



# Circuit Playground: J is for Joule

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<https://learn.adafruit.com/circuit-playground-j-is-for-joule>

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# Table of Contents

<a href="#">Video</a>	3
<a href="#">Transcript</a>	3
<a href="#">Learn More</a>	8
<ul style="list-style-type: none"><li>• <a href="#">How to calculate Joules</a></li><li>• <a href="#">James Prescott Joule</a></li></ul>	

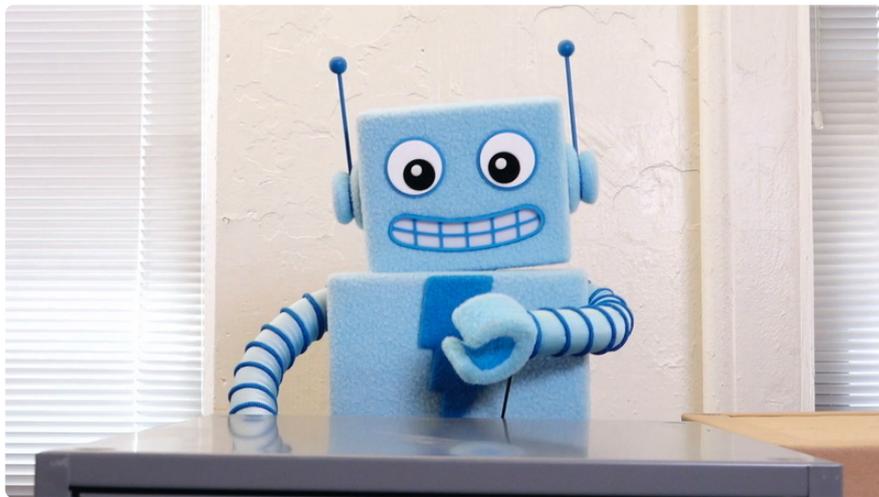
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# Video

Adabot gets working with James Prescott Joule and learns all about the Joule, a unit which measures work itself!

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## Transcript



Joule: RRRise and Shine Adabot! It's time for work!

Adabot: Work?

Joule: Work!

Adabot: Ok!



Adabot: Who are you? – and what are we working on?

Joule: My name is James Prescott Joule - perhaps you've heard of me?

Adabot: I think so - aren't you a scientist?

Joule: Exactly! I've spent my entire career studying the way things work.

Adabot: What do you mean by work, exactly?

Joule: So happy you asked! Let's get working and I'll explain!

Adabot: umm - ok.



Joule: Long ago I defined work as force multiplied by distance. So if we know how much force is applied over a certain distance, then we can know how much work has been accomplished.

Adabot: Force multiplied by distance?

Joule: Exactly! As I'm sure you know, It takes much more work to lift something up above your head than it does to raise it a few inches off the ground. And when we measure force multiplied by distance, we do so using a unit of measurement known as the joule.



Adabot: Wait, I thought you were named Joule?

Joule: I am! I named this unit of measurement after myself - it is my life's work after all.

Adabot: That makes sense.

Joule: Let me give you an example.

Adabot: ok

Joule: To the table!

Adabot: To the table!



Adabot: Ooh - how 'bout them apples!

Joule: Indeed, Adabot. So, it takes a force of about 1 Newton to lift this apple. And if I lift this apple 1 meter then I've done 1 Joule of work!

Adabot: Ok - but what if you lifted forty apples?

Joule: Forty apples would be forty joules of work!

Adabot: Woah - that's a lot of work!.

Joule: Indeed.

Adabot: Indeed.



Joule: So if we light this 3 Watt LED for 3 seconds- then we've done 9 Joules of work: 3 watts times 3 seconds equals 9 joules.

Now, similarly - If we light this 60 Watt incandescent bulb for one hour, then we'll have done 216,000 Joules of work.

Adabot: Woah - that's a lot of joules!

Joule: Exactly. So, if you really wanted to save power,you might consider using something like this - a 12 watt LED bulb.

Adabot: Oh - that would be smart move.

Joule: Indeed, Adabot.

**joules = force x distance**

**joules = power x time**

Adabot: So, to calculate joules ... we multiply force and distance ... or power and time.

Joule: Precisely Adabot!



Joule: So - are you ready to get to work?

Adabot: I think so ...

Joule: Good - because we're scheduled for 5,000 joules of work today.

Adabot: Wait - what?!

Joule: Come on Adabot! Let's make hay while the sun is shining!

Adabot: Wait - there's hay now too?!

Joule: It's just an expression, Adabot - come on!

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# Learn More

## How to calculate Joules

Let's go over some of the examples Adabot and Mr. Joule use in the video. In order to calculate Joules, we can use one of two simple equations. The first one uses measurements of **force in newtons** and **distance in meters** ...

$$\text{joules} = \text{force} \times \text{distance}$$

Mr. Joule uses a force of **1 newton** to lift an apple **1 meter**. Therefore ...

$$1 \text{ newton} \times 1 \text{ meter} = 1 \text{ joule}$$

and in order to lift 40 apples, he uses a force of 40 newtons ...

$$40 \text{ newtons} \times 1 \text{ meter} = 40 \text{ joules}$$

The second equation we can use to calculate Joules uses measurements of Power in watts and time in seconds ...

$$\text{joules} = \text{power} \times \text{time}$$

Mr. Joule explains that if we light a 3 watt LED for 3 seconds we've used 9 joules of work:

$$3 \text{ watts} \times 3 \text{ seconds} = 9 \text{ joules}$$

and if we light a 60 watt incandescent bulb for one hour:

$$1 \text{ hour} = 3600 \text{ seconds}$$

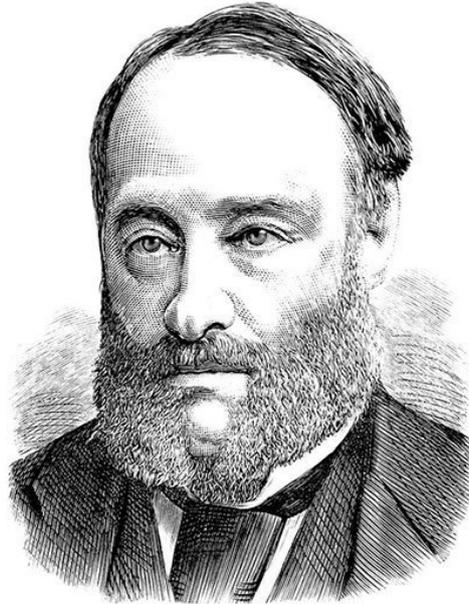
$$60 \text{ watts} \times 3600 \text{ seconds} = 216,000 \text{ joules}$$

and a more efficient LED light bulb which uses 12 watts could use less work to provide just as much light:

$$12 \text{ watts} \times 3600 \text{ seconds} = 43,200 \text{ joules}$$

If you know power & time, or force & distance - calculating joules is quite simple!

## James Prescott Joule



from [Wikipedia \(https://adafru.it/q9f\)](https://adafru.it/q9f)

James Prescott Joule was an English physicist and brewer, born in Salford, Lancashire. Joule studied the nature of heat, and discovered its relationship to mechanical work. This led to the law of conservation of energy, which led to the development of the first law of thermodynamics. The SI derived unit of energy, the joule, is named after James Joule. He worked with Lord Kelvin to develop the absolute scale of temperature the kelvin. Joule also made observations of magnetostriction, and he found the relationship between the current through a resistor and the heat dissipated, which is now called Joule's first law.

[learn more about Mr. Joule \(https://adafru.it/q9f\)](https://adafru.it/q9f)