Model #: EL10

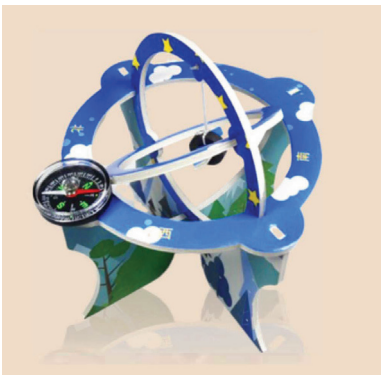
ENGINEERING LAB PROJECTS KIT

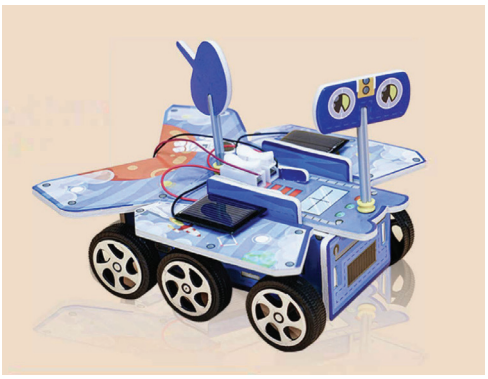
STEAM

Engineering Lab Projects

Assembly Manual

- Planet Exploration Solar Car
- Hydraulic/Air Compressor Alligator Jaws
- Time Tunnel
- Obstacle Avoidance Vehicle
- Galileo Pendulum
- Homemade Slide Projector
- Moon Phase Explorer
- Animation Projector
- Elastic Tension Roller
- Compass





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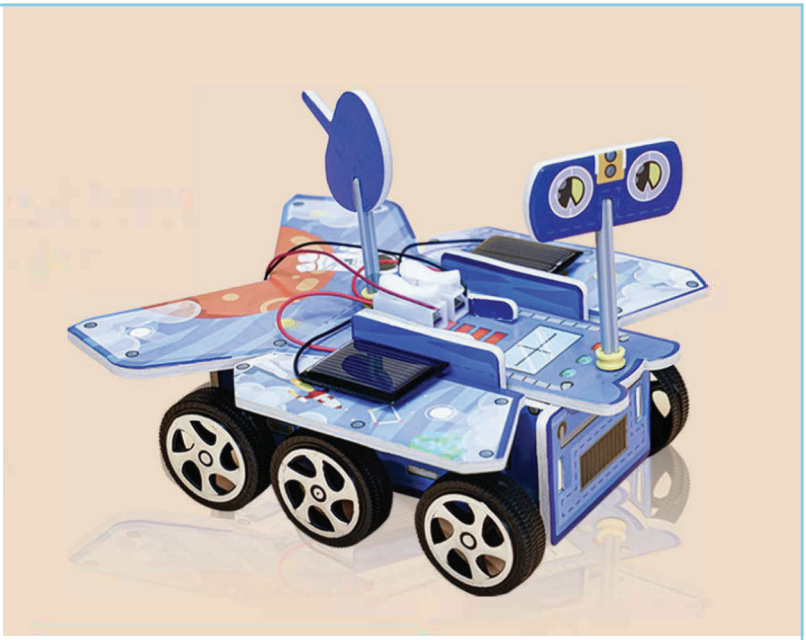
Project 1

Solar Planetary Explorer Car



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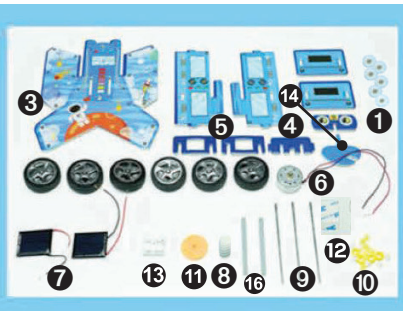
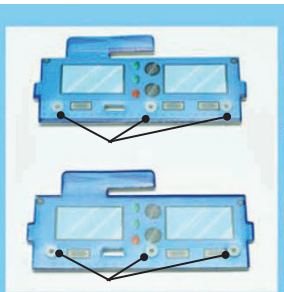


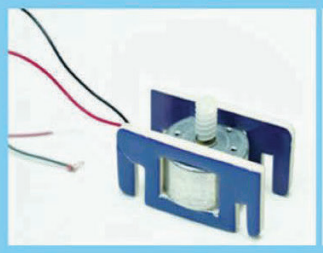


1. Lay out the components. Punch out all the parts from the foamcore.

2. Insert the 6 white bushings (#1) into the holes on the outside of the two body plates (#2).

3. Slide in the support plates (#2) fully on the top cover (#3), with bushing heads (#1) facing out.

4. Slide (#4) into the slots on the left and right support plates (#2).



5. Put the white plastic grooved piece (#8) onto the motor shaft (#6). Then, affix the two brackets (#5) on either side of the motor, as shown.

