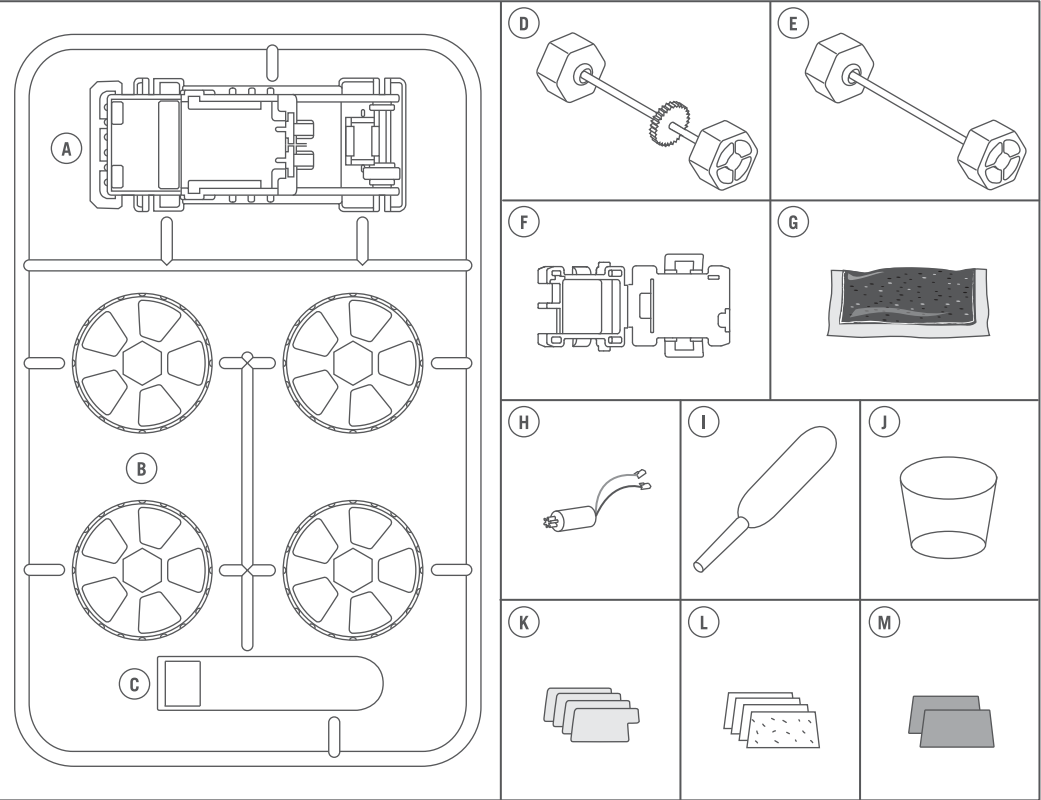


SALT-POWERED TRUCK

A. SAFETY MESSAGES

- 1. Read carefully through all these instructions before you start.
- 2. Identify the contents of the kit before you start putting the parts together.
- 3. Adult supervision is required throughout.
- 4. This kit and its finished product contain small parts which may cause choking if misused. Keep away from children under 3 years old.
- 5. To prevent possible short circuits, never touch the contacts, magnesium sheet, fabric sheet, copper sheets, or active carbon with any metal.

B. CONTENTS



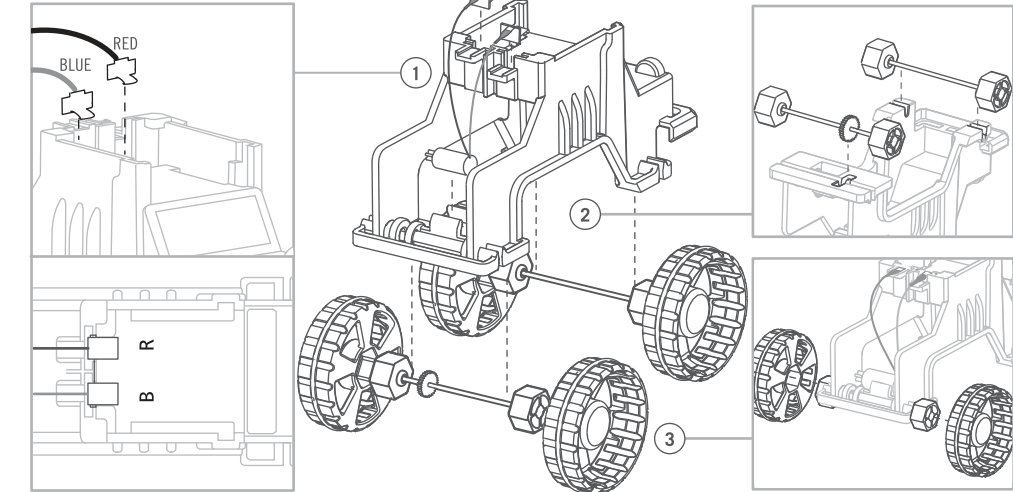
Part A: Truck body x 1, Part B: Wheel x 4, Part C: Spoon x 1, Part D: Axle with gear x 1, Part E: Plain axle x 1, Part F: Battery cartridge x 1, Part G: Bag of active carbon x 1, Part H: Motor with wires and contacts x 1, Part I: Dropper x 1, Part J: Cup x 1, Part K: Magnesium sheet x 4, Part L: Fabric sheet x 4, Part M: Copper sheet x 2. You will also need from home: table salt and a teaspoon.

