



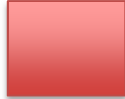
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Lamp Data Sheet

Type of Lamp:

Wattage of Light:



Hours turned per year:



Number of Lights:



Light during daytime

SQM Reading [mag/sq arcsec]:

Near Lamp: _____

Far from Lamp: _____

Lux Meter Reading [lux]:

Near Lamp: _____

Far from Lamp: _____

Check if Applicable:

Light Sensor Shielded

Motion Sensor Timer

Additional Notes:

Light during nighttime

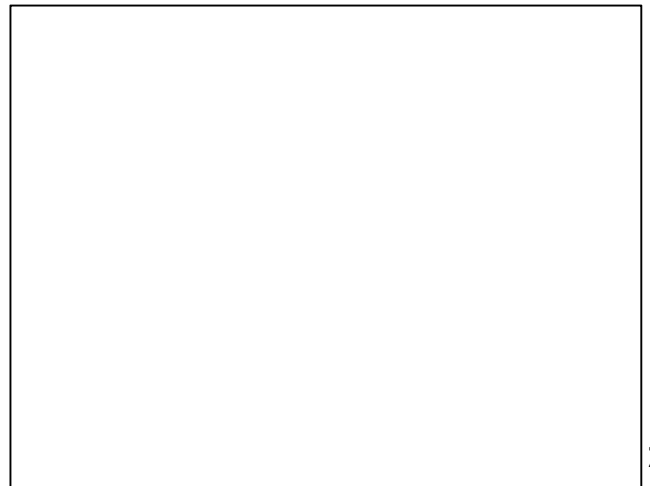
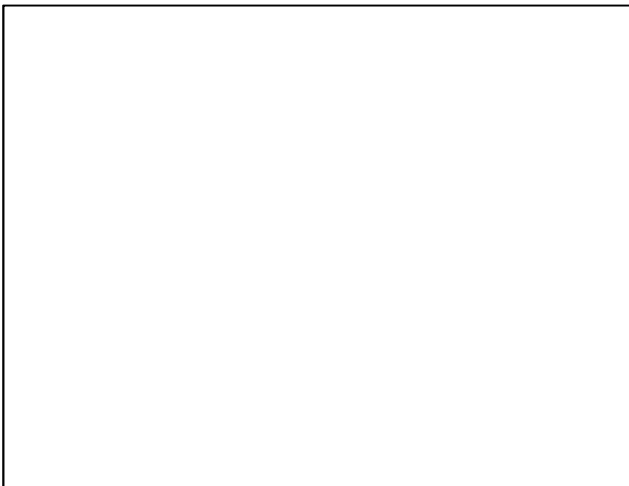
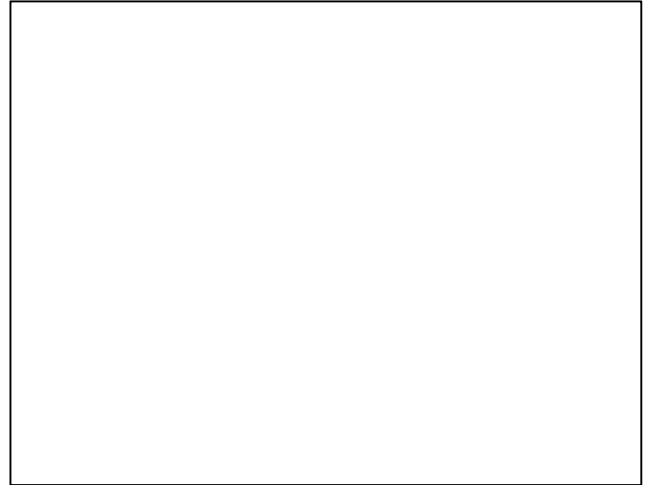
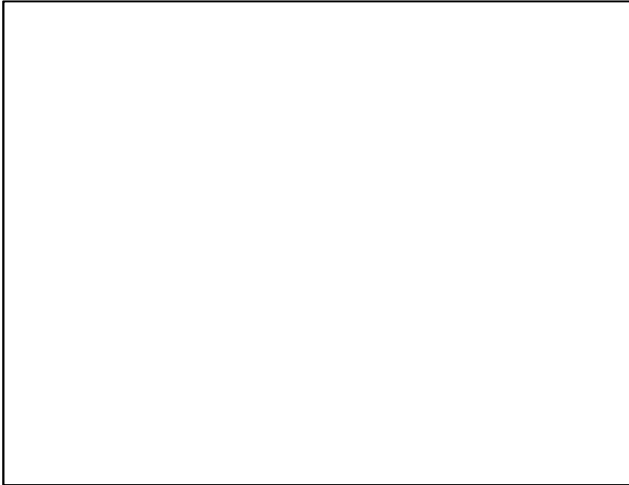
Light with spectra



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**Lamp Data Sheet
Additional Pictures of Lamp**





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Use the table below to record the readings from the Lux Meter and the Sky Quality Meter (SQM) as you investigate each of the lamps around the building. Start beneath the lamp and move away while recording the distances and the readings from each device. Once you reach a certain distance, the lux reading and magnitude reading will stop changing. When you've hit this point, the light is no longer affecting the readings, and you can stop.

