kinia

Age:
10+

Activity Guide

Build a Model Automatic Ball Launcher

Category: **STEAM**
Topic: **Maker**
Level: **Hard**
Duration: **60 mins**

Activity Description

The automatic Ball Launcher is an essential training tool for ball sports, designed to boost individual performance and training efficiency. With this model Ball Launcher, students can explore the inner workings of a full-scale machine, offering a hands-on learning experience.

Learning Outcomes

- Discover the fundamentals of electricity and how it powers devices.
- Apply design thinking principles to build a functional ball launcher.
- Understand the basics of circuitry and electrical flow.
- Learn about conductivity and its role in electrical systems.

21st-Century Skills Developed

- **Collaboration:** Work together to solve challenges and complete the project.
- **Communication:** Share ideas effectively in both individual and group settings.
- **Creativity and Innovation:** Think outside the box to design and improve the launcher.
- **Critical Thinking and Problem-Solving:** Analyse problems and develop practical solutions.

How to Use This Activity Guide

For Educators

- Use the learning outcomes and competencies to help build programme plans, logic models, sessions, and lesson plans.
- Refer to the equipment list to ensure you have all the materials and resources needed for the activity.
- Share the guide with colleagues and volunteers to help them learn how to effectively facilitate the activity.

For Everyone

- Print out the guide, starting with the **Step-by-Step Instructions**, for young people to follow along. This allows you to focus on deepening their understanding and engagement with the activity.
- Use the **Glossary of Terms** to help build young people's technical and science vocabulary as they progress through the activity.

Follow-On Activity

- Explore additional information provided for upskilling or for more advanced activities to extend the learning experience.

Equipment

Components/Technical

- Laptop/PC with speakers

Arts & Crafts Materials

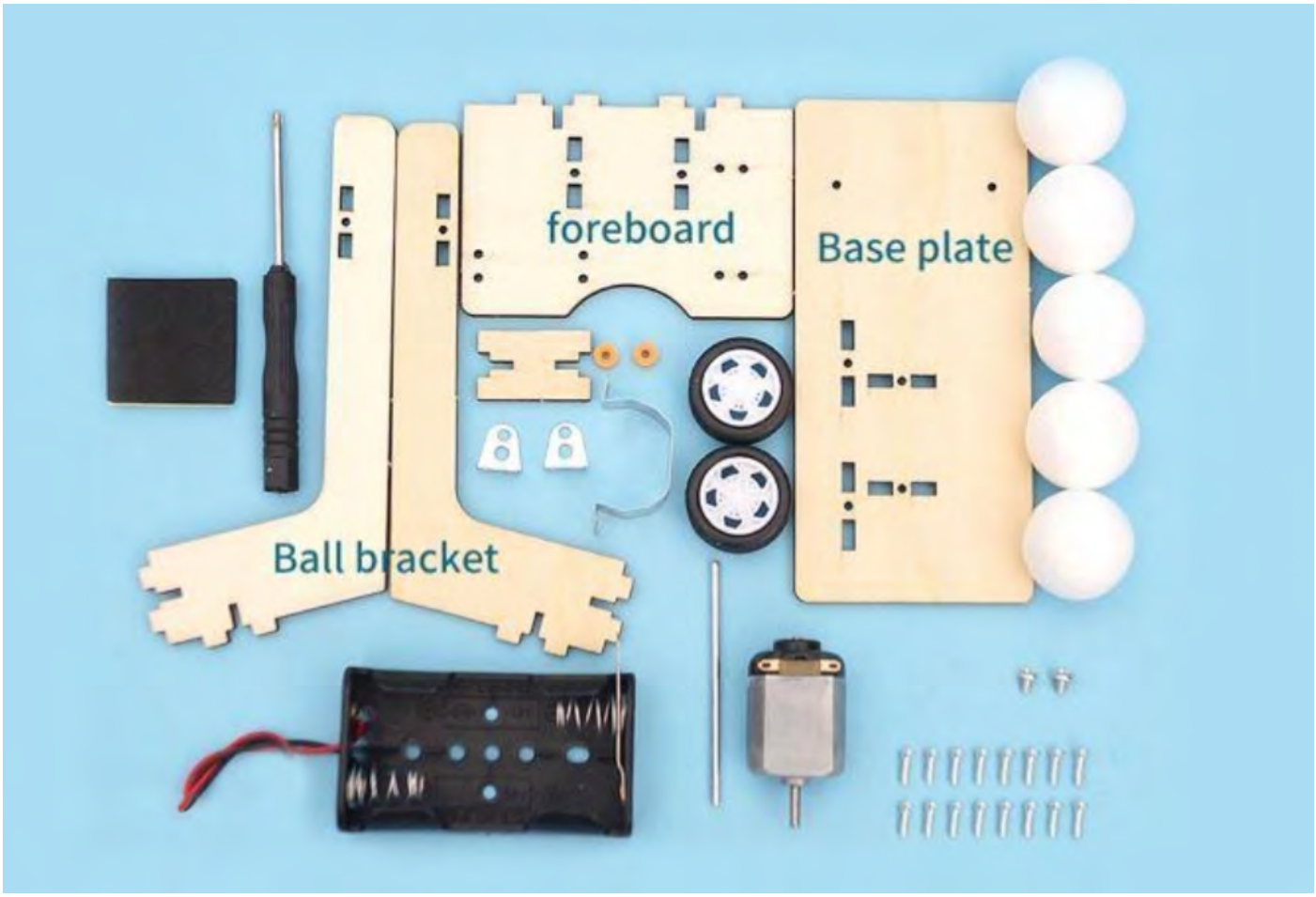
- Small Phillips screwdriver
- Pair of AA batteries

