Do Now:

Turn to the person next to you and share:

What projects, if any, have you done for your electricity & magnetism unit?

What was the outcome? (or what would you want the outcome to be?)
“Today, because knowledge is available on every Internet-connected device, what you know matters far less than what you can do with what you know.

Tony Wagner, Harvard Education Specialist
The capacity to **innovate** — the ability to solve problems creatively or bring new possibilities to life — and skills like **critical thinking**, **communication** and **collaboration** are far more important than academic knowledge.

Tony Wagner, Harvard Education Specialist
We need to focus more on teaching the skill and will to learn and to make a difference and bring the three most powerful ingredients of intrinsic motivation into the classroom: **play, passion and purpose.**
<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:10-9:30</td>
<td><strong>Light-House Project</strong> Description &amp; Handout</td>
</tr>
<tr>
<td>9:30-11:30</td>
<td><strong>Headphone Project</strong> Build</td>
</tr>
<tr>
<td>Student Experience</td>
<td>Wire Diagram</td>
</tr>
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<tr>
<td>Students use circuit schematics to create a wire diagram for their house. Students must get diagram approved by “the city” (teacher) in order to get project materials.</td>
<td>Students receive essential project materials (listed below) and must build prototypes of their series and parallel lights circuits, including switches. They determine a way to power both prototyped circuits from the same voltage source.</td>
</tr>
<tr>
<td>Material</td>
<td>--</td>
</tr>
<tr>
<td>Big Idea</td>
<td>Diagrams allow engineers, architects, and contractors to analyze the performance of a circuit before building it.</td>
</tr>
<tr>
<td>Time</td>
<td>One 55-min period</td>
</tr>
</tbody>
</table>
Objectives

• Teachers will feel prepared to plan a Light-House culminating project in a future electricity unit
1. Make circuit diagram

2. Submit diagram

   Diagram approved  /  Diagram denied

3. Get materials
   - 6 lights
   - 3 paper clips
   - 6 brads
   - foam/cardboard

4. Start prototyping circuits
Light-House Wire Diagram
Switches made from 2 brass brads and one paperclip

from front

side view

front view
http://www.youtube.com/watch?v=o0MDBbH9eGk
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Headphone Project
Objectives

• Teachers will understand how a speaker works by dissecting one

• Teachers will prototype a working speaker

• Teachers will feel prepared to plan a headphone culminating project in their next E&M unit
<table>
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<tr>
<th>Culminating Activity – Headphone Engineering</th>
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<td><strong>Student Experience</strong></td>
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<tr>
<td>Students are introduced to the Culminating Activity (if not done at the beginning of unit).</td>
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<tr>
<td>Students build headphones using T4T materials.</td>
</tr>
<tr>
<td><strong>T4T Material</strong></td>
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<tr>
<td>Thin-gauge wire</td>
</tr>
<tr>
<td><strong>Big Idea</strong></td>
</tr>
<tr>
<td><strong>Δt</strong></td>
</tr>
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</table>
**The Technology**

How do speakers work?

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**The User**

What does the user need/want?
### Requirements

- Research
- Brainstorming
- Prototyping
- Analysis
- Production

What is required that the headphones have or do?
Brainstorming is the process of coming up with ideas.
Prototyping

Prove that your design will work & test different designs
Analysis

What about the prototype is **good**?  
What needs to **change**?  
What **questions** does it bring up?  
What **ideas** does this give us?
Research
Requirements
Brainstorming
Prototyping
Analysis
Production

Production

Do it to it.
Brainstorm Rules

Go for quantity

Build off of ideas

Encourage wild ideas

Be visual

Stay on topic

Do not judge ideas—yet
Voice coil

- Solenoid (coil of wire)
- Magnetic field changes with alternating current (AC)
- Strength of mag. field depends on number of coil loops
Cone

- Attached to voice coil, and vibrates with it
- Creates pressure waves in the air (sound)
- The lighter the better (why?)
Magnets

- Permanent magnetic field required to interact with voice coil
Suspension

- Suspends voice coil and cone above the permanent magnet.
- Allows free movement (why is this important?)
Exit Ticket:

As a result of today’s workshop...

1. I feel prepared to ____________________.
2. I’m still unsure about ______________.