6. Affix the component from step 5 as shown. Then, slide onto the cover (#3), also sliding into the sidewalls (#2). Make sure the wires are facing down, as shown.

7. Before sliding an axle (#9) through each of the two holes in the plates (#2), add a spacer (#10) on the outside of each end, then add a wheel to each. On the center axle, add the sprocket (#11) in the center before putting on the second spacer and wheel. The sprocket (#11) should be just above the white grooved piece, as shown. Spacers (#10) hold axles firmly in place.

8. Use the double-sided tape (#12) to affix solar panels (#7) on the top. Remove the protective film from the solar panels.

9. Remove the plastic tip of the RED wire from the two red solar panel wires (#7). Twist the two red wires together and insert into the top slot of the white clamp (#13). Then, pull the red wire from the motor around to the top and into the bottom slot of the white clamp (#13 in the opposite side of the same clamp). Then, do the same for the black wires, as shown.

10. After Step 9, you can add the sign posts (#16) with the "eyes and tail" (#14) into the holes on the body, as shown in the top picture. Also, add the grill (#15) to the front and back of the car.

Project 2

Hydraulic/ Air Compressor Alligator Jaws

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1. Lay out the components. Punch out all the parts from the foamcore.

2. Connect the top part of the head (#1) to (#2) connecting the bottom hole in the head to the top hole in the body, using a short button and cap (#3).

3. Connect the lower part of the head (#4) to (#2) connecting the top hole in the jaw to the bottom hole in the body, using a short button and cap (#3).

4. Hold both fixing plates (#5) onto the body, then attach the connecting arm (#6) on one side, from the upper part (#1) to (#2) using a tall button and cap (#3), through both sides, as shown.

5. Attach the other (#6) from the bottom part of the head (#4) and to the fixing plate (#5) on the body using a tall button and cap (#3), through both sides, as shown.

6. Make sure the back side looks as shown.

7. Then, make sure the jaws are in a closed position and extend the plunger top of the smaller syringe (#7). Put the top of the plunger into the slit on fixing plate (#5), as shown.

8. Use the Velcro® straps (#8) to secure the syringe to the body, as shown.

9. Connect the tube (#9) and the other syringe (#10) together. Then, put the tube into the syringe on the body, as shown.

Using air from the large syringe (#10) to the small one (#7), this becomes an air compressor. Using water, this becomes a hydraulic pump. Both methods will make the alligator jaws move up and down.

Project 3

Infinity Mirror

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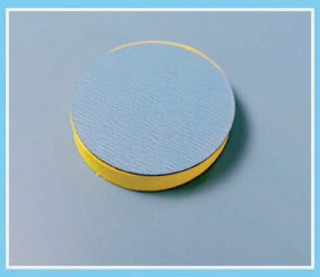
1. Lay out the components. Punch out all the perforated parts from the foamcore.



2. Take out the inner foam from the circle donut (#2). Peel off the adhesive paper from one side. Peel the adhesive paper off the non-transparent mirror (#8). Then, stick (#8) on the adhesive side of (#2) with the mirror side facing in.

3. Wrap wire (#6) in a circle and place it inside the donut (#2) on top of mirror (#8), as shown. Cut a small slit in the edge (#2) for the battery pack (#6) to easily hang outward, as shown. Be sure to remove the small paper battery protector.

4. Peel off the remaining adhesive paper from the donut (#2). Remove the adhesive paper from both sides of transparent mirror (#7). Put (#7) on top of (#2), as shown.

5. Remove one side of the adhesive paper from the double-sided tape (#3), affix onto (#1), as shown. Once affixed, peel off the remaining adhesive paper (#3).

6. Using the component made in Step 4, attach it to the body (#1) on the adhesive circle (#3), as shown. Attach the battery pack with double-sided foam (#9) onto (#1), as shown.

7. Slide (#4) and base feet (#5) into body (#1), as shown. When turned on, effects can be set to slow strobe, fast strobe, solid light, or off.

*Caution: The strobe lighting effect on this project may be hazardous to those with sensitivities to strobe lights.