Instructions

- During the assembly process, use the Phillips screwdriver to install the screws securely.
- After assembly is completed, insert the AA batteries to test if the model functions properly and operates as expected.

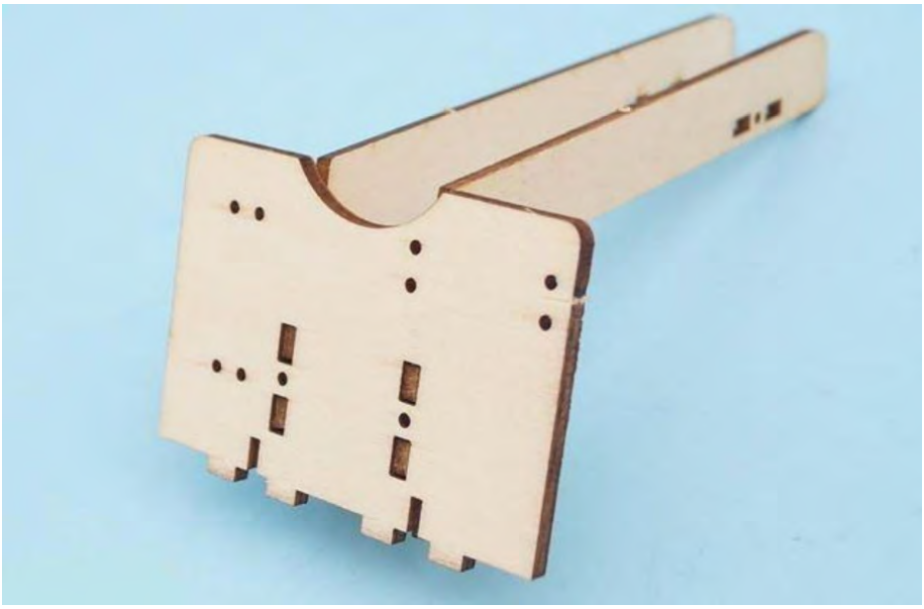
Step-by-Step Instructions

Step 1:
Layout all assembly parts.



