



**The Messy Meter**

Recommended Grades:  
**3 - 5**

Estimated Time:  
**45 minutes**

Subject:  
**Mechanical engineering**

## WHAT YOU'LL NEED

### PANTRY STAPLES:

- AA Battery
- Fine tip washable markers
- Pencil eraser (mechanical pencil is easier because the eraser removes easily)
- Plastic or paper cup
- Paper
- Rubber bands

### SPECIALTY SUPPLIES:

- Toy motor
- 10" copper wire with stripped ends
- Electrical tape

## Can Can Robot

This experiment introduces kids to mechanical engineering. They will learn how moving and nonmoving parts interact when building a machine. In this activity youth will create a robot that draws on paper!

### STEPS

There are lots of different ways to engineer your robot to draw on paper. The steps for one way to make the robot work are below:

1. Tape the pencil eraser to the shaft (the piece that will rotate) on the toy motor.
2. Attach four markers using tape or rubber bands onto the cup with the tips pointing towards the lip of the cup. The marker tips need to clear the cup lip.
3. Tape the pencil eraser to the toy motor axis.
4. Connect the copper wires to the connectors on the back of the toy motor. Secure them with tape or rubber bands to keep them from getting disconnected.
5. Secure the toy motor to the side of the cup using the tape. The motor axis and eraser should be pointing away from the cup (perpendicular to the cup).
6. Tape the battery to the top of the cup.
7. Tape one of the copper wire ends to the + side of the battery.
8. Touch the second copper wire end to the - side of the battery and watch your robot go!

**Bonus Fun:** Experiment with placing the robot parts in different places and compare how the different designs worked. If working with older youth, don't give them instruction but lay out the supplies and let them get creative and try designing the robot on their own or in groups.



### Questions to Engage Youth:

- What aspects of your design worked well?
- What could have been improved?
- How could you change what your robot can draw?

### Explanation:

The off-centered weight attached to the motor's rotational causes the motor to wobble which creates the force that moves the robot forward. The amount of wobble that is created varies depending on the amount of weight you attach, the weight's distance from the shaft, and the speed at which the motor spins. This type of motor can be attached to many different types of objects to create a vibration, which will cause them to move erratically about. This is the same type of system that is found inside cell phones and gaming controllers to make them vibrate.

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# Lab Notebook

ACTIVITY NAME:

DATE:

NOTES:

