mytekDev

Light Show Lab: Watts, Plugs and the Bill

Grades 5-7 · 45 minutes

Math · Engineering



Slides, rubric and answer key **Print and go** **No student accounts**

Chromebook friendly

What's included

- A one-page overview: objectives, essential question, vocabulary, standards and assessment
- A 45-minute lesson sequence: warm-up, direct instruction, guided practice, independent practice, closure
- Slides for the board: a PowerPoint file that also opens in Google Slides
- A student worksheet with a QR code and a cost table
- A 3-question exit ticket, two to a page, with an answer key
- A rubric: 3 criteria, 4 levels, scored out of 12
- Differentiation for English learners, students with IEPs or 504 plans, and students who need more support or more challenge
- Cross-curricular extensions, and notes for teaching it in grade 4 and in grade 8
- Standards: Common Core math and NGSS

Light Show Lab: Watts, Plugs and the Bill

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The same house, with the same 1,488 bulbs, draws 208 watts in LED and 1,394 watts in old glass bulbs. Students work out what a season costs from the watts, the hours, the nights and the price of a kilowatt-hour, check their arithmetic against the app ($6.75 and $45), then halve the hours and predict the bill. Then they light everything: in old bulbs the house passes what one household circuit should carry and needs 17 plugs, and in LED it still fits one circuit. The limits are the constraints of a real design problem.

At a glance

ESSENTIAL QUESTION

What does it cost to keep a house full of lights on, and what limits how many you can plug in?

OBJECTIVES

Students will be able to:

- calculate the cost of running lights for a season from watts, hours, nights and a price per kilowatt-hour
- compare LED and old bulbs for the same house as a ratio and as a cost per night
- name the constraints on a display: the limit on a string's tag, the watts a circuit carries, the outlets, and the cost
- decide which design meets every constraint, and give the numbers that show it

VOCABULARY

Watt, Kilowatt-hour, Unit rate, Circuit, Constraint

STANDARDS

6.RP.A.3b, 7.RP.A.2c, 4.OA.A.3, MS-ETS1-1, MS-ETS1-2

TIME AND MATERIALS

45 minutes, grades 5-7.

- One computer or Chromebook per student
- A projector
- The worksheet and exit ticket, one copy each per student
- The rubric, one copy per student if you grade the work
- Calculators
- Optional: an electric bill, with the price per kilowatt-hour circled

PREP

Make copies of the worksheet and exit ticket. Before class, open mytekdev.com/try/lightshowlab?lesson=watts-plugs-and-the-bill&ref=tpt-lightshowlab-2 once on a student computer: it opens on a lit two-story house, and checks that your school's filter allows the app. Open List and click Old bulbs and LED bulbs once each, about three minutes. Students need calculators, or time to multiply decimals by hand.

ASSESSMENT

- Formative: the questions under What to look for, asked while students work, and the exit ticket (answer key included).
- Summative: the worksheet, scored with the rubric.

TECHNOLOGY AND PRIVACY

Runs in any browser, Chromebooks included, with nothing to install. Students need no account and no email: the link works signed out, and nothing they do is stored on our server unless they choose to save. The music is played by the page, so headphones help, and the Sound button turns it off.

Lesson sequence

MINUTES	STAGE	WHAT YOU DO	WHAT STUDENTS DO
0 to 5	**Warm-up** Hook	Show the title, essential question and Today I can slides (about 1 minute). Then the warm-up: guess the cost of a month of evenings. Write the guesses on the board.	Write a guess on the worksheet.
5 to 13	**Direct instruction (I do)** Model it	Project the app and open List. Read the two big numbers: 208 watts in LED, 1,394 in old bulbs, for the same sets on the same house. Show Same house, two kinds of bulb, then From watts to dollars, and work the LED line on the board: 0.208 × 6 × 30 × 0.18. The app says $6.75 because it keeps the tenths of a watt (208.4). **It's working when:** Say the units aloud at every step: watts, kilowatts, kilowatt-hours, dollars. The units are what keep the three multiplications in order.	Copy the worked example and fill in the vocabulary on the worksheet.
13 to 22	**Guided practice (We do)** Read the list	Students open the link or scan the QR code. A short guide walks them through List: both watt numbers, Old bulbs, the warning under the house, and 3 hours a night. They work out the old-bulb cost by hand and check it against the app. **Watch for:** Students who multiply 1,394 by 0.18 directly. Ask what the price is for, and point at the word kilowatt.	Fill in the first rows of the cost table, and predict the cost at 3 hours before changing it.
22 to 38	**Independent practice (You do)** Light everything	Students open Lights, press All out, and return to List: 1,969 bulbs now. They compare LED and old bulbs against the limits on the worksheet and decide which design works. Walk the room with the What to look for questions. **If they ask:** "The old bulbs need 1,948 watts. One circuit carries 1,800. What would happen at the breaker box?" The circuit	Fill in the All out rows, answer the constraint questions, and work out the cost for one night.
38 to 45	**Closure** Showcase and exit ticket	Show the Showcase slide. Two students give the numbers they would show a neighbor. Go back to the guesses on the board and circle the closest. Hand out the exit ticket.	Answer the exit ticket.

Before you teach: a ten-minute walkthrough

Open mytekdev.com/try/lightshowlab?lesson=watts-plugs-and-the-bill&ref=tpt-lightshowlab-2. A short guide opens over the app. The house has 1,488 bulbs up, and a line under it reads "208 watts on 1 plug. One circuit carries it."

1. **The list.** Open `List`. In LED: 208 watts, $6.75 for a season. In old bulbs: 1,394 watts, $45 for a season. Under them: "1,488 bulbs in 32 sets, on 1 plug and 1 circuit." A table lists each part of the house with its feet,

sets and watts.

2. **Old bulbs.** Press `Old bulbs`. The line under the house becomes a warning: "13 plugs, and this house has 2 outdoor outlets." Click it for the reason: only a few old sets can plug end to end before the limit on the tag, 210 watts.
3. **The season.** Three boxes set the season: 6 hours a night, 30 nights, 18 cents a kilowatt-hour. Change the hours to 3 and both costs halve, to $3.38 and $23.
4. **All out.** Open `Lights` and press `All out`: lights go on everything, 1,969 bulbs in 42 sets. In LED that is 279 watts on 2 plugs, $9.04 a season. In old bulbs it is 1,948 watts on 17 plugs, $63 a season, and the line under the house reads "1,948 watts is too much for one circuit. This needs 2."

> The app rounds what it shows and calculates with the tenths. 208 watts is 208.4, so a student who uses 208 gets $6.74 and the app says $6.75. Accept either. Costs of ten dollars or more are shown to the whole dollar.

Background for the teacher

A watt measures how fast energy is used. The electric company bills for energy, in kilowatt-hours: 1,000 watts for one hour. So the chain is watts, divided by 1,000, times hours, times nights, times the price. The app uses 18 cents, close to the United States average, and students can change it.

An old glass bulb makes light by heating a wire, and most of its energy leaves as heat. An LED makes the same light with far less. For this house the old bulbs draw about 6.7 times the watts of the LED ones, so they cost about 6.7 times as much to run.

The limits are real ones. A common household circuit is 15 amps at 120 volts, which is 1,800 watts, and electricians keep a load that stays on for hours under 80 percent of that, 1,440 watts. A thin-wire light string carries a tag with its own limit, 210 watts here, which is why old sets cannot all plug end to end. The numbers for sets and bulbs are typical ones: the tag on a real box is the authority.

Common mistakes: multiplying watts by the price without converting to kilowatts; thinking more bulbs always means more plugs (in LED, 32 sets run from one); thinking a breaker trips because of the number of plugs and not the watts.

What to look for

Ask these while students work. A student who has understood the lesson can answer them without help:

- Why do you divide the watts by 1,000?
- If the lights run 3 hours a night and not 6, what happens to the bill? Why?
- About how many times more do the old bulbs cost? Where did that number come from?
- With lights on everything, which limit do the old bulbs break?
- What does one night cost in LED?

