

## e-Body Lab Workshop: Lesson Plan

Date: 19/6/2025

Class size: ~30

### Learning Objectives:

- Learn what **resistance**, **current** and **voltage** are (taught content)
- Learn of ohms law  **$V=IR$**  (taught content)
- Understand what determines a bulb's brightness
- Understand greater length of thread results in more resistance  $\Rightarrow$  dimmer bulb (through observation)
- Understand the difference between parallel vs series circuits (taught content)
- Observe how current and voltage get split in circuits

### Resources needed:

- Projector/smart whiteboard
- Imperial PowerPoint
- Imperial hand outs
- E-textile materials
  - 30x sewable coin cells [1]
  - 30x 3v coin cells [2]
  - 60x sewable LEDs [3]
  - ~2m x30 conductive thread [4]
  - 30x sewable slide switches [5]
- General sewing materials
  - fabric
  - scissors
  - 30x sewing needles
  - cotton sewing thread
  - tailors chalk
  - tape measure/ruler
  - 30x sew on press studs

### Sourcing e-textile components:

All the required materials can be purchased from <https://kitronik.co.uk/>

Specific links to the components are at the end of the document, as well as a link to a value pack containing 60 cell holders, 60 coin cells, 4x 45m thread spools, and 140x LEDs (20 per colour)

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### ACTIVITY ONE:

#### Description:

Sewing the circuit needed to light up one LED. Additional switches and nodes sewn to allow adding to the circuit.

#### Materials:

- 30x Activity One hand outs
- 30x sewable coin cells
- 30x 3v coin cells
- 30x sewable LEDs
- ~2m x30 conductive thread
- 30x sewable slide switches
- fabric
- scissors
- 30x sewing needles
- cotton sewing thread
- tailors chalk
- tape measure/ruler
- 30x sew on press studs



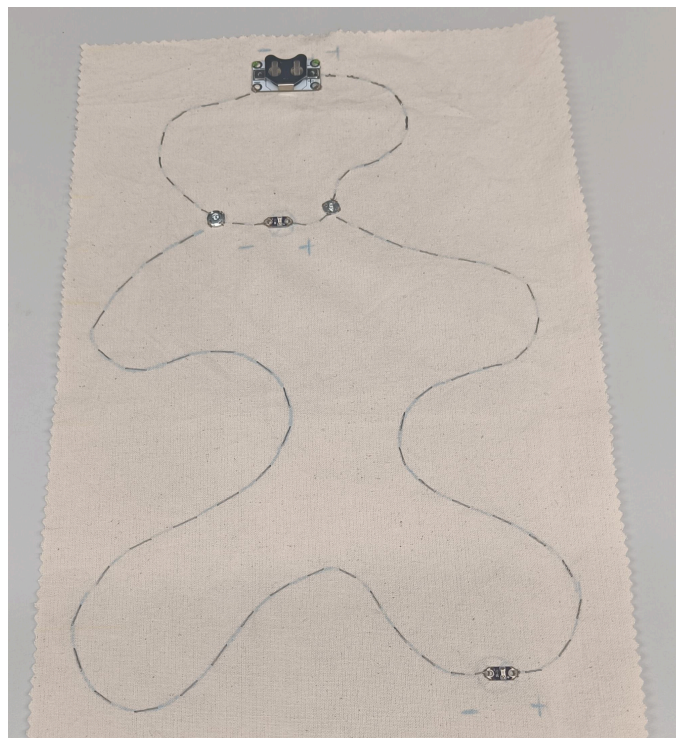
### ACTIVITY TWO:

#### Description:

Adding a second LED to the circuit.

#### Materials:

- 30x Activity Two hand outs
- 30x sewable LEDs
- ~2m x30 conductive thread
- fabric
- scissors
- 30x sewing needles
- cotton sewing thread
- tailors chalk
- tape measure/ruler



