



WATER POWER

GREEN ENERGY



7323

165 PCS



8+

15 MODELS TO BUILD

BUILD YOUR OWN PRESSURE-POWERED ENGINES AND LEARN ABOUT THE LAWS OF PHYSICS!

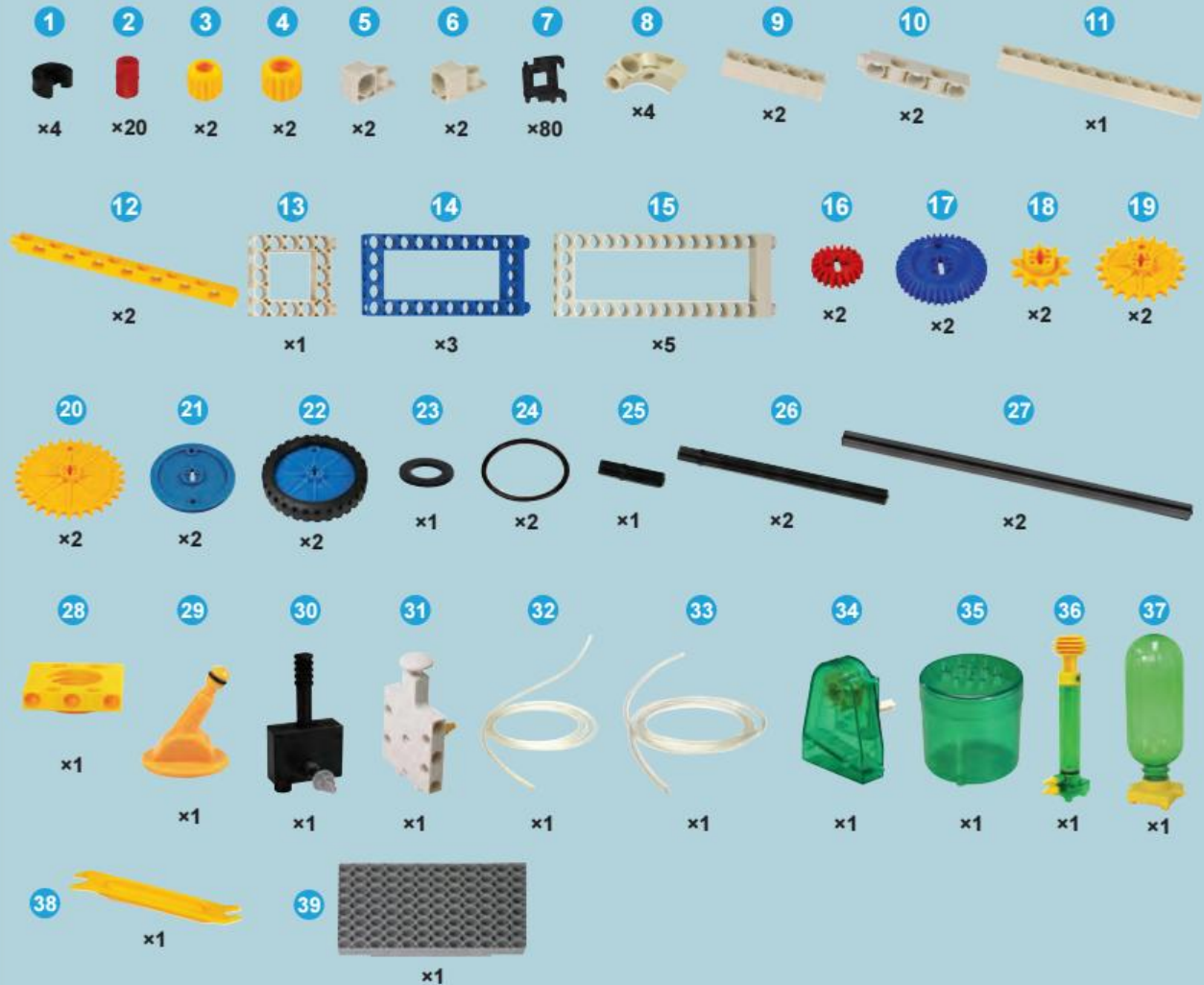
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Important Information

- Please read these instructions carefully before you begin, follow the safety guidelines and keep them for reference. We recommend making the models in the order given. This will help you understand how the parts are assembled; you will then be able to invent many more models.
- This kit is for children over 8 years of age. It was designed to help children discover water power and how it can create energy while making a variety of models.
- Make sure children follow the safety guidelines and understand the possible risks involved before starting to build these models.
- Cleaning:
 - Wipe clean with a damp cloth only.
 - Never use detergent.

PARTS LIST



Checklist : Find - Inspect - Check Off

No.	PARTS NAME	PCS	Item No.
1	C-AXLE FIXING	4	3620-W10-A1D
2	C-LONG PEG	20	7061-W10-C1R
3	C-S SECURITY NUT	2	1156-W10-J1Y
4	C-L SECURITY NUT	2	1156-W10-N1Y
5	C-LATERAL CONVERTER	2	7061-W10-J1SK
6	C-FRONT CONVERTER	2	7061-W10-J2SK
7	C-CHAIN	80	3569-W10-B1D
8	C-BENDED ROD	4	7061-W10-V1SK
9	C- 5 HOLE ROD	2	7413-W10-K1SK
10	C- 5 HOLE DUAL ROD	2	7026-W10-S1SK
11	C-11 HOLE ROD	1	7413-W10-P1SK
12	C-15 HOLE DUAL ROD	2	7413-W10-H1Y
13	C-5X5 FRAME	1	7026-W10-V1SK
14	C-5X10 FRAME BOTTOM CLOSED	3	7413-W10-I1D
15	C-5X15 FRAME	5	7413-W10-J1W
16	C-20T GEAR	2	7026-W10-D2R
17	C-40T GEAR	2	7026-W10-E2B
18	C-10T CHAIN GEAR	2	3569-W10-D2Y
19	C-20T CHAIN GEAR	2	3569-W10-D1Y
20	C-30T CHAIN GEAR	2	3569-W10-C1Y

No.	PARTS NAME	PCS	Item No.
21	C-OD53 PULLEY	2	7344-W10-N1BB
22	C-RACING TIRE	2	1115-W85-F2B
23	C-O RING	1	R12-05
24	C-OD56 O-RING	2	R12-09S
25	C-30mm AXLE III	1	7061-W10-A1D
26	C-100mm AXLE III	2	7413-W10-L1D
27	C-150mm AXLE I	2	7026-W10-P1D
28	C-STORAGE CAP	1	7323-W10-B1Y
29	C-NOZZLE	1	7323-W85-C1Y
30	C-SECURED ONE-WAY SWITCH	1	1155-W85-I3DN
31	C-CAR LAUNCHER	1	7323-W85-D1W
32	C-1200mm TUBE B	1	1155-W85-120
33	C-2000mm TUBE A	1	1155-W85-200
34	C-AIR-WATER POWER PACK	1	1155-W85-H1G
35	C-RECYCLED WATER STORAGE	1	7323-W86-C
36	C-SECURED PUMP	1	1155-W85-D2GN
37	C-SECURED AIR-WATER STORAGE	1	1155-W85-B2GN
38	B-PEG REMOVER	1	7061-W10-B1Y
39	C-BASE GRID	1	7125-W10-A1SK

Learning about Gears

Every transmission system contains gears. A gear is a useful and important transmission component, as it is a transmission method that applies to two shafts, or between a wheel and a shaft.

You can observe the transmission of meshing gears inside old toys or old clocks. There is a gearbox within the transmission system of cars, which combines meshing gears of different sizes. In this way, to change among different speeds becomes easy.

Do you know how gears work? Please carefully read the descriptions below. You will learn the secrets of gear trains from the world patent Gigo GEARS. The design of Gigo scientific educational building blocks (that is, Gigo SCIENCE-TOOL KIT) is based on the number of 10 and its multiples; whether on the size of the components, the distance between the holes, or the unique Gigo gear tooth number. Therefore your child will be able to not only correctly assemble the gears, but also conveniently calculate the gear ratio or change the rotary speed. Different from other gear designs adopting the number of 8 or 7 as their fundamental number, Gigo gears are created with perfect designs for the use of scientific teaching, and express the care on children and passion for scientific education.

We suggest a gradual learning with Gigo gears which starts from the basic structures to understand the combinations of each component. Once you finish your practice following the examples in this instruction, and possess the fundamental concepts of gear trains, you can put your unlimited creativity into action and create various vehicles or airplanes on your own. Let's enjoy the pleasure of creativity!

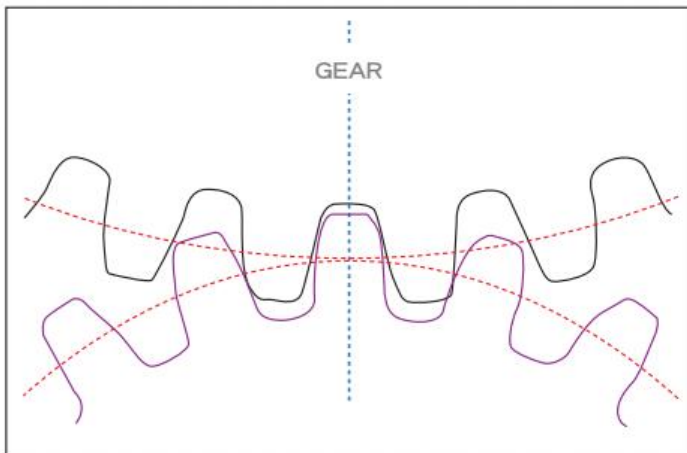


Fig.A The intermeshing of gears can effectively transmit rotation. The red circle represents the actual diameters of the transmission, which is called the pitch diameter.

The meshing of the teeth assures the power transmission along the pitch.

The wheel which has many tooth-shaped objects sticking out of the rim with the same size is called a "gear". Two gears can mesh with each other with the teeth on the rims. When a gear rotates, the other one will be driven to rotate as well. The intermeshing teeth of the two gears transmit rotation and torque.

A simple gear train uses two gears with the same or different sizes. If one of these gears is attached to a motor or a crank, it takes the role as the driver gear. The gear that is turned by the driver gear is called the driven gear. Gears are used to increase or decrease the speed or the power of rotary motion. The mechanism of changing the speed or power is called the gear ratio (speed ratio).

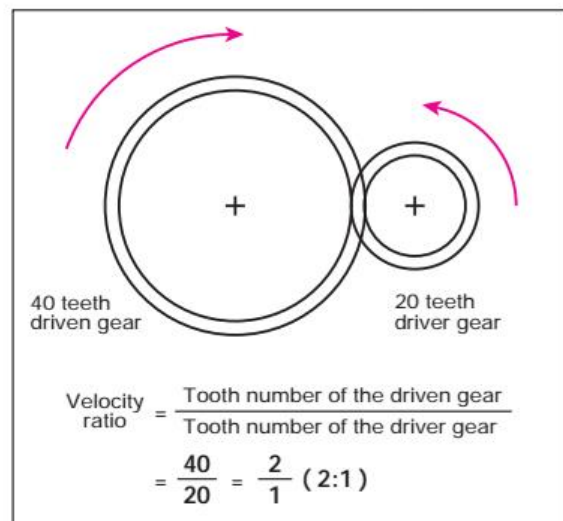


Fig.B Gear ratio calculation

The number of teeth between the big gear and small gear is different. Despite the teeth number or size of the gears, the teeth of the gears in the same gear set should have the same size. In simple gear trains, the driver and driven gears will rotate in opposite directions. When a third gear is inserted between the driver gear and driven gear, and makes them rotate in the same direction, it is called an idler gear.

The world patent gears designed by Gigo come in 5 different types: 20T, 40T, 60T, 80T, and 160T, the extra large gears.

Each of Gigo gear sets contains both spur and bevel gears, "Spur Gears" (gear wheel to gear wheel) meshing in the same plane and regulating speed or direction of turning of the shafts and "Bevel Gears" (the rounded off sections on one edge of your gears in the set) meshed together to change direction at right angles to the initial turning plane of the gears and shafts (axles).

The tooth shape of Gigo gears shares the same specification of module pitch 1mm. Namely, the pitch diameter of the 20T gears is 20mm while the pitch diameter of the 40T gears is 40mm. The pitch diameters refer to the imaginary circles between the meshed gear teeth as shown in Figure E.

The secret of Gigo designs for gears is to place the distance between each hole based on 10 or the multiples. In Fig. E, the distance between the centers of the two gears is

$$R1 + R2 = \frac{20\text{mm}}{2} + \frac{40\text{mm}}{2} = 30\text{mm}$$

and therefore the two gears can be smoothly assembled or transmitted. Other sizes of Gigo gears are also designed with the same perfect concept, and their holes and gears can be greatly meshed and operated with each other!

※ According to the instruction above, can you figure out how many holes there are between the center of a 40T gear and the center of a 60T gear when they are meshed?

A: $\frac{40\text{mm}}{2} + \frac{60\text{mm}}{2} = 50\text{mm}$

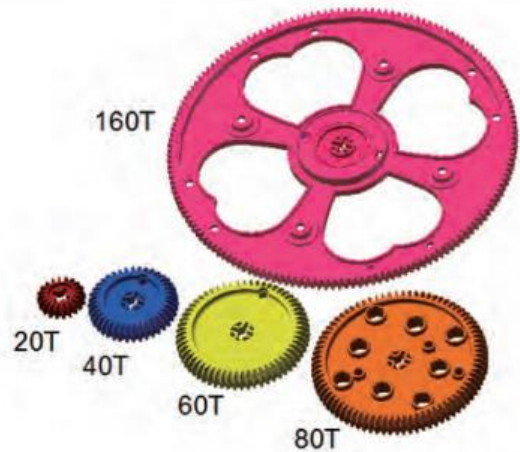


Fig.C
160T Gear is not included in this kit.



Fig.D
Gigo Gear

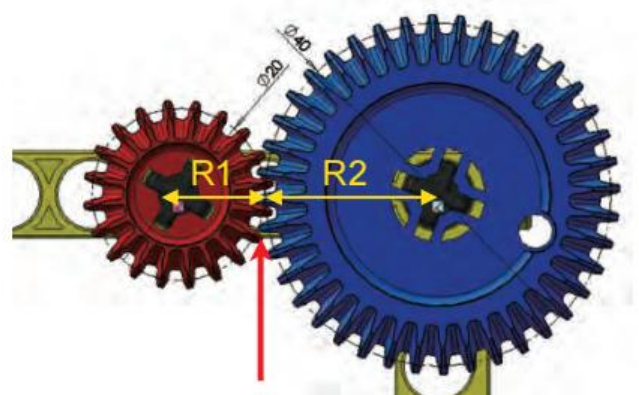


Fig.E
The transmission between the pitches during the intermesh of two gears.

Understanding gear transmission I

1. Use two red 20-tooth gears and two yellow 60-tooth gears to make this system.
2. How many times do you have to turn the small gear A in order to make the second large gear D turn once?
The small gear A turning the large gear B gives a 3 to 1 ratio as you found out on the table. The second small gear C is directly driven by the arrangement and produces another 3 to 1 ratio with the second large gear D. Did you find out that you had to turn the small gear A 9 times to turn the second large gear D once?
The overall gear ratio of the system is 9 to 1. (A gear ratio of 3 to 1 multiplied by another 3 to 1 = 9 to 1).
3. Add a third red 20-tooth gear to the short drive axle at (x). Why does it lock?
4. Add a blue 40-tooth and a red 20-tooth gear to the system. Can you work out mathematically what the gear ratio of system would be? Count the number of turns. Were you right?

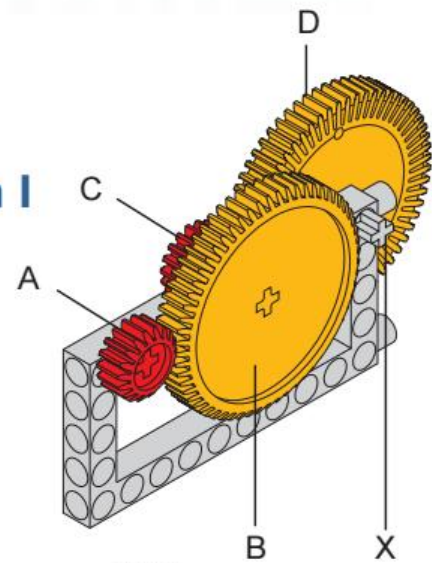


Fig.F

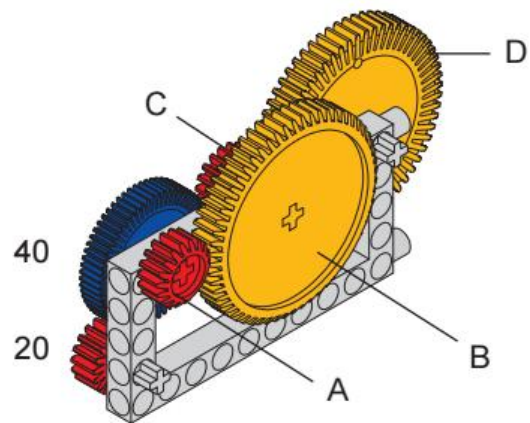


Fig.G

Understanding gear transmission II

1. This gear box uses a combination of red 20-tooth gears and yellow 60-tooth gears.
There are four pairs of red 20 and yellow 60-tooth gears. Each pair produces a gear ratio of 3 to 1.
The overall gear ratio would then be $3 \times 3 \times 3 \times 3 = 81$.
If gear B is turned 81 times then gear A would turn once. (Fig. H)
2. If gear A could be turned once then gear B would turn 81 times!
Could you add another pair of gears to make a ratio of 243 to 1?

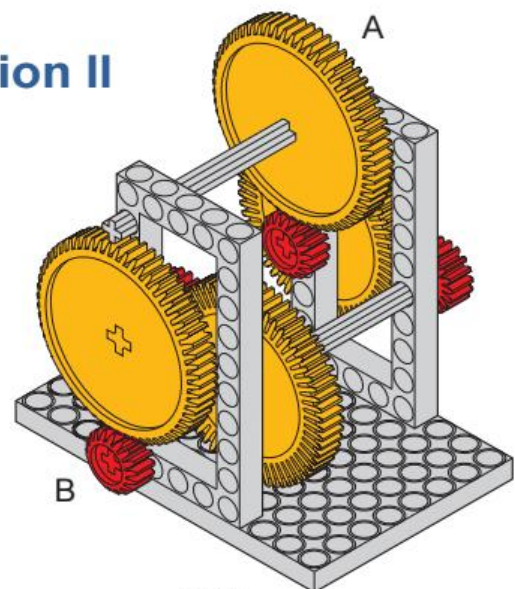


Fig.H

Learning About Chain Gears

1. The power transmission of chain gears depends on chains meshing with each other. The "working" diameters of the chain gears are about 10mm (10-tooth), 20mm (20-tooth) and 30mm (30-tooth).

When connecting chains make sure that they are neither too tight nor too loose so that the motion of one is transmitted efficiently to the other. If the lengths do not fit the required length, a little looser will work better than a little tighter, but be sure that the chains will not come off the chain gears.

This system can be found in normal bikes and escalators.

2. Connect a 10-tooth chain gear to a 30-tooth chain gear as shown.

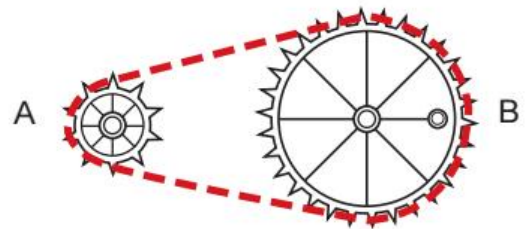
3. Use a pencil point, or something similar, to turn B.

Which way does A turn?

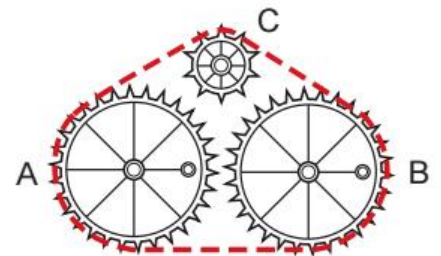
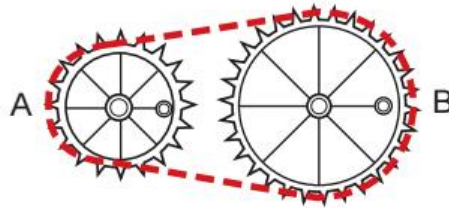
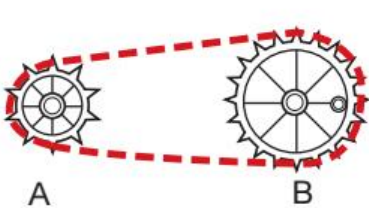
Would this be the same if A and B were two gears in mesh?

How many times would you have to turn A for B to rotate once?

The gear ratio of these two chain gears would be _ to _ ?



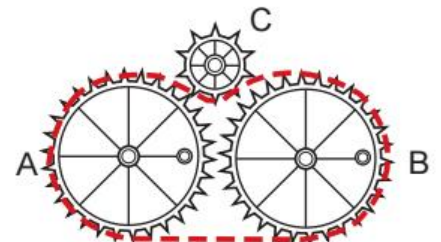
4. Repeat the experiment for the two other sets and make a table of your results for all three.



5. Try chaining a 10-tooth chain gear and two 30-tooth chain gears together. Turn A clockwise.

What happens?

Do all the gears turn in the same direction? Do they turn at the same speed?

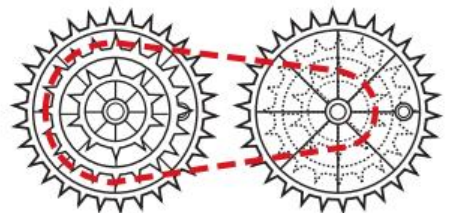


6. Try to chain the 10-tooth chain gear C as shown (on the external side).

Turn A clockwise. What happens?

Do all the gears turn in the same direction?

Do they turn at the same speed?



7. By connecting two sets of chain gears on one chain three speeds can be obtained.

This system is widely used in transmission bikes to add speeds.

Tips And Tricks For Model Building

1. The peg can be used to join rods and frames (Fig. 1).
2. Frames can be connected directly to each other end to end (Fig. 2).
3. Use the connector of the peg remover to pull the peg off (Fig. 3).

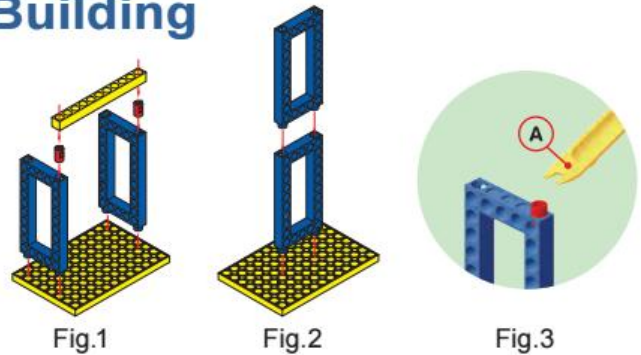


Fig.1

Fig.2

Fig.3

Fixing gears

Fixing gears to the frame

- When fixing the gears onto the frame with an axle, be sure to keep the right amount of space (about 1mm) between the gear and the frames to reduce friction. Try to turn the gear with your fingers and make sure that each gear can turn smoothly. The less friction the more efficient the power transmission (Fig. 4 & 5).