	Distance from Lamp (m)	Lux Meter Reading (lux)	SQM Reading (mag/sq arcsec)
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
19.			
20.			



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Student Worksheet

Here is what you needed to get started. This sheet will act as a reference throughout the rest of the calculations. Fill in each of these with the information from the lamp data sheet. Since you may have many different types of lamps with varying wattages, you'll need to fill out the blue and red squares for each of those. The gray square is used for the cost of electricity per kilowatt hour of all the electricity. Although there can be varying costs per kWh depending on the amount being used or the time of year, here we will use just one value so an average value should be assigned.

Lamp Type #1

Number of lamps around the building:

Wattage of the lamps:

Estimated hours turned on during a year's time:

Lamp Type #2

Number of lamps around the building:

Wattage of the lamps:

Estimated hours turned on during a year's time:

Lamp Type #3

Number of lamps around the building:

Wattage of the lamps:

Estimated hours turned on during a year's time:

Lamp Type #4

Number of lamps around the building:

Wattage of the lamps:

Estimated hours turned on during a year's time:

For all lamps:

Cost of electricity per kilowatt-hour¹:

¹ For more information on this, see the last paragraph on page 7

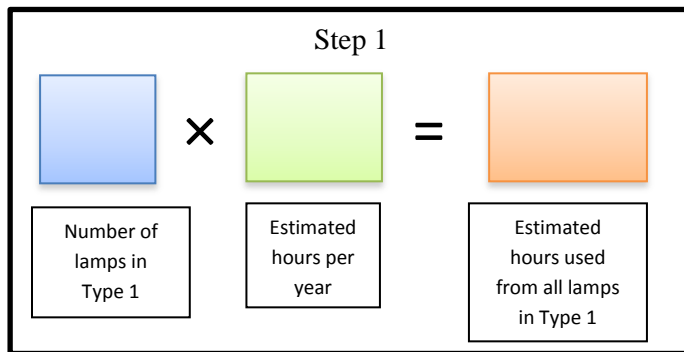


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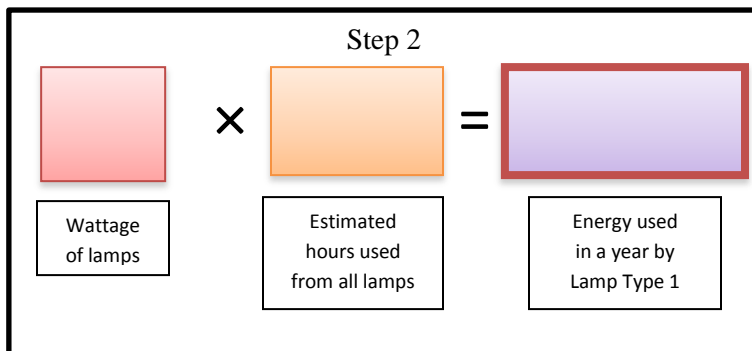


Use the numbers in the colors above to complete the next section of this worksheet. Repeat these steps for each type of lamp.

For this first set of calculations we will use **Lamp Type #1**. First we will calculate how many hours each lamp is on for in one year. This can be done by multiplying the number of lamps and the estimated number of hours per year.



In this next step, we will find the energy used in year. Electric utility companies measure energy in a unit called watts. For example, if you have a 100-watt bulb and the light is on for 10 hours it uses $100W * 10\text{hours}$ or $1,000W * h$.. To calculate the hours of energy used, the wattage (in watts) of the lamps is multiplied by the estimated number the lamps are turned on.