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Time	Tasks and examples	Teacher explanation	Learner participation
10 mins	<p>Entry</p> <p>Arrange sitting in small groups</p> <p>Present intro PowerPoint</p>	<p>Introduce e-textiles as a concept: the role of electronics and where we see it in our lives, then how this is integrated with textiles</p> <p>Show new research at Imperial from the e-Body Lab and the wider world for inspiration.</p>	<p>PowerPoint has questions which will be asked to the students to answer via raising hands.</p> <p>Additional multiple choice questions to prompt thinking about the e-textiles field.</p>
20 mins	<p>Present the first content PowerPoint</p>	<p>Introduce current, voltage and resistance. Use the friction metaphor to help understanding.</p> <p>Introduce <math>V=IR</math> and what this relation means.</p> <p>Explain LED behaviour and what an LED needs to light up. Demonstrate what is needed to build this circuit up.</p>	<p>Students listening to explanations.</p> <p>Answering open ended questions posed to them to prompt thinking about the topics.</p> <p>Several opportunities for asking questions.</p>
75 mins	<p><b>Activity One:</b> sewing LED circuit</p> <p>Give equipment and hand outs to each table.</p> <p>Explain the task at the front, then set students off independently.</p> <p>Circulating to help.</p>	<p>Go through the instructions briefly, explain how to use the hand outs.</p> <p>Show all the equipment to students and clarify what everything is.</p> <p>Break after 40 minutes to check progress (should have done + half of circuit)</p>	<p>Students follow the written instructions and complete the activity.</p> <p>Teachers circulate to answer questions indicated by hands up or otherwise.</p> <p>Students discuss on their tables to work through problems.</p>

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Time	Tasks and examples	Teacher explanation	Learner participation
10 mins	<p>Refocus attention to the front.</p> <p>Class discussion of the activity.</p>	<p>Leading through the discussion questions from the activity sheet.</p> <p>Re-iterating <math>V=IR</math>, and how resistance varies with length.</p>	<p>Q+A with students raising hands to give their observations and opinions from the activity.</p>
15 mins	<p>Present the second content PowerPoint</p>	<p>Introduce series and parallel circuits and how to identify between them.</p> <p>Explain how the current and voltage vary in both parallel and series circuits.</p> <p>Demonstrate how to add more LEDs, show the difference in series vs parallel when adding.</p>	<p>Students listening to explanations.</p> <p>Answering open ended questions posed to them to prompt thinking about the topics.</p> <p>Several opportunities for asking questions.</p>
45 mins	<p><b>Activity Two:</b> adding second LED</p> <p>Give equipment and hand outs to each table.</p> <p>Explain the task at the front, then set students off independently.</p> <p>Circulating to help.</p>	<p>Go through the instructions briefly, explain how to use the hand outs.</p> <p>Show all the equipment to students and clarify what everything is.</p>	<p>Students follow the written instructions and complete the activity.</p> <p>Teachers circulate to answer questions indicated by hands up or otherwise.</p> <p>Students discuss on their tables to work through problems.</p>
5 mins	<p>Summary presentation</p>	<p>Recap <math>V=IR</math> and circuit types. Inform where to find resources online.</p>	<p>Final question time</p>

## E-textile components:

[1] <https://kitronik.co.uk/products/2701-sewable-coin-cell-holder>

*You can instead purchase switch controlled coin cell holders which remove the need for a separate switch:*

<https://kitronik.co.uk/products/2711-electro-fashion-switched-coin-cell-holder>

[2] <https://kitronik.co.uk/products/2262-cr2032-3v-coin-cell-pack-of-5>

[3] <https://kitronik.co.uk/collections/leds-for-e-textiles/easy-sew-leds>

[4] <https://kitronik.co.uk/products/2722-conductive-thread-50-yards-45m>

[5] <https://kitronik.co.uk/products/2709-electro-fashion-slide-switch>

*It is recommended to get the standard slide switch which changes between “on” and “off”. For only turning on the LEDs momentarily, push switches can be used:*

<https://kitronik.co.uk/collections/e-textiles-conductive-thread/products/2708-electro-fashion-push-button-switch>

## Price breakdown (Ex VAT):

Buy each component individually:

Item	Cost per unit	Price (for 60)
Switched coin cell holder	2.10 per 1	£126
3V Coin cells	1.05 per 5	£12.60
Easy sew LEDs	3.90 per 10	£46.80
45m of conductive thread (enough for ~ 20 students)	9.50 per 1	£28.50
		<b>£213.90</b>

Using the bulk pack:

Item	Price (for 60)
BULK PACK [6] <ul style="list-style-type: none"> <li>• 60 cell holders</li> <li>• 60 coin cells</li> <li>• 4x 45m thread spools</li> <li>• 140x LEDs (20 per colour)</li> </ul>	£135
Slide switch	£51
<b>£186</b>	

[6] <https://kitronik.co.uk/products/2764-electro-fashion-60-student-bulk-pack-sewable-led>