

## TEAMS Monthly High School Math Challenge, January 2017

Directions: Copy and distribute to your students. Coaches may e-mail their student's answers to [teams@tsaweb.org](mailto:teams@tsaweb.org) --subject line: HS Math Challenge. Make sure to include the student's name, your name, your school, city and state. Correct entries for that month will be placed in a drawing and one name will be randomly drawn on the 2<sup>nd</sup> Friday of the month following the challenge. The student whose name is drawn will be sent a \$25 Visa gift card via their TEAMS coach.

### Rules:

- 1) E-mailed answers must be received by 11:59PM on the last day of the month.
  - 2) All questions must be answered correctly.
  - 3) Answers submitted must be for the current month's posted problem.
  - 4) One entry per student per month allowed.
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### Home Lighting

Energy saving light bulbs are a great way to help the environment and a simple way to help change the electrical consumption of your household. However, since different bulb technologies have different energy demand, cost and lifespan, the choice for best bulb type may not be obvious. When we calculate the overall cost, we should consider the cost of the bulb given its lifespan as well as the cost to power the bulb.

#### Given information:

Energy usage in a household is based on kilowatt hours: using 1000 Watts of power for one hour requires 1 kWh.

One kilowatt hour of electricity in New York City costs 16¢.

Incandescent bulbs were popular for decades, but have largely been replaced in most households. The cost of a typical incandescent light bulb is 45 cents and the typical life expectancy is 1,000 hours. Many light fixtures use 60 watt bulbs, giving approximately 800 lumens of light.

1. How many hours would we need to light a 60W light bulb to consume 1 kWh?
2. Find the total cost to light a room with a single 60W incandescent bulb for one year, assuming the light burns 24 hours/day.



light

Compact Fluorescent (CFL) bulbs quickly gained popularity in replacing incandescent bulbs. The 13W CFL bulb gives the same amount of light as the 60W incandescent bulb, but costs a bit more at \$1.67 each and a typical life of 8,000 hours.

3. How many hours would we need to light a 13W CFL light bulb to consume 1 kWh?
4. Find the total cost to light a room with a single 13W CFL light bulb for one year, assuming the light burns 24 hours/day.

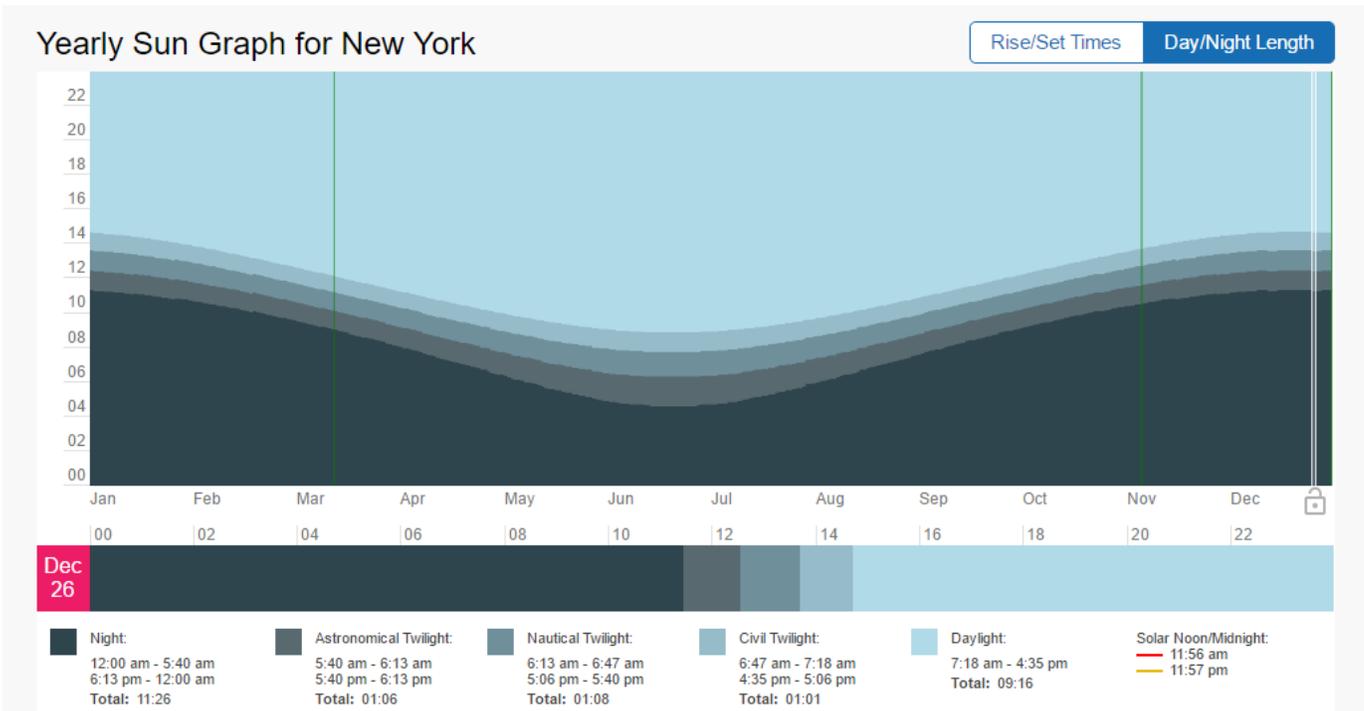


Light-emitting diode (LED) bulbs have emerged in recent years and show signs of replacing both other types of light bulbs. The 9W LED bulb gives the same amount of light and has a much longer lifespan of 50,000 hours. It costs more at \$2.49/bulb.

5. How many hours would we need to light a 9W LED light bulb to consume 1 kWh?
6. Find the total cost to light a room with a single 9W LED light bulb for one year, assuming the light burns 24 hours/day.
7. How many hours of light would be required to make the cost of an LED bulb equal to the cost of an incandescent bulb?



This graph shows the average hours of darkness for New York City per day for the entire year.



- Find the cost savings for using a single 9W LED bulb vs. a 60W incandescent bulb assuming the bulb is burned for all night hours.
- Find the extra cost for the year to burn a 13W CFL bulb if we turn it on each day at Civil Twilight vs. Night.