# Multi-Functional Electric Car - Model NR

Hakubun

In accordance to the new course of study by Ministry of Education, Culture, Sports, Science and Technology

## Introduction

※Use a pair of scissors to cut out parts with the frame, be careful not to tear off by hand

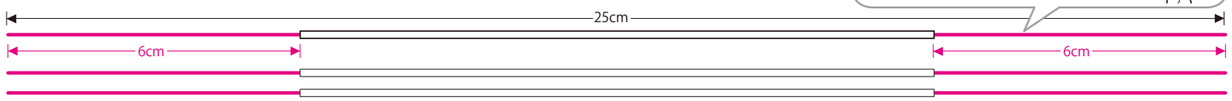
## Prepare for experiment

※Please check the flap of the box regarding the items inside

### Preparation A: Prepare vinyl leads

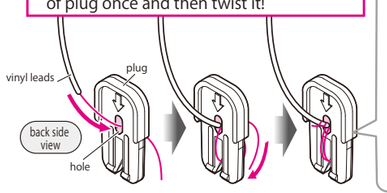
○As shown below, Cut the vinyl leads.
※Make 3 of the same thing, please keep extra vinyl leads in case of loss or breakage.

○Pinch and pull the vinyl of vinyl leads

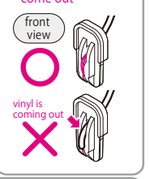



○Pass the vinyl stripped leads through the hole in the plug twice, twist firmly so that leads do not come loose

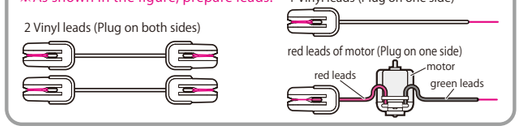
**Note**
○When attaching the plug to leads of motor or socket, pass the leads through the holes of plug once and then twist it!




**Note**
※Make sure the vinyl of the leads do not come out

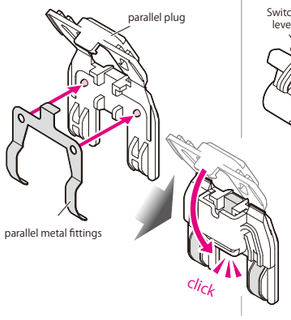



※As shown in the figure, prepare leads.



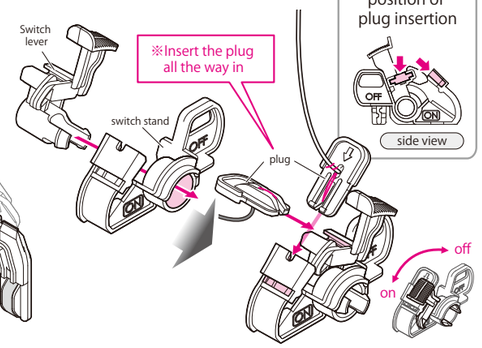

### Preparation B: Assembly of parallel plug and switch

○Insert the parallel metal fittings into the parallel plug




○Insert the switch lever into the switch stand. Then, insert plug into the switch

※Insert the plug all the way in




position of plug insertion

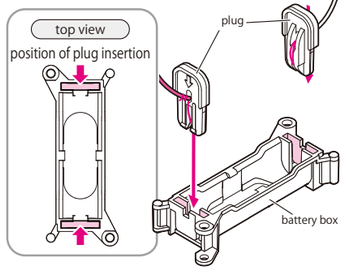



※Before the experiment, keep the switch lever off

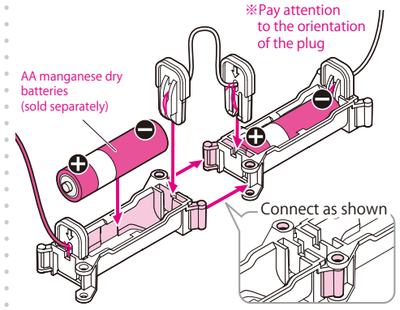
## Plug, How to use parallel plug and dry battery box

●Please use manganese dry batteries for this experiment
●After use, be sure to remove dry batteries

