EXPERIMENT MANUAL

SpringBots 3-IN-1 SPRING-POWERED MACHINES

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Good to know!

If you are missing any parts, please contact Thames & Kosmos technical support.



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KIT CONTENTS

Checklist:

No.	Description	Quantity	Part No.
С	Plastic frame C (Parts C1	-C29) 1	724854
D	Plastic frame D (Parts D1	-D26) 1	724855
Е	Plastic frame E (Parts E1	-E17) 1	724856
P1	Round metal rod, S	1	724859
P2	Round metal rod, M	4	724860
P3	Round metal rod, L	5	724859
P4	Round metal rod, XL	1	724859
	No. C D E P1 P2 P3 P4	No. DescriptionCPlastic frame C (Parts C1)DPlastic frame D (Parts D1)EPlastic frame E (Parts E1)P1Round metal rod, SP2Round metal rod, MP3Round metal rod, LP4Round metal rod, XL	No.DescriptionQuantityCPlastic frame C (Parts C1-C29)1DPlastic frame D (Parts D1-D26)1EPlastic frame E (Parts E1-E17)1P1Round metal rod, S1P2Round metal rod, M4P3Round metal rod, L5P4Round metal rod, XL1

J	No.	Description	Quantity	Part No.
Ο	P5	Hexagonal metal rod, M	1	724859
0	P6	Hexagonal metal rod, L	1	724859
0	P7	Foam sticker sheet	1	724860
Ο	P8	Plastic spiral spring, larg	ge 1	724857
Ο	P9	Plastic spiral spring, sm	all 1	724858
0	P10	Plastic storage bag	1	724860

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) TIP





PART D14 is a SPECIAL TOOL NEEDED FOR BUILDING THE MODELS. THE INSTRUCTIONS WILL TELL YOU WHERE TO FIND IT AND HOW TO USE IT.

) YOU WILL ALSO NEED:

Scissors or diagonal cutter, nail file



SAFETY INFORMATION

WARNING

Not suitable for children under 3 years. Choking hazard — small parts may be swallowed or inhaled. Keep the packaging and instructions as they contain important information.

Hold the built models as shown in the instructions. When operating the models, do not put your fingers near the moving parts.

THE RIGHT TOOL

Using the right tool can make assembling your models easier and it can also make your models work better in the end. It is best to cut the plastic parts out of their frames with a small diagonal cutter (such as those used for electronics work) or model pliers. Using these tools, the parts can be precisely cut so that no burrs remain on the parts and there is no need to file them down. If you don't have these pliers at home, you can use scissors and a nail file. Normal scissors do not cut as precisely as a diagonal cutter, so you may have to file some of the rough edges down with the nail file.

Dear parents and adults,

Children want to explore, understand, and create new things. They want to try new things and they want to do this on their own. They want to gain knowledge! They can do all of this with Thames & Kosmos experiment kits. With every single experiment, they grow smarter and more knowledgeable.

Before building and experimenting, read the instructions together with your child and discuss the safety instructions. Support your child with advice and a helping hand, especially during tricky assembly steps or experiments.

To prevent damage to the work surface on which your child is building and experimenting, provide them with a mat or other surface protection. When cutting the plastic parts out of the frames with the diagonal cutter or scissors, special care must be taken, not just because of the sharp edges on the tools, but also because the plastic parts can yield sharp edges or burrs. These can be removed with the help of the diagonal cutter or a nail file. Supervise your child when they are using the sharp tools until you trust that they can handle the tools independently.

We hope you and your child have a lot of fun building and playing with SpringBots!

IMPORTANT: REMOVE THE PARTS FROM THE FRAMES ONLY WHEN THEY ARE NEEDED. REMOVE EXCESS MATERIAL BEFORE ASSEMBLY WITH THE HELP OF A DIAGONAL CUTTER OR A NAIL FILE.







TIPS FOR STORING THE PARTS AFTER ASSEMBLY



Wow!

This device stores up and releases energy!

The Spring Matas

The windup spring motor is the core of your three models. It includes a complete gearbox to transmit energy from the spring to the moving parts of the models. On the following pages, you will learn how to assemble the spring motor.

SPRING MOTOR ASSEMBLY



















SPRING MOTOR TESTING





Energy from Muscle Power

Did you know that you are a small power plant? This is true because your body is able to produce **energy** from the food you eat. An average adult needs around 1,000 kilowatt hours (kWh) of energy per year. Ninety percent of this is needed to keep the body functions running, especially to keep the body temperature at approximately 98.6 °F (37 °C). So there are around 100 kWh left to do other activities. You can see in the table below what you can do with 1 kWh.



WHAT YOU CAN DO ON 1 KWH OF ENERGY

(Example calculation: With 1 kWh, you can vacuum for one hour with a vacuum cleaner that requires 1,000 watts (1kW) to operate.)

- Charge your mobile phone about 100 times
- Drive 4.2 miles (6.7 km) with an electric car
- Operate a refrigerator for 2.5 days
- Toast 130 slices of bread in a toaster
- Light an LED bulb for 100 hours



We use the energy our bodies generate from food for everything we do — playing sports, tidying up our

bedrooms, and for just moving around. Our muscles convert this energy into **kinetic energy**, which is the energy of motion. Whether we're cycling, skateboarding, swimming, or running, we are using our muscles to move.