C. ASSEMBLY

Before you start assembling, gently twist and detach all parts from the plastic frame. You may use a nail clipper to trim away any excess plastic from the parts.

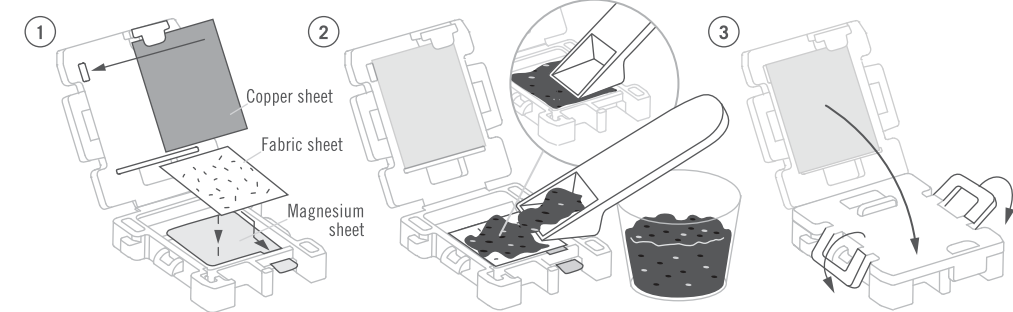
ASSEMBLING THE TRUCK

- 1. Clip the motor into place and fits into the slot. There are two contacts on the wires attached to the motor. Slot the contact on the blue wire into the deeper slot (“B”) . Slot the contact on the red wire into the shallower slot (“R”).
- 2. Turn the truck body upside down. Push in the two axles as shown, making sure that they are correct way round and fits into its slot until you hear a clock sound. Also check the gear on the motor and the gear on the axle are interlocked.
- 3. Slot the four wheels onto the wheel hubs.



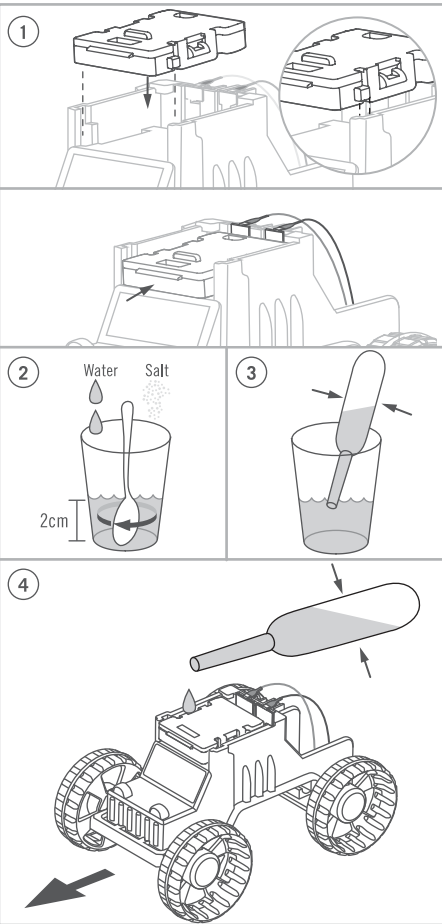
ASSEMBLING THE SALT WATER BATTERY

- 1. Cover the work area with old newspaper first. Now make the battery. Place a magnesium (silver) sheet on the inside of the battery cartridge, with its tab fitting through the hole. Put a fabric sheet on top of the magnesium. Slide a copper (brown) sheet to the battery cartridge cover from the right as shown.
- 2. Carefully cut open the bag of active carbon (ask for adult assistance). Pour some active carbon out into the cup provided. Using the spoon, transfer one spoonful of the active carbon to the battery cartridge, over the fabric. Use the flat underside of the spoon to press the active carbon in place, so that the carbon perfectly fills the cartridge. (More carbon gives greater power!)
- 3. Flip down the cover. Lock the cartridge with the clips on its sides. If it can barely close, remove a little active carbon and try again. Now your battery cartridge is ready!