Project 4

Obstacle Avoidance Vehicle

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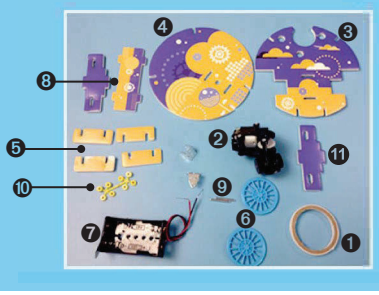
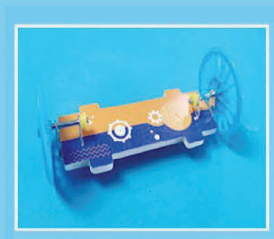


1. Lay out the components. Punch out all the perforated parts from the foamcore.

2. Stick a piece of double-sided tape (#1) on the flat part of the motor (#2), as shown.

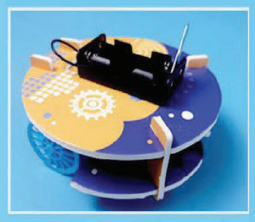
3. Remove the protective film from the double-sided tape (#1). Then, stick the motor box into the holes on the circular top piece (#4), as shown, matching up the holes from top to bottom.



4. Slide one side of a bracket through the slit on the side panels (#8). Do the same on both sides. Then, insert a pin (#9) into each bracket (#8), as shown. Affix a spacer (#10) onto each pin (#9), and install the wheels (#6) on either side. Then, attach the two side walls (#8) by inserting them each into the punched-out spaces.

5. Affix the wheel section #6 from Step 4 to the foamcore cutout piece. Be sure to attach the wheel section on the correct side, as shown.

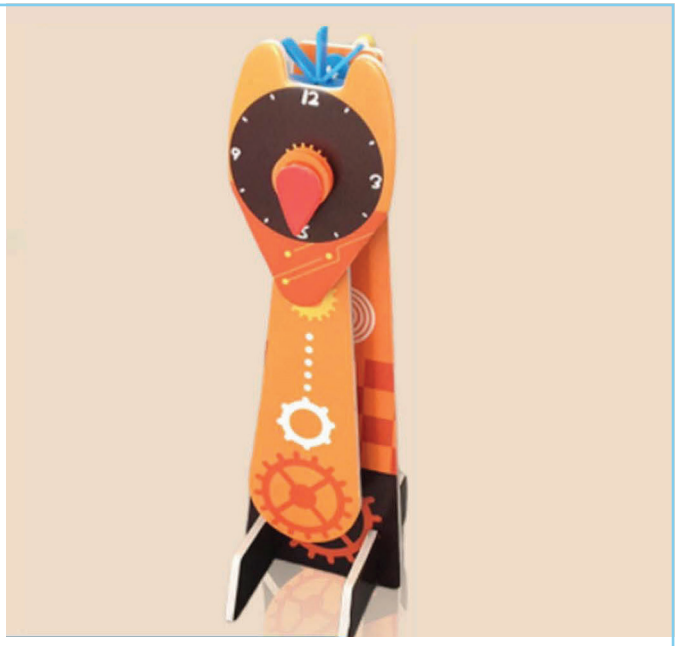
6. Using two pieces of the double-sided tape (#1), secure the battery box (#7) to the cutout (#4). Then, connect the battery box (#7) to the motor through the hole, as shown.



7. Combine the two pieces (#3 and #4) using the four brackets (#5) through the slots, from top to bottom, as shown. Insert 2 "AA" batteries (not included). Turn on the switch and see obstacles avoided!