○Insert plug into the dry battery box
※Pay attention to the orientation of the plug



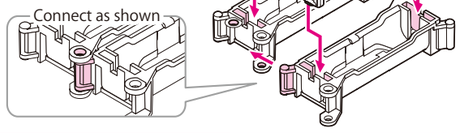

dry batteries connected in series




dry batteries connected in parallel

○Insert the plug into the parallel plug. Then, insert the parallel plug into the dry battery box connected to the side

※Pay attention to the orientation of the plug and parallel plug

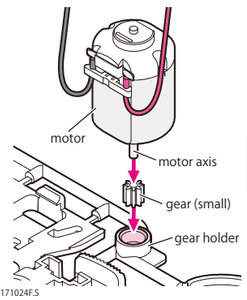



**Be careful of short circuit** ※Insert the parallel plug only after removing the dry batteries

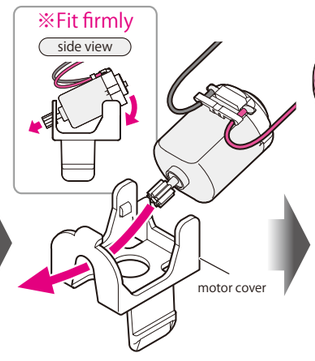
### Preparation C: Attach the propeller to the motor

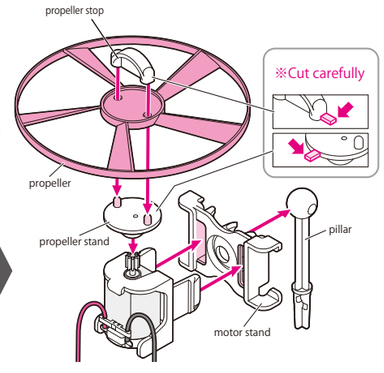
○Put the gear (small) to the gear holder and insert the motor axis into the gear

※Use the gear holder which is attached to the frame




○Attach the motor to the motor cover



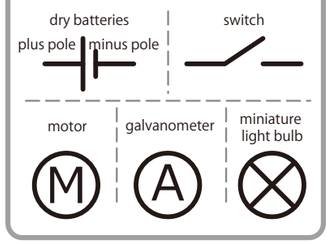




### Let's try! How to represent the circuit

○If you use symbols to represent a circuit diagram, it is easy to understand how they are connected

★Draw a circuit diagram using symbols below!

circuit symbols

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## Experiment 1

## Let's check the connection between direction of the dry batteries and the direction of the current

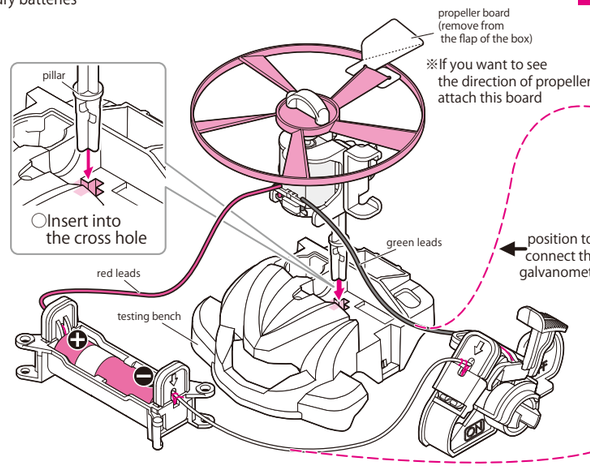
●Please use manganese dry batteries for this experiment
●After use, be sure to remove dry batteries

1 Let's predict the direction of the motor after changing the direction of dry batteries

Prediction: Same, turn opposite
Change the direction of dry batteries
Result

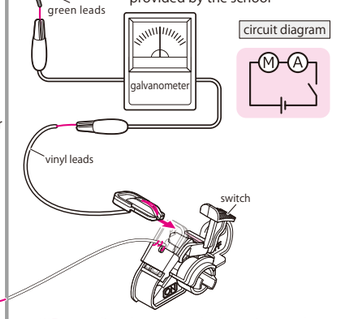
2 Let's predict the direction of the current after changing the direction of dry batteries