The models in this experiment kit also use your muscular strength to move. But what's really cool is that your muscle strength does not directly trigger the movement of the models. Rather, the energy is first stored up by **the winding up of the spring motor** and then simply released at the push of a button. When the spring unwinds, the stored energy is slowly released again into motion. But the energy originally came from you, when you wound up the spring.

Whoa!

Wind me up and watch me go!

The Race Cas Model

VROOOMI

After you have built the spring motor, you can tackle your first model: the windup race car. Using the power of the spring motor, the race car zooms across the floor up to 60 feet! Experiment to see how far you get can it to go. Challenge your friends to a race — this car will leave the competition in the dust!

Race Car

RACE CAR ASSEMBLY



















Push

HOW TO USE



Hold the model by rods D16 and D17 as shown. Don't hold the model by the moving parts. Don't put your fingers near the moving parts.

2

D17





СНЕСК ІТ ОИТ

THE SPRING MOTOR STORES ENERGY

The secret behind the fascinating machines in this kit is a power source called a **mainspring** — a spiral-shaped spring that stores up energy when wound up by hand, and then converts that stored energy back into motion when it discharges. Mainsprings have long been used to store energy. In the past, **gramophones**, cameras, rotary telephones, and clocks were all operated with mainsprings. **Windup toys** have also always been a popular application. All of these items worked the same way: the mainspring was wound up by hand and the stored energy was then used to set a mechanism in motion.

Mainsprings are still used in some wristwatches today, but mostly in automatically winding mechanisms. These watches use the movements of the wearer's arm to wind the spring inside a little bit with every movement. This means that these clocks can run for an unlimited period of time without batteries, as long as they are being worn and charged up regularly.

Read more about energy storage on page 41.

Tick Tock!

It's time to wind the clock!

The Times Model

Strictly speaking, this model is a timer, not a clock — but it works a lot like a mechanical clock. You can set the timer to count down from between one and six minutes.

This timer model uses some complex parts with technical-sounding names like balance wheel, escapement, and anchor. These are terms from the watchmaking trade. These special mechanical parts ensure that your timer runs smoothly. See for yourself how they work!

Countdown Timer

COUNTDOWN TIMER ASSEMBLY





















17

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COUNTDOWN TIMER ASSEMBLY













The countdown timer can count down from up to six minutes.



DISASSEMBLY TIPS

Finishing the countdown:



When the hand arrives at the end point, it is normal for the low-speed escapement to still swing for up to 30 seconds.

8

When you are finished, release the spring motor and store the model with the spring unwound. If you store the model with the spring wound up, it can deform and lose its strength over time. Refer to page 62.





Countdown Timer 🔗





OTHER FORMS OF ENERGY STORAGE

CHECK IT OUT

Mainsprings aren't the only devices that can serve as energy stores. There are many different forms of energy storage. For example, **batteries** use chemical processes to store energy.

Coal and crude oil, known as **fossil fuels**, are also energy stores, because they essentially consist of plants and other organisms that stored solar energy millions of years ago.

Your body's power plant is also dependent on **solar energy.** This is because we feed on plants or animals, which in turn live on plants, and plants can only grow if they "soak up" sunlight. So our food is actually also an energy store for solar energy.

> Pumped storage power plants are also interesting energy stores. In these power plants, energy is used to pump water up a mountain. This is done at night, for example, when households use less electricity and it is less expensive. When the energy is needed again during the day, the water flows down the mountain and drives turbines that produce electricity.



The Robot Model

Windup robots are something of a modern classic in the toy box. With this set you can build your own. The spiral motor lets your robot walk up to 20 inches. Not only does it move its two legs to walk, but it also swings its arms back and forth.













Robot

view



Robot



ROBOT BODY ASSEMBLY















ROBOT HEAD, ARMS, AND FEET ASSEMBLY



Robot





HOW TO USE







fingers near the moving parts.

Wind the knob clockwise until the

spring is tightly wound up.

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HOW TO USE



FROM ROBOT BODY TO SPRING MOTOR

If you want to assemble the race car or the countdown timer after assembling the robot, here's how to convert the robot body back to the original spring motor.











Robot



FROM ROBOT BODY TO SPRING MOTOR





TROUBLESHOOTING TIPS

What should I do if the car doesn't run after I switch it on?

Make sure that the rear wheel axle is assembled correctly (p. 19, steps 3 and 4).



What should I do if the timer doesn't run smoothly after I switch it on?

Make sure 😢 and 🔺 remain aligned even when you are not holding C23 (p. 28, step 6).



Also, make sure D5 is free of dust and lint, which can build up during use. To clean it, remove D5 and dust it with a dry cloth or tissue.



What should I do if the timer seems to work but the minute hand doesn't move?

Make sure E16 is clipped on (p. 37, step 6).



What should I do if the timer doesn't work, or the spring is completely released right after I switch it on?

Make sure that the low-speed escapement is perfectly connected to the spring motor, as shown in the illustration.



STORING YOUR MODELS

When you are not actively using your models, the windup spring should always be released (unwound). Do not store the models with the spring wound up. Otherwise it can become deformed and lose its strength over time. The following illustrations show you how to release the spring in each of the models.

Countdown Timer





Race Car







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