X (without a space)



Fig.4

✓ (with a space)



Fig.5

Axle fixing

- Axle fixings are designed to prevent a pulley or gear from moving along the axle, or slipping. They are easy to install without removing any other part (Fig. 6).



Fig.6

Lengthening axles

- Use a chain gear to connect two axles to extend the transmission (Fig. 7).



Fig.7

Arranging gear wheels in symmetry

- The gear wheels should be arranged in symmetry (the holes on the two opposite chain gear wheels must be kept in a horizontal line, see Fig. 8). Check that gears turn at the same speed, or the motor will stall and the vehicle won't move (Fig. 8).

TIP!
These two holes must be facing each other

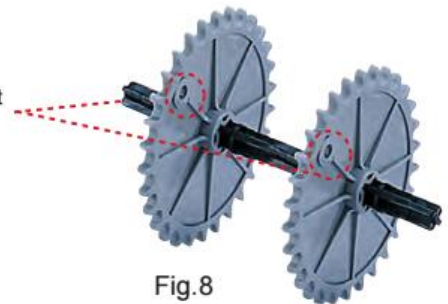


Fig.8

Meshing gears at 90°

- How do you mesh two gears at 90°? The gear on the axle must be assembled as close as possible to the outer end of the axle to achieve good mesh (Fig. 9).



Fig.9

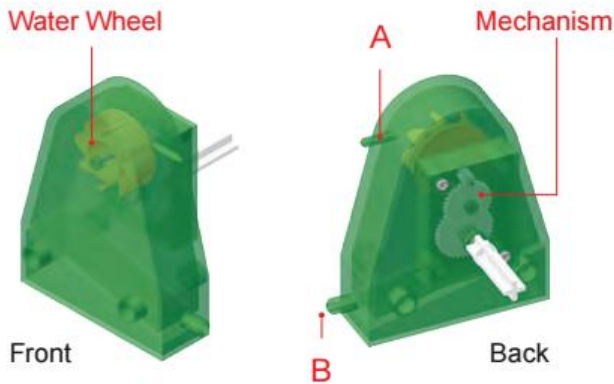
Connecting unit chains

- Ensure that all units are in the same direction when connecting them to one another as a drive chain so that transmission takes place efficiently and smoothly (Fig. 10).



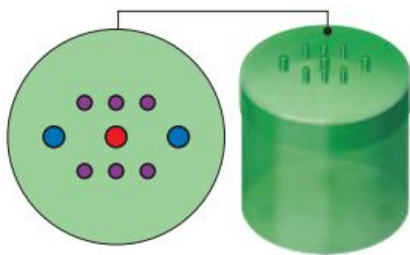
Fig.10

About The Main Components



Air-Water Power Pack

"A" is the entrance and "B" is the exit. Air and water enter the power pack through the entrance to strike the water wheel directly and drive the mechanism. The water then goes back to the storage tank and is recycled.



Recycled Water Storage

- Exit
- Hose B Entrance
- Hose A Entrance



Secured Pump

"A" is the entrance and "B" is the exit. The water in the Recycled Water Storage is driven by the Secured Pump and goes back to the Air-Water Storage. When the pump rod is pulled up, air and water flow into the Secured Pump through the entrance; when the pump rod is pushed down, water flows into the Air-Water Storage through the exit.

Secured Air-Water Storage

"A" is the entrance and "B" is the exit. Air and water in the Secured Recycled Water Storage flow into the Air-Water Storage through A and flow out through B.



Secured One-Way Switch

"A" is the entrance and "B" is the exit. When the switch rod is in the middle, the exit is closed, and air and water flow to the One-Way Switch. When the switch rod is turned toward the entrance, the exit is opened and the air and water flow out.



Assembly Guide

- Insert a 9.5cm/3.75in long tube A into the protruding hole on the reverse side of the lid of the Recycled Water Storage, and cut its other end on the bias (Fig. 11). Then attach the bias-cut end to the inside bottom of the storage so that water will easily enter the hose when pumping.
- The lengths of the hoses for the models given in this guide are for reference only. Be sure not to twist, compress or make them too tight (Fig. 12) so that water can go through them smoothly.
- Put a security Nut through a hose and screw it tightly before connecting the hose to a secured basic part (Fig. 13 & 14).
- Use a L Security Nut for tube A, and an S Security Nut for Tube B. The hoses may become stiff with time and easily come off the connected part after repeated use. The solution is to cut off about 1-1.5cm/0.4-0.6in from the stiff end. Be sure to wipe the connected part dry with tissue paper before connecting the hose again.
- The cut hoses can be used for different models.



Fig.11

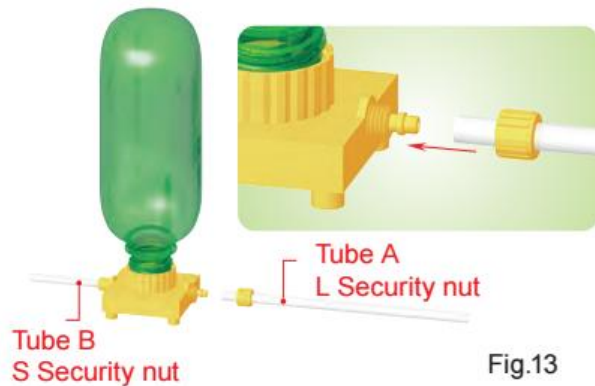


Fig.13

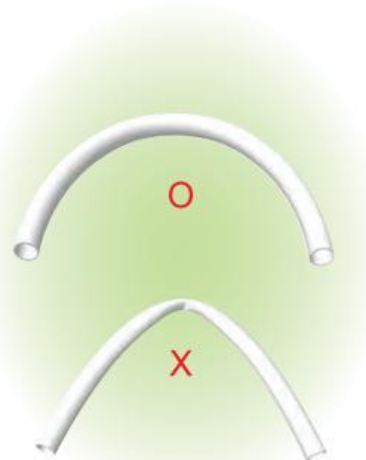


Fig.12

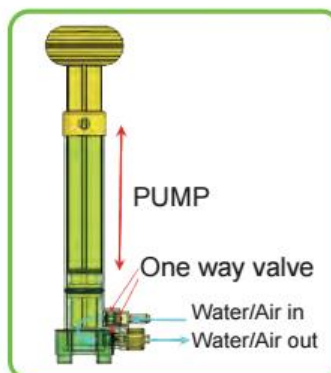
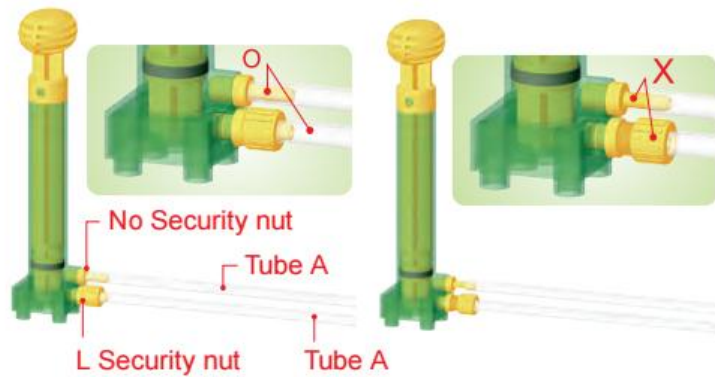


Fig.14

Operating Guide

- Make sure that all the hoses are attached in the right positions before pumping.
- Make sure that all the Switch Rods are positioned in the middle of the Switches (i.e. in a closed position as shown in Fig. 16) before pumping so that the pumped air/water does not escape.
- The Switch Rod should be snug to avoid air/ water leakage. It should fit snugly and not move easily.
- Check that the Air/Water Storage is screwed to the end (Fig. 15).
- Move the Pump from the model to the tabletop whenever you pump it and backer-connect it after you finish pumping (Fig. 17).
- The first 10 pumping is for pushing the water from the Recycled Water Storage to the Secured Air-Water Storage. Try to hold the pump rod up for 2-3 seconds before you push it down so that the most water can be driven into the pump cylinder in each pumping (Fig. 18).
- Pump no more or less then 50 times. If pumping over 50 times, the basic parts might be under too much pressure and become damaged. On the contrary, if pumping less than 50 times, the power might be too weak to lead to a smooth operation. The more the air is pumped into the basic part, the bigger the air pressure and the air power are caused ($PV=nRT$).
- Do not pull off the hose during operation or before all the water goes back into the Recycled Water Storage. This could potentially cause injury or property damage.
- If the hoses do come off during operation, stop the flow of water by moving the switch rod back to the middle. Be sure to wipe the hose opening dry before putting it back on again.
- Use the secured One-Way Switch to release the air/ water left in the Air-Water Storage before you put the models away.

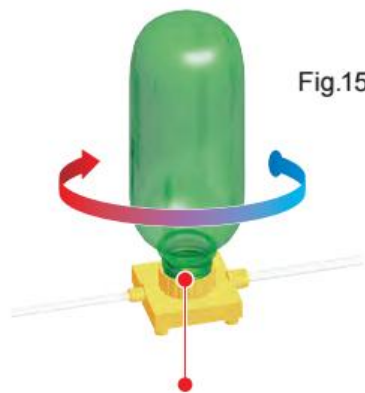


Fig.15

Screw Air / Water storage to the end.



Fig.16

In the closed condition.

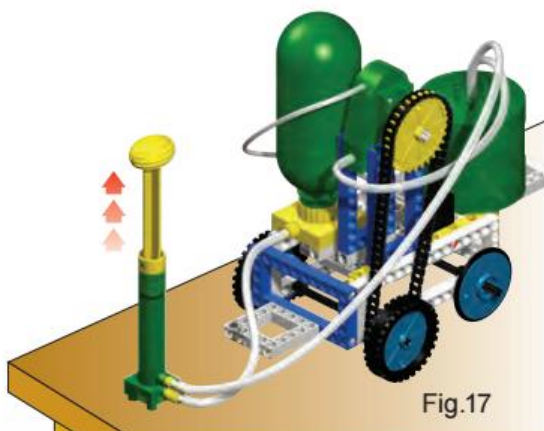


Fig.17



Fig.18

Hydro-Pneumatics

Principles :

Each time the Secured Pump drives the water from the Recycled Water Storage into the Secured Air-Water Storage, the water squeezes the entire air inside the Secured Air-Water Storage upward. Air is a gaseous compressible fluid; in other words, the volume of air can be reduced by compressing, whereas water cannot. When more and more water is added to the Secured Air-Water Storage, the water fills more capacity. Since the space within the Secured Air-Water Storage is limited, the water which eventually occupies increasingly more space compresses the air inside the Secured Air-Water Storage. As a result the pressure inside is much higher than the air outside the Secured Air-Water Storage. This high-pressurized air pushes the water within the Secured Air-Water Storage, such that the water pushes against the lateral sides of the storage and attempts to flow out to restore the pressure equilibrium.

Boyle's law:

For a fixed amount of gas kept at a fixed temperature, the product of the volume and pressure is constant.

$$P_1.V_1 = P_2.V_2$$

$$P_1/P_2 = V_2/V_1$$

As more air is compressed inside a fixed volume, the air pressure rises.

Pascal's Law: pressure exerted anywhere in a confined fluid is transmitted equally and undiminished in all directions throughout the fluid.

How much energy is stored within the Secured Air-Water Storage?

According to the experiment, when the Secured Pump draws water into the Secured Air-Water Storage and is then pumped for another 50 times, the value is approximately $3.5\text{kg/cm}^2 - 50\text{ PSI}$

Experiment:

You will need a pressure gauge to perform this experiment. Most hardware stores and home centers carry them.



1. In the beginning the value of the pressure gauge is zero.
2. Pump the water from the Recycled Water Storage into the Secured Air-Water Storage by evenly pressing the Secured Pump for about 10 times.
3. At this point, the pressure is approximately $0.9\text{kg/cm}^2 - 13\text{PSI}$



4. Each time the Secured Pump drives the water from the Recycled Water Storage into the Secured Air-Water Storage, the water squeezes upward all the air inside the Secured Air-Water Storage. Air is a compressible fluid, in other words, the volume of air can be reduced by compressing, whereas water cannot. When more and more water is added into the Secured Air-Water Storage, the water fills more and more capacity.

Since the space within the Secured Air-Water Storage is limited, the water that eventually occupies increasingly more space compresses the air inside the Secured Air-Water Storage. As a result the pressure inside is much higher than the air outside the Secured Air-Water Storage.



5. Pump the Secured Pump another 50 times. Pumping steadily to perform a completed stroke as long as you can: the value is approximately $3.5\text{kg/cm}^2 - 50\text{PSI}$.
The more air pumped into the remaining fixed space, the greater the air pressure inside.

Models with water-recycling system

Atmospheric pressure, which is all around us, can be written as:

1 atmospheric pressure (atm) = 76 cm-Hg (mercury)
 = 76×13.6 (density of mercury)
 = 1033.6 cm H₂O (water)
 = 10 m-H₂O

3.5kg/cm² of compressed air is thus equal to 3.5 atm (about the height of a 10-story building). Do you understand why the energy stored through air pumping within the pressure storage tank can push and run your models?



How to operate

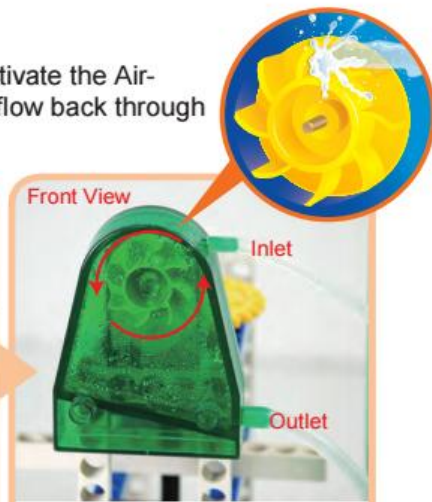
1. Pump the Secured Pump about 10 times to get all water from Water-Recycled Storage into the Secured Air-Water Storage and keep pumping another 40 times to compress the air in the Secured Air-Water Storage.
2. Then turn the rod of the Secured One-Way Switch to open it.
3. The released water will strike the blades of the water wheel to activate the Air-Water Power Pack and drive the mechanism behind it, and then flow back through the exit to the Recycled Water Storage to be used again.



Step 1 Pump 50 times.



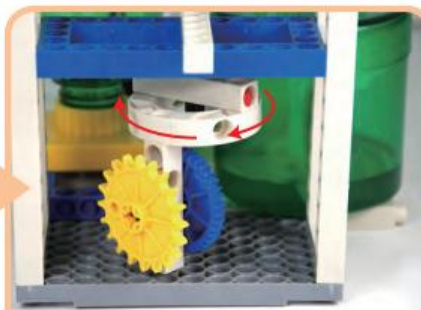
Step 2 Turn on the switch.



Step 3 Activate the Air-Water Power Pack Back.



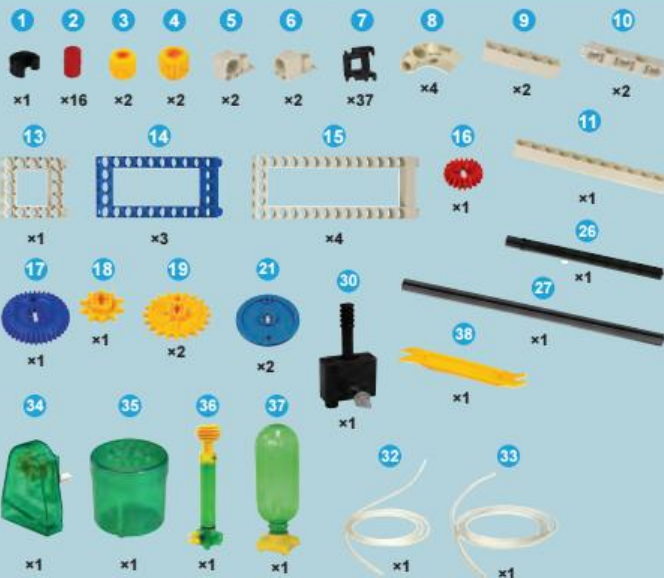
This activates the mechanism.



The grinder works!

Cutting Machine Model 1

Parts Needed



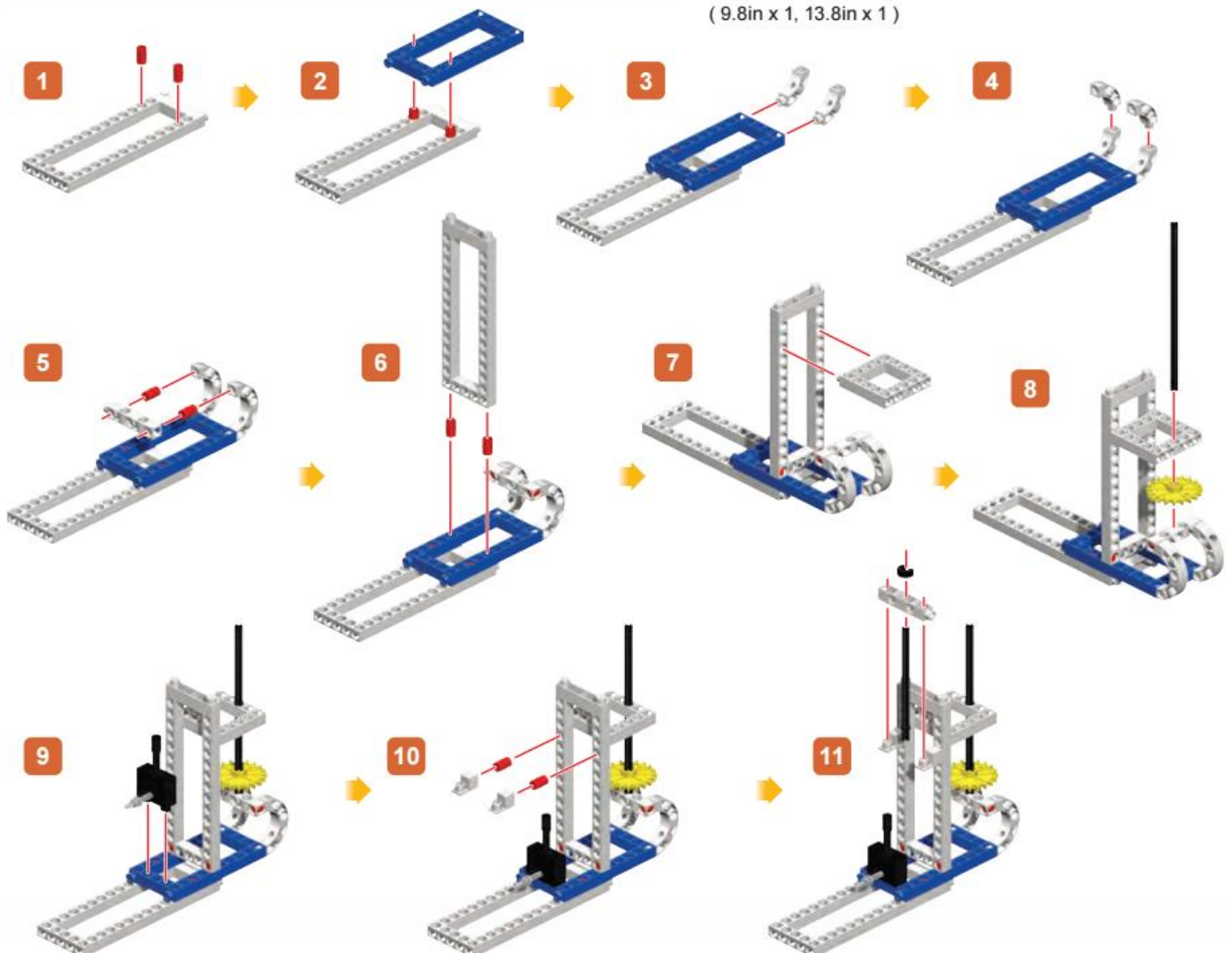
Assembly Precautions

1. Mesh the gears correctly for smooth operation.
2. The chain gears must be aligned in order for the chain to operate smoothly.
3. Cut Tube A and Tube B to the following lengths for this model.