Prediction: Same, turn opposite
check with the galvanometer
Result




### how to connect the galvanometer

○connect galvanometer between green leads and switch
※Please use the galvanometer provided by the school




※Do not directly connect dry batteries toonly the galvanometer

## Experiment 2

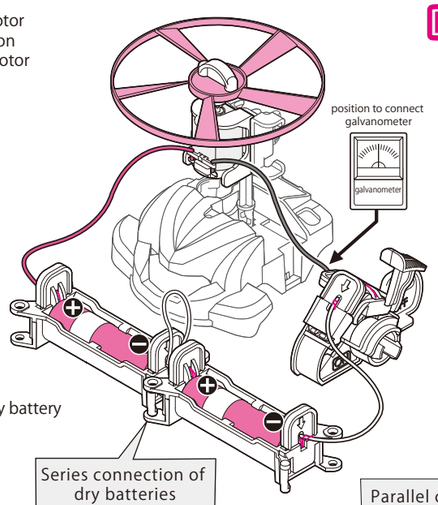
## Let's check the strength of the current if you change connection of dry batteries

1 Let's predict the speed of motor with parallel/series connection compared to the speed of motor with 1 dry battery

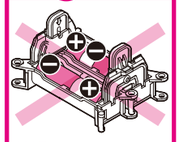
Prediction
Series same, turn faster
Parallel same, turn faster
Change the connection of dry batteries
Result
Series
Parallel

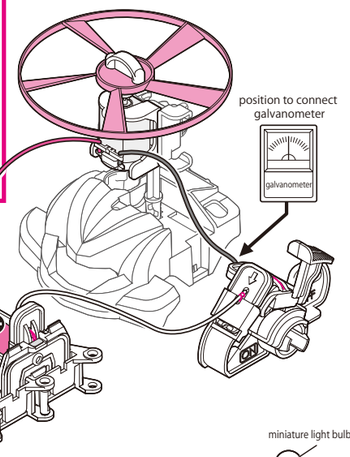
2 Let's predict the strength of current with parallel/series connection compared to the speed of motor with 1 dry battery

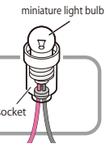
Prediction
Series same, stronger
Parallel same, stronger
check with the galvanometer
Result
Series
Parallel




**Dangerous!**




**Let's try!**
★Let's compare the brightness when you change the motor to miniature light bulb
※Keep the miniature light bulb firmly in the socket

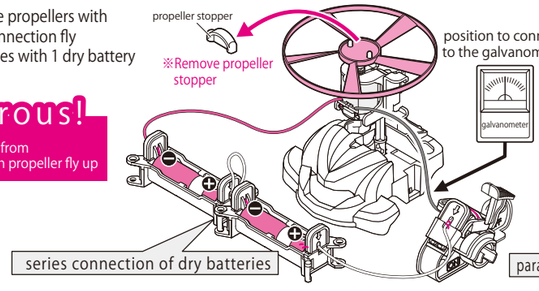
## Let's try! Let's check how to connect batteries and check how to fly the propeller.

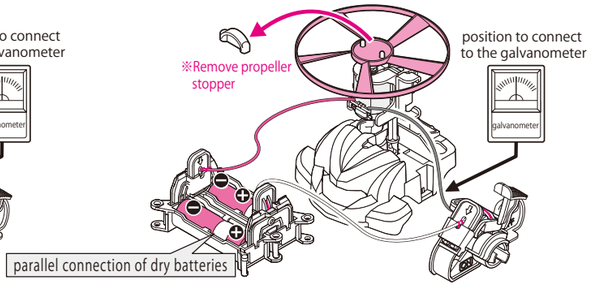
○Change the direction of dry batteries so that wind comes down

※If the dry batteries are weak, it may not fly.