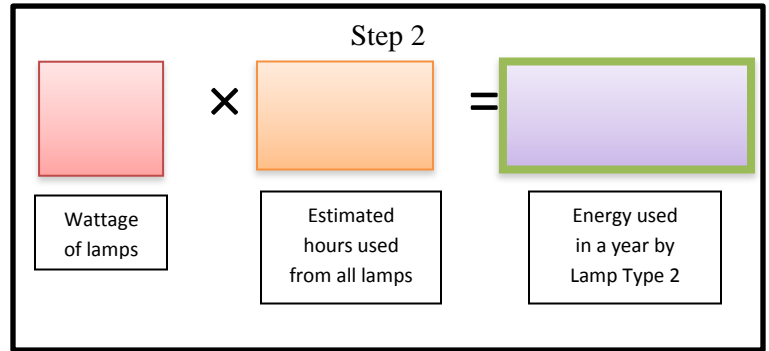
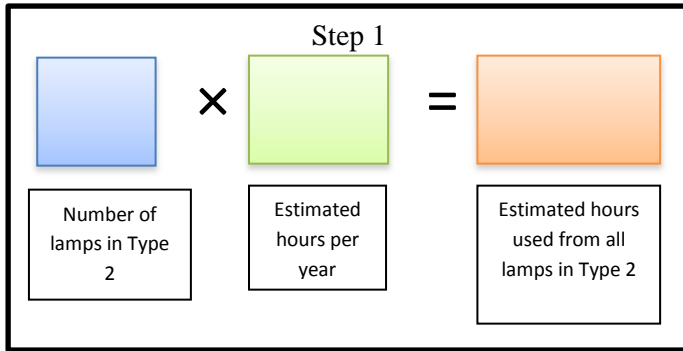


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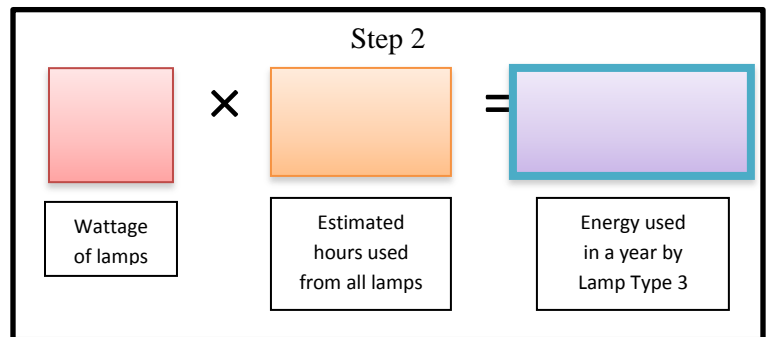
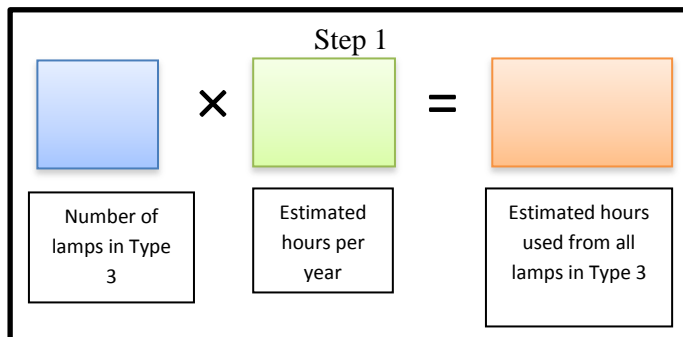


Repeat the above steps for Lamp Types 2, 3 and 4.

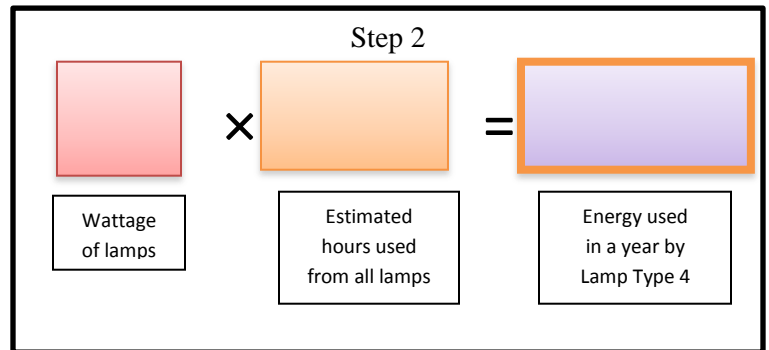
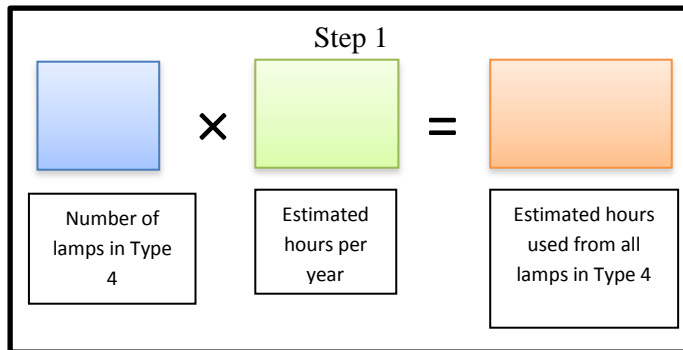
Lamp Type #2