Project 5

Galileo Pendulum



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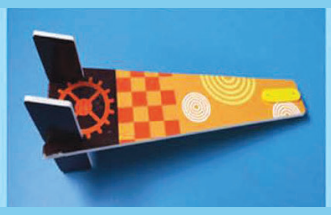
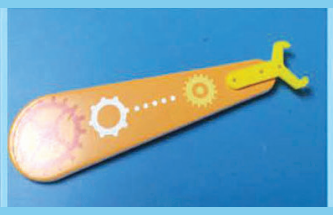
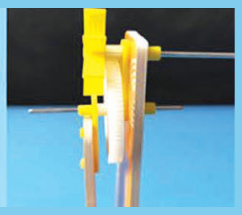
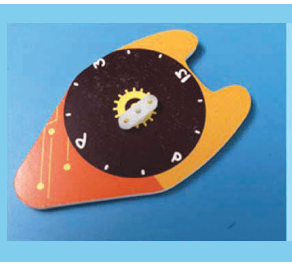
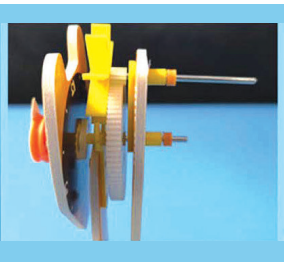
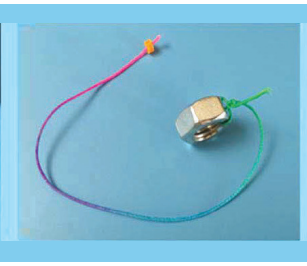
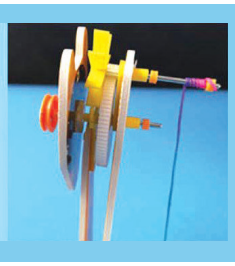


1. Lay out the components. Punch out all the perforated parts from the foamcore.
2. Slide the two base pieces (#2) into the slots on the body (#1), as shown.
3. Put the yellow fan-like piece (#3) and the rod (#4) together, as shown.
4. Put the yellow "Y" piece (#5) onto the foamcore (#6), as shown.
5. Insert yellow (#7) into the holes that match on piece (#7), as shown. Then, attach the white gear (#8) making sure the flat side is put towards the foamcore (#6). Insert the white gear rod (#4) into the top hole of (#5), as shown.

6. Install the plastic "T" shape (#9) on plate (#10), as shown.
7. Affix the plate (#10) as shown and install the round shaft stopper (#11), leaving a small gap.

   *Use glue or double-sided tape to attach the small arrow piece to make a clock "hand".
8. Tie one end of the string (#12) onto the nut (#13), and insert a spacer (#14) at the other end, as shown.
9. Attach the end with the spacer (#14) to the top shaft (#4), winding the string (#12) clockwise, as shown.
   Make sure to leave small gaps when securing the top rod spacers. Then, manually swing the pendulum to start.

Note: If any of the parts are very loose, affix with a small drop of glue.

Project 6

Homemade Slide Projector

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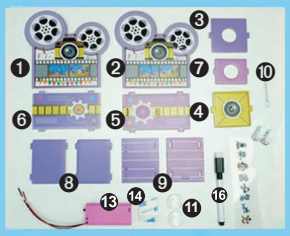
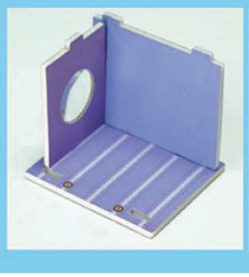


1. Lay out the components. Punch out all the perforated parts from the foamcore.

2. Install one of the lenses (#11), into (#3). Add the side (#1) and bottom piece (#5), as shown.

3. Insert the back panel piece (#4) with the small holes into the bottom (#5).

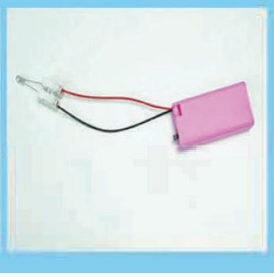
4. Attach the side panel (#2) and top cover (#6), as shown.



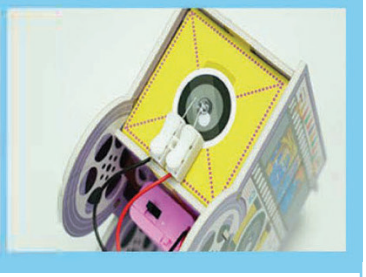
5. Insert the other lens (#11) into the round hole (#7), as shown.

6. Make a box from side panels (#8) and top and bottom panels (#9), as shown.

7. Position the box with the lens side facing out, as shown.



8. Connect the LED light (#10) to the 4-sided clamp (#12) using the wires from the battery box (#13). Connect the short pin of the LED light to the black wire, and the long pin of the LED light to the red wire.



9. Insert the LED light into the back panel (#4) and bend the wires, as shown. Put 2 "AA" batteries in the battery box (#13) and attach to the top with double-sided tape (#14). Then, insert a filmstrip (#15), or draw one of your own with the included marker (#16) on a blank strip. Feed through the side opening and pull your filmstrip through to project your film!