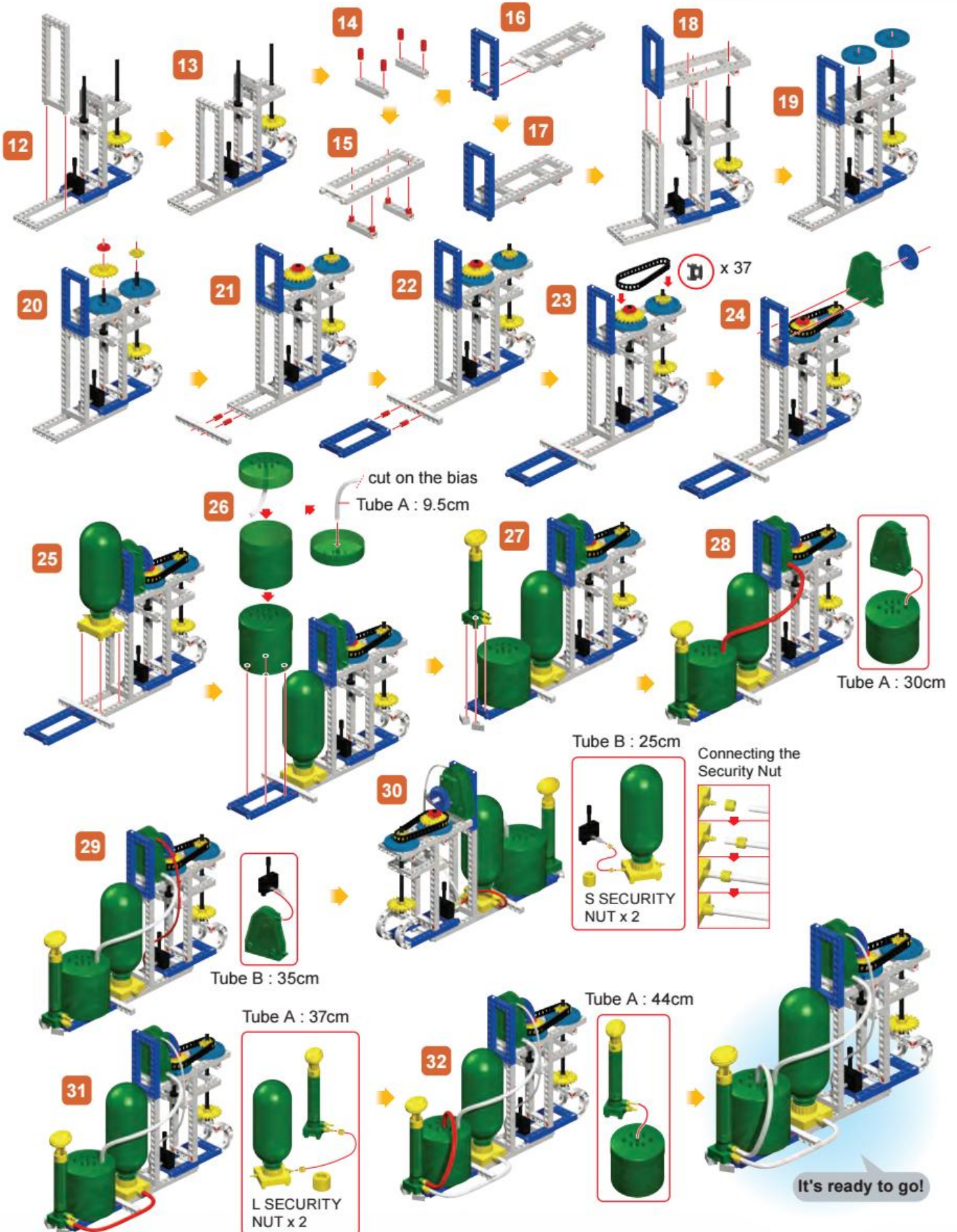
Tube A : 9.5cm x 1, 30cm x 1, 37cm x 1, 44cm x 1
(3.75in x 1, 11.8in x 1, 14.5 in x 1, 17.3 in x 1)

Tube B : 25cm x 1, 35cm x 1

(9.8in x 1, 13.8in x 1)

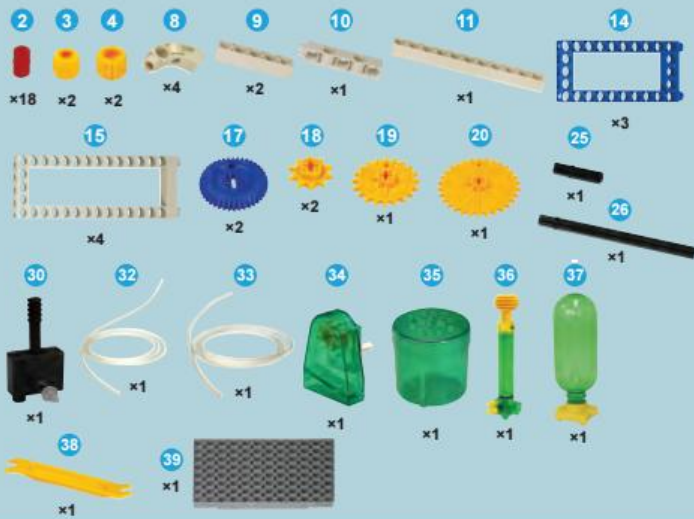


Model 1 Cutting Machine



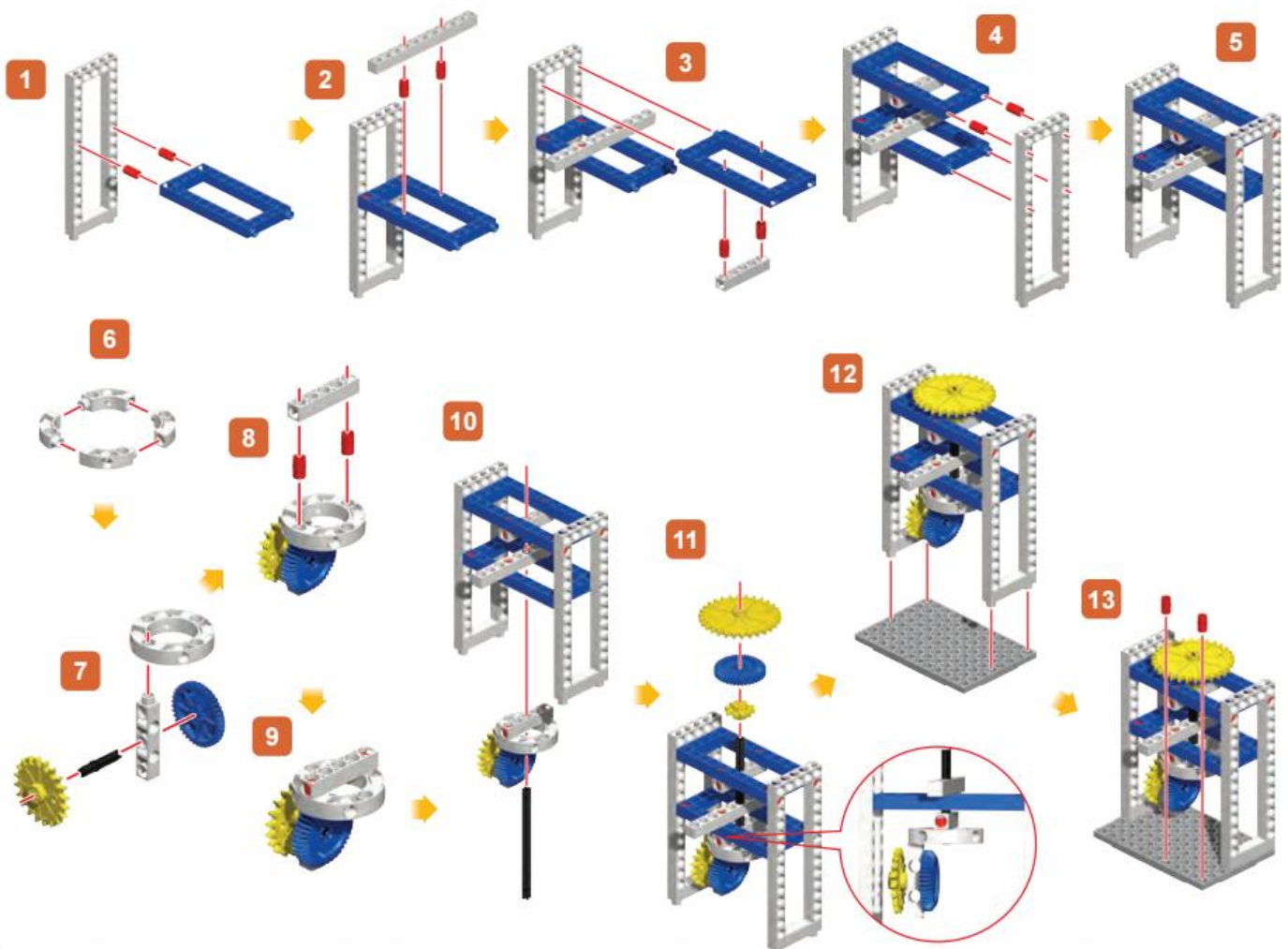
Grinder Model 2

Parts Needed



Assembly Precautions

1. The gears should be meshed correctly for smooth operation.
2. Cut Tube A and Tube B to the following lengths for this model.
 Tube A : 9.5cm x 1, 30cm x 1, 37cm x 1, 44cm x 1
 (3.75in x 1, 11.8in x 1, 14.5 in x 1, 17.3 in x 1)
 Tube B : 25cm x 1, 35cm x 1
 (9.8in x 1, 13.8in x 1)



Model 2 Grinder

14 **15** **16** **17** **18**

19 **20** **21** **22**

23 **24** **25**

26 **27**

28 **29**

cut on the bias
Tube A : 9.5cm

Tube A : 30cm

Tube B : 25cm
S SECURITY NUT x 2

Connecting the Security Nut

Tube B : 35cm

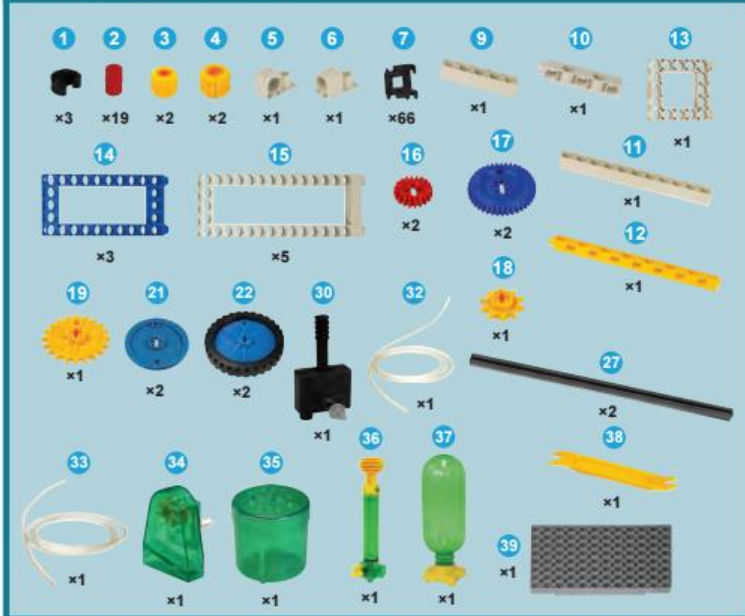
Tube A : 37cm
L SECURITY NUT x 2

Tube A : 44cm

It's ready to go!

Truck Model 3

Parts Needed

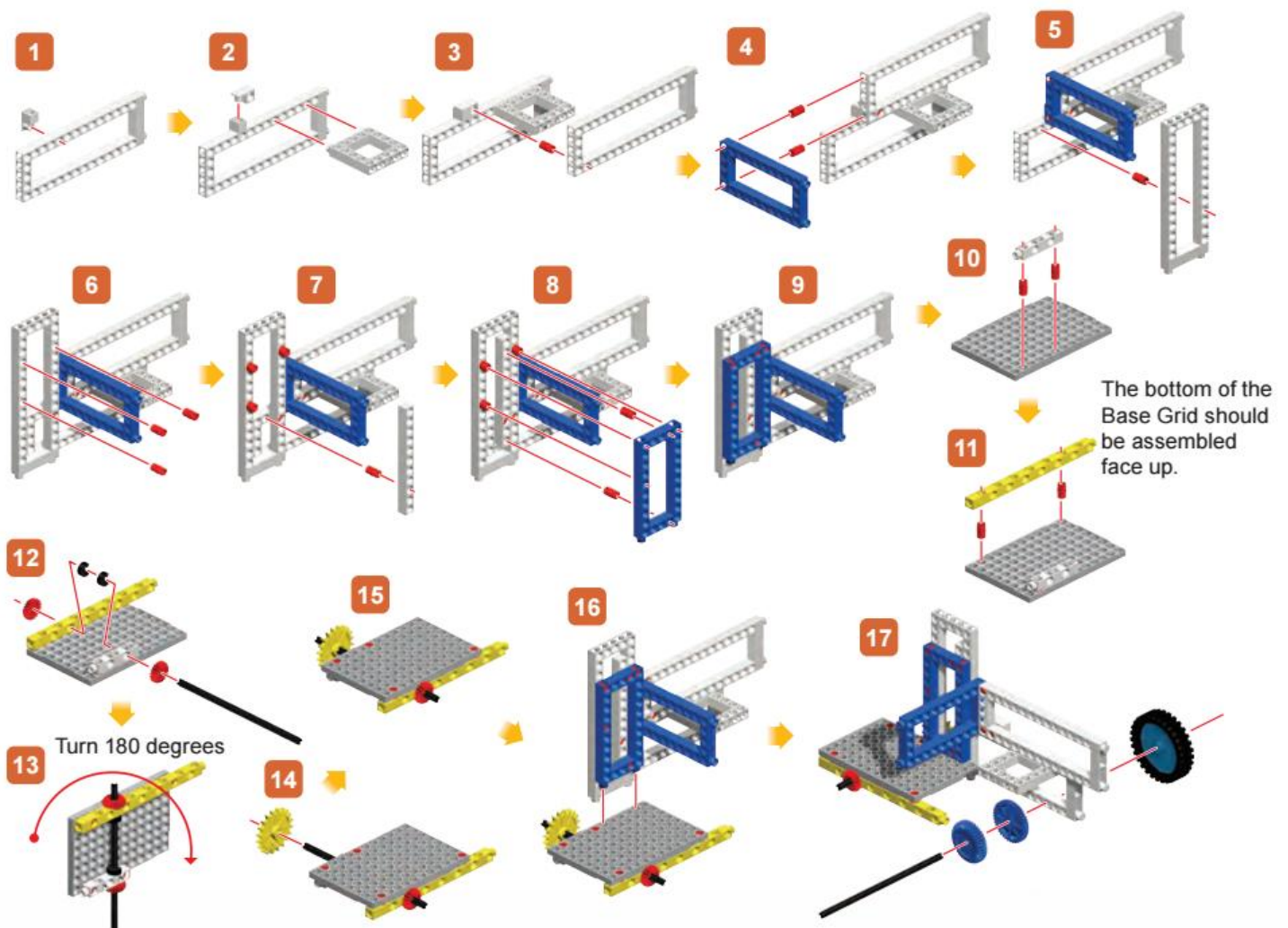


Assembly Precautions

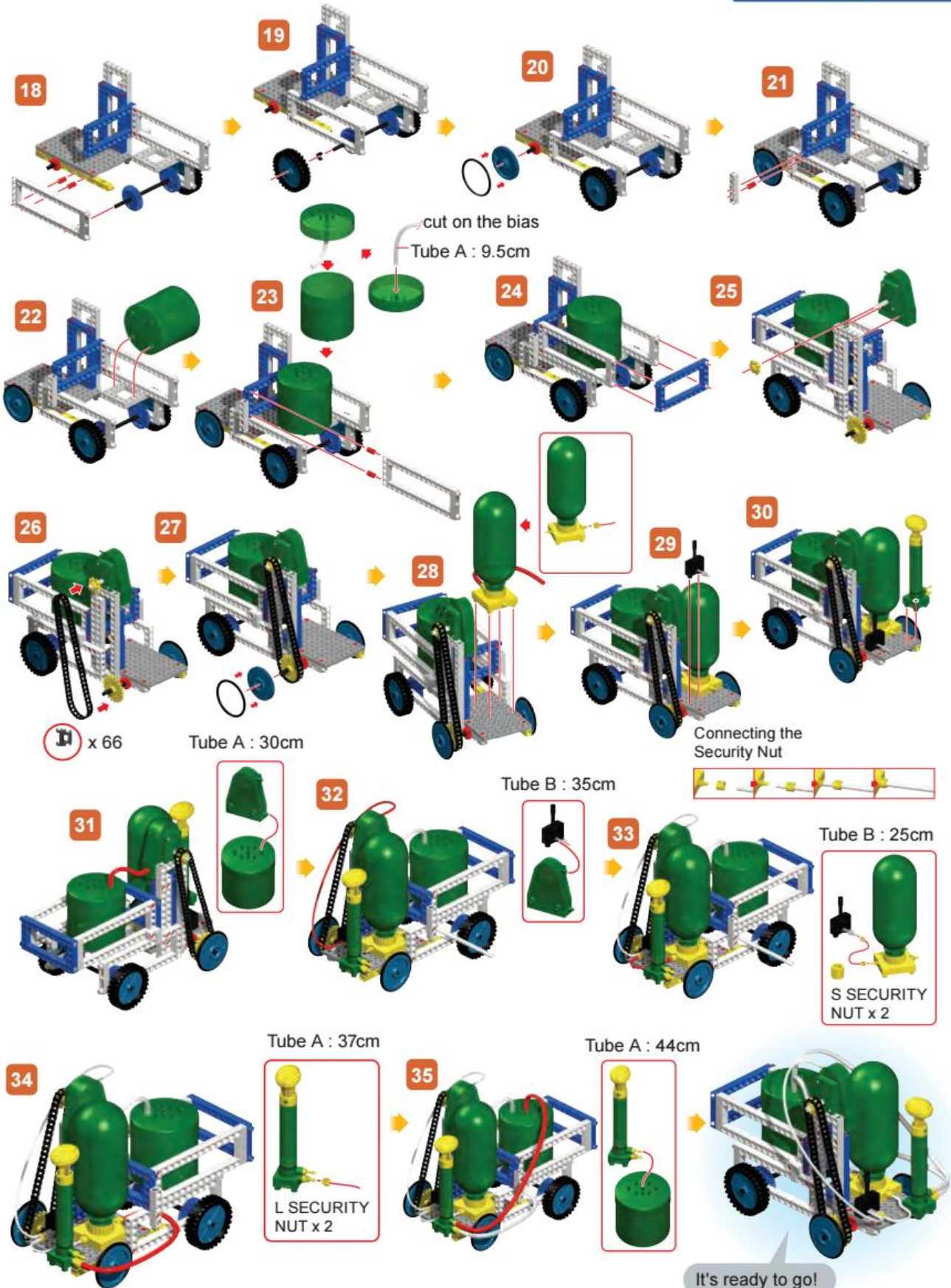
1. Leave a 1mm gap between the gear and the frame for the wheel to turn smoothly.
2. Cut Tube A and Tube B to the following lengths for this model.

Tube A : 9.5cm x 1, 30cm x 1, 37cm x 1, 44cm x 1
(3.75in x 1, 11.8in x 1, 14.5 in x 1, 17.3 in x 1)

Tube B : 25cm x 1, 35cm x 1
(9.8in x 1, 13.8in x 1)

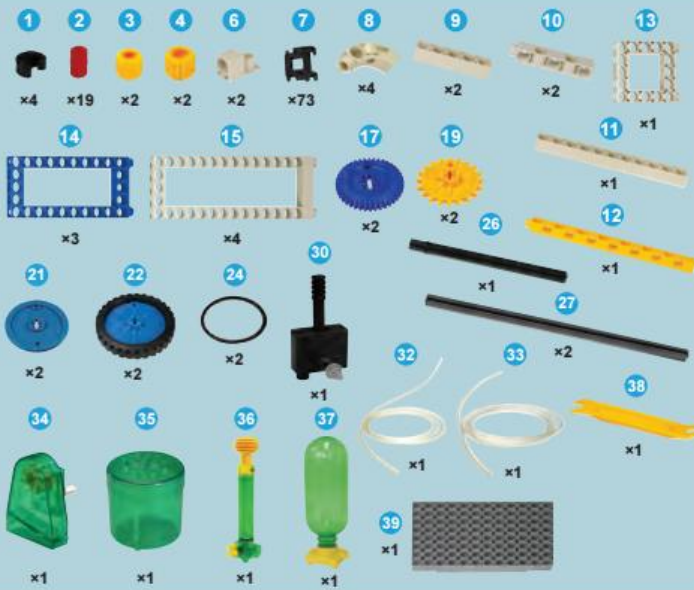


Model 3 Truck



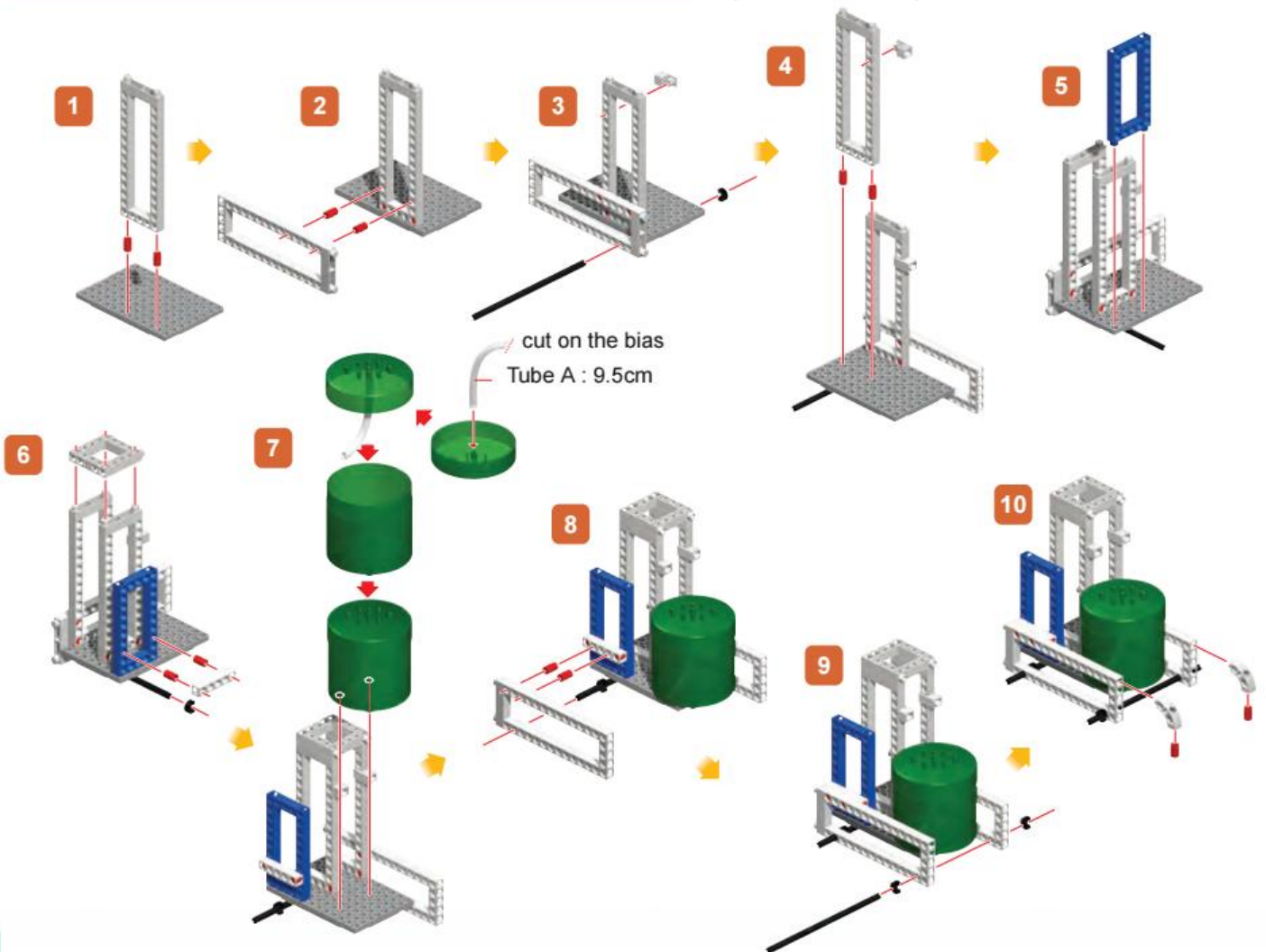
Excavator Model 4

Parts Needed



Assembly Precautions

1. The gears should be meshed correctly for smooth operation.
2. Cut Tube A and Tube B to the following lengths for this model.
 Tube A : 9.5cm x 1, 30cm x 1, 37cm x 1, 44cm x 1
 (3.75in x 1, 11.8in x 1, 14.5 in x 1, 17.3 in x 1)
 Tube B : 25cm x 1, 35cm x 1
 (9.8in x 1, 13.8in x 1)



Model 4 Excavator

11 **12** **13** **14** **15** **16** **17**

18 **19** **20** **21**

22 **23** **24** **25** **26**

27 **28** **29** **30**

31 **32**

For L SECURITY NUT

For S SECURITY NUT

Tube B : 35cm

Tube A : 30cm

Connecting the Security Nut

Tube B : 25cm

S SECURITY NUT x 2

Tube A : 37cm

Tube A : 44cm

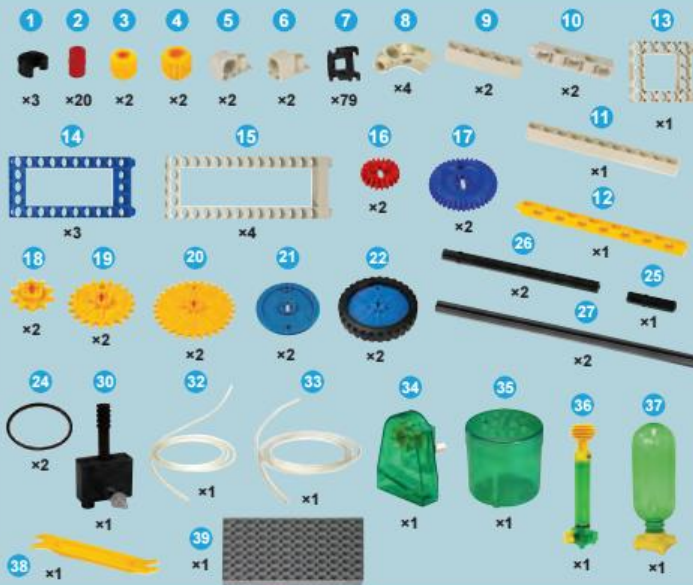
L SECURITY NUT x 2

Connecting the Security Nut

It's ready to go!