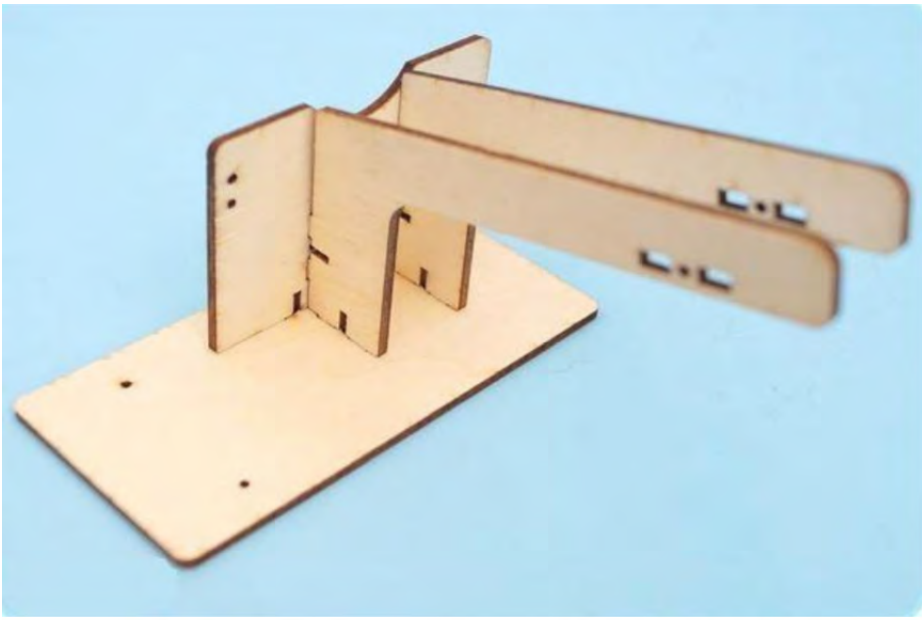
Step 2:

Refer to the figure on the right, first put the front plate and the ball bracket plate together, pay attention to the position of the screw hole, please do not install the wrong direction.



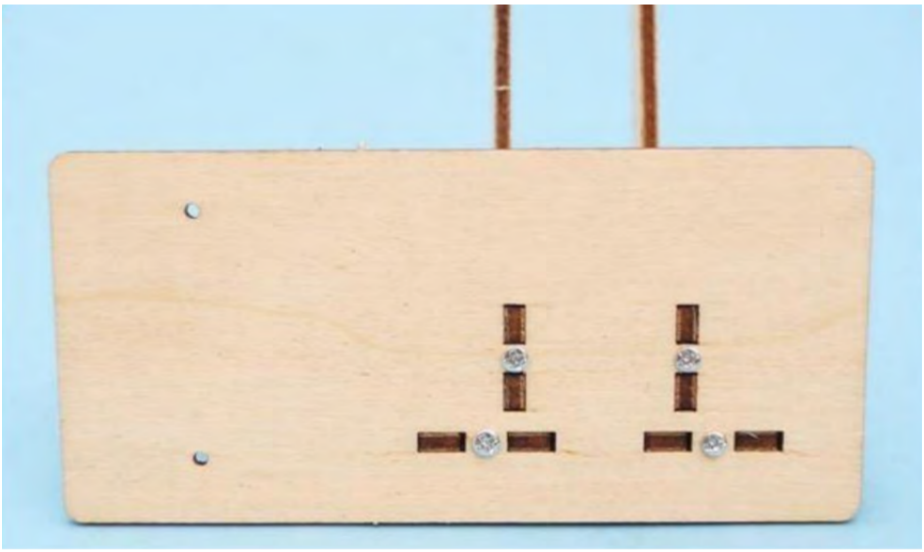
Step 3:

Insert the front plate and the ball carrier into the base plate at the same time.



Step 4:

Install the 7mm screw at the bottom of the base plate to secure the front plate and the ball carrier.

