Multi-Functional Electric Car - Model NR

Compliant with the new course of study of the Ministry of Education, Culture, Sports, Science, and Technology

Introduction

*Do not tear off the parts attached to the frame by hand but cut them carefully with scissors.

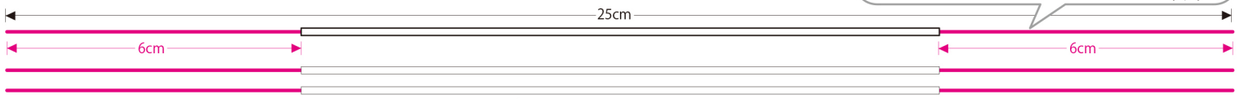
Prepare for experiment

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

Preparation A: Prepare vinyl leads

○Make three vinyl leads, as shown in the figure below.
(One of the three wires will be used to connect the galvanometer.)
*Keep the excess vinyl leads just in case it is lost or broken.

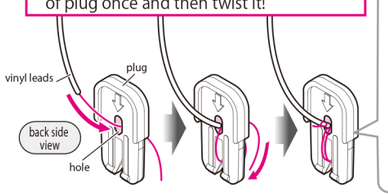
○Pinch and pull the vinyl of vinyl leads



○Pass the leads through the plughole once, and twist and wrap it tightly so that the leads does not come loose.

Note

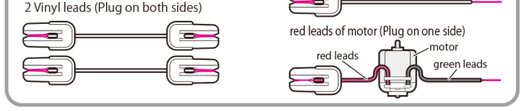
○When attaching the plug to leads of motor or socket, pass the leads through the holes of plug once and then twist it!



Note

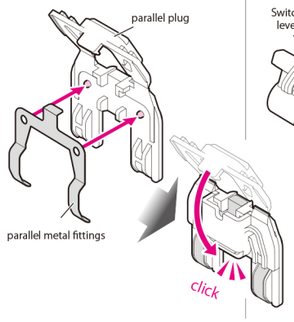
※Make sure the vinyl of the leads do not come out

※As shown in the figure, prepare leads.

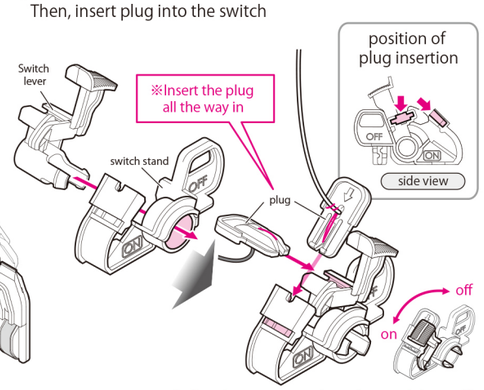


Preparation B: Assembly of parallel plug and switch

○Insert the parallel metal fittings into the parallel plug



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



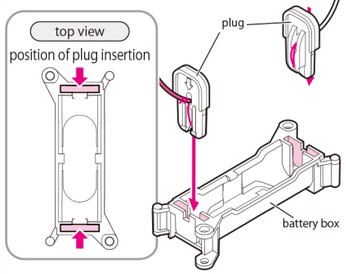
※Before the experiment, keep the switch lever off

Plug, How to use parallel plug and dry battery box

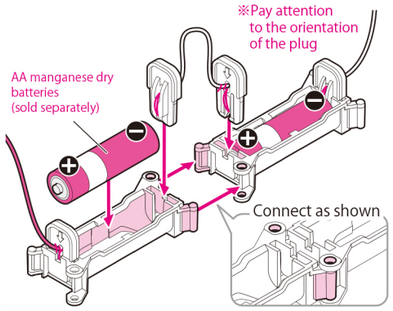
●Please use manganese dry batteries for this experiment
●After use, be sure to remove dry batteries