Locator Car Model 5

Parts Needed

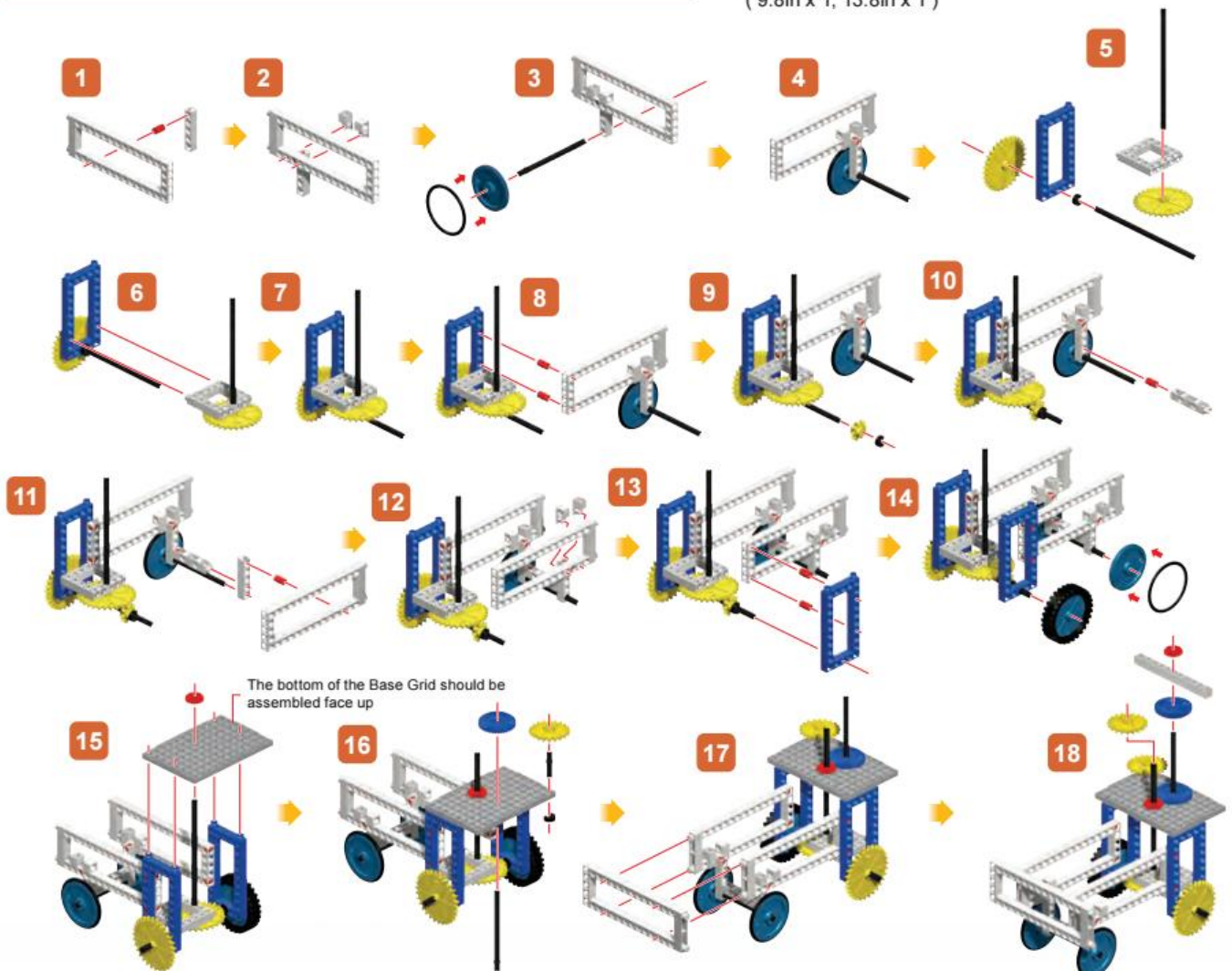


Assembly Precautions

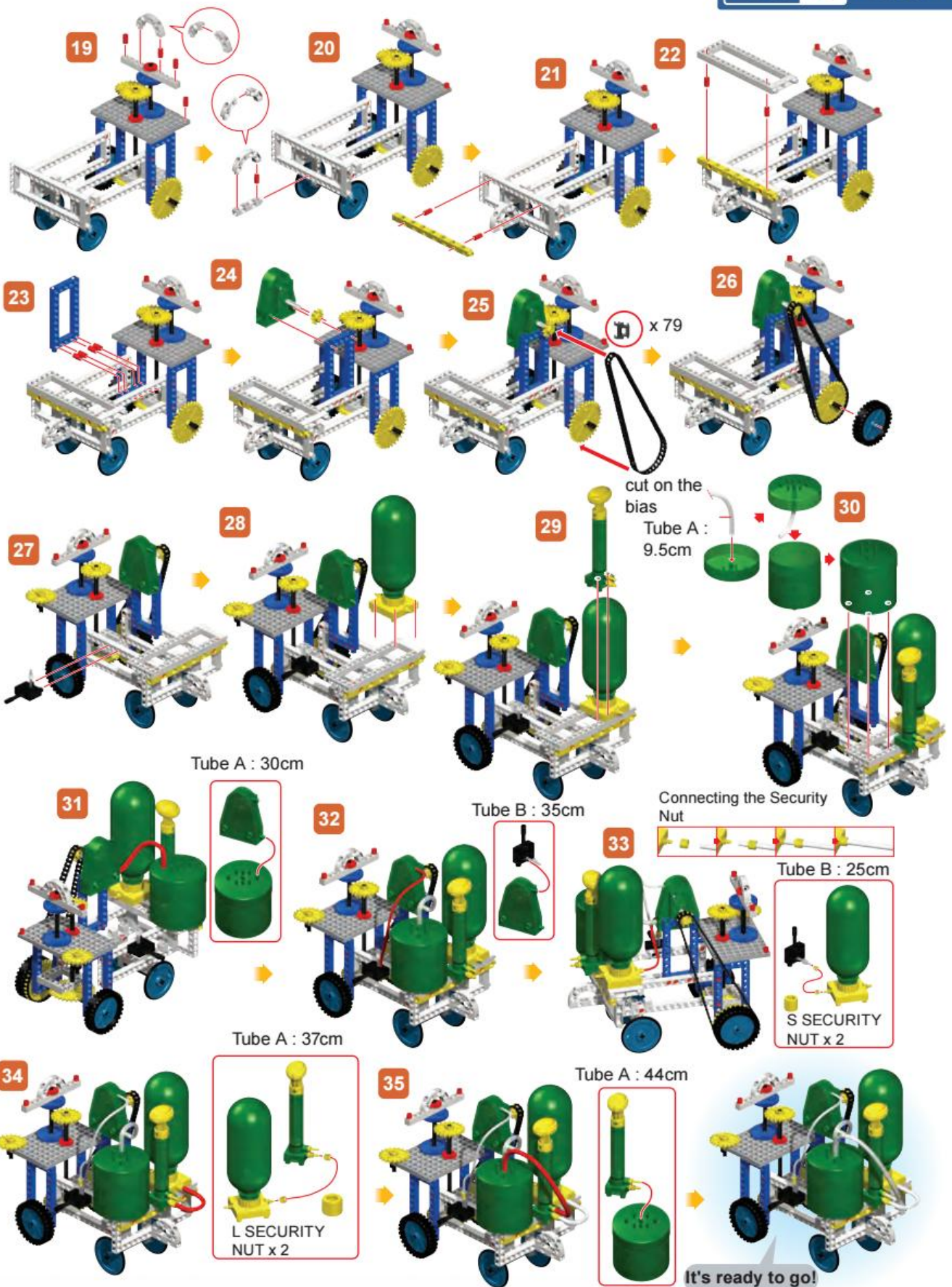
1. The gears should be meshed correctly for smooth operation.
2. Cut Tube A and Tube B to the following lengths for this model.

Tube A : 9.5cm x 1, 30cm x 1, 37cm x 1, 44cm x 1
(3.75in x 1, 11.8in x 1, 14.5 in x 1, 17.3 in x 1)

Tube B : 25cm x 1, 35cm x 1
(9.8in x 1, 13.8in x 1)

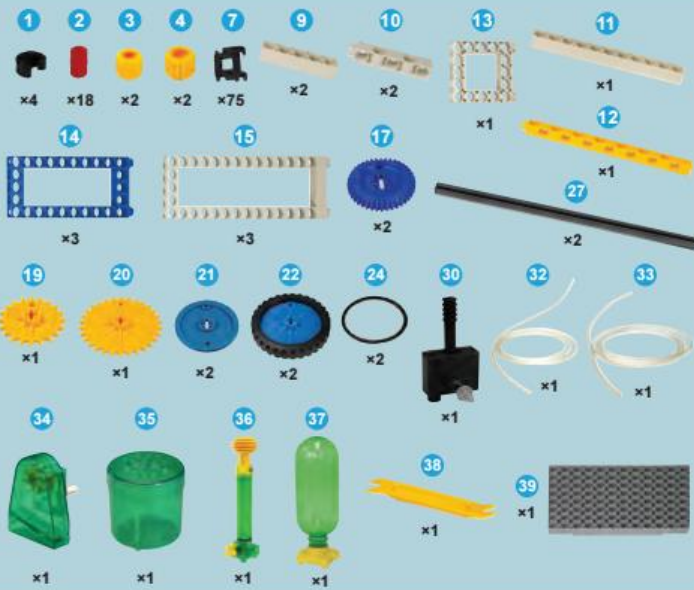


Model 5 Locator Car



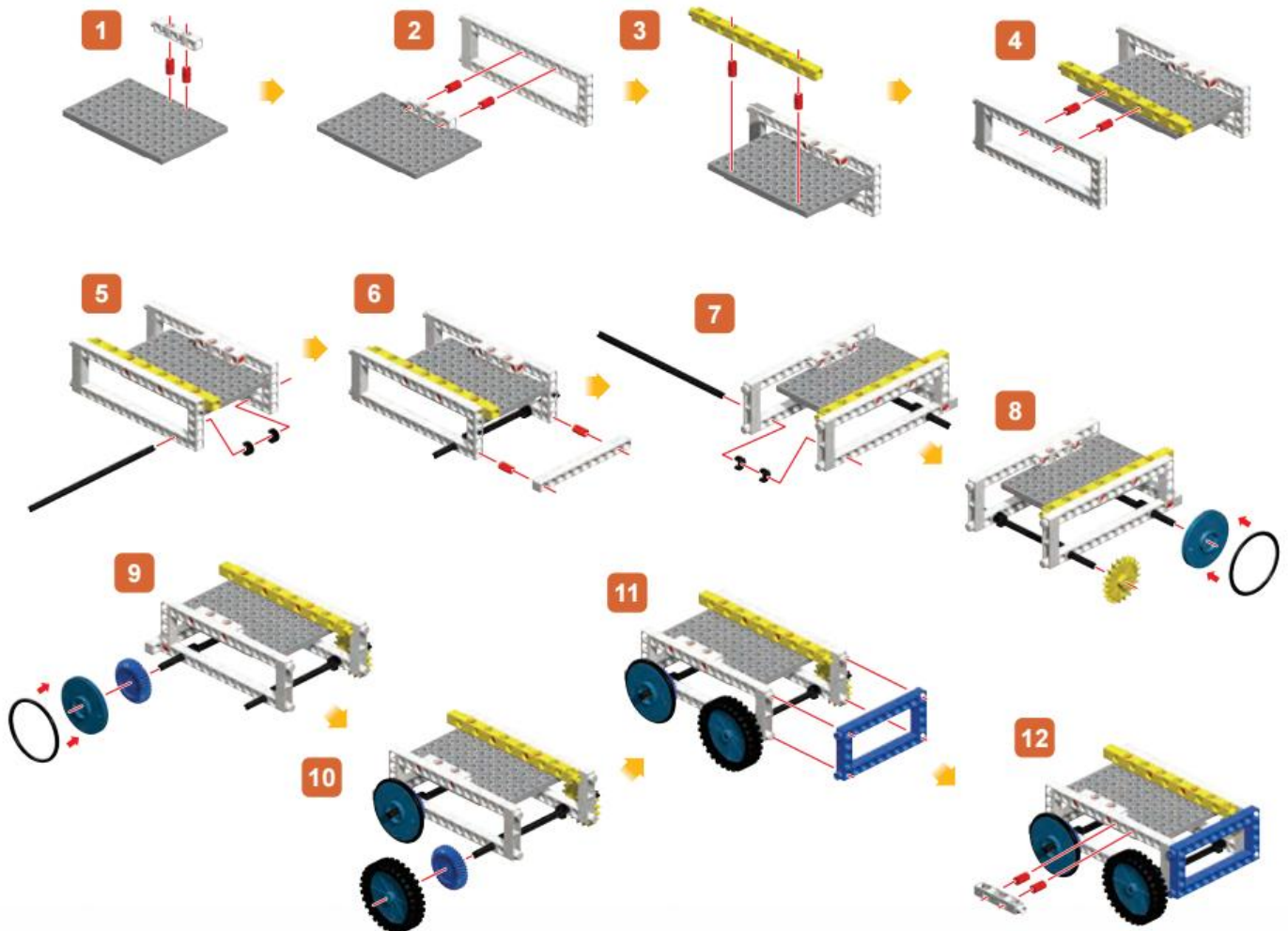
Car Model 6

Parts Needed



Assembly Precautions

1. The gears should be meshed correctly for smooth operation.
2. Cut Tube A and Tube B to the following lengths for this model.
 Tube A : 9.5cm x 1, 30cm x 1, 37cm x 1, 44cm x 1
 (3.75in x 1, 11.8in x 1, 14.5 in x 1, 17.3 in x 1)
 Tube B : 25cm x 1, 35cm x 1
 (9.8in x 1, 13.8in x 1)



Model 6 Car

13 **14** **15** **16**

17 **18** **19** **20**

21 **22** **23** **24**

25 **26** **27** **28**

cut on the bias
Tube A : 9.5cm

x 75

Tube A : 30cm

Tube B : 35cm

Tube B : 25cm

Connecting the Security Nut

S SECURITY NUT x 2

Tube A : 37cm

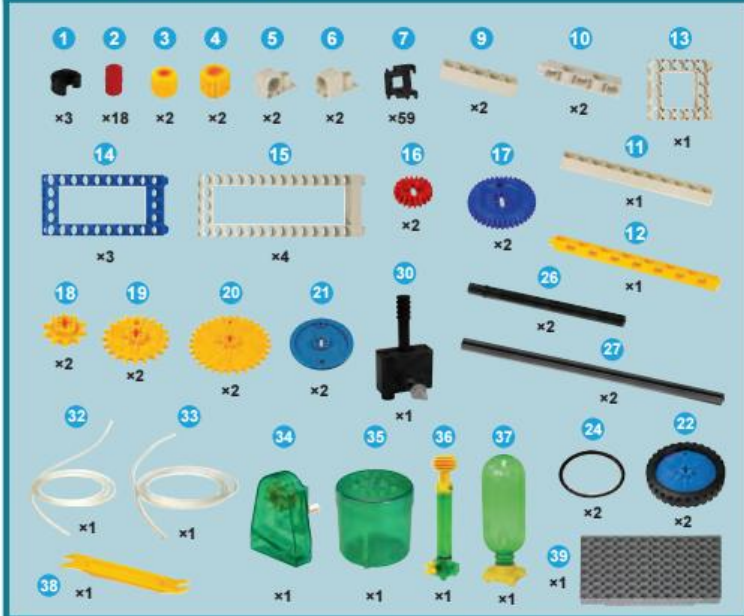
L SECURITY NUT x 2

Tube A : 44cm

It's ready to go!

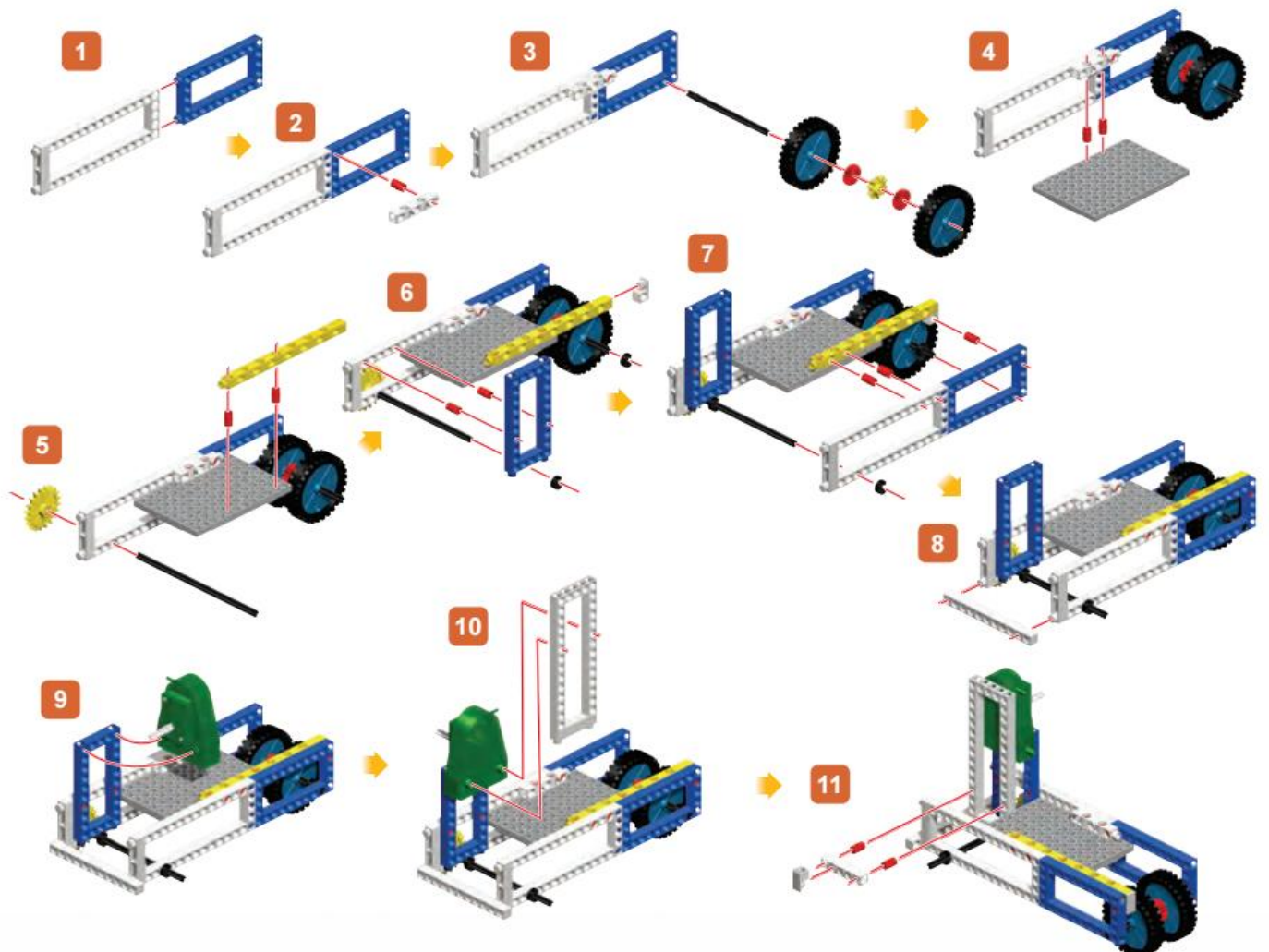
Antique Car Model 7

Parts Needed

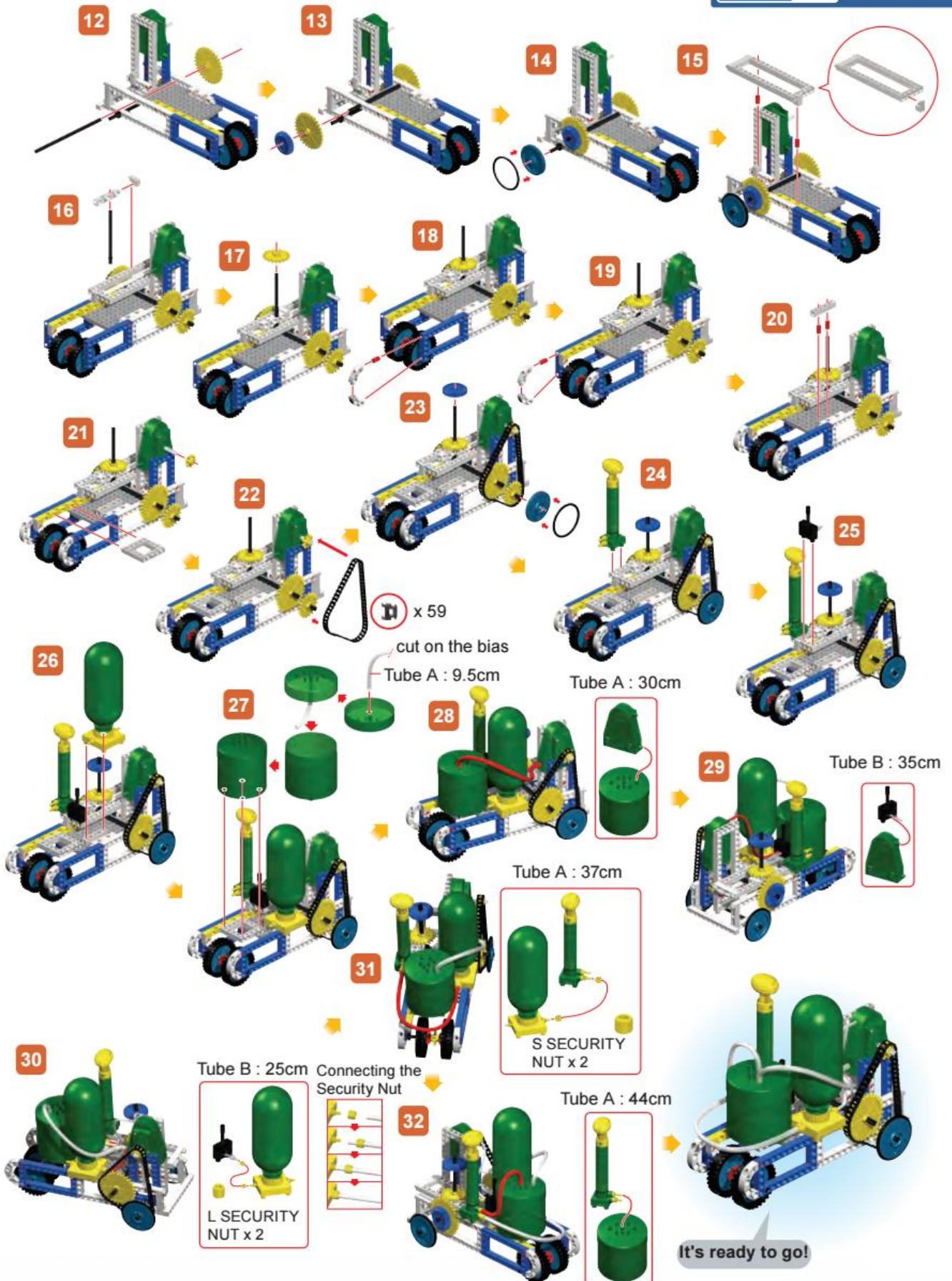


Assembly Precautions

1. The gears should be meshed correctly for smooth operation.
2. Cut Tube A and Tube B to the following lengths for this model.
 Tube A : 9.5cm x 1, 30cm x 1, 37cm x 1, 44cm x 1
 (3.75in x 1, 11.8in x 1, 14.5 in x 1, 17.3 in x 1)
 Tube B : 25cm x 1, 35cm x 1
 (9.8in x 1, 13.8in x 1)



Model 7 Antique Car



Models without water-recycling system

• Water-Jet Vehicles

Water-Jet Vehicles are hydro-pneumatic models WITHOUT a water recycling system. They consist of two separate parts - the vehicle itself and the launcher, unlike the hydro-pneumatic models WITH a water recycling system that are in one piece.