Project 7

Moon Phase Explorer

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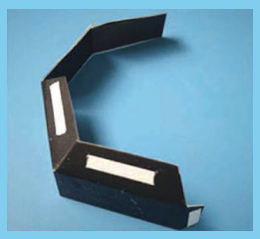

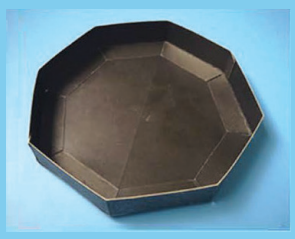

1. Lay out the components. Punch out all the perforated parts.

2. Fold all the angles on (#1) and (#2), as shown. Tape the tabs together so the two pieces form a hexagon.

3. Secure the top (#3) to the edging (#1 and #2) as shown using double-sided tape on the tabs.

4. Fold all the angles on walls (#4) and (#5) to form the sides and tape the tabs together. Then, add the bottom (#6) to complete the hexagon shape, as shown.

5. Insert the rod (#7) into the styrofoam ball (#8). On the opposite side of rod (#7), add the #9 sponge base (removing the protective white cover). Position it as shown using double-sided tape.

6. Put the socket (#11) through the hole from the outside wall. Then, put the bracket (#12) on the inside wall to secure the socket (#11) using a little double-sided tape, if needed. Then, screw the lightbulb (#10) into the socket (#11).

   Connect the battery box (#13) to the adjacent panel from the lightbulb (#10) panel, as shown. Then, connect the RED wire (#14) to the long tab on the bulb end and the BLACK wire (#15) to the shorter tab, as shown.

7. Put the top on and turn on the switch on the battery box (#13). You can then observe the moon phases through the holes. Make sure the moon (#8) is at the same height as the holes on the panels to properly see the phases.

   You can use a label (not included) to identify the moon phases as they appear through each hole.

Note: If any of the parts are very loose, affix with a small drop of glue (not included).

Project 8

Animation Projector

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1. Lay out the components.

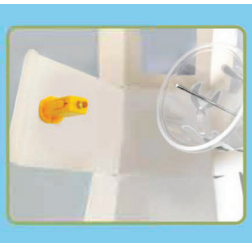
2. Fold the striped piece (#1) and secure ends together, forming a box, using the double-sided tape. Fold the white tabs inward. Do the same for the other box (#3). Then, affix the lens sticker from the sticker strip (#4) onto #3, as shown.

3. Use the double-sided tape to affix the lens onto the smaller box (#3) in the lens hole.

4. Making the handle from the items in the bag (#2): Put the long rod through the yellow gear. Add the small yellow tip to the end of the short rod. Add the short rod to the other side of the gear, as shown.

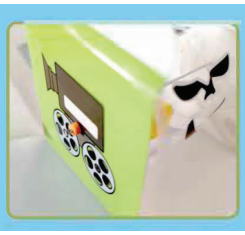
5. Using the small clear plastic cup (#5), put on the bird stickers (#4) in numerical order.

6 Put the rotary handle (from Step 4) through the hole on the larger box (#6), and put a spacer on the shaft on the inside of the box. Then, put the cup over the rotary shaft, as shown.



7. Use double-sided tape to affix the LED light from the bag (#2) to the opposite side panel from the cup, and position slightly away from the small hole, as shown, without covering the hole, so the shaft can go into the small hole and rotate, when fully closed.

8. Turn the LED switch on before closing the box completely. Then, close all sides using double-sided tape. Note: The LED light will stay on until the battery runs out.



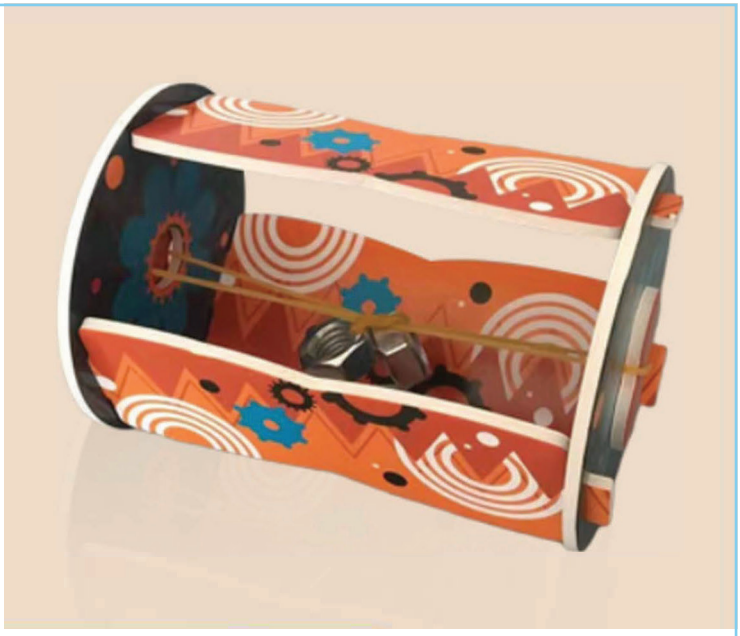
9. Add a spacer from the bag (#2) onto the shaft on the outside of the box (#6), as shown.

