Holiday Decoration Activities

Grade Level:

- Pri Primary
- Elem Elementary
- Int Intermediate
- Sec Secondary

Subject Areas:

- Science
- Creative Arts
- Math

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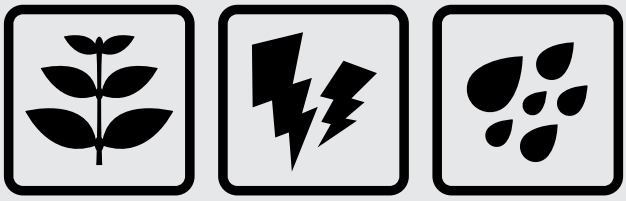

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In support of NEED, the national Teacher Advisory Board (TAB) is dedicated to developing and promoting standards-based energy curriculum and training.

Energy Data Used in NEED Materials

NEED believes in providing teachers and students with the most recently reported, available, and accurate energy data. Most statistics and data contained within this guide are derived from the U.S. Energy Information Administration. Data is compiled and updated annually where available. Where annual updates are not available, the most current, complete data year available at the time of updates is accessed and printed in NEED materials. To further research energy data, visit the EIA website at **www.eia.gov**.

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Holiday Decoration Activities

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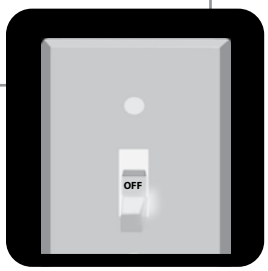


Teacher Guide

Introduction

Almost everyone loves to look at holiday light displays! This set of activities is designed to help your students consider energy consumption when choosing holiday lights. These activities connect well with an energy efficiency and conservation unit. The activities differ by grade band, and each level is asked to work toward and achieve a separate objective as listed below. Preview each of the objectives and activities at the Primary, Elementary, Intermediate, and Secondary levels. Decide if you will have students complete only the activities at their grade level or more. Teacher instructions begin below and continue onto pages 5-7, with student handouts to follow on pages 8-18.

Objectives

- Students will be able to explain the factors they consider when choosing holiday outdoor lighting.
- Students will be able to design a holiday light display within a budget, (Elementary).
- Students will be able to determine the overall holiday decorating season cost of a holiday light display, (Intermediate).
- Students will be able to design a holiday light display that minimizes energy consumption, meets design specifications, and maximizes visual impact, (Secondary).

Primary Students

Time

15-20 minutes, plus coloring time if desired

Materials

- *Which Holiday Decorations Should You Choose?* Worksheet, page 8-9
- White board, projector, or smart board
- Strings of incandescent and LED lights
- Power strips

Preparation

- Make as many copies of the student activity page as necessary.
- Gather coloring supplies, such as crayons, colored pencils, or markers, if desired.
- Place light sets around the room and plug them into power strips with the power strip turned off.

Procedure

1. Introduce the activity, explaining that students will be comparing different kinds of holiday lights. Explain that LEDs (light emitting diodes) use a special type of metal to convert electricity to light. LEDs can produce many colors of bright light. Incandescent lights are bulbs that use a wire that must get hot to glow. These bulbs get hot, use more energy, and last less time.
2. Instruct students to go to the power strips you have placed around the room and turn on the switch. Younger students may need help with this.
3. Ask students to describe the lights they see. Ask them if their lights are getting hot or staying cool. Students observing incandescent lights should notice that the bulbs are getting warm.
4. Have students return to their seats, and talk about the light displays that Jack and Emma must choose between.
5. Walk the students through the comparison and calculation. Ask students which light sets they like better that they observed, and which they think should be used. Ask them to explain their answers.

Extensions

- Use a Kill A Watt® meter to show the difference in power consumption of both kinds of lighting.

Elementary Students

Time

15-25 minutes

Materials

- *Decoration Budget Basics* Worksheet, page 10-11
- *Holiday Decorations* master, page 12
- Calculators, if needed
- Internet access, if desired

Preparation

- Make copies of the worksheet for each student.
- Prepare the master to project for students.