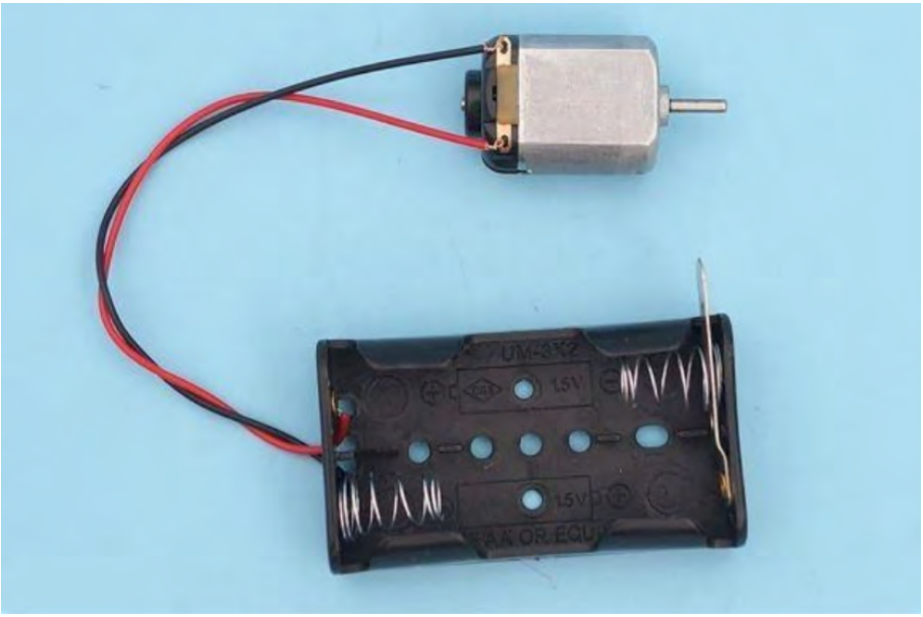


Step 5:

Use 4 7mm screws to install the two center shaft racks on the front plate, and then use 2 7mm screws to secure the ball holders.

Step 6:

Connect the wires on the motor according to the position of the red and black wires above.

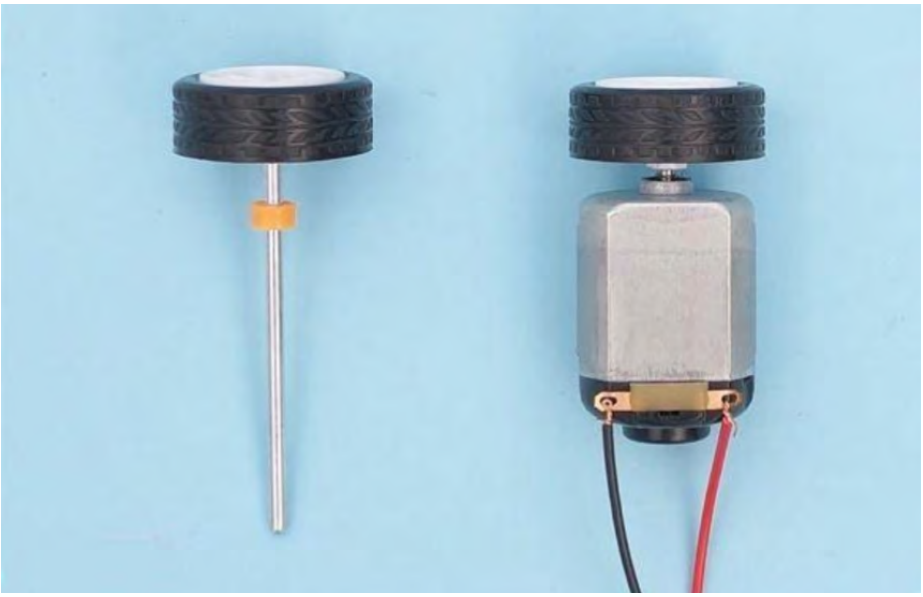


WIRING METHOD:

First screw the metal wire core into a spiral shape, and then screw the metal wire core through the holes in the copper piece of the motor wiring. screw 3-4 turn

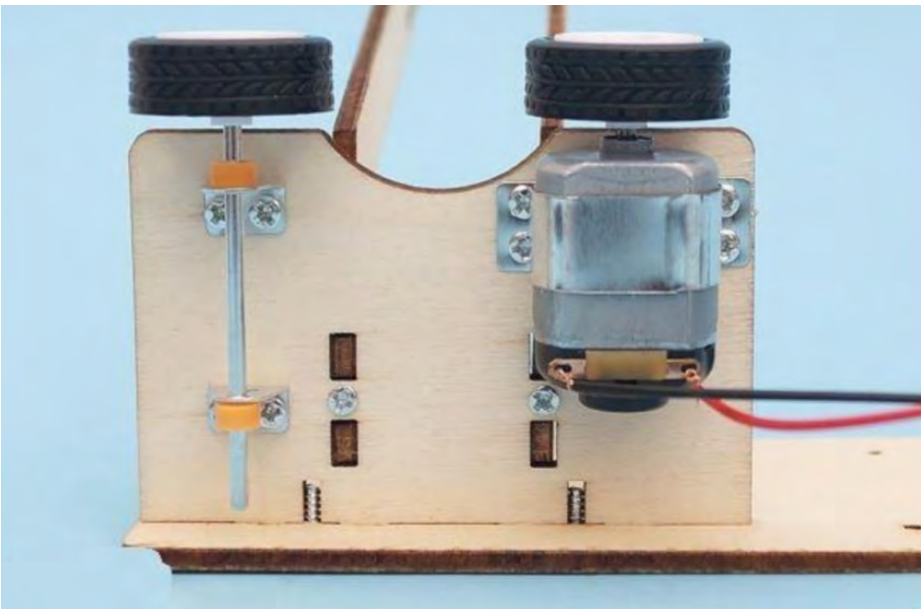
Step 7:

First, the rubber wheel is installed on the motor rotating shaft and the long iron shaft, and then a wheel shaft fixing ring is set on the iron shaft.



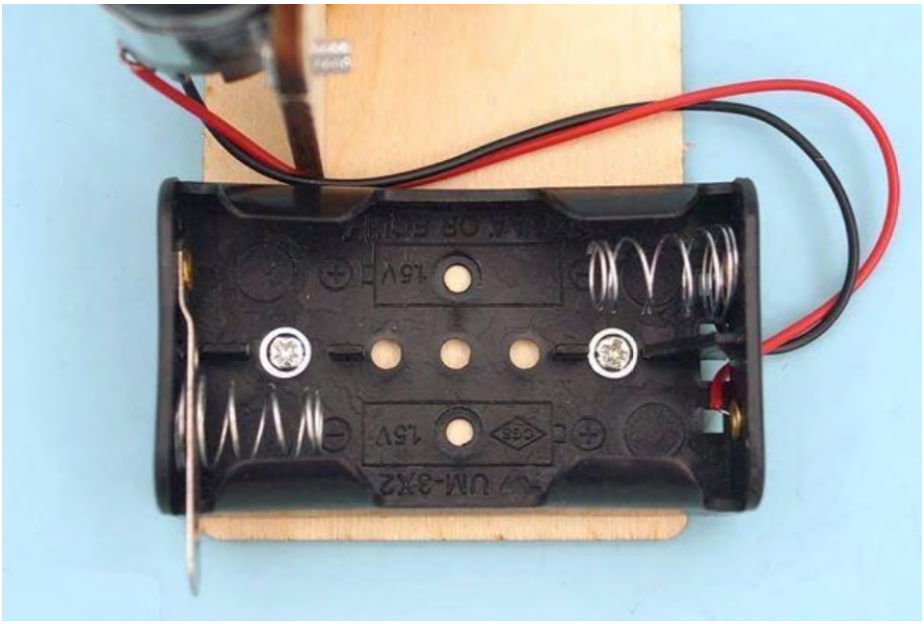
Step 8:

First, the iron shaft with wheels is installed on the small round hole of the central shaft frame, and an orange fixing ring is set under the second central shaft frame. Install the motor on the front plate with 7mm screw and metal motor clip. After installation, adjust the height of the rubber wheels on both sides to keep the same.



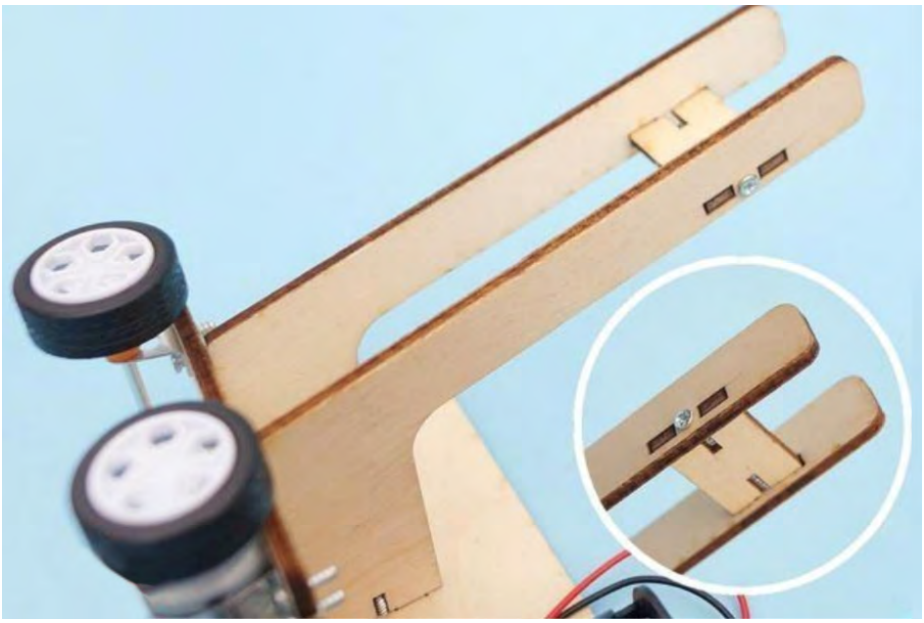
Step 9:

Install the battery box on the base plate with 4mm screws.



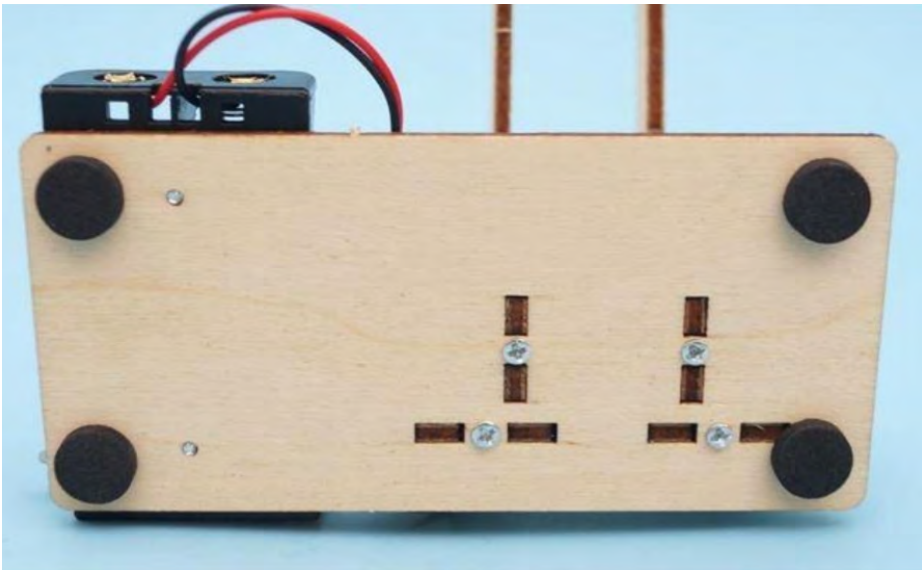
Step 10:

Install the ball carrier support plate with 7mm screw.



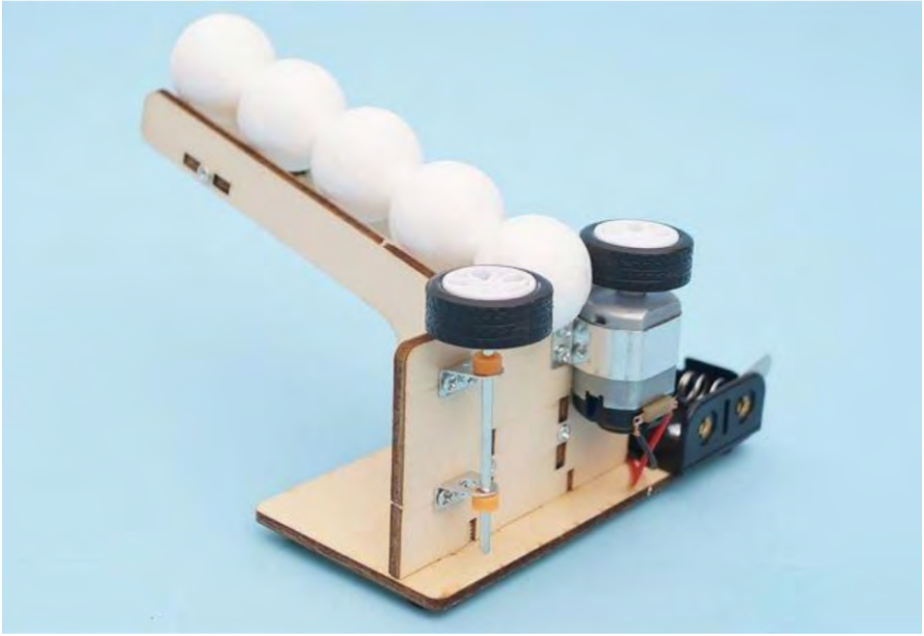
Step 11:

Glue the pads to the 4 corners of the base plate.



