

Making a speaker

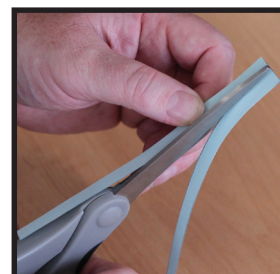
Materials

- 1 magnet (round 0.5 cm wide)
- 1 business card
- Wire (38 SWG or 32 AWG)
- Paper (printer)
- Tape (plastic or masking)
- Glue (model and hot glue gun)
- Scissors
- Ballpoint pen
- Lego bricks or wood
- Ruler
- Tweezers

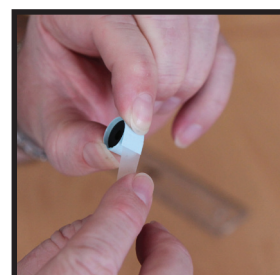


Instructions

1 Cut two long strips of paper, 1 cm thick and 14 cm long.

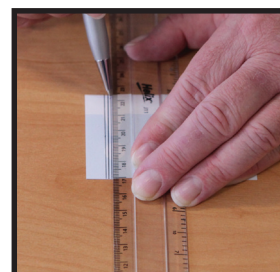


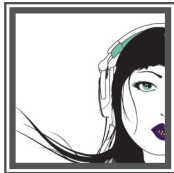
2 Roll one strip of paper around the magnet. Use some tape to hold it. The cylinder needs to be removed from the magnet, so do not tape the paper to the magnet.



3 Roll the second strip of paper around the first one. Do not glue or tape the paper cylinders together. Use tape to keep the paper as a cylinder.

4 Using the ballpoint pen, draw three lines on each side of the business card. The lines should be 3mm apart and 1cm from each end of the business card.



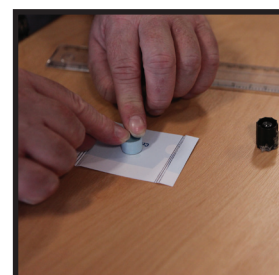


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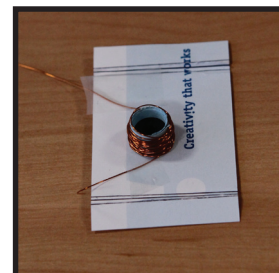
- 5 Fold the business card as shown, using the lines as reference. The lines will help to fold it.



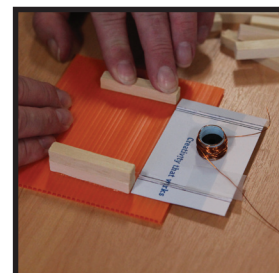
- 6 Remove the magnet from the paper cylinder. Glue the paper cylinders to the centre of the business card as shown. Use model glue or hot glue.



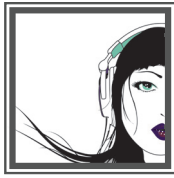
- 7 Once the glue is dry, put the magnet back inside the cylinder and start making the coil. Wind the wire 50 times round the paper cylinder. After you finish winding the wire, use some tape to secure it. Do not try to make the coil without attaching the cylinder to the business card first, it is an almost impossible task.



- 8 Make the frame, as shown, approximately the size of the business card and not higher than 1 cm. You can use Lego bricks or wood may work better. Do not to use any metal that can be attracted to the magnet.



- 9 Put some glue on the magnet when it is inside the cylinder. Hot glue works better than model glue. Be sure the glue doesn't touch the paper cylinder. Assemble the speaker and let the magnet fall and glue itself to the frame. It will position the magnet exactly on the centre of the coil. Wait until the glue is dry.



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- 10 Once the glue attaching the magnet to the frame is dry, remove the business card and the coil. Try not to disturb any piece on the frame or the business card. Now, remove the inner cylinder using tweezers. It is OK to break it as it will be discarded. Do not damage the outer paper cylinder. The last step is to put back the coil onto the frame. The paper cylinder should not touch the magnet and should move freely.

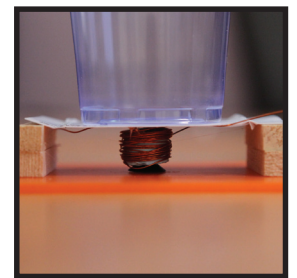
Now try your speaker!

Improving your speaker

Now that you have your speaker you can try to improve the volume and quality of the sound it produces.

The following modification may improve the volume of the sound:

- 1 Once the speaker is assembled, cut a hole in the business card (as shown).
- 2 Glue the coil to the bottom of the cup instead of the business card.
- 3 Glue the plastic cup to the business card and that's it! Now it looks like a real speaker.



Using different materials may change the sound or even make it louder. See if you can improve the design.

The sound is still too quiet? Or there's no sound at all? Try these ideas:

- Make sure the coil has at least 50 turns or, if you have a multi-meter, a resistance of more than 7 ohms.
- Adjust the distance from the coil to the magnet.
- Use only neodymium magnets - these are more powerful.
- Some personal or portable audio devices do not have enough power to drive a speaker. Try many audio sources if you get no sound or the volume is low.

Your speaker sounds horrible? Check that the:

- Coil (or paper cylinder) can move freely.
- Cards are completely glued to the cup.
- Coil has no loose wires. Try to keep the coil tight and secure it with glue or tape. Loose wires may vibrate and cause distortion.
- Paper cylinder does not touch the magnet or the frame.
- Crocodile clips are making a good connection to the wires.