# Energy Explorations

Lessons developed for Janine Jenzano's Fifth Grade
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Intro discussion to get students thinking about energy:

- brainstorm what energy is
- what do we use energy for
- energy = ability to do work
- how we generate electricity
- food as energy

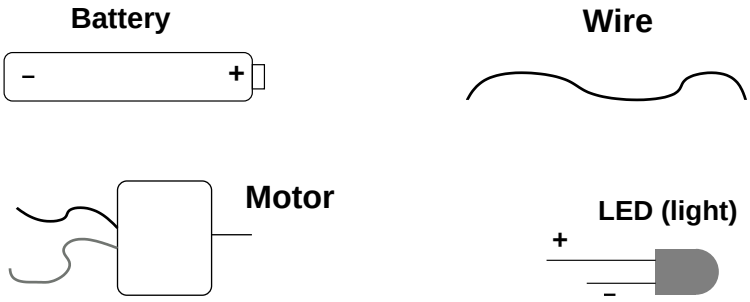
# Notes

Vocabulary:
power
energy
electricity
current
light energy
kinetic energy
chemical energy
motor
generator
battery
solar panel

Name _____ Date _____

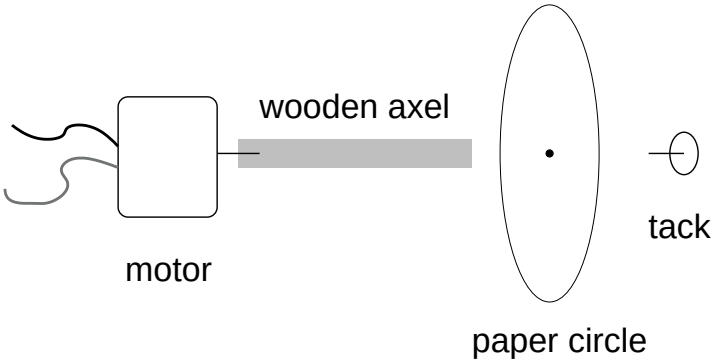
# Making Electric Circuits

**Equipment**: Identify these items




You can use these symbols to draw the circuits you make during these activities. Watch out for the + and – sides to some of the parts!

**Setup**: You also have a paper circle which you can draw on and attach to the motor using the wooden axle and thumbtack. This will give you a spinning design to watch!



# Notes

For each group of 2-3:

- 3 solar panels
- 1 motor
- 2 batteries, holder
- 1 LED
- 1 thumbtack
- 1 card circle
- 3 ft. dental floss

Name _____ Date _____

# Making Electric Circuits II

**Challenge 1**: Can you use a *battery* to make the *motor* turn?

Draw your *circuit* here using symbols from above.

**Challenge 2**: Can you make the motor turn faster?

Draw or explain the new circuit you made.

Name _____ Date _____

# Making Electric Circuits III

**Challenge 3**: Can you make the motor turn in the opposite direction?

Draw or explain the new circuit you made.

**Question 1**: Why do you think are these called *circuits*?

# Notes

Discuss:

- draw diagrams on board
- circuits (Q1)
- current can flow in either direction
- transfer of energy from one form to another

Name _____ Date _____

# Making Electric Circuits IV

**Challenge 4**: Can you use the batteries to make the *LED* shine? (Watch out for the + and − here.)

Draw or explain the new circuit you made.

**Challenge 5**: Can you use the motor as a *generator* to make the LED shine? (Instead of + and − try spinning the motor both directions.)

Draw or explain the new circuit you made.

# Notes

Discuss:

- LEDs care which direction the current goes
- motor vs. generator
- hooking up axle as waterwheel or windmill, alternate kinds of power plants

HW: Is there something on windmills or waterwheels they can read?

Name _____ Date _____

# Energy in Circuits

**Question 2**: Which parts (battery, wire, motor, LED) did you use to put energy into your circuits?

**Question 3**: Which parts (battery, wire, motor, LED) gave off energy from your circuits?

Name _____ Date _____

# Types of Energy

**Question 4**: Match the energy transfers below to which "Challenge" you used to make them.

_____ chemical energy in battery $\rightarrow$ electrical energy in LED $\rightarrow$ light energy

_____ chemical energy in battery $\rightarrow$ electrical energy in motor $\rightarrow$ kinetic energy

_____ kinetic energy on motor $\rightarrow$ electrical energy in LED $\rightarrow$ light energy

**Question 5**: Where do you think the energy came from to get the chemical energy into the battery? How about the kinetic energy into the motor?

# Notes

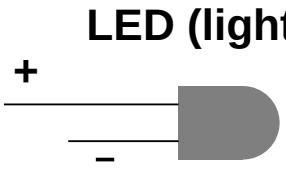
Discuss:

- energy transfers
- loss of energy to sound, heat, etc.
- show crank radio
- rechargeable batteries

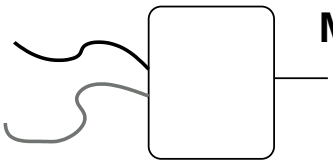
Name _____ Date _____

# Solar Panels I

**Equipment**: Identify these items. Watch out for the + and − again!

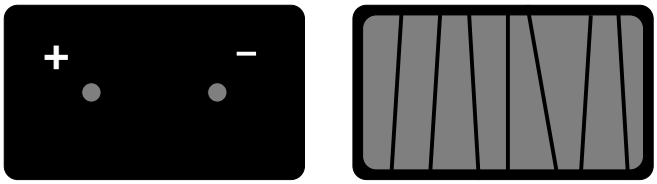



**LED (light)**



**Motor**

**solar panel**




*back* *front*

**Challenge 6**: This time you have no battery! Can you use the solar panel to run the motor?

Draw or explain the circuit you made.

# Notes

Discuss:

- how do you make the solar panel work best
- direct vs. indirect sunlight

Name _____ Date _____

# Solar Panels II

**Super Challenge 7**: Can you use the solar panel to light the LED? (Hint: you'll need several solar panels, and be very careful of the $+$ and $-$!)

Draw or explain the circuit you made.

**Question 6**: How is the solar panel like a backwards lightbulb?

# Notes

Discuss:

- how many solar panels to light the LED?
- how did you have to arrange $+$ and $-$ (draw on board)
- “backwards lightbulb” idea

Name _____ Date _____

# Power vs. Energy

**Challenge 8**: Attach a string to your motor axle at one end and an unbent paper clip “hook” at the other. Tape your motor down to the desk so that it’s nice and stable, with the string hanging over the edge. What’s the most paper clips your motor can lift at once, using 1 battery?

**Question 7**: Which was the motor able to lift faster: a few paper clips, or many paper clips?

**Challenge 9**: What’s the maximum number of paper clips the motor can can lift at once, using the solar panel?

# Notes

Discuss:

- discuss results from groups
- energy vs. power (time in Q7)
- relative power of solar panel, battery
- gravitational energy lifting weight
- spring potential energy

Name _____ Date _____

# Energy Transfers at Home

**Question 8**: You could write:

**motor** = *turns electrical energy into kinetic energy and a little sound energy*

– OR –

**solar panel** = *turns light energy into electrical energy*

Some types of energy we've talked about:

| | | |
|---|---|---|
| sound | electrical | chemical/food |
| heat | kinetic | stored spring |
| light | nuclear | gravitational (lifting) |

For homework, think of 5 devices around your house and write them as things that turn one kind of energy into another. For example:

**toaster** = *turns electrical energy into heat energy and a little light energy*

Can you think of any that don't start with electrical energy? Be creative!

# Notes

Before:

Brainstorm types of energy

After:

Have them share and discuss these definitions, in the reverse direction: can the class guess what each item is?

Mine:

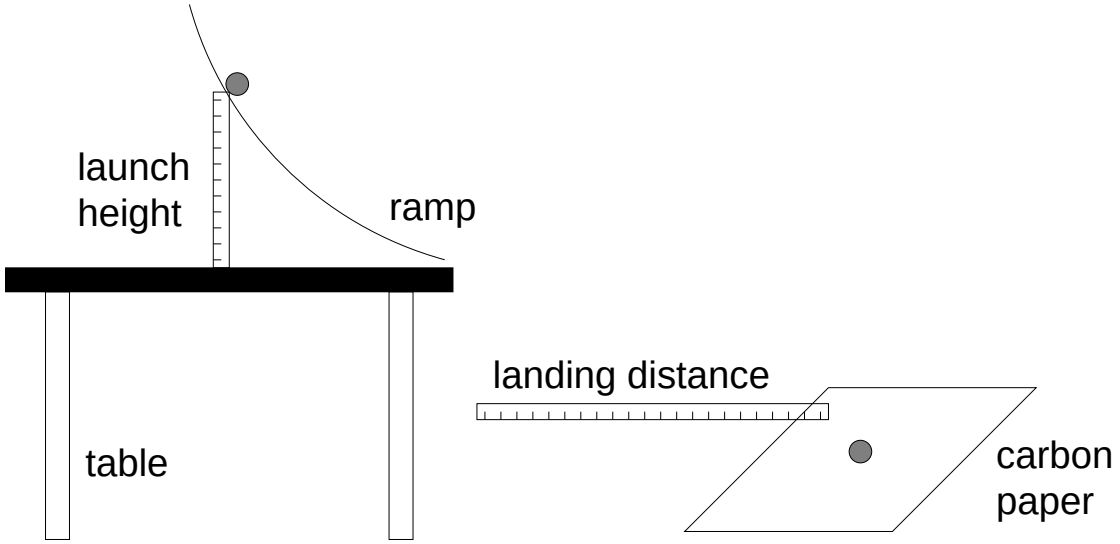
- compost pile turns food into heat
- CD player turns electricity into sound
- furnace turns chemical into heat

Name _____ Date _____

# Launch Time

**Setup**: We will launch cars/ball from various heights on the ramp to see what effect it has on the distance the car/ball can travel.

Set up your equipment like this:




**Jobs**: Decide who in your group will take each job.

measure launch height _____

record launch height _____

launch car/ball _____

watch for landing spot _____

measure landing distance _____

record landing distance _____

# Notes

For each group of 2-3:

- ramp
- meter-stick
- car
- contact paper

Name _____ Date _____

# Launch Time Data

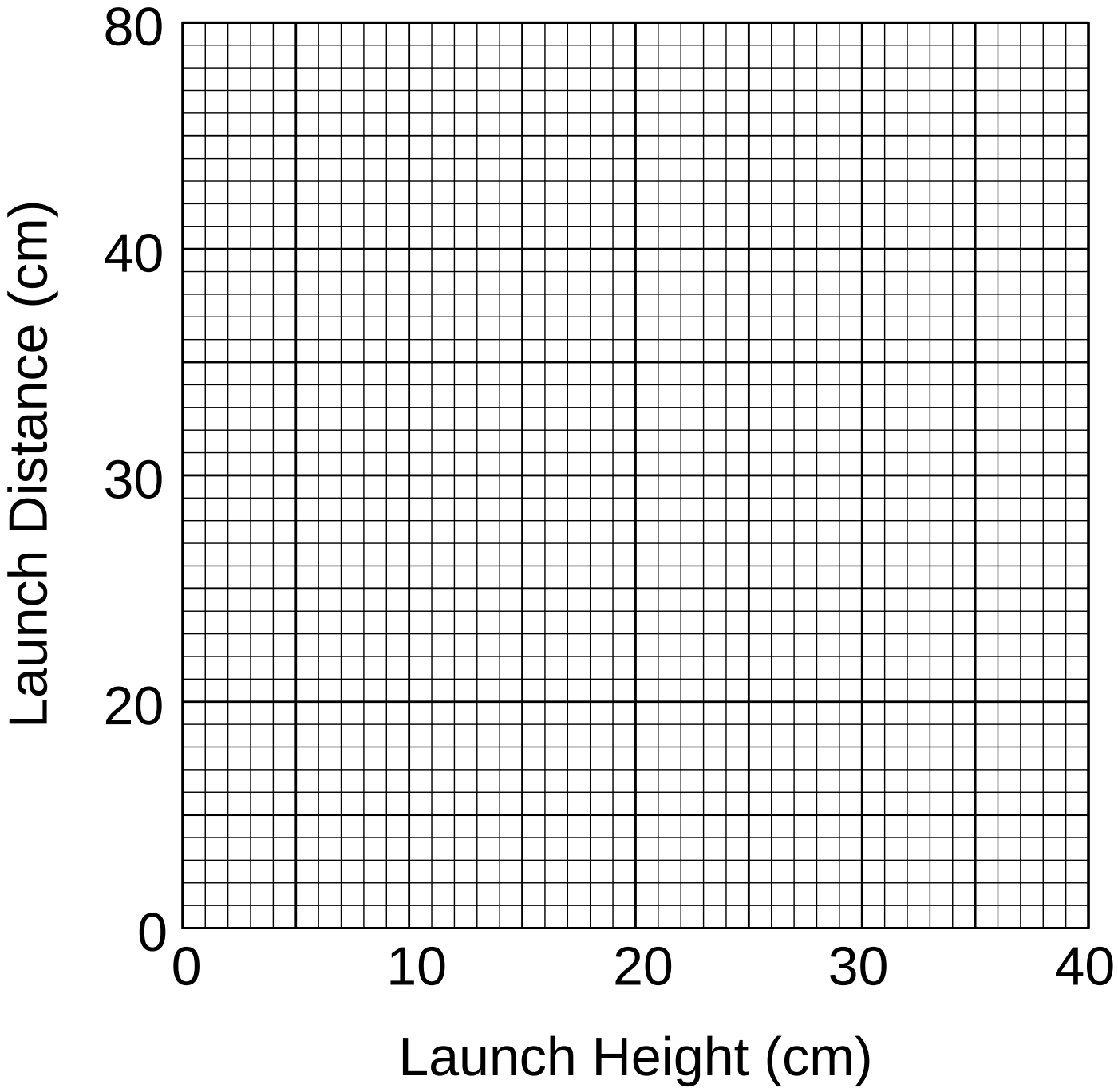
**Data**: Record your data here

| Launch Height (cm) | Landing Distance (cm) |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |

*If you were the recorder, be sure to share your data with the rest of your group when you're done.*

Name _____ Date _____

# Launch Time Graph




*Graph your group's data here, putting one dot on the graph for each pair of measurements you made.*

Name _____ Date _____

# Reading the Graph

**Question 8**: Take a look at the graph you made, and complete these sentences.

- The higher we launched the ball/car, the _____ the ball/car went.
- When the car is launched higher, it leaves the ramp with _____ (more/less) kinetic energy.
- The kinetic energy of the car came from _____ energy.

# Notes

Discuss:

- trend in graph
- potential, kinetic energy
- friction/air resistance

# Notes

To develop:

lesson on siphons

# Notes

# Solar Cooking

(I still need to try this out)

Vocabulary: mirror, focus, light energy, heat energy, passive solar, active solar

Equipment: coffee cans cut in half and predrilled for skewer at focus

wires as adjustable legs (tape at correct angle for latitude)

skewers, hot dogs, buns, condiments

Activity: aim at correct angle, can toast buns if time

Discussion: passive solar water heaters, heating houses, compare to active solar (needs to go by way of electricity)

Some websites:

http://www.energyquest.ca.gov/

http://p2.utep.edu/watts/projects/cook.cfm