Step 12:

Automatic ball machine finished, put 5pcs foam balls on the tray, install the battery in the battery box, you can test. (when the knife switch is closed, the power is turned on; when it is turned on, the power is turned



Potential Troubleshooting

Issue 1: The machine does not work after closing the blade switch.

1. Check if the wiring is properly connected and ensure there is no short circuit.
2. Verify the battery power. If the battery is low, replace it with a new one.

Issue 2: The motor is turning, but the ball is stuck.

1. Check if the red and black wires connected to the motor are reversed. If they are, reverse the connections to ensure the motor pushes the ball forward instead of backward.

Science Tips

Understanding the Ball Launcher

The **Automatic Ball Launcher** is an essential piece of training equipment in ball sports, allowing individuals to train effectively on their own and greatly improve individual training efficiency. There are various types of machines, ranging from mechanical models to intelligent, real-person simulation controls. All machines are designed to enhance the skills of athletes by providing consistent, controlled practice.

Principle of the Automatic Ball Launcher
The automatic ball launcher or mechanical serve machine converts motor power into thrust, quickly propelling the ball out of its track. The key mechanism involves the rubber wheels, where the channel distance between them is intentionally smaller than the diameter of the ball. This design ensures that, as the ball passes through the channel, its speed synchronises with the rotating rubber wheels, resulting in an acceleration effect—similar to how we serve a ball by hand.

It is important that the channel is neither too wide nor too narrow. If the channel is too wide, the ball won't make contact with the rotating rubber wheels and will fail to accelerate. If the channel is too narrow, the ball may get stuck due to increased resistance.

Glossary of Terms

Electrical Charge	An electrical charge is what makes electricity work. It can be positive or negative, kind of like how magnets have a north and south pole. The movement of these charges is what creates electric current in wires and powers things like lights and motors.
Light Emitting Diode (LED)	An LED is a small light that turns on when electricity flows through it. It has two legs: one is positive **(anode)** and one is negative **(cathode)**. The LED only works if you connect the positive leg to the positive side of the battery and the negative leg to the negative side. Devices like LEDs that only work when connected a certain way are called **diodes**.
Polarity	**Polarity** is about having two opposite sides, like positive and negative. • **Electrical Polarity:** In a circuit, polarity tells you which side is positive and which is negative. This is important because some things, like LEDs, only work if connected the right way. • **Magnetic Polarity:** Just like how magnets have a north and south pole, electricity also has a positive and negative side that controls how it works.

Battery type
Only use Zinc Chloride Cell batteries while using this kit.

Warning! Battery Box:

1. The supply terminals are not to be short-circuited
2. Insert batteries with the correct polarity
3. Remove batteries when not in use
4. Do not use rechargeable batteries
5. Different types of batteries of new and old are not to be mixed
6. Only use Zinc Chloride Cell Batteries

Battery Safety Warning

Batteries, such as the AA batteries used with this teaching kit, are a source of electrical energy and must be handled with care. To ensure your safety and the proper functioning of your STEM activities, please adhere to the following guidelines:

Keep Away from Heat

Avoid exposing the battery to direct heat sources or prolonged sunlight, as excessive heat can affect its performance and safety.

Avoid Short Circuits

Do not connect the battery box terminals to each other, as this can cause the battery and wire to become extremely hot. Always use the designated connectors and components. Always use the provided connectors, wires, or components as intended.

Polarity

Ensure that you insert the battery with the correct polarity, aligning the positive (+) and negative (-) terminals accordingly.

Dispose of Properly

When your battery is no longer in use, dispose of it in accordance with your local regulations and guidelines for battery recycling.

Inspect for Damage

Before use, carefully inspect the battery for any visible damage, such as leaks, dents, or corrosion. Do not use a damaged battery.

Adult Supervision

Always have an adult supervise your use of batteries and electrical components.