• Principle

They use Newton's Third Law of Motion: when two objects interact, the force from each acts on the other with the same intensity but in opposite directions. This law is also known as the "Law of action and reaction."

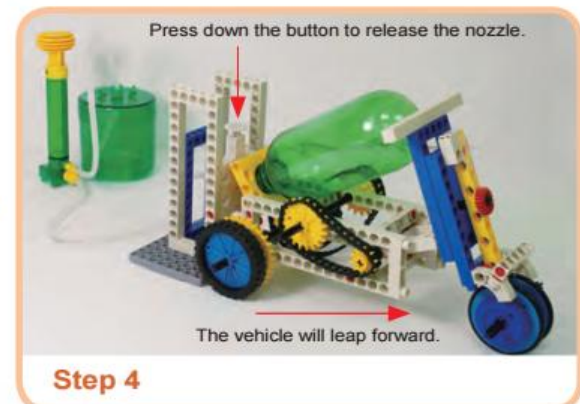
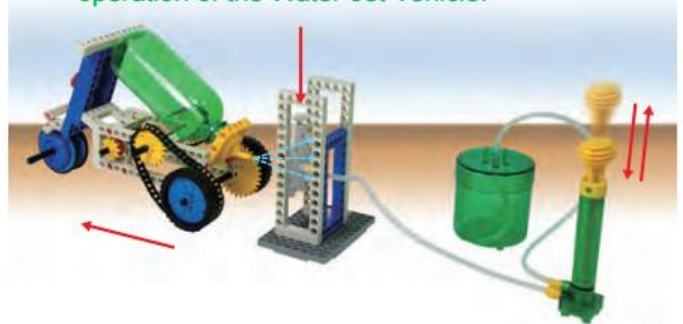
How to operate

Follow the following steps to operate.

1. Build a Water-Jet Vehicle model using the illustrations in this instruction manual.
2. Press the button on the Car Launcher down and insert the nozzle of the Secured Air/Water Storage on the vehicle into the center hole of the Car Launcher and then release the button so that the vehicle and the launcher are connected.
3. Pump the Secured Pump about 50 times until all the water goes from the Recycled Water storage to the water storage and the air in it is fully compressed.
4. Press the button on the Car Launcher to release the nozzle. The vehicle will instantly leap forward due to the highly pressurized water coming from the nozzle.



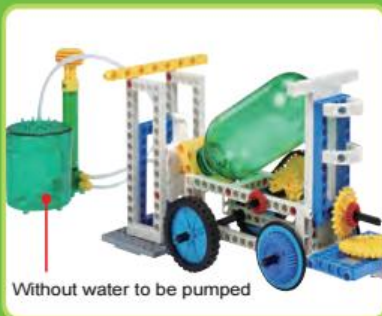
The picture shows you the setting and the operation of the Water-Jet Vehicle.



How to proceed

Try it ! Adding water to the Water Recycled Storage

For a given volume, the mass of water is much greater than that of air and thus its reaction force will be greater, according to Newton's Third Law of Motion and the conservation of momentum. However, if too much water is added this will reduce the amount of space for the air and diminish the generation of kinetic energy. So, what amount of water gives you the best results? This is the basis for your next experiment .



(1) No water is added

If no water is added, no water will enter the Secured Air-Water Storage, the limited air in the storage will spurt out as soon as the nozzle is opened, which will lead to a slight change in momentum of the Water-Jet Vehicle. As a result, the Water-Jet Vehicle will move forward at low speed for a shorter distance.

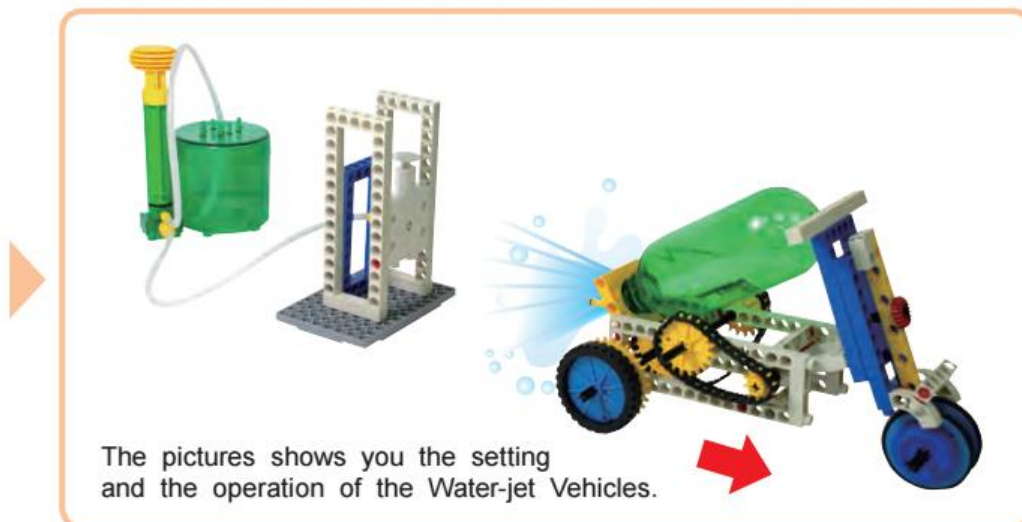


(2) Some water is added

If some water is added, the water will enter the Secured Air-Water Storage. Because water will not be compressed, it will be pushed out of the storage at high speed by the compressed air (getting into the storage by pumping). In the meantime, the compressed air (pumping air) will cause a reaction force due to the difference in pressure inside and outside the storage. Finally, a considerable change in momentum (the enhanced reaction force) occurs to push the Water-Jet Car forward very fast.

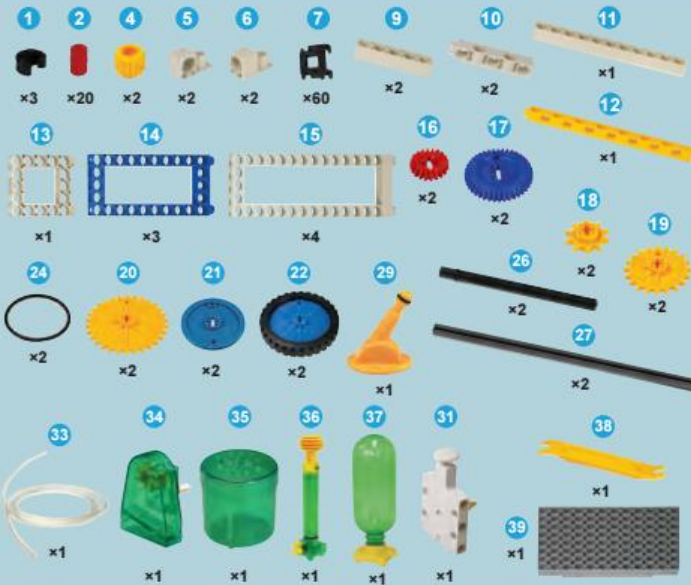
(3) Adding water until halfway full

First, pour water into the Recycled Water Storage until it is about half way full. Then, use the Secured Pump to draw water into the Secured Air-Water Storage, and pump air into the storage as well. At this point, since the volume of the Secured Air-Water Storage remains the same, the air density in the storage will increase as increasingly more air molecules are pumped into it.



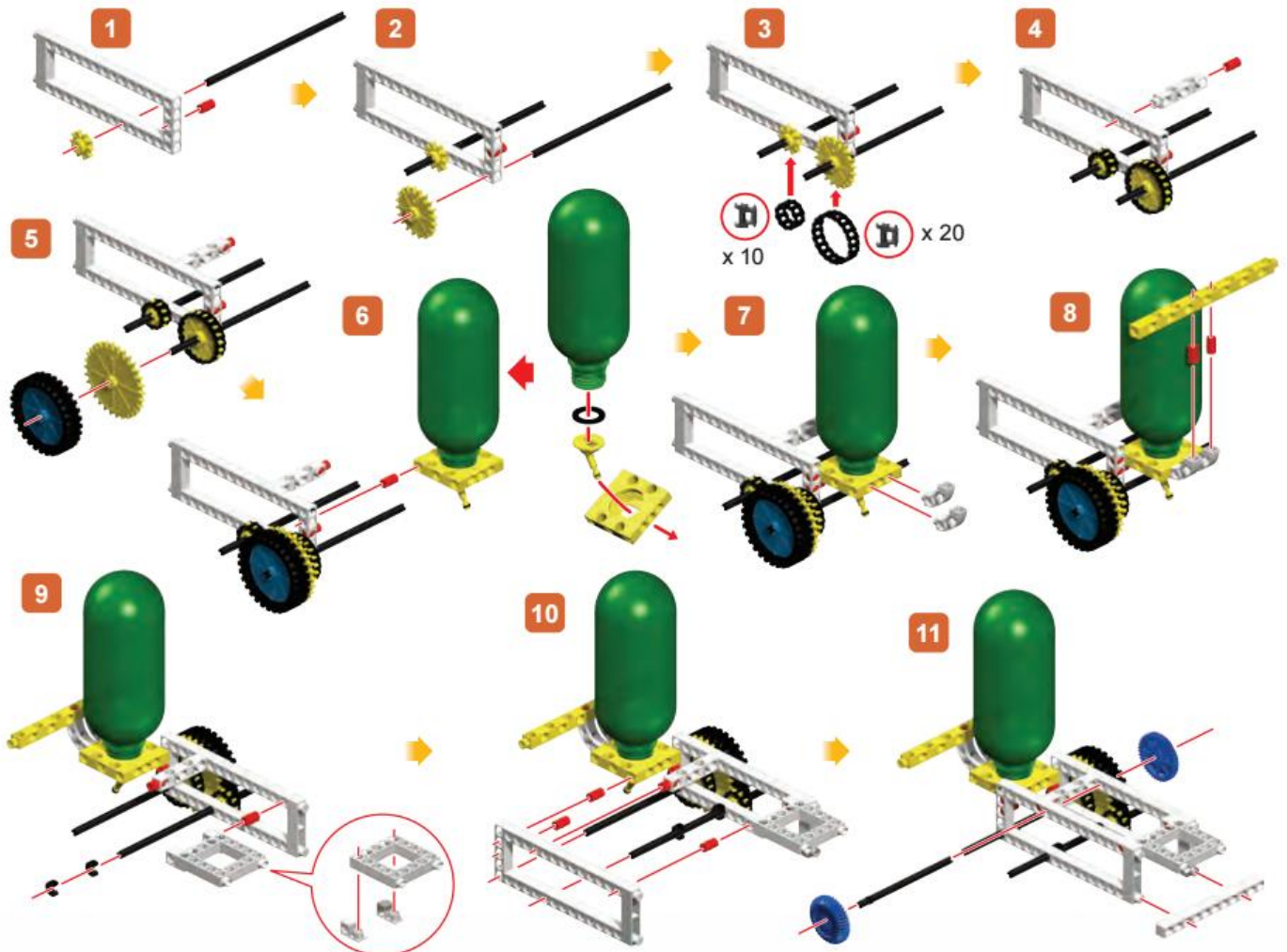
Dragster Model 8

Parts Needed



Assembly Precautions

1. Screw off the original cap of the Secured Air-Water Storage before the model assembly starts. The original cap will not be used in this model.
2. Leave a 1mm gap between the gear and the frame for the wheel to turn smoothly.
3. Cut Tube A to the following lengths for this model.
 Tube A : 9.5cm x 1, 21cm x 1, 40cm x 1
 (3.75in x 1, 8.3in x 1, 15.75in x 1)



Model 8 Dragster

12 **13** **14** **15**

16 **17** **18**

19 **20** **21** **22**

23 **24** **25** **26**

27 **28**

Dragster is ready to go!

Launcher is ready to go!

cut on the bias
Tube A : 9.5cm

Tube A : 21cm

Connecting the Security Nut

Tube A : 40cm

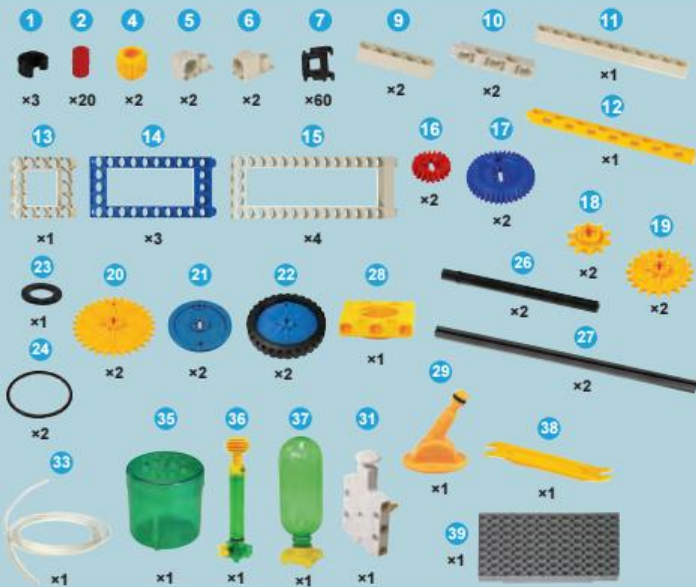
L SECURITY NUT x 2

x 20

x 10

Excavator Model 9

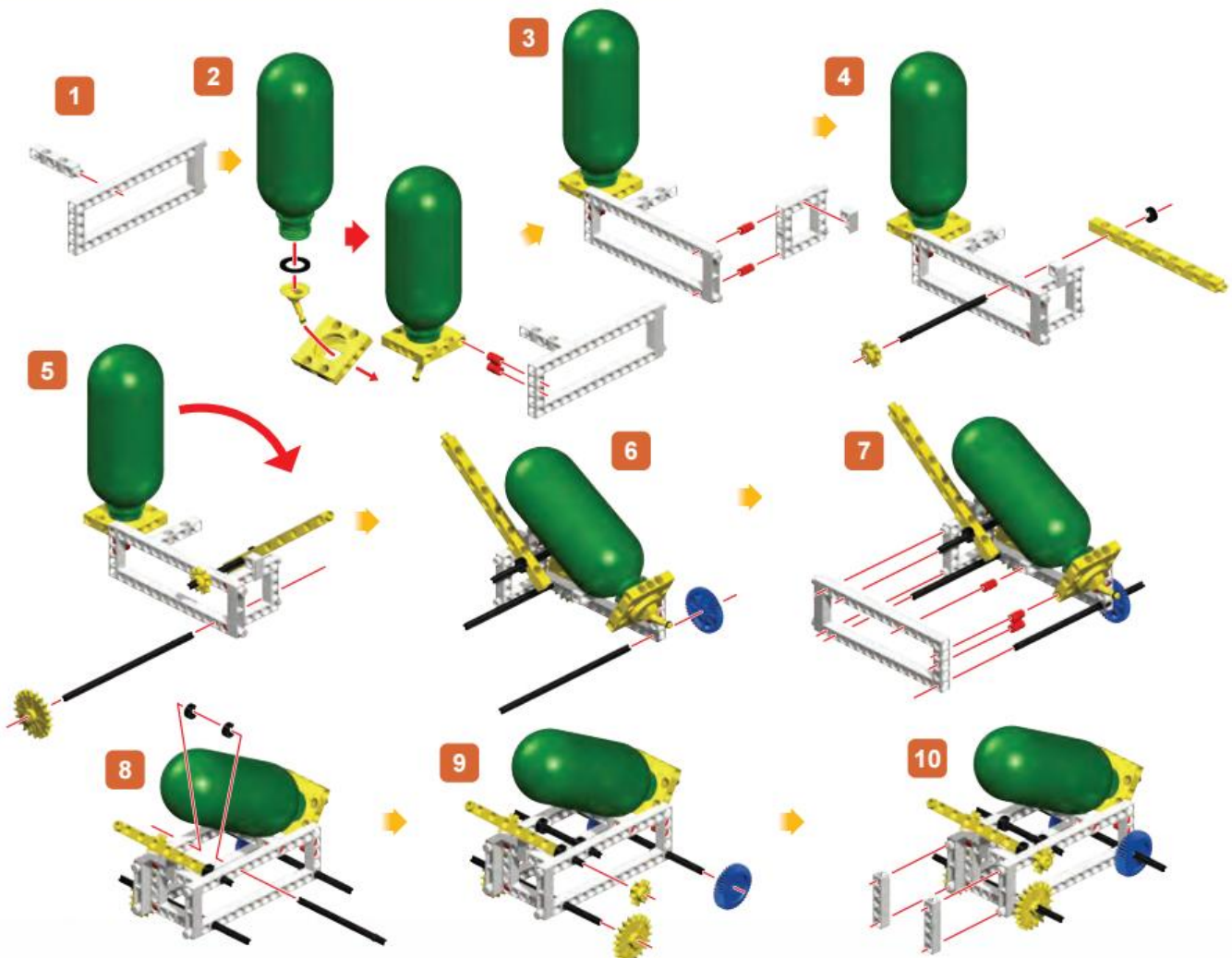
Parts Needed



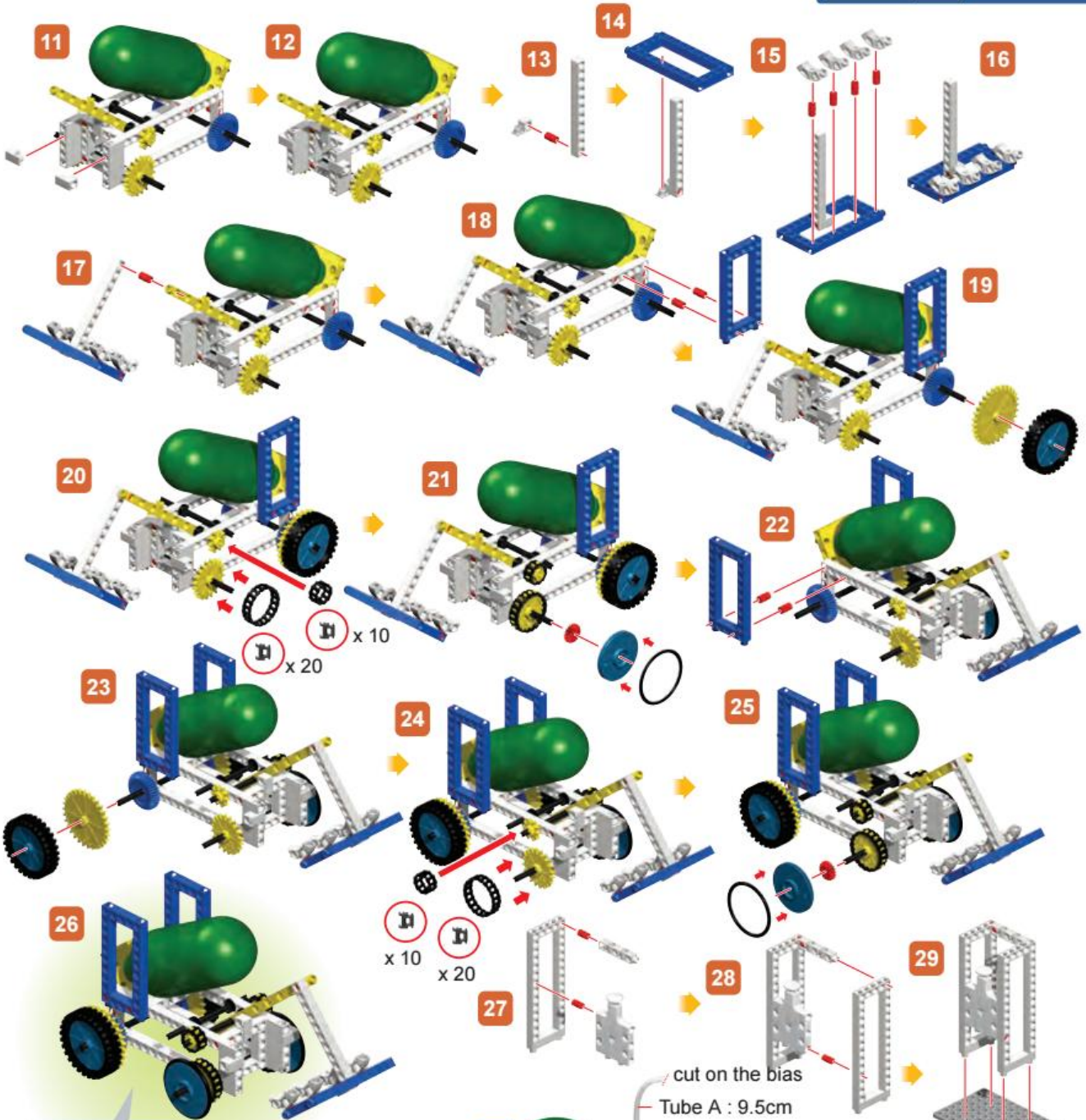
Assembly Precautions

1. Screw off the original cap of the Secured Air-Water Storage before the model assembly starts. The original cap will not be used in this model.
2. Leave a 1mm gap between the gear and the frame for the wheel to turn smoothly.
3. Cut Tube A to the following lengths for this model.