○Insert plug into the dry battery box

※Pay attention to the orientation of the plug



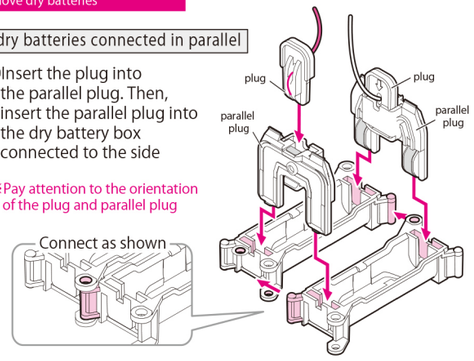
dry batteries connected in series



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

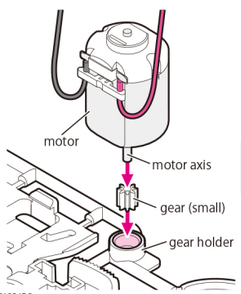


Be careful of short circuits ※Insert the parallel plug only after removing the dry batteries

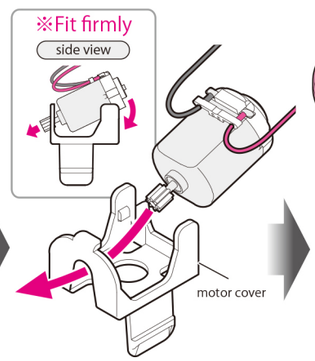
Preparation C: Attach the propeller to the motor

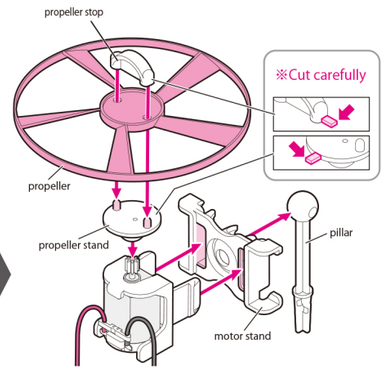
○Put the gear (small) to the gear holder and insert the motor axis into the gear

※Use the gear holder which is attached to the frame



○Attach the motor to the motor cover





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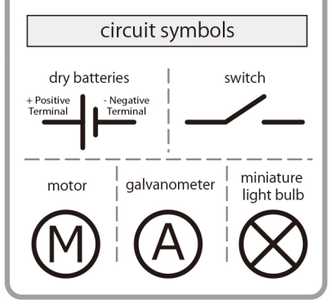
Let's try! How to represent the circuit

○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



Experiment 1

Find out which way the batteries are connected and how the current flows!

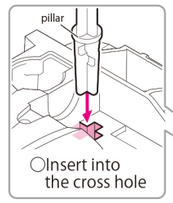
●Please use manganese dry batteries for this experiment
●After use, be sure to remove dry batteries

1 Let's see what happens to the direction of rotation of the motor when we change the direction of the battery.

Prediction: Same, turn opposite

Change the direction of the battery

Result



2 Let's see what happens to the current direction when we change the direction of the battery.

Prediction: Same, turn opposite

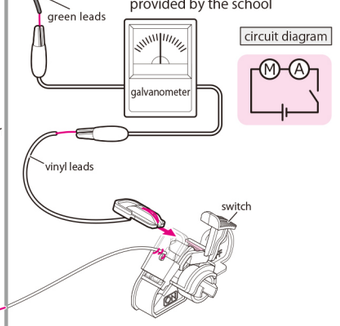
Check with a galvanometer

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

Find out how strong the electric current is by changing how the batteries are connected!

1 Try to estimate the speed of a motor connected in series and parallel compared to the speed of a motor with a single battery.

Prediction
Series: same, turn faster
Parallel: same, turn faster

Change the connection of the battery

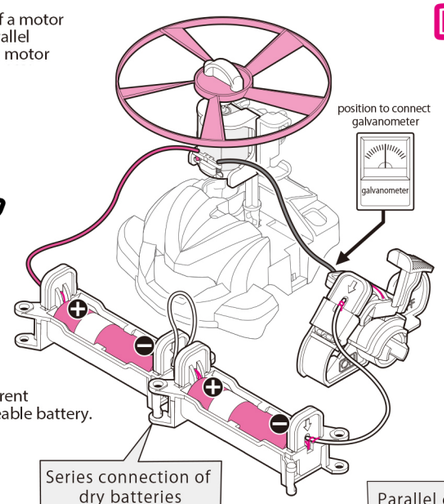
Result
Series
Parallel

2 Let's estimates the electric current strength of series and parallel connections compared to the electric current strength of a single rechargeable battery.