> One night in LED is $6.75 ÷ 30, about 23 cents. In old bulbs it is about $1.50. A student who can get from the season to one night has the unit rate.

Cross-curricular extensions

- Science: hold a hand near an old glass bulb and near an LED bulb, with an adult. Where did the extra energy go?
- Social studies: find the price of a kilowatt-hour in three states. Where would this house cost the most to light?
- Writing: write a note to a neighbor explaining, with numbers, whether new LED lights are worth buying.
- Careers: find out what an electrician checks before adding outdoor outlets to a house.

Vocabulary

Watt	A measure of how fast something uses electrical energy. A brighter or older bulb uses more watts.
Kilowatt-hour	The amount of energy the electric company bills for: 1,000 watts running for one hour.
Unit rate	An amount for one of something: cents for one kilowatt-hour, dollars for one night.
Circuit	One loop of house wiring behind a breaker. A common one carries 1,800 watts, and lights left on for hours should stay under 1,440.
Constraint	A limit a design has to stay inside, such as cost, watts or the number of outlets.

Differentiation

ENGLISH LEARNERS

- Keep the vocabulary slide up, and point at the house on the board as you say each word: the lights carry the meaning.
- Keep From watts to dollars on the board for the whole lesson; the table is numbers only.
- Accept the constraint answers as a table of numbers with a check or a cross beside each.

STUDENTS WITH IEPS OR 504 PLANS

- Provide a calculator and a copy of the worked example with blanks for the new numbers.
- Pair students, one reading numbers from the screen and one recording.
- Allow the first-house rows alone where the IEP allows a modified assignment.

STUDENTS WHO NEED MORE SUPPORT

- A sentence starter: "The old bulbs cost more because they use ___ watts and the LED use ___."
- Work the old-bulb line together on the board before students try the 3-hour prediction.
- Round the watts to 200 and 1,400 for the first try.

STUDENTS READY FOR MORE

- In List, change the price to what your family or your state pays for a kilowatt-hour and work the season again.
- Press Print the list and read the plug plan. Why are some plugs carrying 175 watts and others only 61?
- The front peak needs 28 feet of big bulbs and the sets are 25 feet long. How many sets, and how much

is left over?

Adapting for other grades

Younger students: In grade 4, use the Feet and Sets columns in List instead of the cost: the front peak needs 28 feet, the sets are 25 feet, so it takes 2 sets with 22 feet to spare. That is a remainder that has to be read (4.OA.A.3). Give the season costs as facts and compare them. Score the first two rubric rows, total 8, and 6 meets the objectives.

Older students: In grade 8, have students write the cost as an equation, c = 0.18 × k for k kilowatt-hours, then as one in watts, hours and nights, and graph cost against hours a night for both kinds of bulb. The two lines have very different slopes.

Student worksheet

Name: _____ Date: _____

Open the app: scan the QR code, or go to mytekdev.com/try/lightshowlab?lesson=watts-plugs-and-the-bill

Essential question: What does it cost to keep a house full of lights on, and what limits how many you can plug in?

Warm-up: This house has 1,488 bulbs. My guess for a month of evenings: $_____

1. **Vocabulary.** Watt, kilowatt-hour, unit rate, circuit, constraint: write each in your own words.

2. **The first house.** LED: _____ watts. Old bulbs: _____ watts. Work each cost: watts ÷ 1,000 × 6 hours × 30 nights × $0.18. LED: $_____. Old bulbs: $_____. The app says: $_____ and $_____.

3. **Half the hours.** At 3 hours a night I predict: LED $_____, old bulbs $_____. The app says: $_____ and $_____.

4. **All out.** LED: _____ watts on _____ plugs. Old bulbs: _____ watts on _____ plugs and _____ circuits.

1. A circuit should stay under 1,440 watts for lights left on all evening, and this house has 2 outdoor outlets. With lights on everything, which design meets both limits? Give the numbers.

2. What does one night cost for the first house in LED? In old bulbs? Show your division.

Exit ticket

Name: _____

1. Lights that draw 500 watts run for 4 hours. How many kilowatt-hours is that? (A) 2 (B) 125 (C) 2,000

2. A house draws 1,948 watts in old bulbs. One circuit carries 1,800. What does it need? (A) fewer outlets (B) a second circuit, or LED bulbs (C) longer cords

3. Write one sentence, with a number in it, comparing what LED and old bulbs cost to run.

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Answer key: exit ticket

QUESTION	ANSWER	WHY
1	A	500 watts is 0.5 kilowatts, and 0.5 × 4 hours = 2 kilowatt-hours.
2	B	1,948 is more than 1,800, so the breaker would trip. Splitting the load or using bulbs that draw less both fix it.
3	Open answer	A full answer gives a number: the old bulbs draw about 6.7 times the watts, or $45 against $6.75 for the season.

Rubric

Score each row from 1 to 4.

Name: _____

CRITERIA	4 EXCEEDS	3 MEETS	2 APPROACHING	1 BEGINNING
The calculation	Cost worked from watts through kilowatt-hours to dollars for both kinds of bulb, with units, matching the app to the dollar.	Cost worked correctly for both kinds of bulb.	One cost correct, or the kilowatt step missing.	No cost worked.
Comparing	Compares LED and old bulbs as a ratio and as a cost per night, and predicts the 3-hour cost before checking.	Compares the two costs and says about how many times more.	Says one costs more with no numbers.	No comparison.
Constraints	Names the circuit, the plugs and the cost as limits, and shows with numbers which design meets all three.	Says which design fits one circuit, with the watts.	Names a limit without checking a design against it.	No limits named.

Total: ____ / 12. A score of 9 or more meets the objectives.

Standards

The lesson is built for unit rates and proportional relationships, 6.RP.A.3b and 7.RP.A.2c, with the circuit, the outlets and the cost as the constraints of MS-ETS1-1 and MS-ETS1-2. 4.OA.A.3 is for the grade 4 notes.

FRAMEWORK	CODE	GRADES	STANDARD	HOW THE LESSON MEETS IT
Common Core Math	**6.RP.A.3b**	6	Solve unit rate problems including those involving unit pricing and constant speed.	Students use a unit price, 18 cents for one kilowatt-hour, to find the cost of a season, and find the cost for one night.
Common Core Math	**7.RP.A.2c**	7	Represent proportional relationships by equations. For example, if total cost t is proportional to the number n of items purchased at a constant price p, the relationship between the total cost and the number of items can be expressed as t = pn.	Cost is price times kilowatt-hours. Students use that relationship for both kinds of bulb and see the cost halve when the hours halve.
Common Core Math	**4.OA.A.3**	4	Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.	In the grade 4 notes, students find how many 25-foot sets cover 28 feet of roof edge and say what the leftover means.
NGSS	**MS-ETS1-1**	6-8	Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.	Students state the limits on a display with their numbers: 1,440 watts on a circuit, 2 outdoor outlets, and the cost of a season.
NGSS	**MS-ETS1-2**	6-8	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.	Students check two designs, LED and old bulbs, against each limit in a table and decide which meets them all.

Checked November 2026 against: Common Core State Standards, Grade 6 Ratios and Proportional Relationships, Common Core State Standards, Grade 7 Ratios and Proportional Relationships, Common Core State Standards, Grade 4 Operations and Algebraic Thinking, NGSS MS-ETS1 Engineering Design.

Optional: save student work in a free class

The whole lesson runs at the link on the worksheet, with no accounts and no sign-up.

To keep students' work, and see it all in one place, make a free class. It takes about ten minutes, once, and covers every lesson in this series: mytekdev.com/tools/class-setup

Students in a class open mytekdev.com/tools/light-show-lab/lessons/watts-plugs-and-the-bill/start instead of the worksheet link. Each one gets their own copy of the starter, and the same link reopens it next time.

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