10. Slide the smaller gray box (#3) into the slightly larger striped box (#1) so the lens is facing outward. Then slide the two boxes (#1 and #3) into the larger box (#6).

Please Note: If the double-sided tape becomes loose, try using glue instead (glue not included).

Project 9

Elastic Tension Roller



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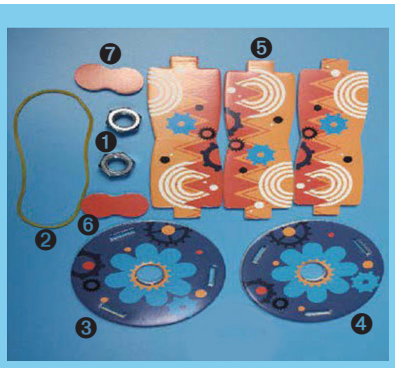

1. Lay out the components. Punch out all the perforated parts from the foamcore, as shown.

2. Tie the two nuts together (#1) with the rubber band (#2), as shown.

3. Feed the rubber band through the base (#3) and use the "8" shaped peanut (#6) to hold the rubber band on the outside, as shown. Then, feed the rubber band through the other piece on the opposite end and secure the rubber band on the outside with the other "8" shaped peanut (#7).

4. Then, insert the 3 side wall pieces (#5) into the base and top, into the notches, which will stretch the rubber band into place, as shown in the top picture. Twisting the "8" shaped peanuts (#6 and #7) will create elastic tension and mobility.

Project 10

Compass

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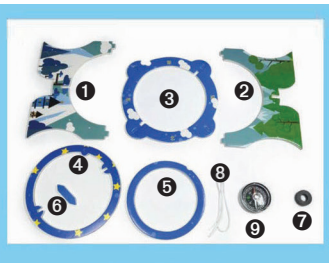
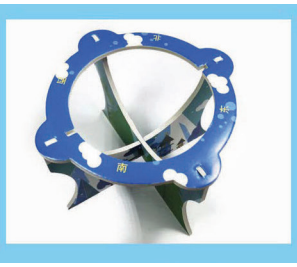


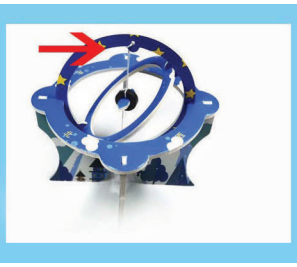
1. Lay out the components. Punch out all the perforated parts from the foamcore.



2. Assemble a base by sliding the two base pieces (#1 and #2) together and adding the top piece (#3), as shown.

3. Install parts (#4) and (#5), as shown.

4. Put the pointer (#6) through the ring magnet (#7) and tie the magnet with the string (#8), as shown.



5. Tie the string into the upper hole on the component shown.

6. Add the compass (#9) as shown.

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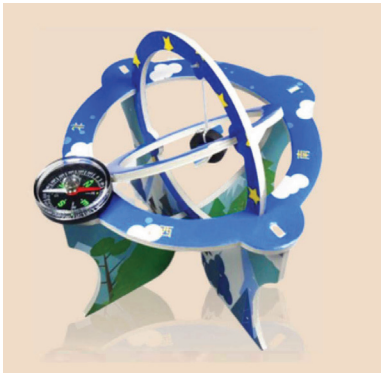

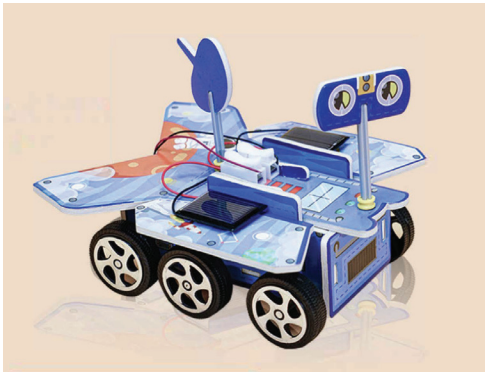

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