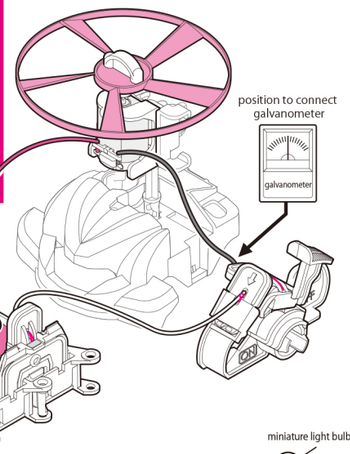
Prediction
Series: same, stronger
Parallel: same, stronger

Check with a galvanometer

Result
Series
Parallel



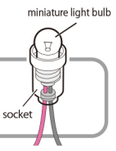
Dangerous!



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.

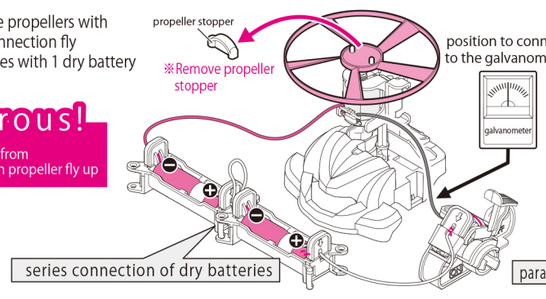
○Change the direction of dry batteries so that wind comes down

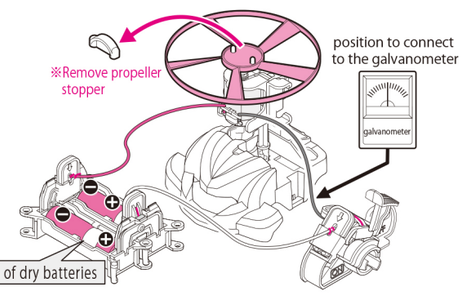
※If the dry batteries are weak, it may not fly.

★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





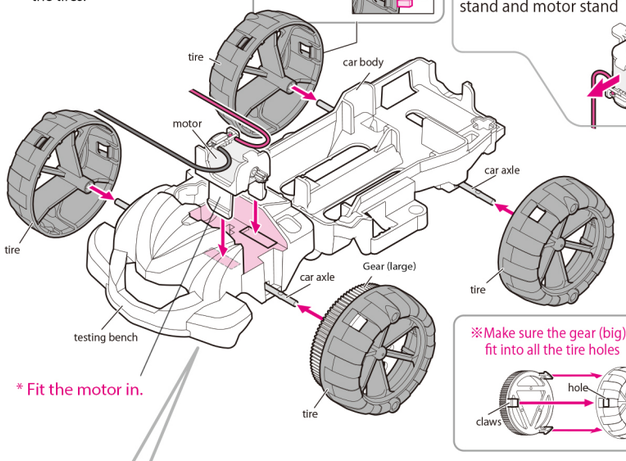
Preparation D: Assemble motor car

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

STEP 1

○ Combine the testing bench with the car body and attach the tires.

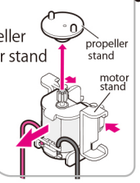
※Cut carefully



* Fit the motor in.

Preparation before assembly

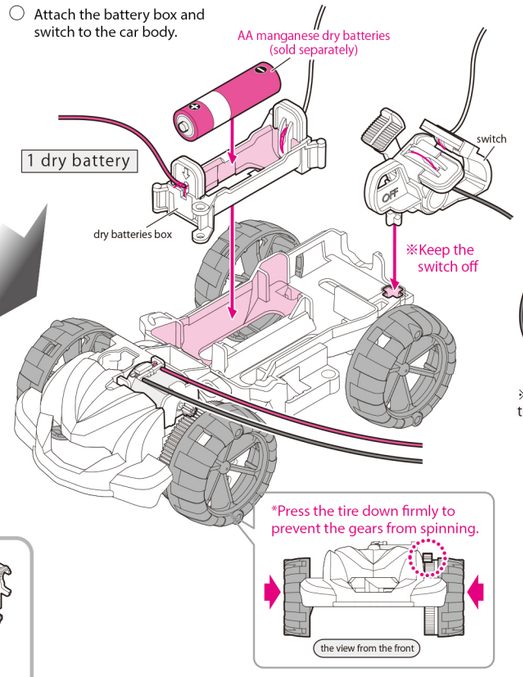
○remove propeller stand and motor stand



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

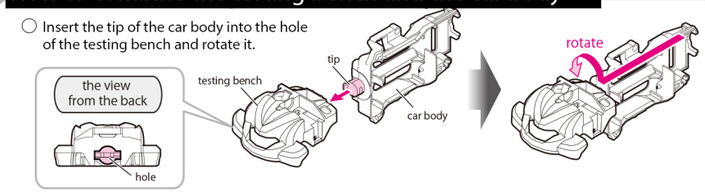
STEP 2

○ Attach the battery box and switch to the car body.



