

# JITTERBUGS

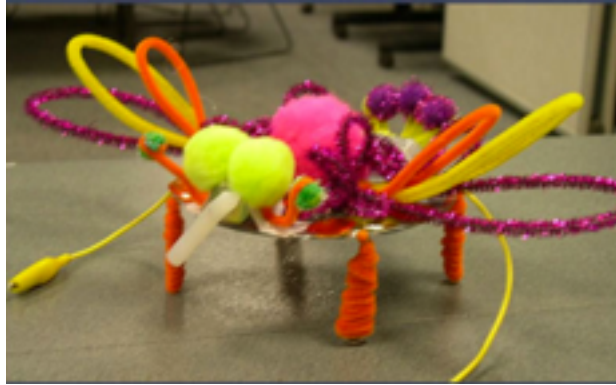
Goal: To introduce students to basic circuitry and the design process while fostering problem solving and critical thinking skills

## Scientific Significance

Understand concepts related to circuits, energy, and Newton's laws. Explore the conversion of chemical to kinetic energy.

## Key Terms

- ✦ Circuit: a closed path through which an electric current may flow
- ✦ Battery: an electrical component that creates the driving force for the circuit
- ✦ Motor: an electrical component that converts electrical energy to kinetic energy (motion)
- ✦ Jumper leads: electrical components that pass current easily from one part of a circuit to another (often connected using alligator clips)
- ✦ Lead: an electrical connection (metal pad or wire) that is used for physical support, to transfer power, and/or to probe circuits.



## What are Jitterbugs?

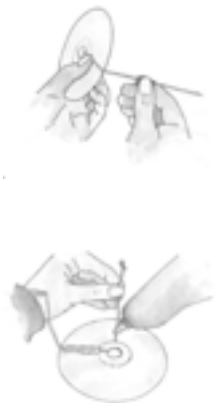
Jitterbugs are simple-to-assemble robots where the motion is caused by the transfer of kinetic energy from the motor that vibrates through the robot to the ground.

## Directions:

1) Describe jitterbugs and show examples to students. Discuss how the *circuit* will be made to make the jitterbug move, and what each part will be used for.

2) Each student will get a CD, 6 jumbo paper clips (or six pieces of thick wire or hangers), a *motor*, *battery*, and *alligator clips*. Have the students draw a sketch of their bug body (ask where the motor and battery would go to instigate design).

2) Instruct the students to line up their (paper clips/wire) with the center of the CD (which will form the body of the bug) and then bend each (wire/paper clip) down over the edge of their CD to create the legs for their bug. (Remind



## Supplies

- ◆ hot glue gun and glue sticks (for gluing and balance)
- ◆ Jumbo paper clips (or pieces of thick wire, 6in long)
- ◆ CDs
- ◆ jumper lead (wire with alligator clips at each end)
- ◆ 3v motor
- ◆ batteries (AA)
- ◆ pennies or erasers
- ◆ craft materials
- ◆ scissors
- ◆ wire cutters/strippers
- ◆ duct or electrical tape

## Facilitator Tips

- ◆ Promote problem solving by asking students how placing the motor or weights at different parts of the CD would affect how their robot wobbles
- ◆ Point out how an unbalanced load of laundry is similar to their jitterbug. The glue stick creates an off-center weight which pulls the motor and Jitterbug with it as it spins, creating a rotational vibration.
- ◆ Engage students by asking about different robots they have seen or know of



them that all legs should be the same length). The students can bend the ends of their wires to make the feet of their bugs.

3) Then the students will hot glue gun their 6 “legs” to the CD, re-aligning the wire with the center of the CD. (Make sure that students are spreading their legs out evenly around the CD so it will balance properly).

4) Next the students will begin forming their *circuits* by taping the motor to the CD (placement depends on the student’s design, but it works best when placed at the edge of the CD). Students can cut a 3/4in piece of hot glue stick and push onto the shaft of the motor so that it is slightly off center (this causes the motor to be off balance and creates vibration).

5) Next they attach their battery pack to another edge of the CD. To complete the circuit, cut the *jumper lead* in half and strip about 3/4in of plastic off the end of the wires. Have the students connect the stripped ends of the jumper leads to the battery pack.



6) To make the jitterbug move, have the students connect the two alligator clips to the motor *leads*. In order to turn the jitterbug off, one alligator clip can be taken off the motor.

## Troubleshooting Tips:

- If the motor is not running, ensure that all parts of the battery-motor circuit are connected. Make sure the alligator clips are secured to the motor leads.
- If the jitterbug is not vibrating well, take note of how the glue stick is placed on the motor. Having the stick be off center will help the jitterbug be more jittery

### References

<http://www.exploratorium.edu/afterschool/activities/index.php?activity=136&firstDisplayedItem=4>