic systems. Tractors also offer valuable services in agriculture and farming, replacing the work of animals. Tractors are so important to mechanical farming that mass food production could not have existed without them!

STEM Levels

Construction Levels:

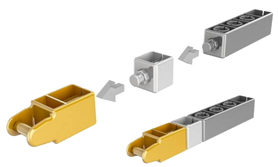
Building	Mechanics	Motors	Coding
Level 1 2	Level 1 2	Level 1 2	Level 1 2

Learning Levels:

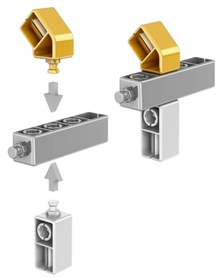
Theory	Quiz & Exercices	Experiments	Open projects
Level 1 2	Level 1 2	Level 1 2	Level 1 2

Building System

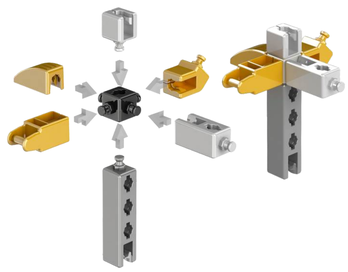
1 Building in one direction



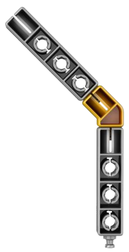
2 Building in two directions



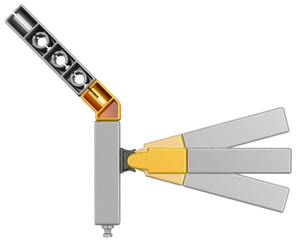
3 Building in three directions



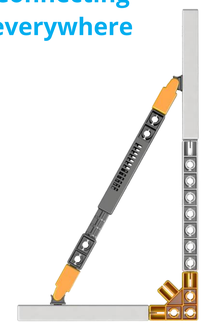
4 Connecting in fixed angles



5 Connecting in every angle



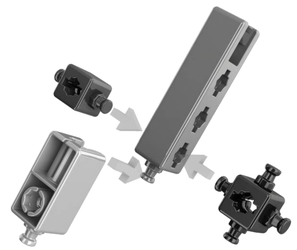
6 Connecting everywhere



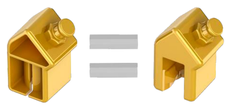
List of Materials

Building Tips

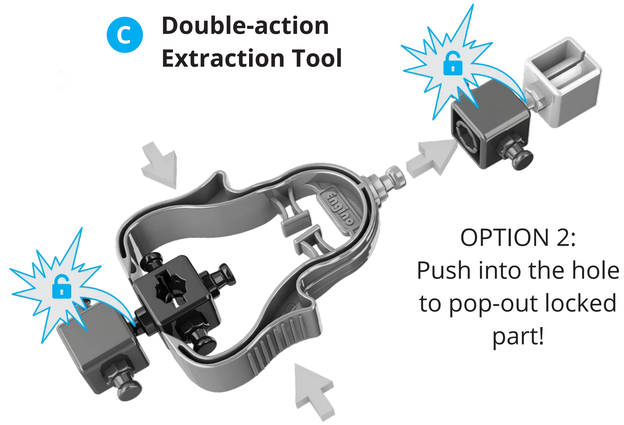
A



B



C Double-action Extraction Tool



OPTION 2:
Push into the hole to pop-out locked part!

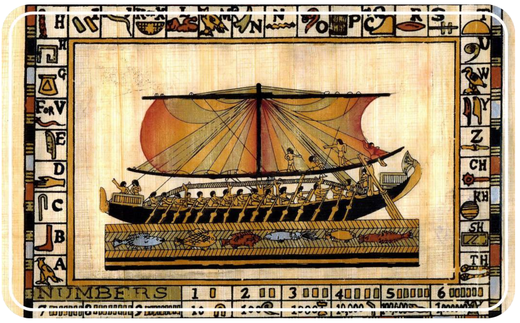
OPTION 1:
Squeeze the tool to disassemble small parts!

Theory

What we will learn

Tractors are big tug vehicles which are used mainly for gathering and moving heavy objects. An excavator is a piece of heavy construction equipment. Excavators are used to dig in the ground or to move large objects.

Have you ever wondered what are the excavators and what are they used for? What is the Pascal's law? What are the hydraulic machines? Read through the pages to gain useful information and amazing facts about these vehicles. Folllow the building instructions to build your own models. Finally, take the quiz to test your newly acquired knowledge.



History of fluid mechanics

Ancient civilizations were established close to locations where water supplies were abundant, such as rivers and seas. Without any mathematical knowledge and using only empirical conceptions, they were able to build structures to protect them from river overflows. They also developed simple rafts to cross the seas and exchange goods with neighbours.