★Let's check how the propellers with parallel or series connection fly compared to the ones with 1 dry battery

**Dangerous!**
Keep your face away from the direction in which propeller fly up



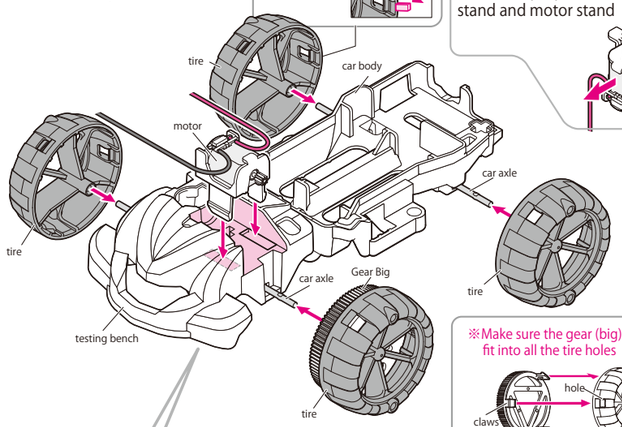
# Preparation D: Assemble motor car

●Please use manganese dry batteries for this experiment
●After use, be sure to remove dry batteries

## STEP 1

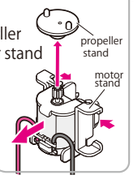
○combine testing bench and the car body and install tires