Tube A : 9.5cm x1, 21cm x 1, 40cm x 1
(3.75in x 1, 8.3in x 1, 15.75in x 1)



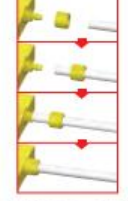
Model 9 Excavator



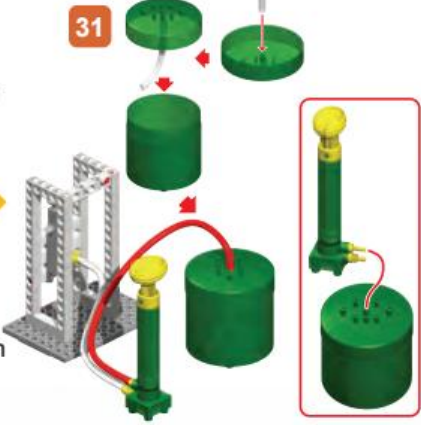
Excavator is ready to go!



Connecting the Security Nut



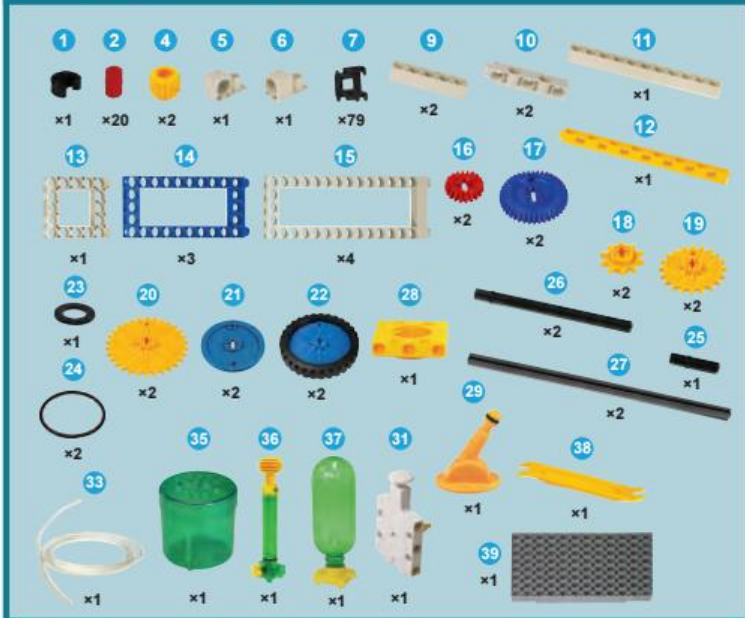
Tube A : 40cm



Launcher is ready to go!

Scooter Model 10

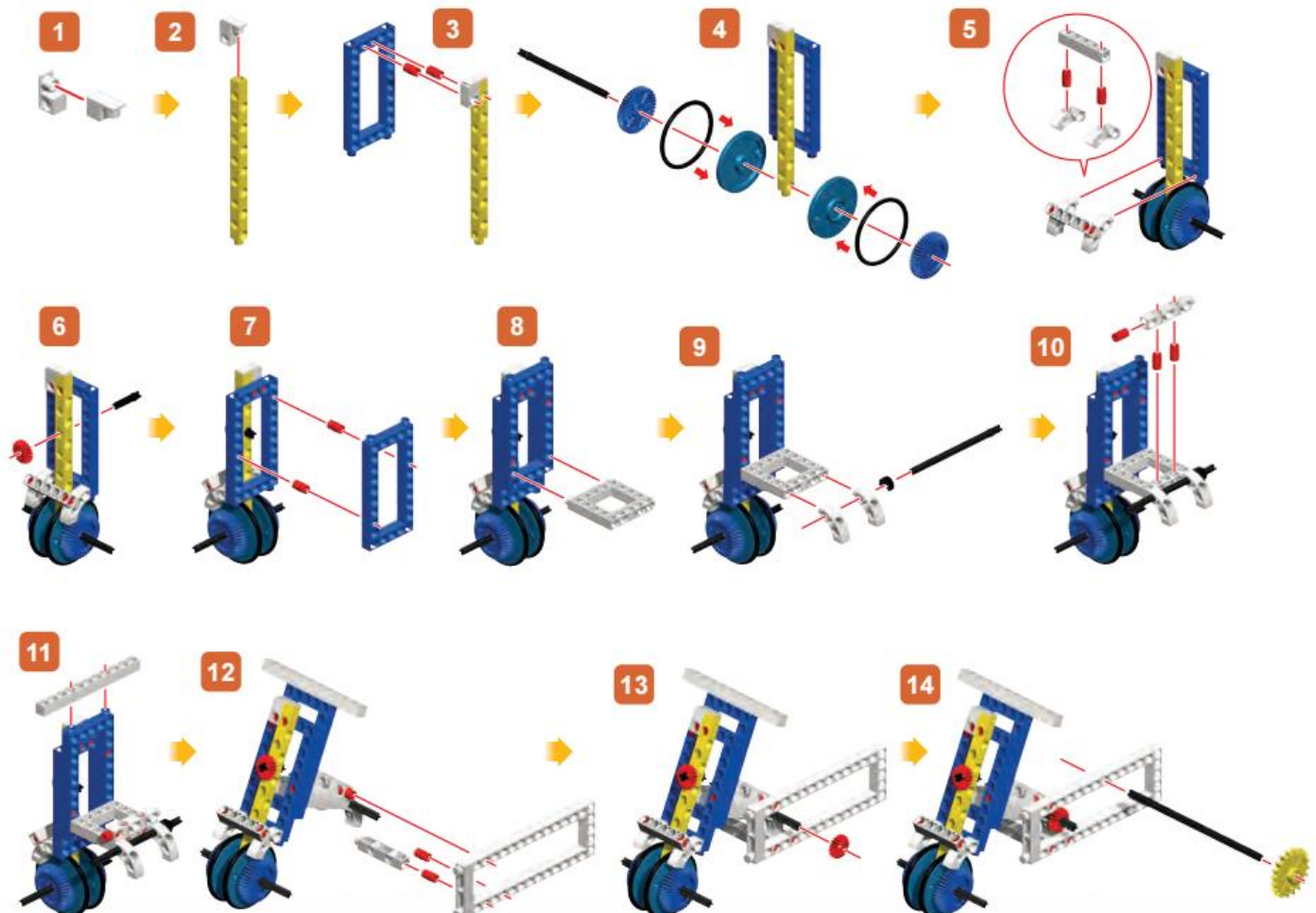
Parts Needed



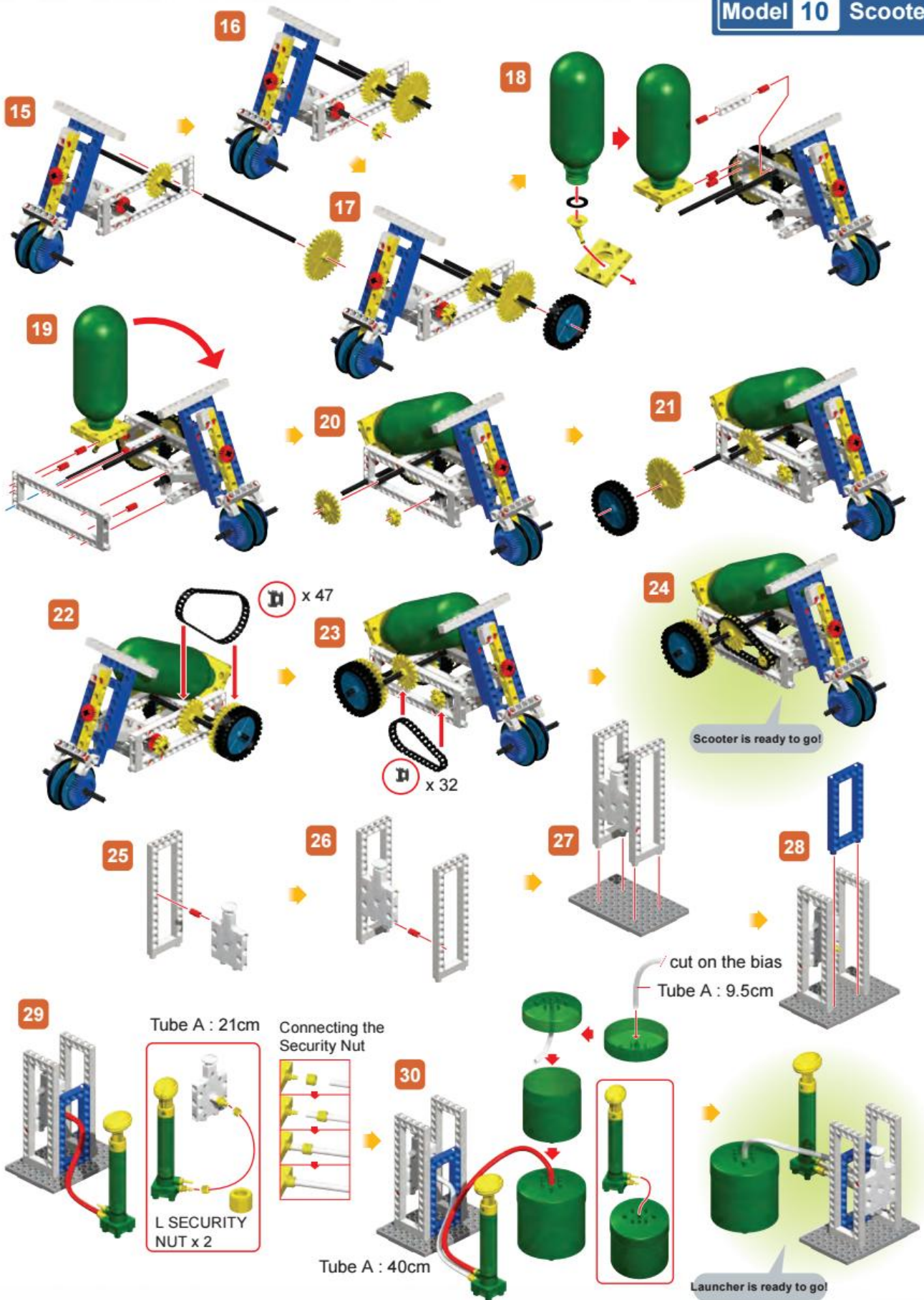
Assembly Precautions

1. Screw off the original cap of the Secured Air-Water Storage before the model assembly starts. The original cap will not be used in this model.
2. Leave a 1mm gap between the gear and the frame for the wheel to turn smoothly.
3. Cut Tube A to the following lengths for this model.

Tube A : 9.5cm x1, 21cm x1, 40cm x1
(3.75in x 1, 8.3in x 1, 15.75in x 1)

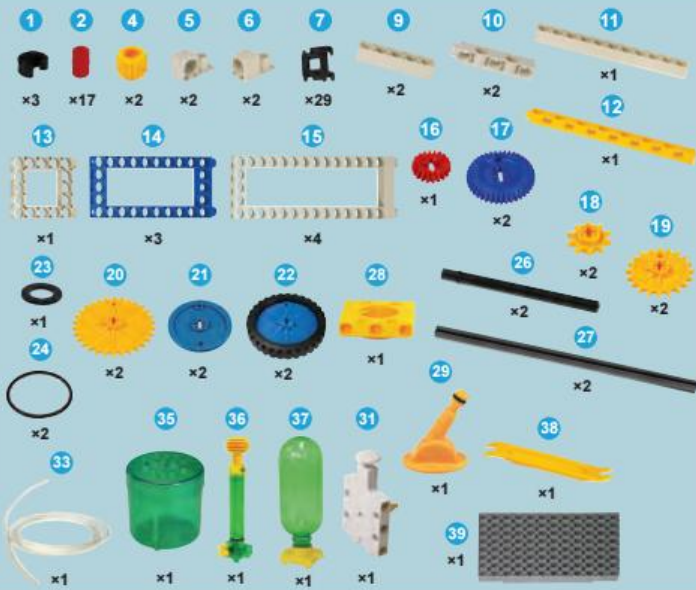


Model 10 Scooter



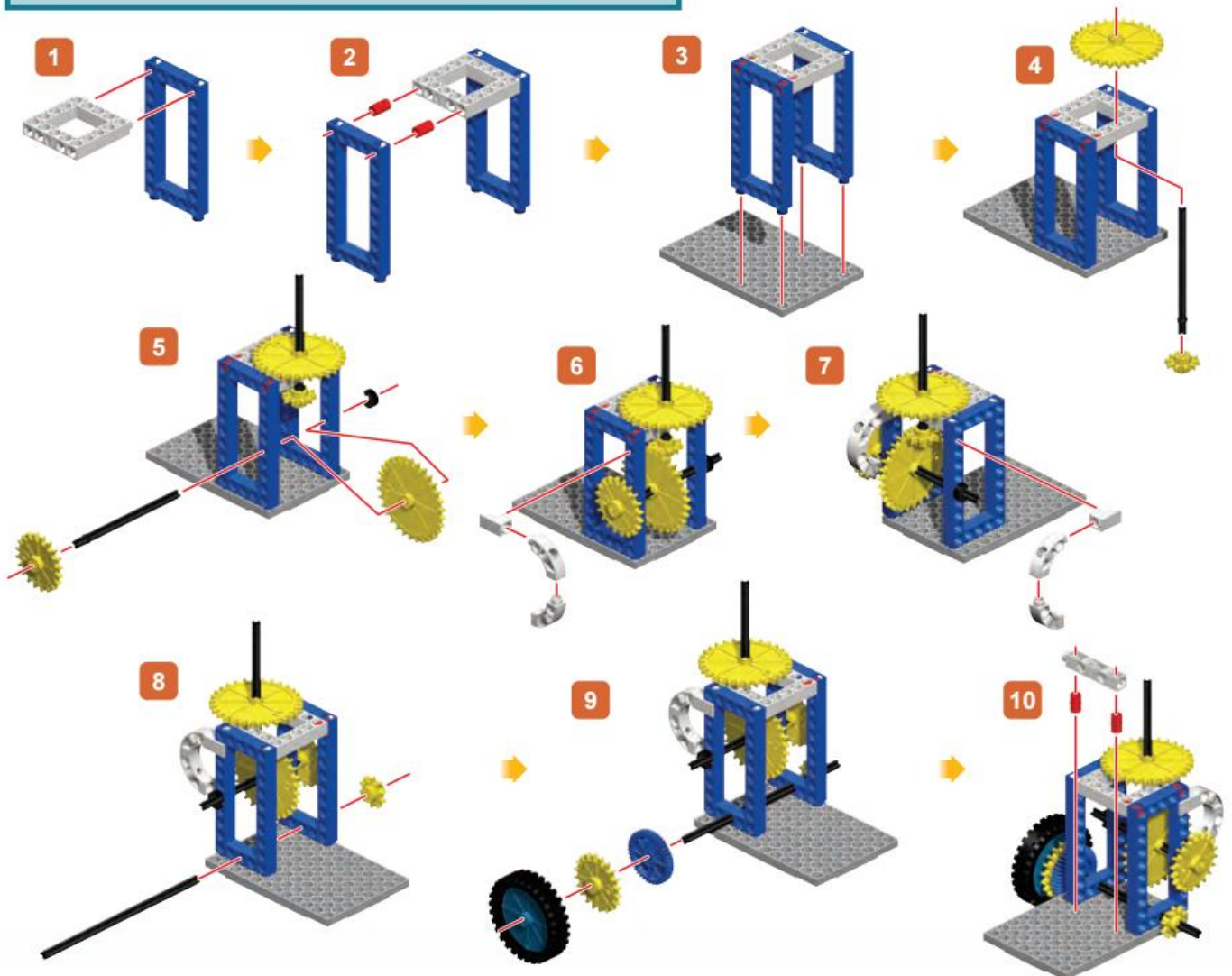
Helicopter Model 11

Parts Needed

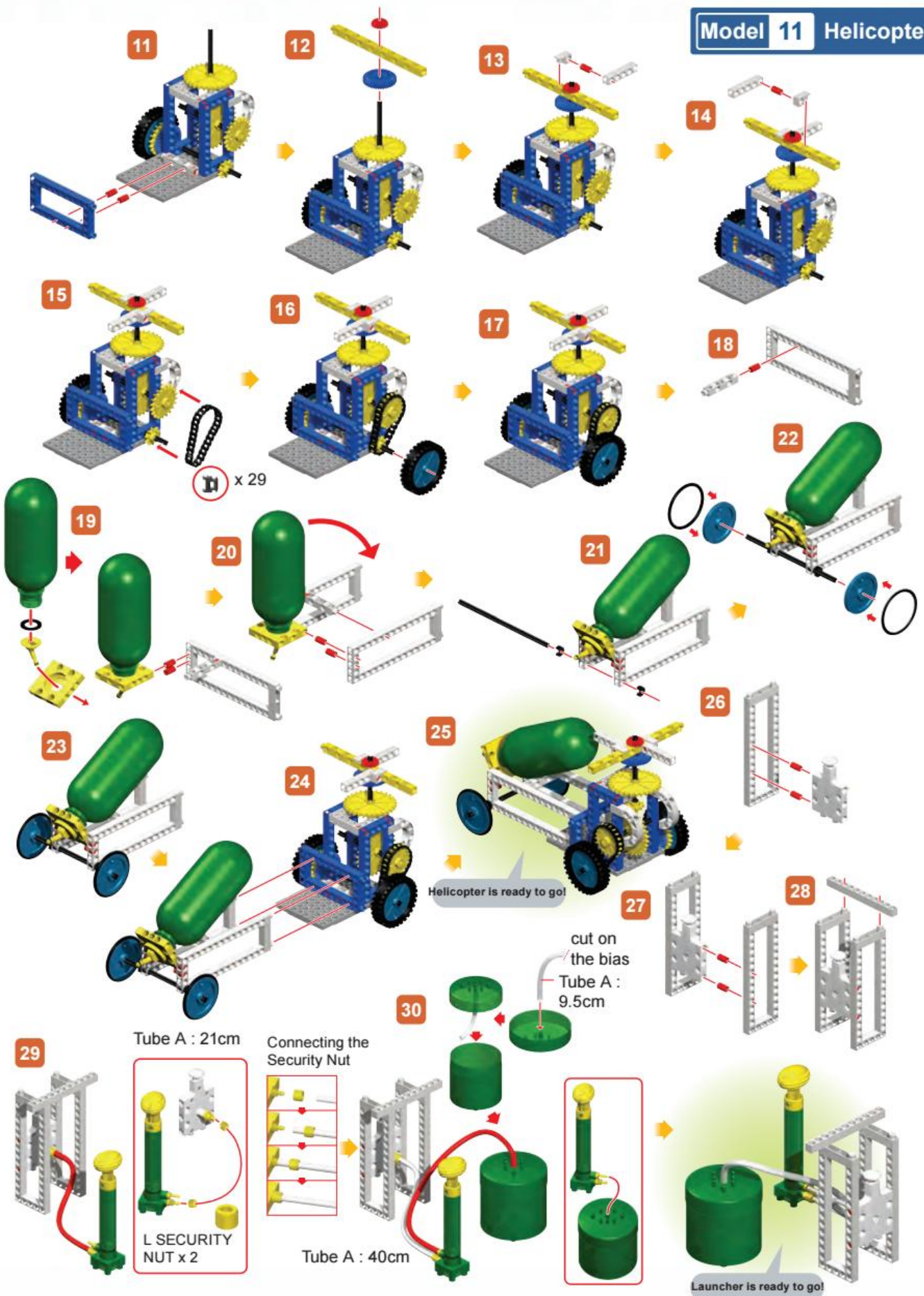


Assembly Precautions

1. Screw off the original cap of the Secured Air-Water Storage before the model assembly starts. The original cap will not be used in this model.
2. Mesh the gears correctly for smooth operation.
3. Leave a 1mm gap between the gear and the frame for the wheel to turn smoothly
4. Align the chain gears for smooth operation.
5. Cut Tube A to the following lengths for this model.
 Tube A : 9.5cm x1, 21cm x 1, 40cm x 1
 (3.75in x 1, 8.3in x 1, 15.75in x 1)