How to combine the testing bench and the car body

○ Insert the tip of the car body into the hole of the testing bench and rotate it.



Experiment 3

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

If the motor does not turn, check the connection

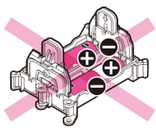
❶ Let's predict and compare the speed of motor car with parallel/series, to the speed of motor car with 1 dry battery

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

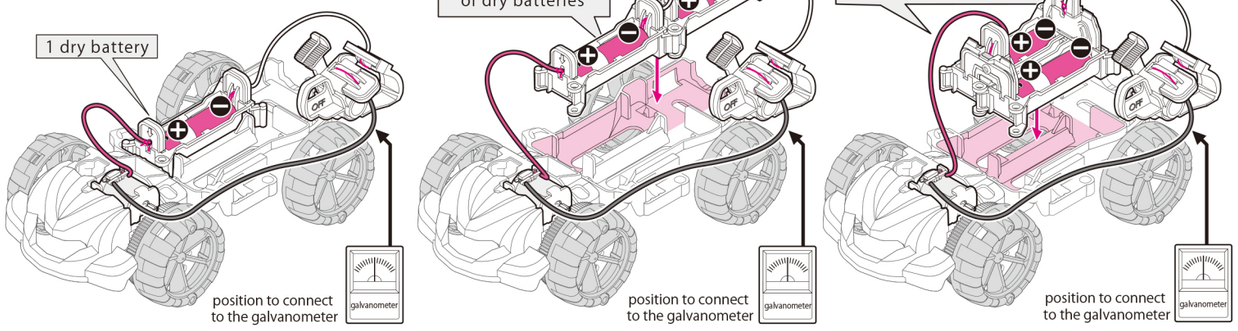
❷ Compare the electric current strength of a motor car with a single battery to the electric current strength of a motor car with series and parallel connections.

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

Dangerous!



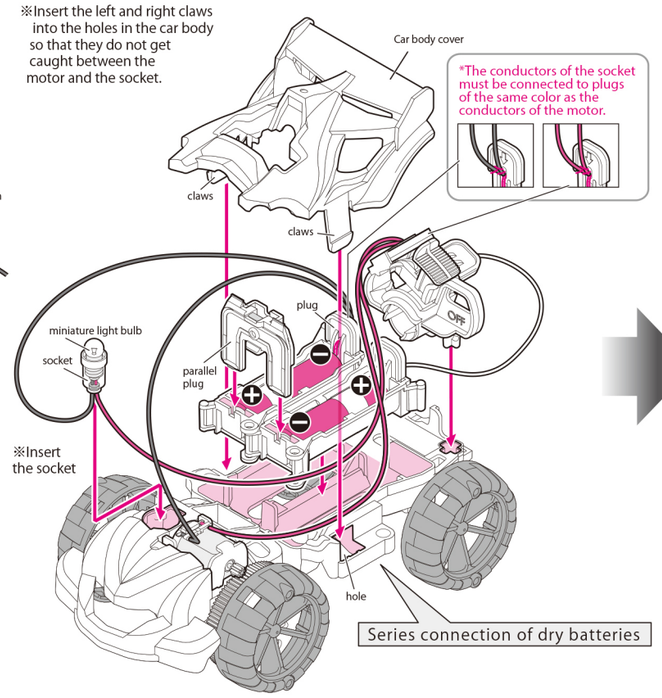
※Do not connect dry batteries in the direction as shown