Procedure

1. Introduce the activity by asking students if they have ever had to budget for anything. Ask students to describe what a budget is, and what happens if their expenses exceed their budget.
2. Walk students through the worksheet and clarify the decisions Jack and Emma must make and the budget available.
3. Project the master, explaining the options available to Jack and Emma. Define any unfamiliar terms.
4. Guide students through the activity. Younger students may need help getting started, and/or with the multiplication. Older students can complete the activity independently or as homework.
5. Discuss each student's ideas. Ask them to justify their choices based on the information presented.
6. If desired, allow students time to research other holiday decoration options they might prefer.

Extensions

- Have students visit stores or online stores with their parents, looking at the cost of the different items available as well as the power consumption. Ask them to determine how much it would cost to decorate and provide power to their decoration choices.

Intermediate Students

Time

One or two class periods, depending on option chosen

Materials

- *Decoration Decisions* worksheet, page 13
- *Comparing Holiday Decorations* worksheet, or *Comparing Holiday Decorations (Blank)* worksheet, pages 14-15
- Calculators, if necessary
- Internet access, if desired

Preparation

- Decide if you will have students research decorations or use the examples provided.
- Secure Internet access, if necessary.
- Copy student pages as needed.
- Determine your area's cost of electricity per kilowatt-hour (available from your utility company), or just use the average listed on the worksheet.

Procedure

1. Introduce the *Decoration Decisions* activity, explaining to students that they are going to be calculating the total cost to decorate and provide electricity for outdoor holiday decorations.
2. If you are having students research their own decorations, direct them to approved shopping sites to conduct their research.
3. Introduce the *Comparing Holiday Decorations* worksheet you have chosen. Show them that mathematical operations are indicated along the left margin; if multiplication is needed, a multiplication symbol is displayed, and so on.
4. Explain to students that comparisons are only valid if they are standardized. Because holiday decorations vary so much, the standard that you will be using is 500 light bulbs, or the equivalent. Projectors count as one 500-light decoration, and lighted inflatables count as 250 lights. Remind students that they should round up to the next whole number when standardizing because they cannot purchase fractions of a holiday decoration.
5. Allow students enough time to complete the calculations and answer the questions.
6. Use the conclusion questions as a springboard for classroom discussion.

Extensions

- Use strings of holiday lights and a Kill A Watt® meter to determine how much energy one string of lights uses. Calculate the total cost of the string of lights, and the carbon dioxide produced.
- Have students bring in their favorite outdoor decoration and use a Kill A Watt® meter to determine the cost to run it.

Secondary Students

Time

1-3 class periods

Materials

- *Design Challenge House Model* master
- *Outdoor Decor Design Challenge* worksheet, pages 17-18
- Calculators
- Colored pencils

Preparation

- Copy student pages for each student.
- Provide scrap paper as necessary.
- Gather calculators and colored pencils for student use.
- Prepare the house model master for projection.

Procedure

1. Project the *Design Challenge House Model* master for students. Trace the roof line and porch roof that will be lit, as well as the location of the porch columns, railing, and electrical outlets.
2. Explain the goal of the design challenge: Students are to light the roof line, porch roof, and front porch, maximizing visual impact while minimizing cost and energy consumption.
3. Answer any questions students may have.
4. Allow students enough time to complete their designs and make a colored pencil sketch of what it would look like.
5. If you like, have students choose the design challenge "winner" and provide a simple prize for the best design.