Lamp Type #3



Lamp Type #4

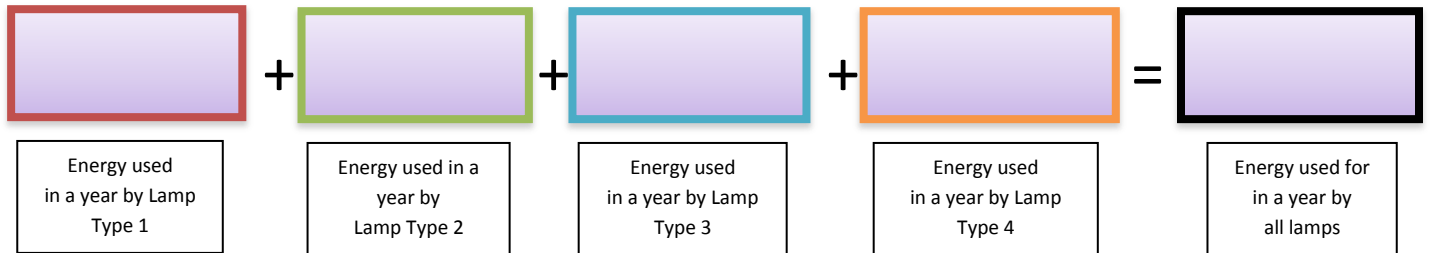




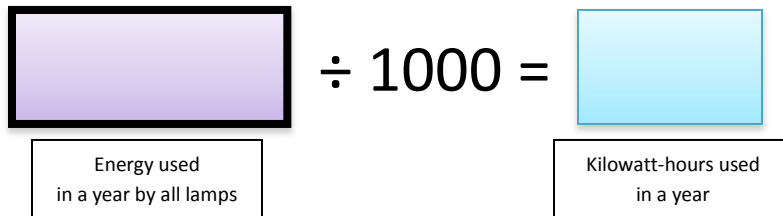
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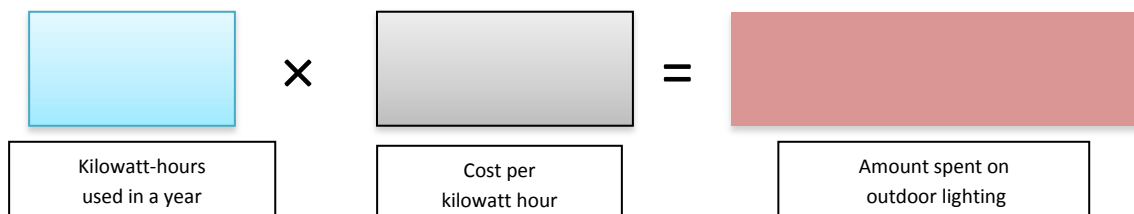
Knowing how much energy each type of lamp uses is great. But it is easier to understand the energy being consumed if it is in one large number. So next we will add together the energy used for all of the lamps.



Because of how quickly watt-hours add up, the term kilowatt hour is used to represent 1000 watt hours. You can convert the number of watt hours to kilowatt hours by dividing the number of watt hours (or energy) by 1000. We use kilowatt hours when handling a large number of watt hours so that it is a more manageable number.



An important part component of light pollution is the enormous cost of that is required to keep the lights turned on. The amount of money spent on lighting can be a huge issue for anybody. Electric utility companies charge for electricity by the kilowatt-hour (kWh). Next we will calculate how much it costs to use the amount of kilowatt-hours around your building. You can ask a district administrator for a school, your parents for your home or a business administrator for a local business about the cost per kilowatt-hour from their electricity company.