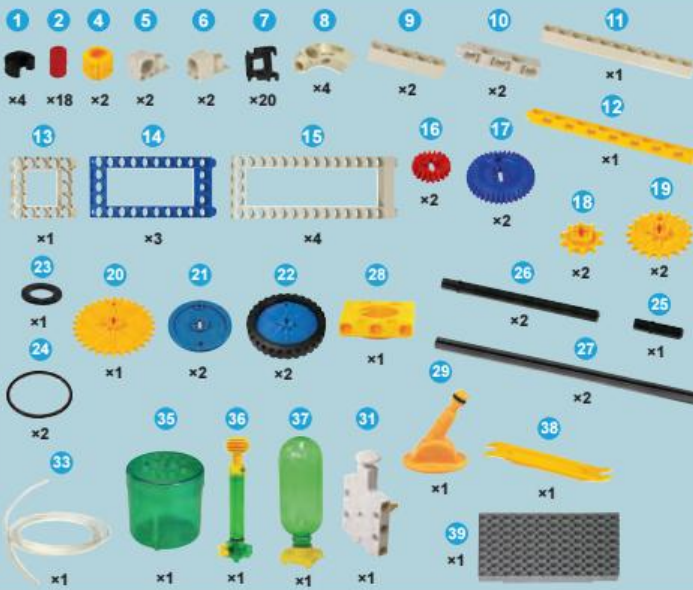


Model 11 Helicopter



Rescue Vehicle Model 12

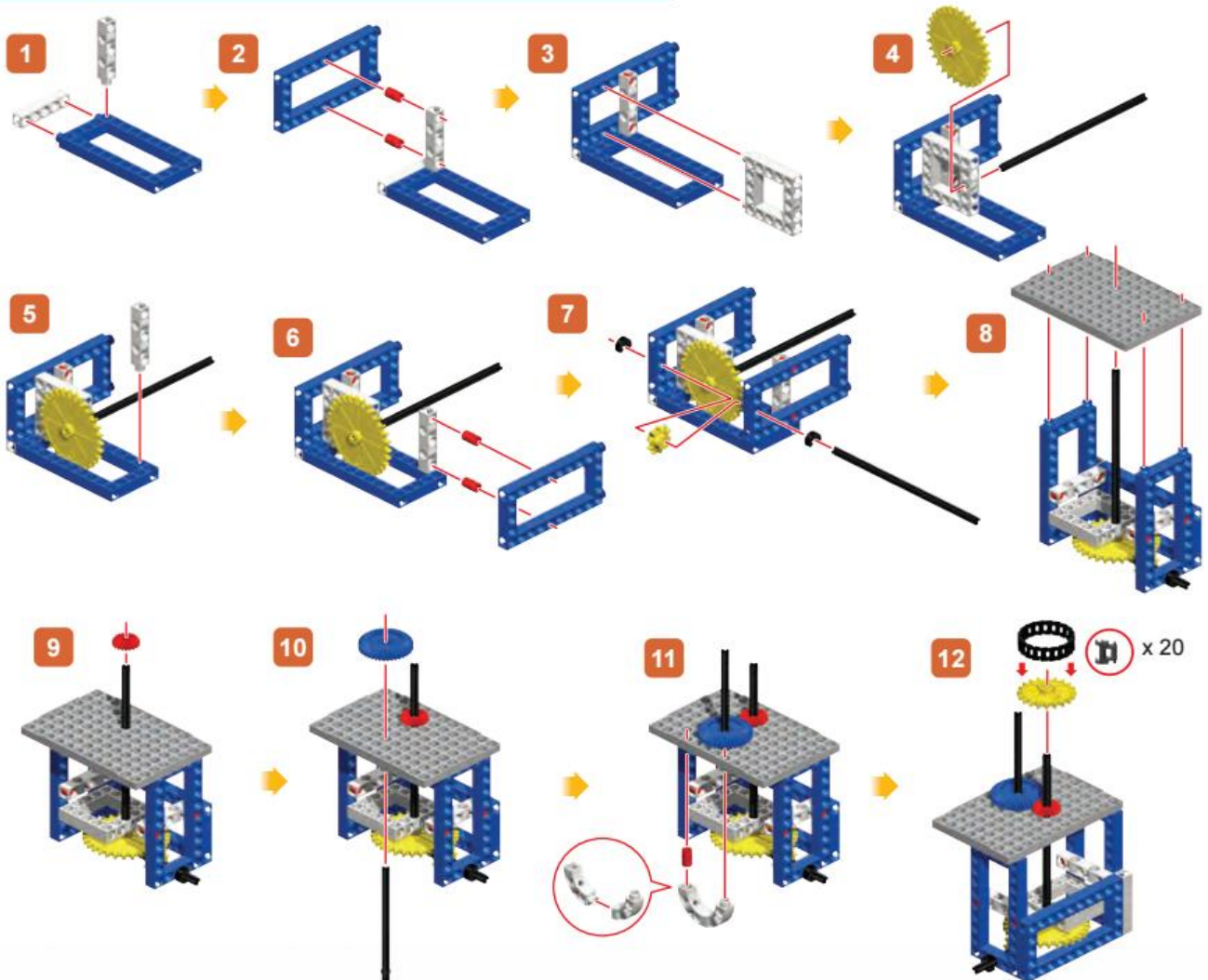
Parts Needed



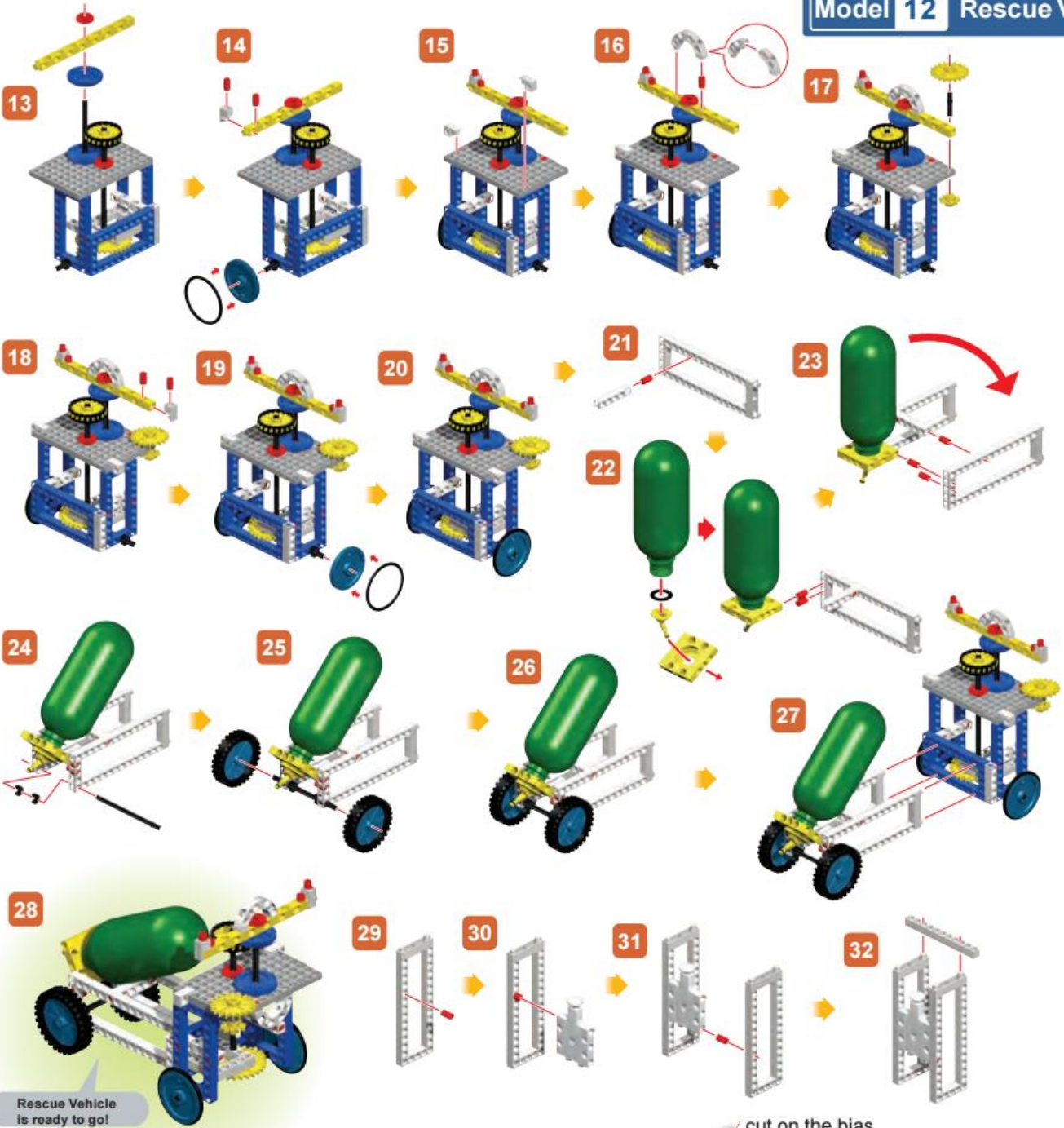
Assembly Precautions

1. Screw off the original cap of the Secured Air-Water Storage before the model assembly starts. The original cap will not be used in this model.
2. Mesh the gears correctly for smooth operation.
3. Leave a 1mm gap between the gear and the frame for the wheel to turn smoothly
4. Align the chain gears for smooth operation.
5. Cut Tube A to the following lengths for this model.

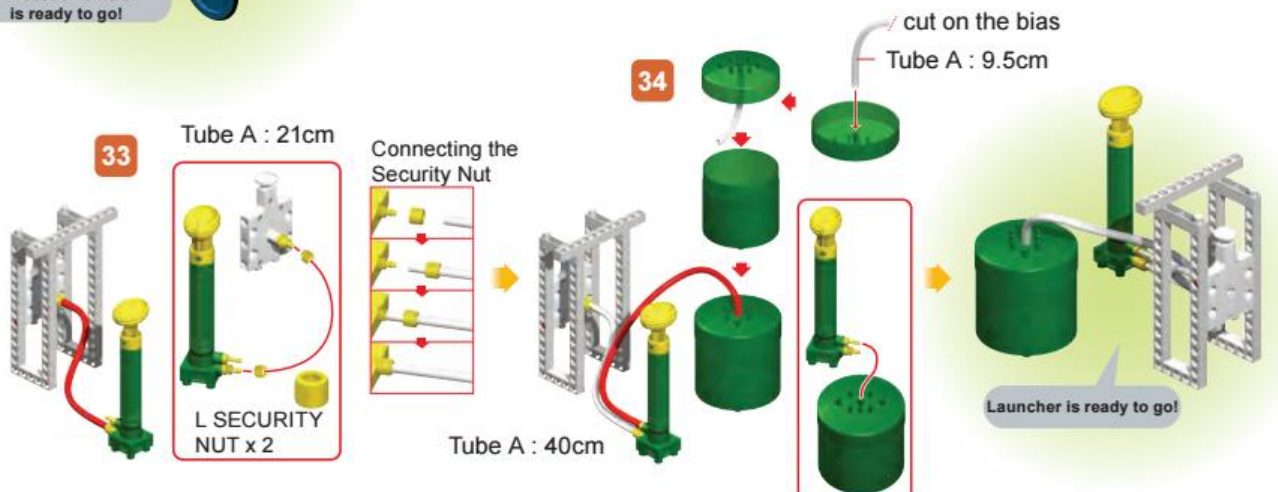
Tube A : 9.5cm x1, 21cm x 1, 40cm x 1
(3.75in x 1, 8.3in x 1, 15.75in x 1)



Model 12 Rescue Vehicle

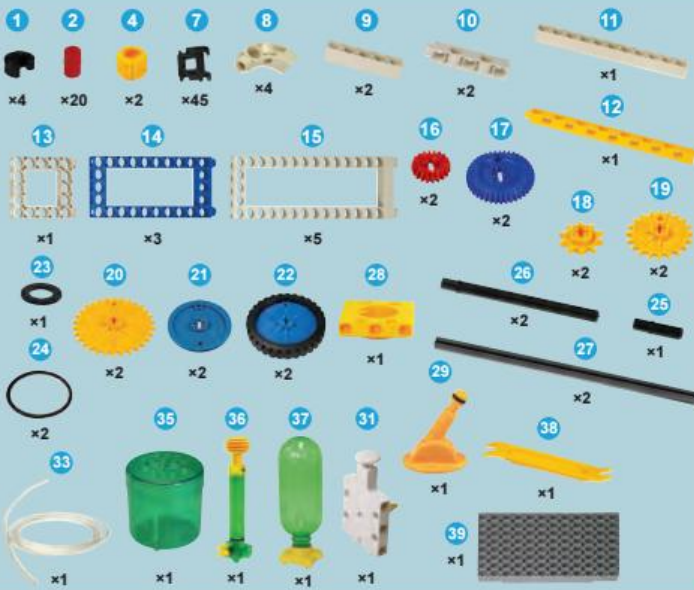


Rescue Vehicle is ready to go!



Fork Lift Model 13

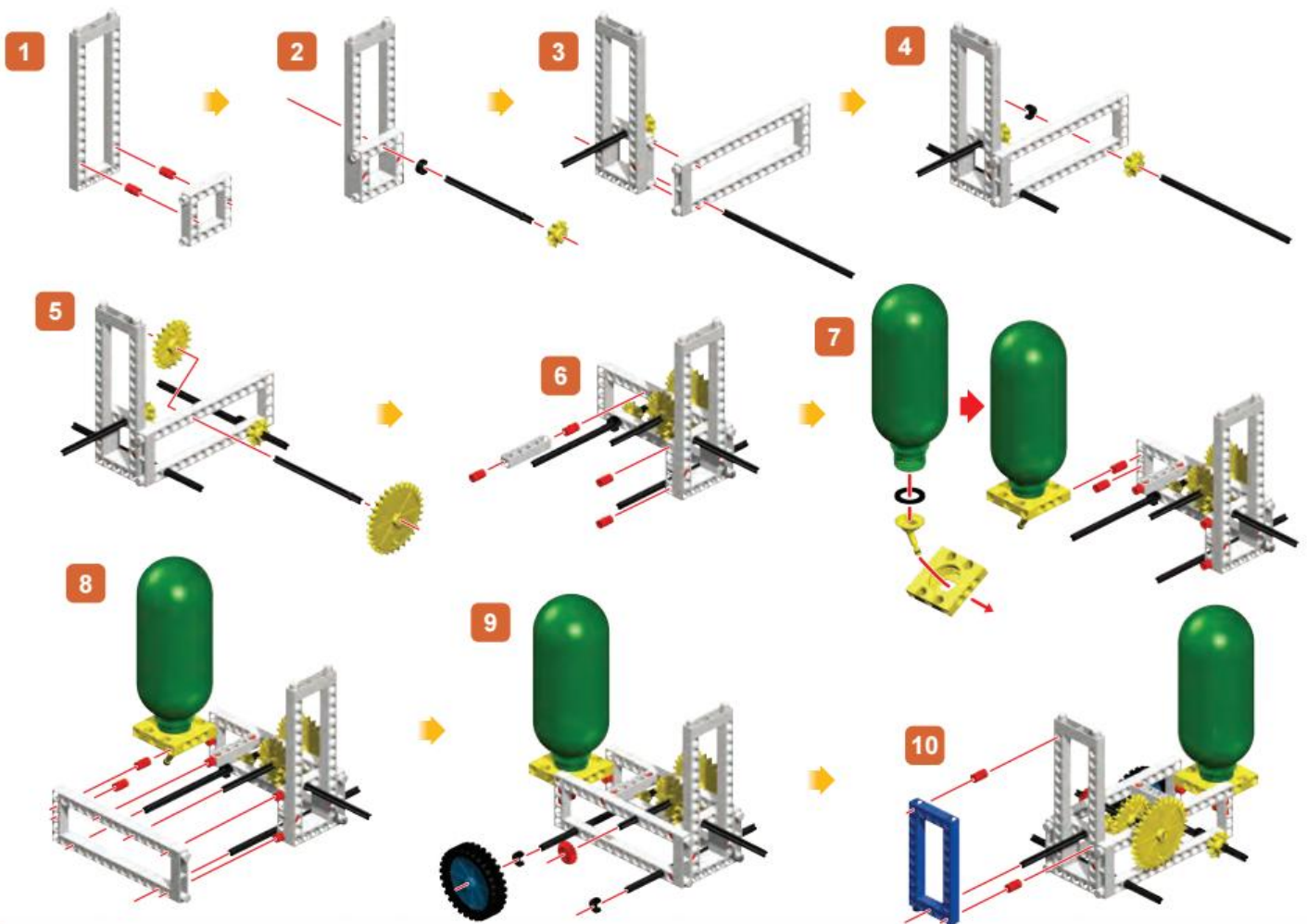
Parts Needed



Assembly Precautions

1. Screw off the original cap of the Secured Air-Water Storage before the model assembly starts. The original cap will not be used in this model.
2. Mesh the gears correctly for smooth operation.
3. Leave a 1mm gap between the gear and the frame for the wheel to turn smoothly
4. Align the chain gears for smooth operation.
5. Cut Tube A to the following lengths for this model.

Tube A : 9.5cm x 1, 21cm x 1, 40cm x 1
(3.75in x 1, 8.3in x 1, 15.75in x 1)



Model 13 Fork Lift

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

26

27

28

29

30

x 45

Fork Lift is ready to go!

Connecting the Security Nut

Tube A : 21cm

L SECURITY NUT x 2

cut on the bias

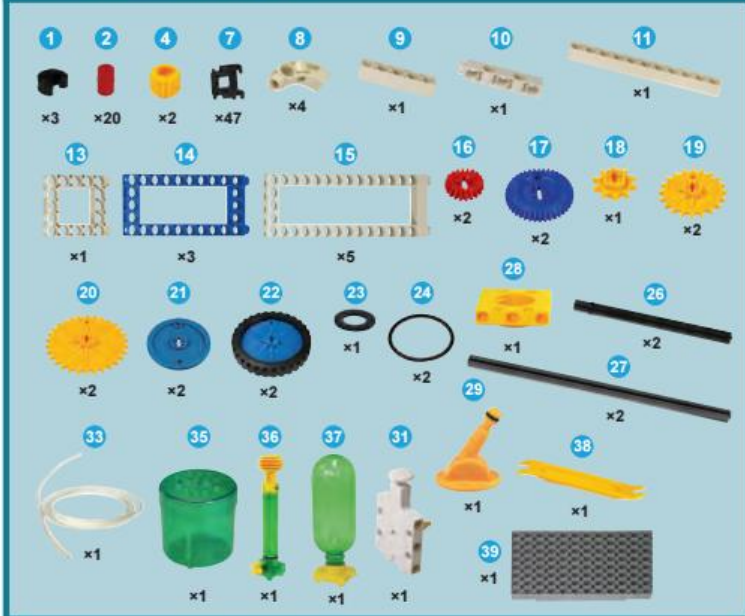
Tube A : 9.5cm

Launcher is ready to go!

Tube A : 40cm

Vintage Car Model 14

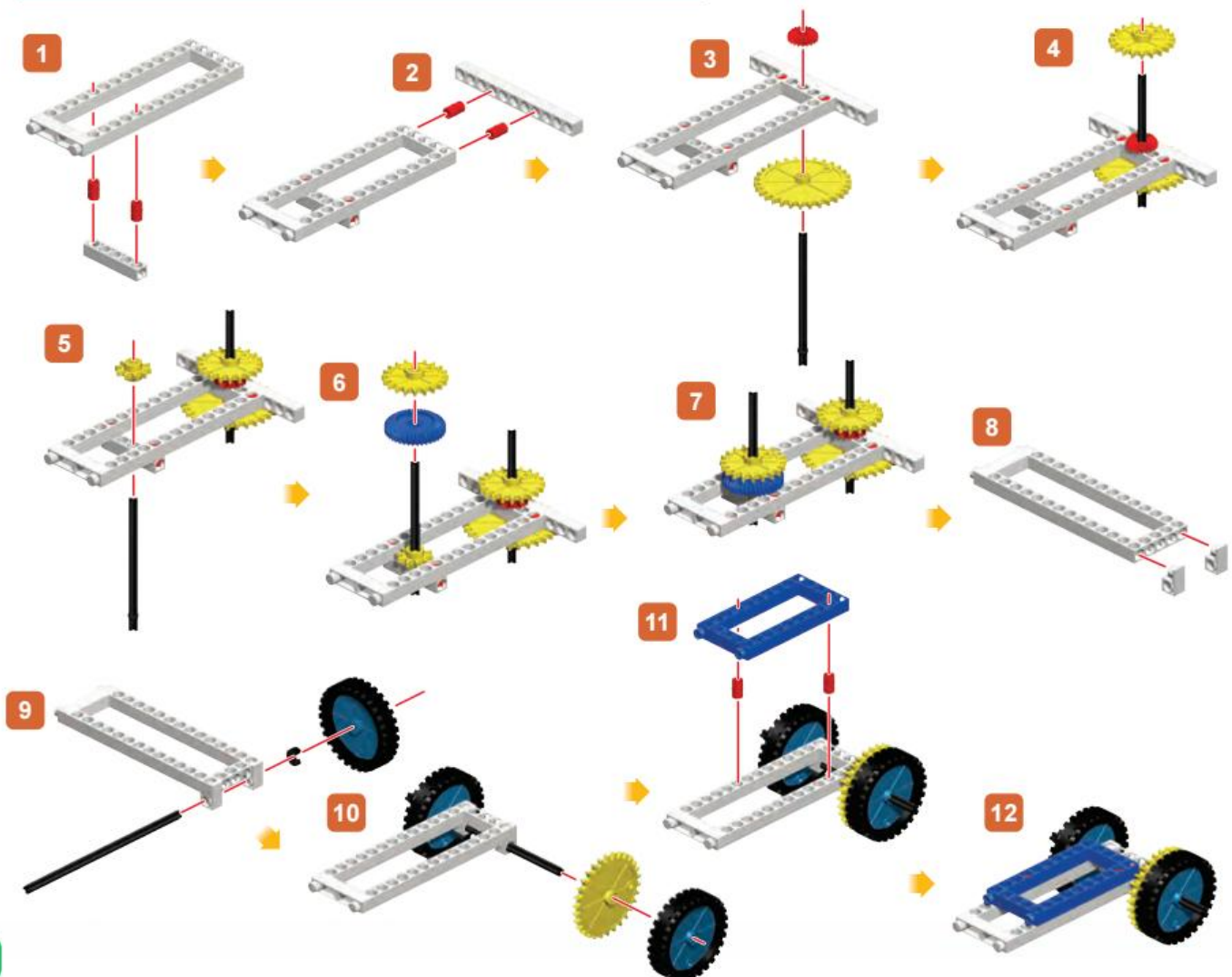
Parts Needed



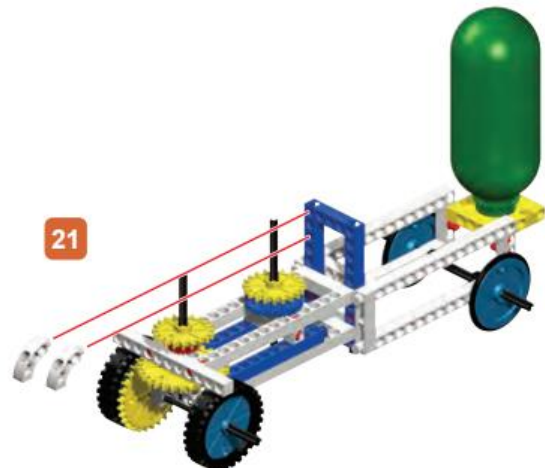
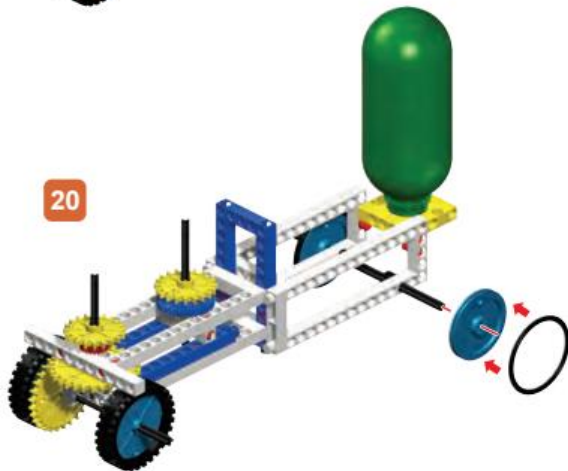
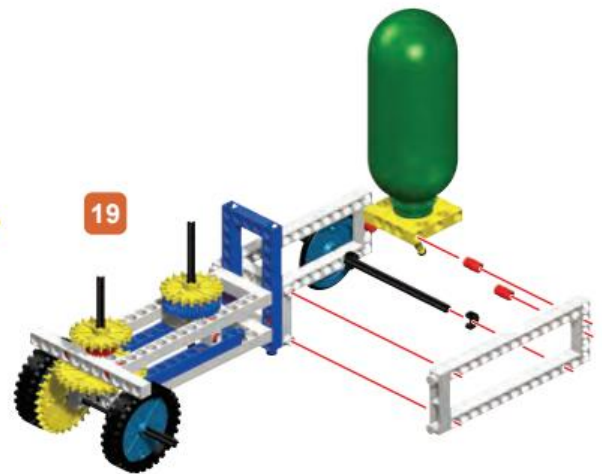
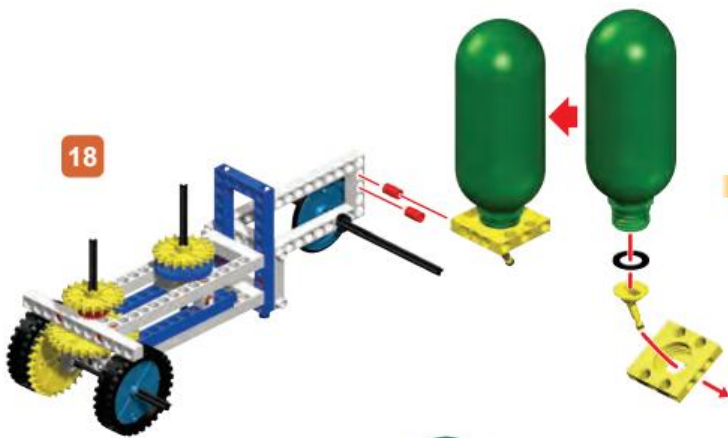
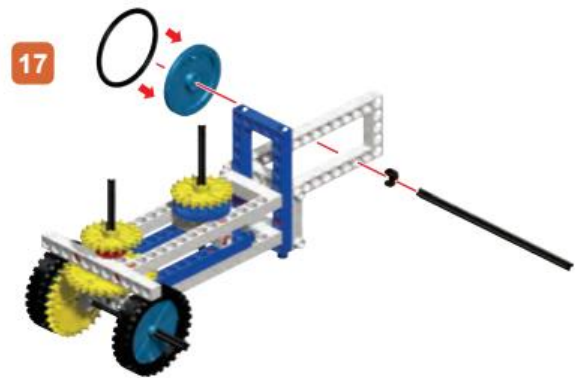
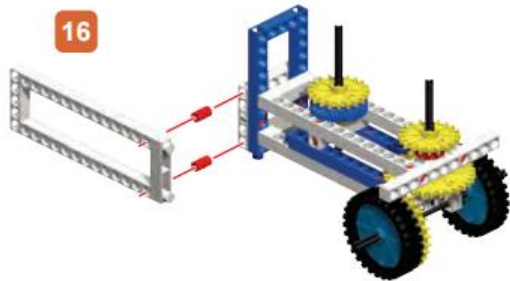
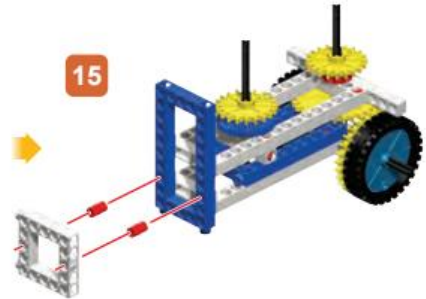
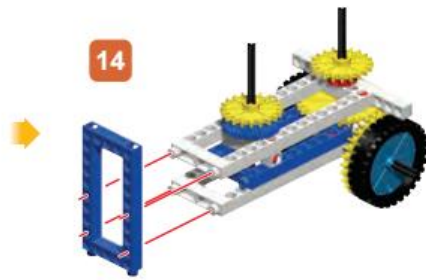
Assembly Precautions