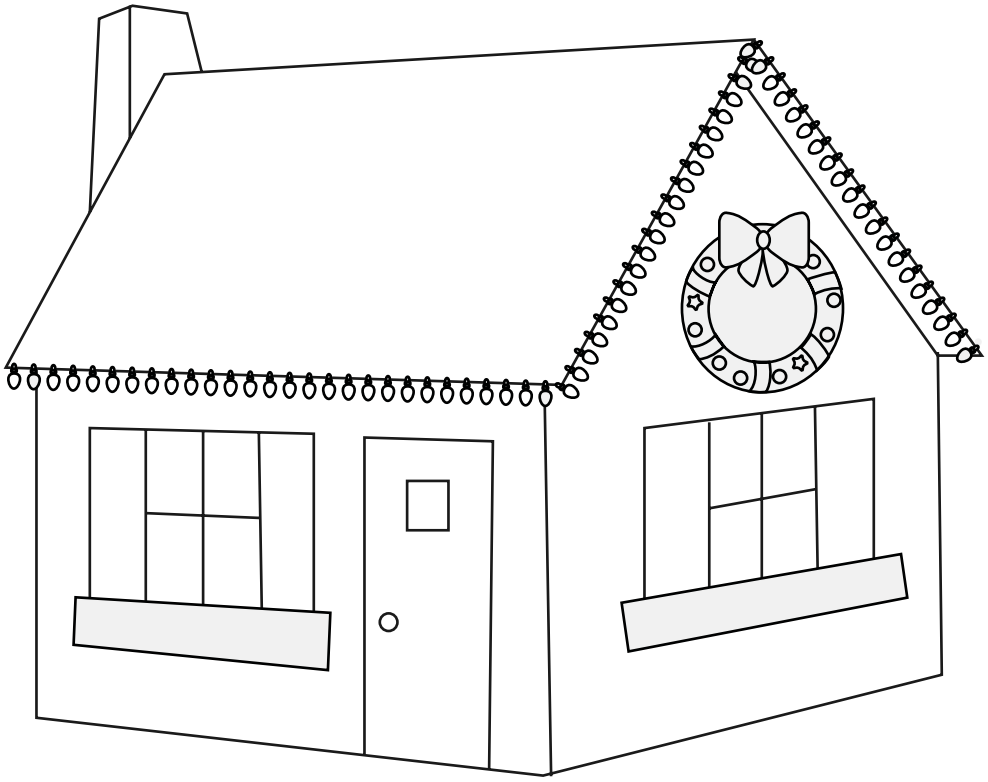
Extensions

- Have students use photographs and measurements of their own homes instead of the model provided

Which Holiday Decoration Should You Choose?

The pictures on page 8 and 9 show two types of lights Emma and Jack can use to decorate their house for the holidays. They need five strings of lights. Which should they choose?

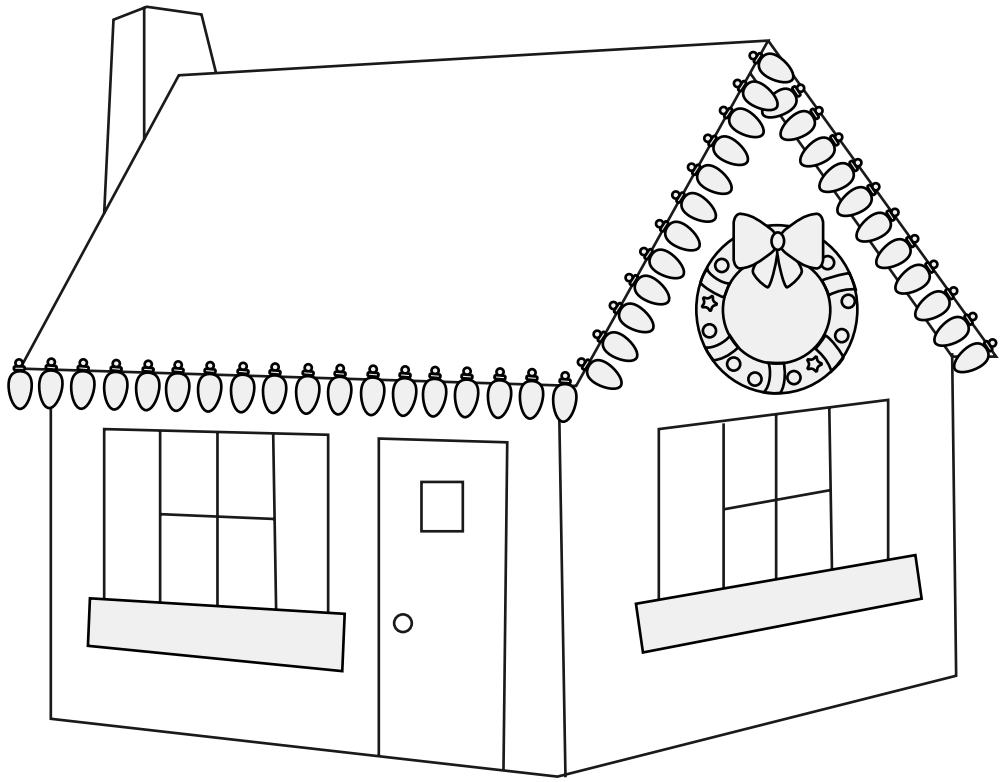
OPTION 1



These lights are incandescent. They use more energy but can melt snow and ice off of them.