Pascal's Law

One of the most important contributions in the field of fluid mechanics was done by Blaise Pascal, a French physicist and mathematician. Just at the age of 16, Pascal showed his outstanding abilities in mathematics by deriving his very first theorem. His interest in physics was mostly focused on fluids and pressure. His findings set the foundations of fluid dynamics. Pascal was experimenting on measuring the precise value of atmospheric pressure.

Blaise Pascal (1623 - 1662)

In fact, he was the first who demonstrated that it can vary from place to place and explained the variation due to altitude difference. The fundamental principle, called as Pascal's law states that "when a pressure change occurs in one part of a fluid, it is transmitted without loss to every portion of the fluid and to the walls of the container".

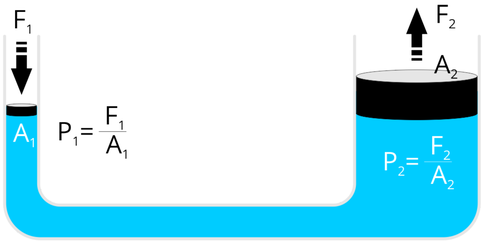
Hydraulic machines

A major application of Pascal's law are the mechanical properties of fluids when compressed by pistons. This branch of physics is called hydraulics and has multiple applications in engineering. Examples of machines which use such systems are car breaks, construction vehicles, forklifts and industrial arms.

Hydraulic pressure pipes system

Hydraulic press

A very important advantage of hydraulic machines is that they provide an efficient method of multiplying forces. Small forces can be amplified and used to move heavy objects. A basic design of such a device, called hydraulic press, is constituted of a tube that has two apertures of different diameters and a fluid filled inside.



A typical hydraulic press

Due to Pascal's law the pressure should be equal at both sides. Thus when a force pushes the piston on one side, the same pressure will be transferred to the other one. The difference in the area between the two sides is working as a force magnification!

$$F = F1 \times (A2/A)$$

F = Income force
F = Outcome force
A = Area of small piston
A2 = Area of large piston

Formula for hydraulic press

Did you know?

When we watch an iceberg floating in ocean, we actually see only 10% of its natural size. The rest lies below the sea surface! This happens due to water's strange behaviour when freezing. While the majority of liquids lessen their volume as they freeze, water expands. Therefore, ice has 10% lower density compared to liquid water.

An iceberg is hidden below the sea

Fluid Mechanics

We are all familiar with the 3 states of matter, which are solids, liquids and gases. A common characteristic between liquids and gases is the fact that they can flow and change shape according to the volume in which they are placed. The ability of a material to flow is essentially the reason to be called as a fluid. The brunch of physics which studies the behaviour of fluids is called fluid mechanics. When studying a fluid in motion, the field is called fluid dynamics.

Fluids in nature

To appreciate the field of fluid dynamics we only have to look around us. Consider that nearly 70% of the Earth is covered by water, while all of its atmosphere is gaseous. Ocean circulation patterns and weather forecast is achieved due to the understanding of how fluids move. From a biological viewpoint, our bodies are mostly made of fluids and all cellular activities involve fluids.

Underneath the surface of our planet lies a very hot fluid, called lava. This glowing hot fluid is essentially rock, which has melted due to the high pressures and temperatures that occur in the interior of Earth. Geologists need to apply the laws of fluid dynamics to predict and understand the process of a volcanic eruption.

Let us leave the Earth and ponder at our vast Universe. A spiral galaxy is mostly made of hydrogen gases. To understand the motion of a spiral arm, astrophysicists have to apply laws of fluid dynamics. In addition, stars are made of extremely hot gases. The physical processes that undergo both in the interior and on the surface of stars, are understood by applying the principles of fluid mechanics.

Quiz

Exercise 1:

a) A force of 500N is applied on the small piston (left one) which has an area of 0.2m2. Calculate the upwards force which is acted from the big piston, if it has an area of 5m2.

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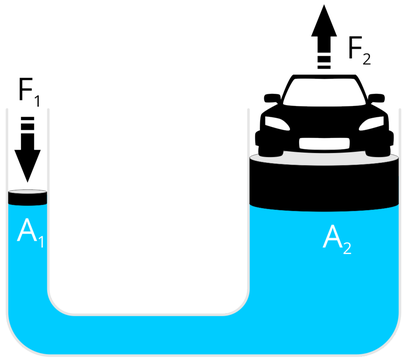

b) Would such a configuration be able to lift up a car that weighs 10,000N and is placed on the big piston? Explain the reasons of your answer.

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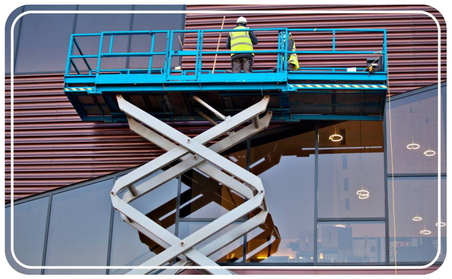
Exercise 2:

The images below show some machines and mechanisms. Can you identify which of them show hydraulics? Place a tick to the correct box.



Folding platform ☐

Catapult ☐

Lever ☐

Excavator ☐