1. Screw off the original cap of the Secured Air-Water Storage before the model assembly starts. The original cap will not be used in this model.
2. Mesh the gears correctly for smooth operation.
3. Align the chain gears for smooth operation.
4. Cut Tube A to the following lengths for this model.

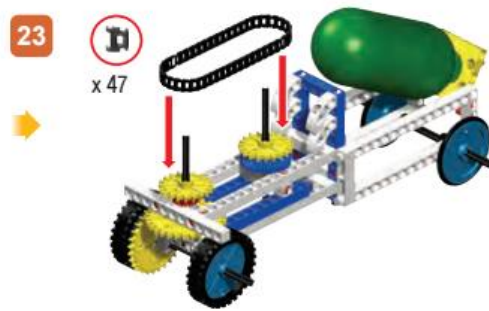
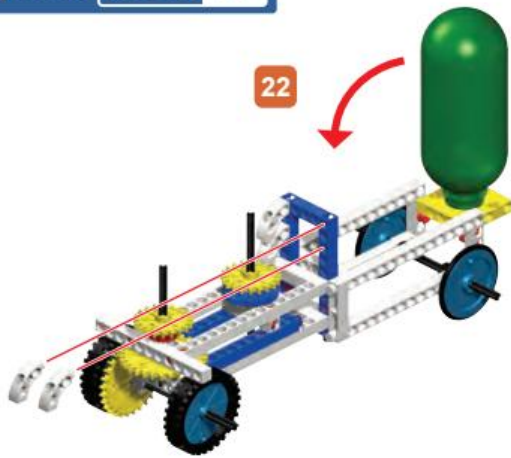
Tube A : 9.5cm x 1, 21cm x 1, 40cm x 1
(3.75in x 1, 8.3in x 1, 15.75in x 1)



Model 14 Vintage Car



Vintage Car Model 14



Tube A : 40cm



31

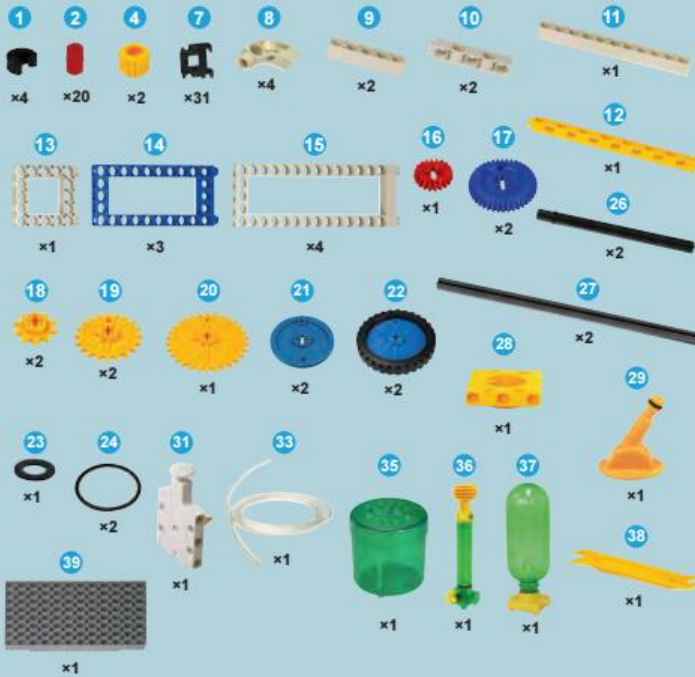
Tube A : 21cm



Launcher is ready to go!

Model 15 Propeller Plane

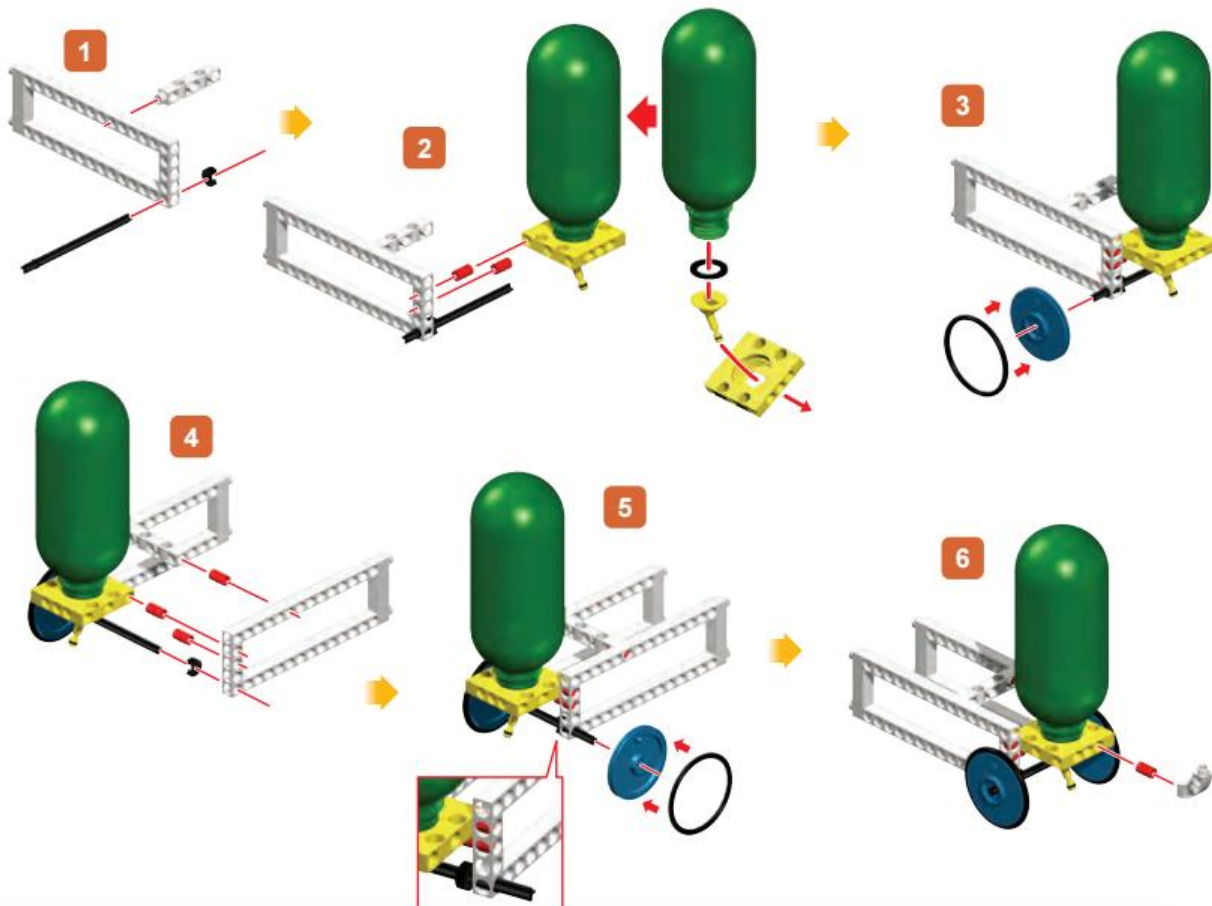
Parts Needed



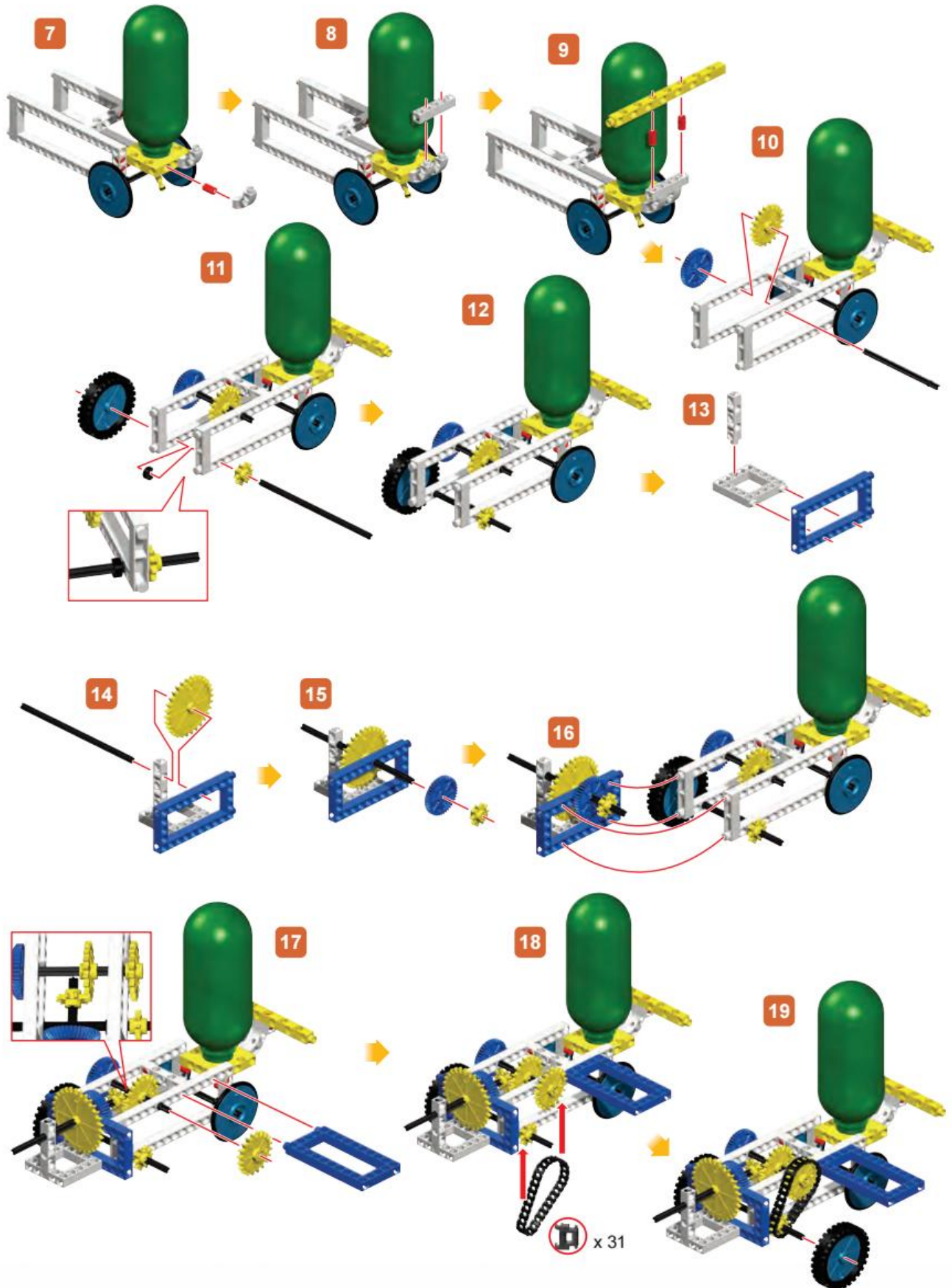
Assembly Precautions

1. Screw off the original cap of the Secured Air-Water Storage before the model assembly starts. The original cap will not be used in this model.
2. The parts shown here on the model must be connected tightly for the propeller to rotate.
3. Mesh the gears correctly for smooth operation.
4. Align the chain gears for smooth operation.
5. Leave a 1mm gap between the gear fixing and the frame for the wheel to turn smoothly.
6. Cut Tube A to the following lengths for this model.

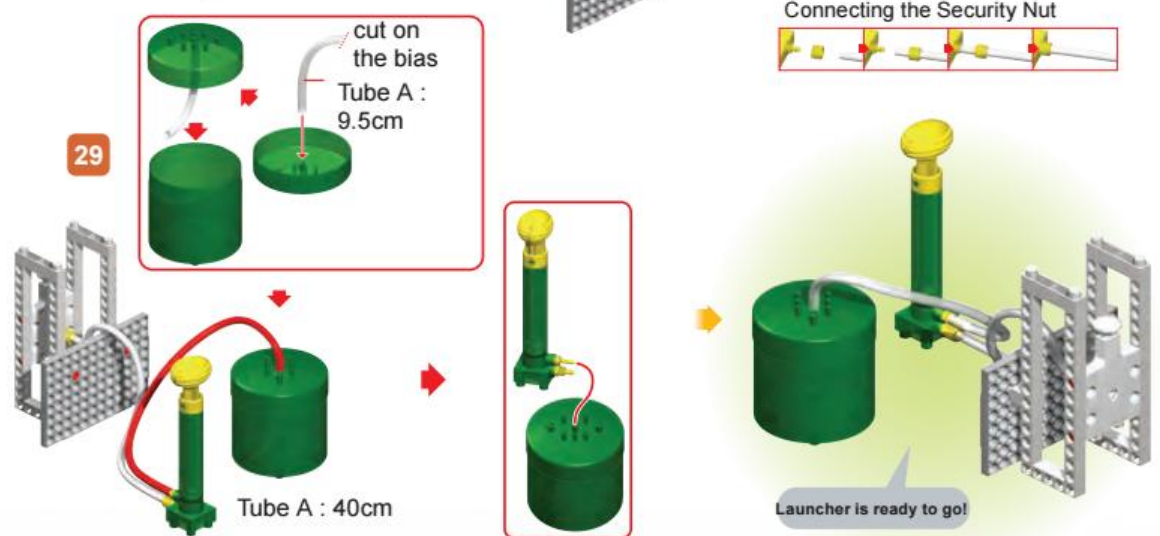
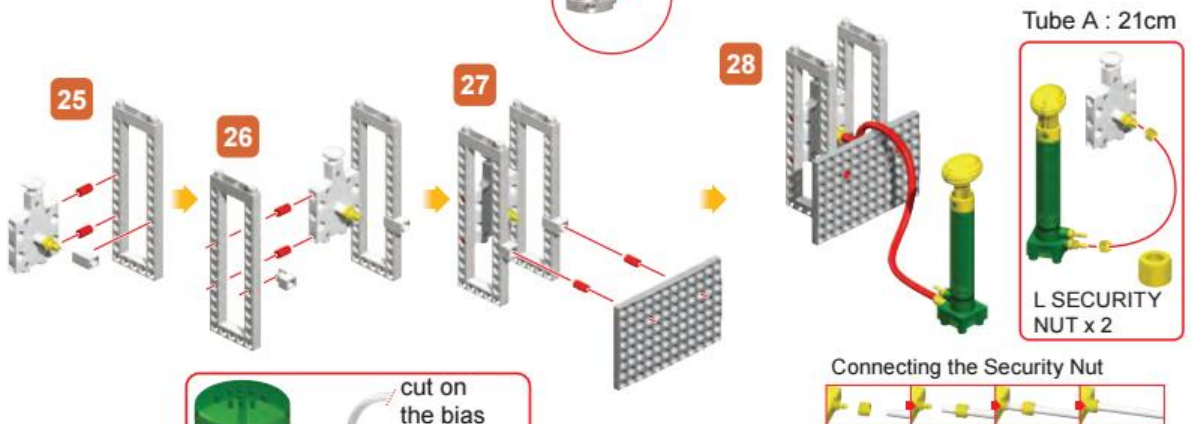
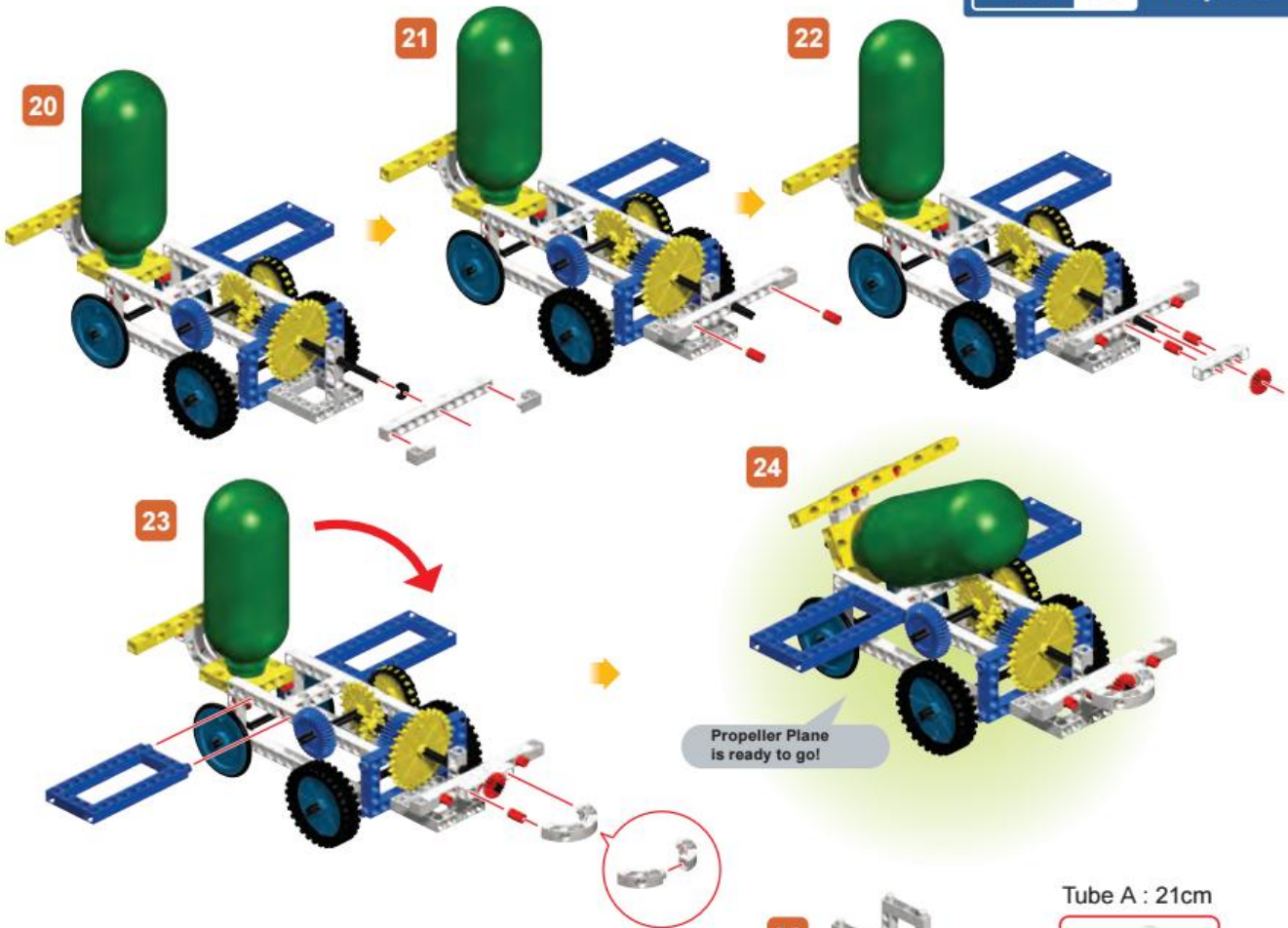
Tube A : 9.5cm x1, 21cm x 1, 40cm x 1
(3.75in x 1, 8.3in x 1, 15.75in x 1)



Propeller Plane Model 15



Model 15 Propeller Plane



GREEN ENERGY



SUPER WATER POWER
#7375
30 Models to build
176 PCS



WIND TURBINE
#7400
5 Models to build
77 PCS



WIND POWER
#7324
8 Models to build
133 PCS



RC RACE CAR
#7407
10 Models to build
260 PCS



CROSSBOWS AND CATAPULTS
#7406
10 Models to build
110 PCS



WATER POWER MINI
#7389
6 Models to build
60 PCS



MINI GYRO
#7395
20 Models to build
88 PCS



GECKOBOT
#7409
7 Models to build
176 PCS



SMART MACHINES
#7416
8 Models to build
230 PCS



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