Lights cost to purchase:	$35
Energy cost for the season:	$50
Total cost for decorating:	**$**

OPTION 2



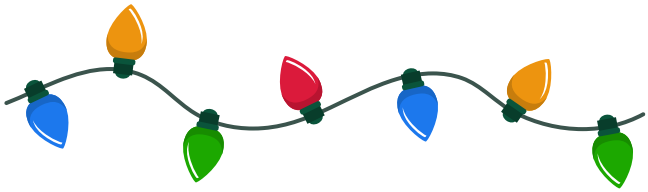
These lights are LED. They use less energy but do not get warm enough to melt the snow and ice off of them.

Lights cost to purchase:	$65
Energy cost for the season:	$10
Total cost for decorating:	**$**

Decoration Budget Basics

Which holiday decorations should you use?

Jack and Emma have $150 to spend to decorate the outside of their house however they want. However, the cost of the electricity to power the decorations must also come from that decorating budget. Read the description of the holiday decorations below. Decide which you would choose. Make sure you have enough money to purchase the decorations and pay for the electricity to power them.

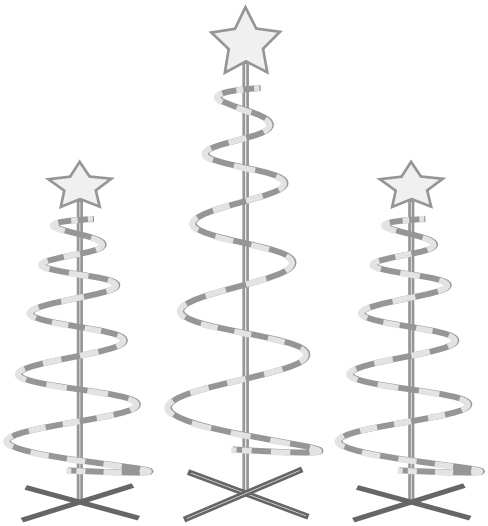


INCANDESCENT STRING LIGHTS

$5 per string
$10 per string for electricity for season

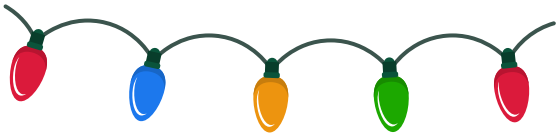
INFLATABLE SNOWMAN

$25 per snowman
$20 per snowman for electricity for season



SPIRAL TREES WITH INCANDESCENT LIGHTS

$20 for set of 2
$15 per set for electricity for season



LED STRING LIGHTS

$9 per string
$2 per string for electricity for season

Decorating Budget Table

Decoration	How many?	Cost for 1	Purchase total	Electricity cost for 1	Electricity total	Total cost
		$	$	$	$	$
		$	$	$	$	$
		$	$	$	$	$
		$	$	$	$	$
		$	$	$	$	$
		$	$	$	$	$
					Total for all decorations	$

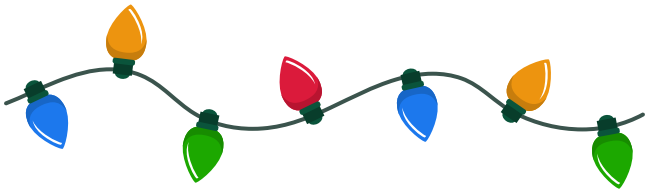
1. Why did you choose those decorations?

2. How much money in total would Jack and Emma need to spend to decorate?

3. Will Jack and Emma have any money left over? If so, how much?

4. Are there any decorations you would choose instead of the four listed? How much do you think they cost? How much energy do you think they use compared to the decorations shown? Ask your teacher if you can use the internet to find out.