D. OPERATION

- 1. Slide the battery cartridge vertically down into space in the top of the truck body. The two tabs on the cartridge fit into the vertical slots on the body. Then push the cartridge inwards to connect the terminals with the battery.
- 2. Pour some water into a cup until the water is about 2 cm (4/5 in.) deep. Add a teaspoon of salt to the water and stir to make the salt dissolve. If all the salt dissolves, add some more salt and stir again. Keep adding salt until no more will dissolve.
- 3. Suck up some of the salt water with the dropper.
- 4. Squeeze a few drops of the water through the gap in the battery lid so that the water soaks into the fabric. Put the truck on a smooth, flat surface. The truck should whizz along as the electricity from the battery reaches the motor. The battery will keep producing electricity for about 5 - 8 minutes depend on quantity of active carbon and salt water. If you want to stop the truck, slide the battery cartridge away from the terminals. If the battery has stopped producing electricity, or if you are not going to use the truck for a few hours, remove the battery from the truck body to be cleaned. Open the lid and pour away the active carbon. Wash the metal sheets, fabric sheet, and cartridge with clean water. Leave them to dry thoroughly. The copper and fabric sheets can be used again and again. If they are not washed well, salt crystals might grow and affect the truck operation. The magnesium sheet will become black because of a chemical process called oxidation. You can clean it with a cotton bud soaked in vinegar. (Cautions: Do not place the plate into the vinegar directly.) The magnesium sheets can be used up to three times.



E. TROUBLESHOOTING

- If the motor does not turn when you put the battery into the battery holder:
- Try adding a few more drops of salt water to the fabric.
 - You may have to spin the truck’s wheels with your fingers to get the motor started.
 - Check that the metal contacts on the wires are touching the magnesium and copper plates. You may gently bend the metal contact upwards. This will secure a better contact.
 - Make sure the metal plates are not touching each other.
- If your truck runs backwards:
- You might have reversed the polarities of the wires. Check all connections and the battery’s assembly as in the above instructions.
- If the battery loses power:
- Try adding a few more drops of salt water.
 - Wipe the oxidised surface of the magnesium plate with a cotton bud and vinegar to remove any deposits that might stop electricity flowing. Each magnesium plate can be cleaned and reused 3 times. After that, you will need to replace the plate. Replace the active carbon at the same time. Also replace the fabric sheet if you want to.
 - Sand the surface of the copper plate with sand paper (from home).

E. HOW IT WORKS

The magnesium, copper, salt water and carbon form a battery, and this makes electricity that turns the motor. A battery with these parts is called a magnesium-air battery. That’s because it produces electricity from a chemical reaction between the magnesium and oxygen from the air. The magnesium combines with the oxygen to make magnesium oxide. The reaction releases energy in the form of electricity. Copper here acts as a conductor of electricity between the cartridge and the metal contacts from the motor.

In the battery, several things are happening when the battery is giving out electricity. The electric current that makes the motor work is made up of a flow of tiny particles called electrons. At the active carbon, oxygen from the air and water from the fabric combine with electrons coming along the wire from the motor. This makes particles called hydroxide ions in the water. At the magnesium sheet, hydroxide ions in the water combine with the magnesium to make magnesium oxide and some electrons that flow, via the copper plate, down the wire to the motor. Salt is a material called sodium chloride. When salt dissolves in water, it splits up into sodium ions and chlorine ions. These move through the water, carrying an electric charge from the carbon to the magnesium. So overall, as the magnesium is turned to magnesium oxide, electrons flow out of the magnesium and into the carbon. They make up the electric current that makes the motor work.

G. FUN FACTS

- The active carbon is a special form of carbon. It is full of tiny holes. This gives the salty water plenty of carbon to touch, which lets more oxygen into the battery.
- The small amount of active carbon in the battery cartridge of your Salt-powered Truck has more surface area than a tennis court!
- We get most of the magnesium we use from seawater, which contains a chemical called magnesium chloride.
- A magnesium-air battery has a very high-energy density. That means it can produce lots of electrical energy for its size. In fact, it can produce five times as much electricity of a lithium-ion battery (the sort of battery used in mobile phones).
- A fuel cell is like a battery that never runs out of chemicals. It continuously converts the chemical energy from a fuel into electricity. In a magnesium-air fuel cell, fresh magnesium is slowly fed into the cell as the magnesium is used up.
- The battery sends lots of electrons through the motor to make the motor work — hundreds of billions of them every second!

QUESTIONS & COMMENTS

We treasure you as a customer and your satisfaction with this product is important to us. In case you have any comments or questions, or you find any parts of this kit missing or defective, please do not hesitate to contact our distributor in your country, whose address is printed on the package. You are also welcome to contact our marketing support team at Email: infodesk@4M-IND.com, Fax (852) 25911566, Tel (852) 28936241, Web site: WWW.4M-IND.COM