※Cut carefully

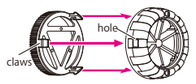



### Preparation before assembly

○remove propeller stand and motor stand

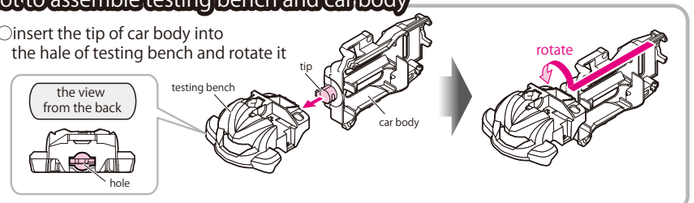



※Make sure the gear (big) claws fit into all the tire holes



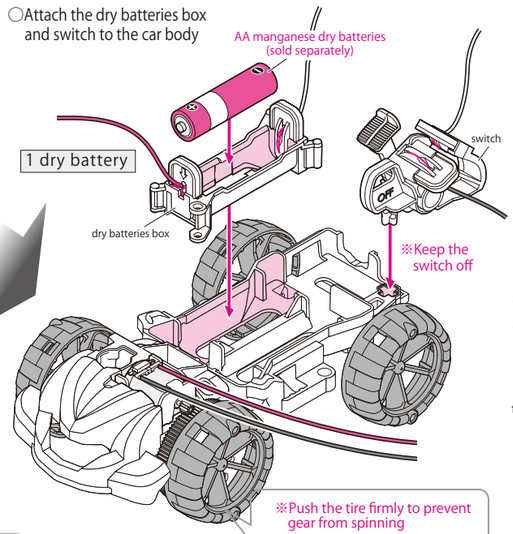

### Hot to assemble testing bench and car body

○insert the tip of car body into the hale of testing bench and rotate it

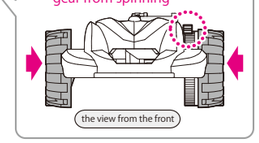



## STEP 2

○Attach the dry batteries box and switch to the car body



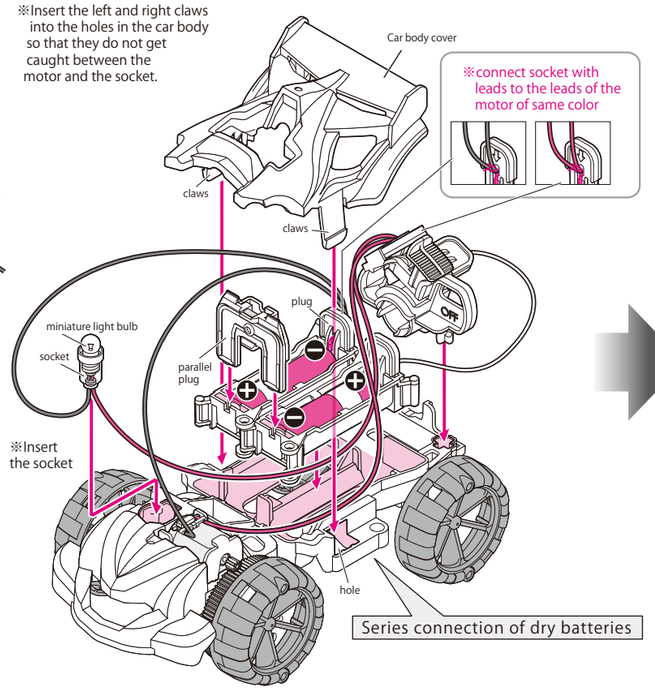

※Push the tire firmly to prevent gear from spinning




## Let's try! Let's run a motor car with miniature light bulb

○Attach the socket (miniature light bulb) and car body cover by connecting the drbatteries in series

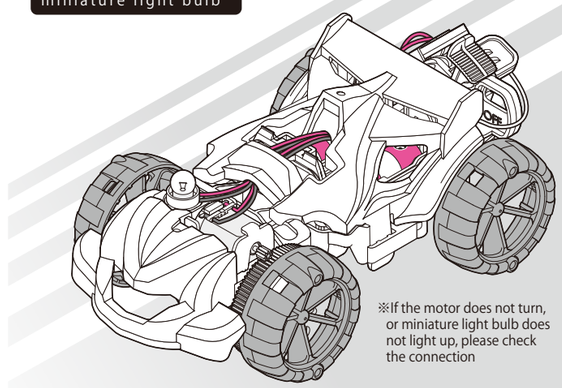
※Insert the left and right claws into the holes in the car body so that they do not get caught between the motor and the socket.




### ⚠ Note

●Please use manganese dry batteries for this experiment.Alkaline batteries and rechargeable batteries have large current, if you accidentally connect plus pole and minus pole directly, dry batteries and leads get hot and it may cause burns or fire.
●Please read precautions written on the dry batteries body carefully before use.
●Do not mix different (manganese, alkaline or rechargeable) or (new and old) batteries to use. It may cause liquid leakage or explosion.
●Do not drop the battery or give it a strong shock
●Do not put small parts in your mouth
●Please use leads and sharp parts carefully as it may cause injuries.
●Please hold the flat surface of metal fittings. If you hold the edge, you may cut your hands.
●Do not connect more than 3 dry batteries to miniature light bulb
●After the experiment and learning, be sure to remove dry batteries

motor car with miniature light bulb



※If the motor does not turn, or miniature light bulb does not light up, please check the connection

### ⚠ Note

●When you run the motor car, please do so in a safe and wide place
●If the motor car hits the wall and stops, change direction immediately or off the switch

## Experiment 3

## Let's check the strength of the current using motor car

If the motor does not turn, check the connection

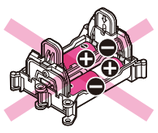
1 Let's predict and compare the speed of motor car with parallel/series, to the speed of motor car with 1 dary battery

Prediction
Series same, run faster
Parallel same, run faster
Compare the speed
Result
Series
Parallel

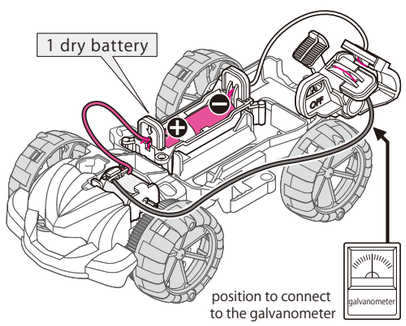
2 Let's predict and compare the strength of the current of motor, to the strength of the current of motor car with 1 dary battery

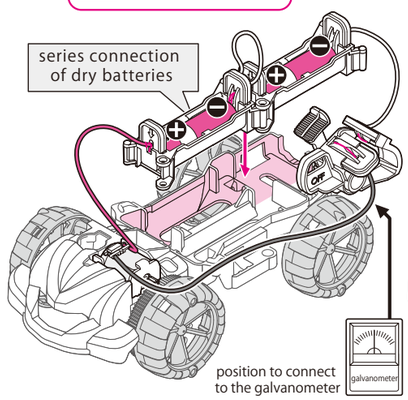
Prediction
Series same, stronger
Parallel same, stronger
check with the galvanometer
Result
Series
Parallel