Holiday Decorations Master

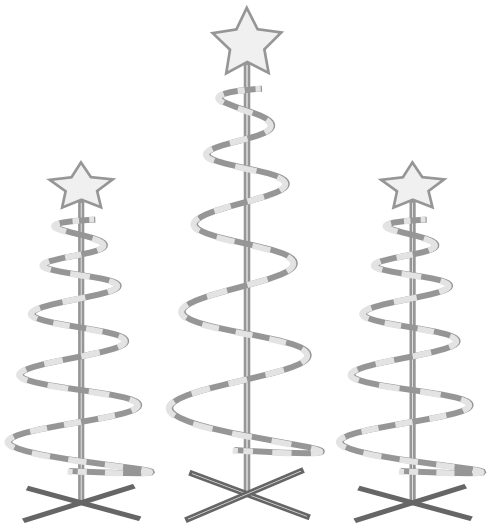


INCANDESCENT STRING LIGHTS

$7 per string
$10 per string for electricity for season

INFLATABLE SNOWMAN

$25 per snowman
$20 per snowman for electricity for season



SPIRAL TREES WITH INCANDESCENT LIGHTS

$20 for set of 2
$15 per set for electricity for season

LED STRING LIGHTS

$10 per string
$2 per string for electricity for season

Decoration Decisions

Background

When shopping for holiday decorations, we usually just look at the appearance of each item available. Unless you are in charge of paying the electricity bill, you probably don't think much about the cost to power your decorations for the entire holiday season. However, the electricity used by holiday decorations can increase a family's electricity bill by as much as 100% during the the holiday season!

Question

What factors should you consider when selecting holiday decorations?

Hypothesis

Make a list of things you should think about when choosing holiday decorations for the outside of your home.

Materials

- *Comparing Holiday Decorations* worksheet
- Calculator
- Internet access or list of holiday decorations

Procedure

1. If you are choosing holiday decorations to compare, research the types of decorations you want to investigate using approved shopping sites to gather information. Make sure you record the type of light, how much power the device consumes if it moves or has a blower (inflatable), and the purchase price of each item in the appropriate locations on the worksheet.
2. Calculate the number of each decoration you would need to have 500 lights total. Projector-style decorations count as 250 lights each, and light-up inflatable decorations count as 500 lights each.
3. Calculate the amount of electricity consumed by each device if it is run overnight for 25 nights. Use the average numbers of darkness for your area to determine how many hours each day it will be turned on.
4. Calculate the total decorating season cost for each decorating type.
5. Calculate the amount of carbon dioxide released into the atmosphere by using each decoration type.

Conclusion

1. Which type of decoration proves to be the most expensive? Which decoration surprised you the most in terms of its total cost? Which type of lighting has the lowest carbon impact?
2. Some people hire others to install their holiday decorations. If it costs $30 per hour to install outdoor decorations, how much do you think each type of decoration would cost, including installation? Does this change which decoration is most expensive?
3. If you had a budget of $200 for everything(to purchase, install, and power), what decoration(s) would you choose for your home? Justify your answer based on your calculations.

Comparing Holiday Decorations

Decoration description, including type of lights (incandescent or LED)	Icicle lights, incandescent, 300 mini lights per set	Icicle lights, LED, 70 mini lights per set	Snowflake LED projector, 500 light equivalent, 6W total power	Light-up multicolor spiral trees, incandescent, 130 lights total
Cost of Decoration				
Number of lights on the decoration	lights	lights	lights	lights
Number of decorations needed for 500 lights	decorations	decorations	decorations	decorations
× Price per decoration	$10.00	$10.00	$11.00	$25.00
Cost of decorating with at least 500 lights	**$**	**$**	**$**	**$**
Cost of Electricity				
Total hours per night	hours	hours	hours	hours
Watts per light (0.41 per incandescent mini light, 0.07 per LED mini light)	Watts	Watts	------ Watts	Watts
× 500 lights	Watts	Watts	6 Watts	Watts
Electrical energy used per night (watts for 500 lights × hours per night)	watt-hours	watt-hours	watt-hours	watt-hours
÷ 1000 = kWh for 500 lights for one night	kWh	kWh	kWh	kWh
× price per kWh ($0.13 average)	$	$	$	$
Total Cost of Electricity per night	$	$	$	$
Number of nights	nights	nights	nights	nights
Total cost of electricity for entire season	**$**	**$**	**$**	**$**
Holiday Season Decorating Cost				
Cost of Decoration	$	$	$	$
+ Cost of Electricity	$	$	$	$
Holiday Decorating Cost	**$**	**$**	**$**	**$**
Environmental Impact				
Total kWh Consumed all season (kWh per night × number nights)	kWh	kWh	kWh	kWh
× pounds CO_2 per kWh (0.92 average)	lbs/kWh	lbs/kWh	lbs/kWh	lbs/kWh
Pounds of carbon dioxide released	**pounds**	**pounds**	**pounds**	**pounds**