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

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

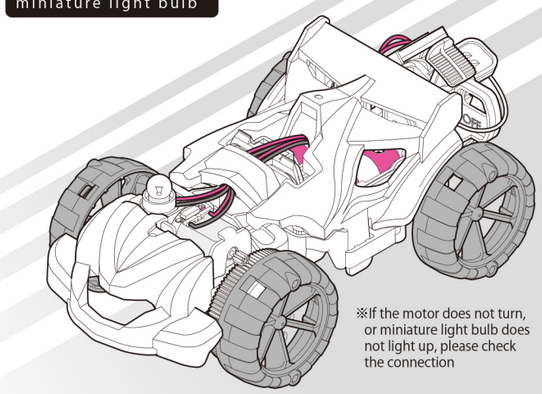
※Insert the left and right claws into the holes in the car body so that they do not get caught between the motor and the socket.



⚠ Note

- Use manganese dry cell batteries for this teaching material. Alkaline batteries and rechargeable batteries have a large amount of current. If you accidentally connect the + and - terminals of the battery directly, the battery and the conductors may become hot, resulting in burns or a fire.
- Please read the instructions on the battery carefully before use.
- Do not use different batteries (manganese, alkaline, rechargeable, etc.) or mix new and old batteries. Doing so may cause leakage of fluid or leaks.
- Please do not drop the battery or subject it to a shock.
- Do not put small parts in your mouth.
- Be careful when handling conductors and sharp parts, as they may cause injury.
- Always hold the metal fitting on a flat surface. If you hold the edge of the metal fitting, you may cut your hand.
- Do not connect more than three batteries to the miniature bulb.
- Be sure to remove the battery when you have finished testing or learning.

motor car with miniature light bulb



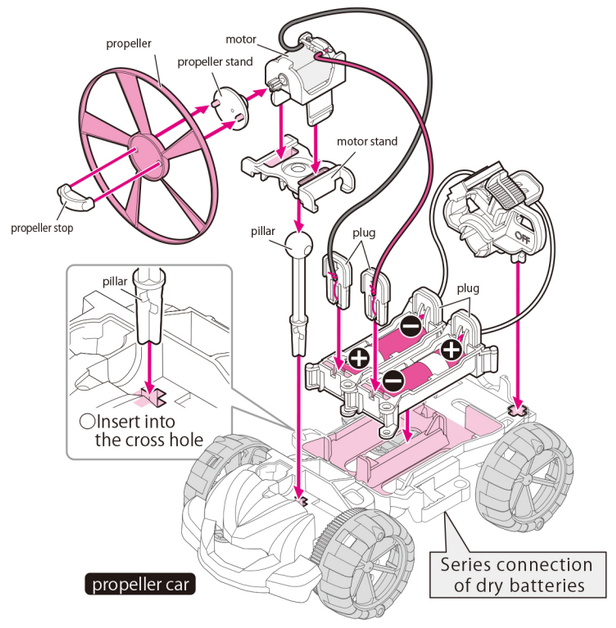
※If the motor does not turn, or miniature light bulb does not light up, please check the connection

⚠ 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

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!

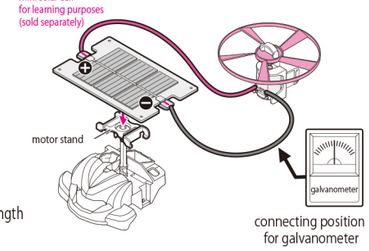
❶ Connect the solar cell to the motor, change the direction of the shining light, and then observe how the motor turns

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

various different shadows
solar cell

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

mini solar cell for learning purposes (sold separately)

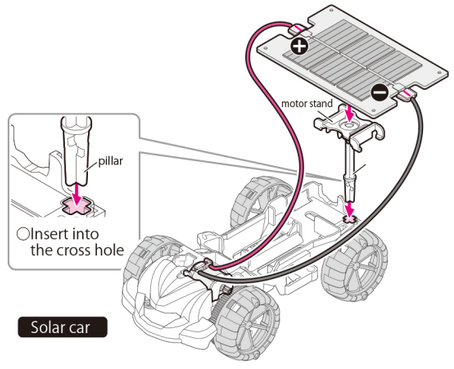


※Do not connect the solar cell directly to the galvanometer on its own

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

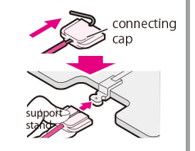
Let's try! Let's run a solar car

○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