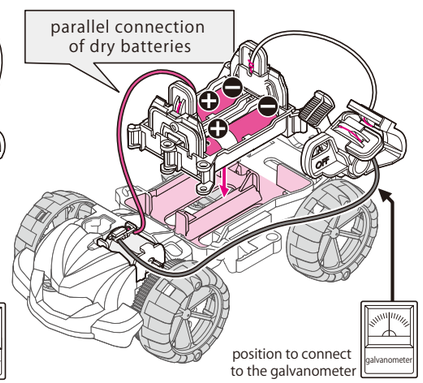
### Dangerous!



※Do not connect dry batteries in the direction as shown

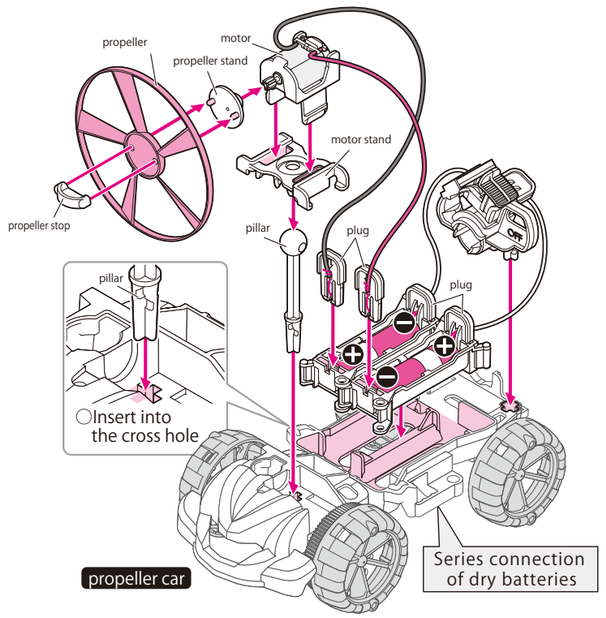



## Let's try! Let's run a propeller car

○remove motor and socket (miniature light bulb), assemble while paying attention to the orientation of the batteries and how to connect the wires.



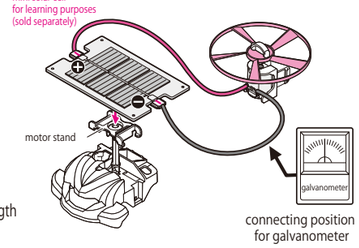

## Let's try! Let's explore the use of solar power!

1 Connect the solar cell to the motor, change the direction of the shining light, and then observe how the motor turns

2 Cast different shadows on the solar panel, and observe how the motor turns

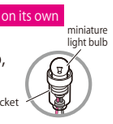
various different shadows
solar cell

3 Connect to galvanometer and observe the strength of the flowing electric current.



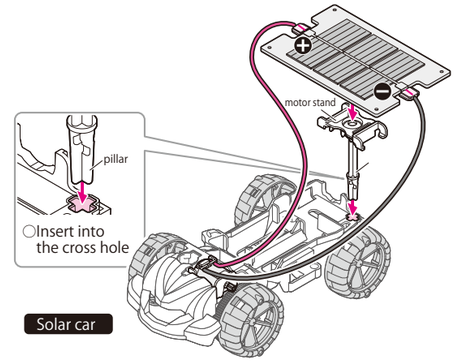

※Do not connect the solar cell directly to the galvanometer on its own

4 Replace the motor with the mini light bulb, and observe the brightness



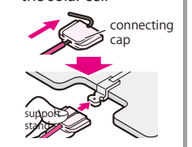

## Let's try! Let's run a solar car

○Pay attention to how the wires are connected and arrange




## How to attach solar cell

○Connect the wires to the cap attached with the solar cell




○Attach a rubber band to the motor stand and insert the solar cell