Comparing Holiday Decorations *Blank*

Decoration description, including type of lights (incandescent or LED)	**Icicle lights, incandescent, 300 mini lights per set**	**Icicle lights, LED, 70 mini lights per set**	**Snowflake LED projector, 500 light equivalent, 6W total power**	**Light-up multicolor spiral trees, incandescent, 130 lights total**
Cost of Decoration				
Number of lights on the decoration	lights	lights	lights	lights
Number of decorations needed for 500 lights	decorations	decorations	decorations	decorations
× Price per decoration	$	$	$	$
Cost of decorating with at least 500 lights	**$**	**$**	**$**	**$**
Cost of Electricity				
Total hours per night	hours	hours	hours	hours
Watts per light (0.41 per incandescent mini light, 0.07 per LED mini light)	Watts	Watts	------ Watts	Watts
× 500 lights	Watts	Watts	6 Watts	Watts
Electrical energy used per night (watts for 500 lights × hours per night)	watt-hours	watt-hours	watt-hours	watt-hours
÷ 1000 = kWh for 500 lights for one night	kWh	kWh	kWh	kWh
× price per kWh ($0.13 average)	$	$	$	$
Total Cost of Electricity per night	$	$	$	$
Number of nights	nights	nights	nights	nights
Total cost of electricity for entire season	**$**	**$**	**$**	**$**
Holiday Season Decorating Cost				
Cost of Decoration	$	$	$	$
+ Cost of Electricity	$	$	$	$
Holiday Decorating Cost	**$**	**$**	**$**	**$**
Environmental Impact				
Total kWh Consumed all season (kWh per night × number nights)	kWh	kWh	kWh	kWh
× pounds CO_2 per kWh (0.92 average)	lbs/kWh	lbs/kWh	lbs/kWh	lbs/kWh
Pounds of carbon dioxide released	**pounds**	**pounds**	**pounds**	**pounds**

Design Challenge House Model

Outdoor Decor Design Challenge

This challenge requires that you consider energy consumption, length, and energy cost to decorate a typical 2-story house with holiday lights. Choose lighting that illuminates the front roof line and lights the porch, while minimizing cost and power consumption. Also consider the "wow factor" of your design. After all, the goal of this challenge is to be the talk of the neighborhood!

Decorating the roof line and porch roof of the house shown below requires 150 feet of lights. The porch columns and railing require a total of 150 lights in addition to the roof line and porch roof lighting. There is one outdoor electrical outlet available, and it is on the front porch. The circuit for the outlet has a 15-amp circuit breaker, which has a maximum power capacity of 1,800 watts before the circuit breaker is tripped. The safe maximum capacity of the circuit is 1,440 watts. Inside the attic window there is another electric outlet that can be used, but the cord will need to run through the window, preventing it from closing properly. The maximum load of that outlet's circuit is also 1,800 watts, but it is currently powering a computer and two lamps for a total of 1,000 watts.

Incandescent mini-lights use 0.41 watts of power per light; LED mini-lights use 0.07 watts of power for each light. The maximum number of incandescent strings that can be safely connected end-to-end is three strings. LED lights have no limit due to their exceptionally low power consumption, but they cost more to purchase.

Lighting Options:

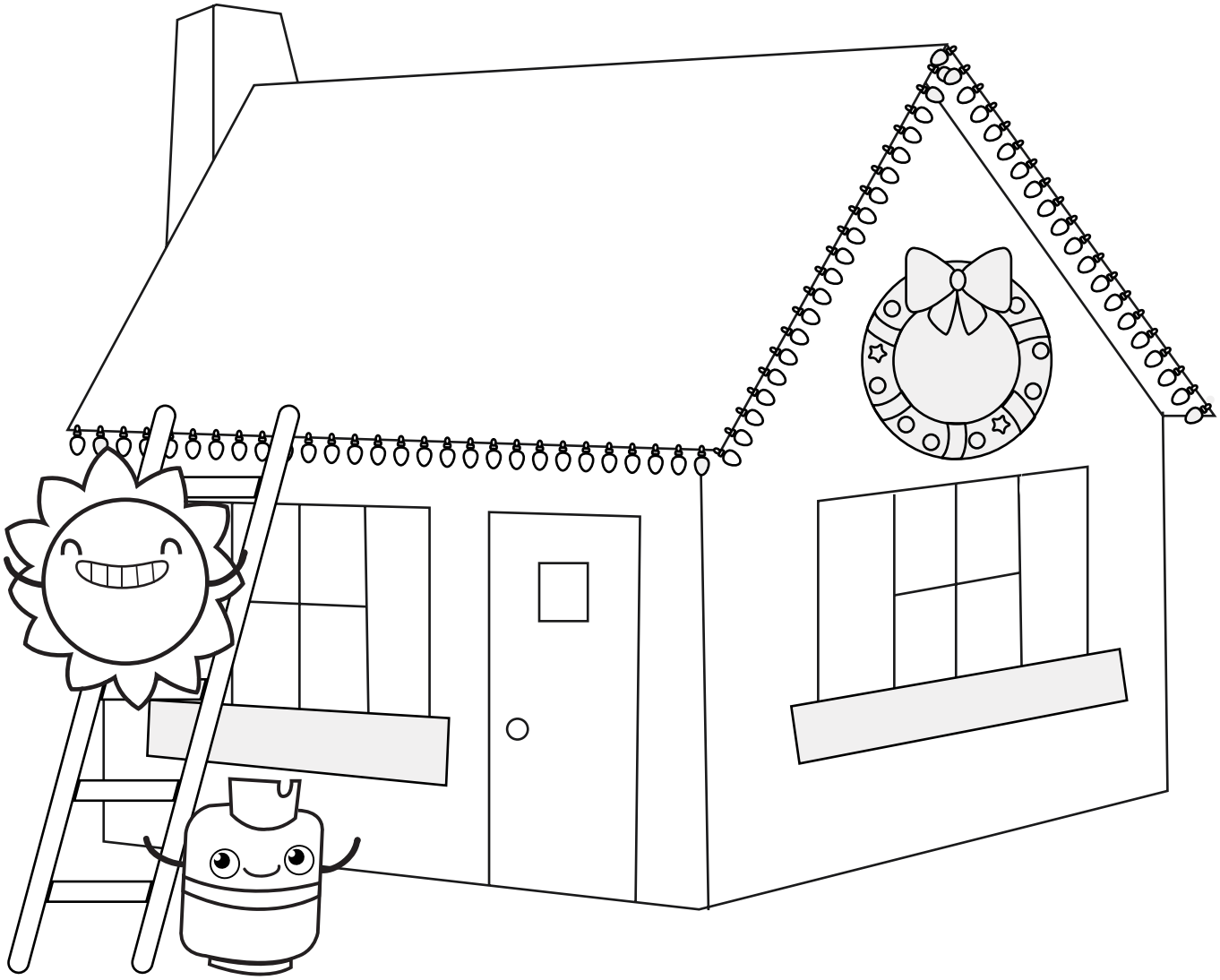
The "wow factor" listed below is a 5-point scale, where 1 is low and 5 is high. Because of the nature of projector-style lighting, only one can be plugged into an outlet (no stringing or interconnecting); the power for a projector-style light is listed in the description.

Light type	Length	Number of lights	Cost	"Wow" Factor
Incandescent string (color)	62 feet	300	$8	3
Incandescent string (clear)	20	100	$11	2
LED string (color)	62 feet	300	$17	3
LED string (clear)	61 feet	300	$15	2
Incandescent Icicle Lights	10 feet	300	$10	4
LED Twinkling Icicle Lights	9 feet	70	$10	5
Snowflake Projector, LED, 4W total power	---	---	$16	5
LED Superbright warm white G30 (round bulb) lights	58 feet	240	$17	4
LED Color changing multicolor to warm white C7 (classic shape) lights	22 feet	50	$13	5

Design Your Look

Decoration Type	How many?	Total length	Total power consumption	"Wow" Factor

Use colored pencils to show what your design would look like after it is installed.



SAVE ENERGY WITH LIGHTING

Use light emitting diodes (LEDs) instead of incandescent lights for holiday decorations. LEDs look just as festive, while saving energy AND money!

Incandescent lighting produces 90% heat and only 10% light from the electricity they use. LEDs are more efficient and convert most of their electricity into light.

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