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Electricity is most commonly produced from coal, hydropower, or nuclear power. When chemicals are burned, greenhouse gases are emitted that contribute to air pollution and global warming. The final important aspect of light pollution is the amount of greenhouse gases that are emitted during the production of electricity. Greenhouse gases are measured by the mass of the carbon dioxide gas. Depending on what is used to produce the electricity the greenhouse gases the emissions are typically 0.64kg to 1.09kg for every kilowatt-hour. Because it's hard to know exactly, we're going to average this as 0.91kg per kilowatt-hour. To calculate how much greenhouse gas is produced, you need to multiply the kilowatt-hours used in a year by 0.91kg

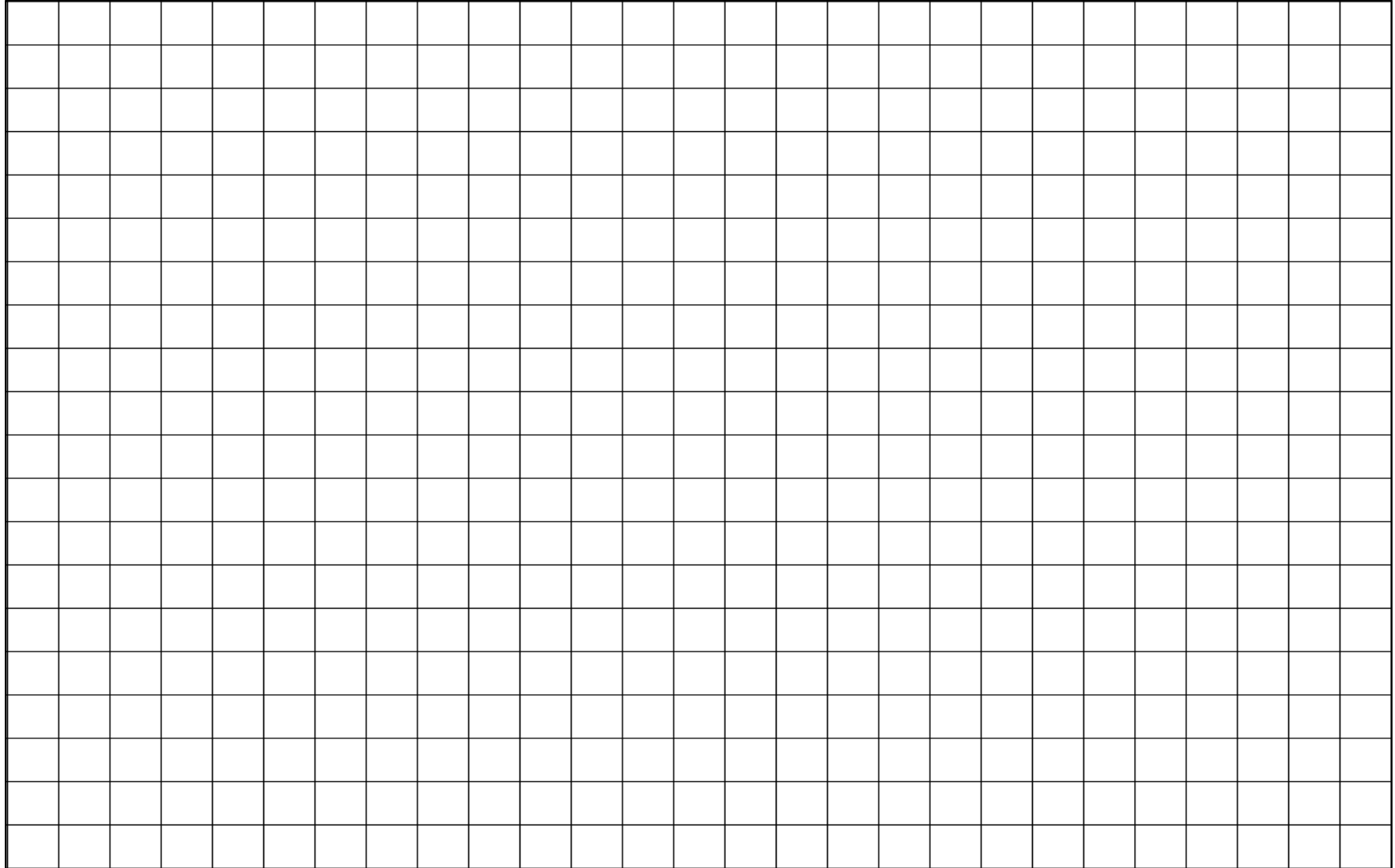
<div data-bbox="191 688 443 808" style="background-color: #add8e6; width: 155px; height: 57px; border: 1px solid black;"></div>	$\times 0.91 \frac{\text{kg}}{\text{kWh}} =$	<div data-bbox="797 688 1239 808" style="background-color: #90ee90; width: 272px; height: 57px; border: 1px solid black;"></div>
Kilowatt-hours used in a year		Amount of greenhouse gas produced while powering outdoor lighting each year



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Lux Meter Reading [lux]



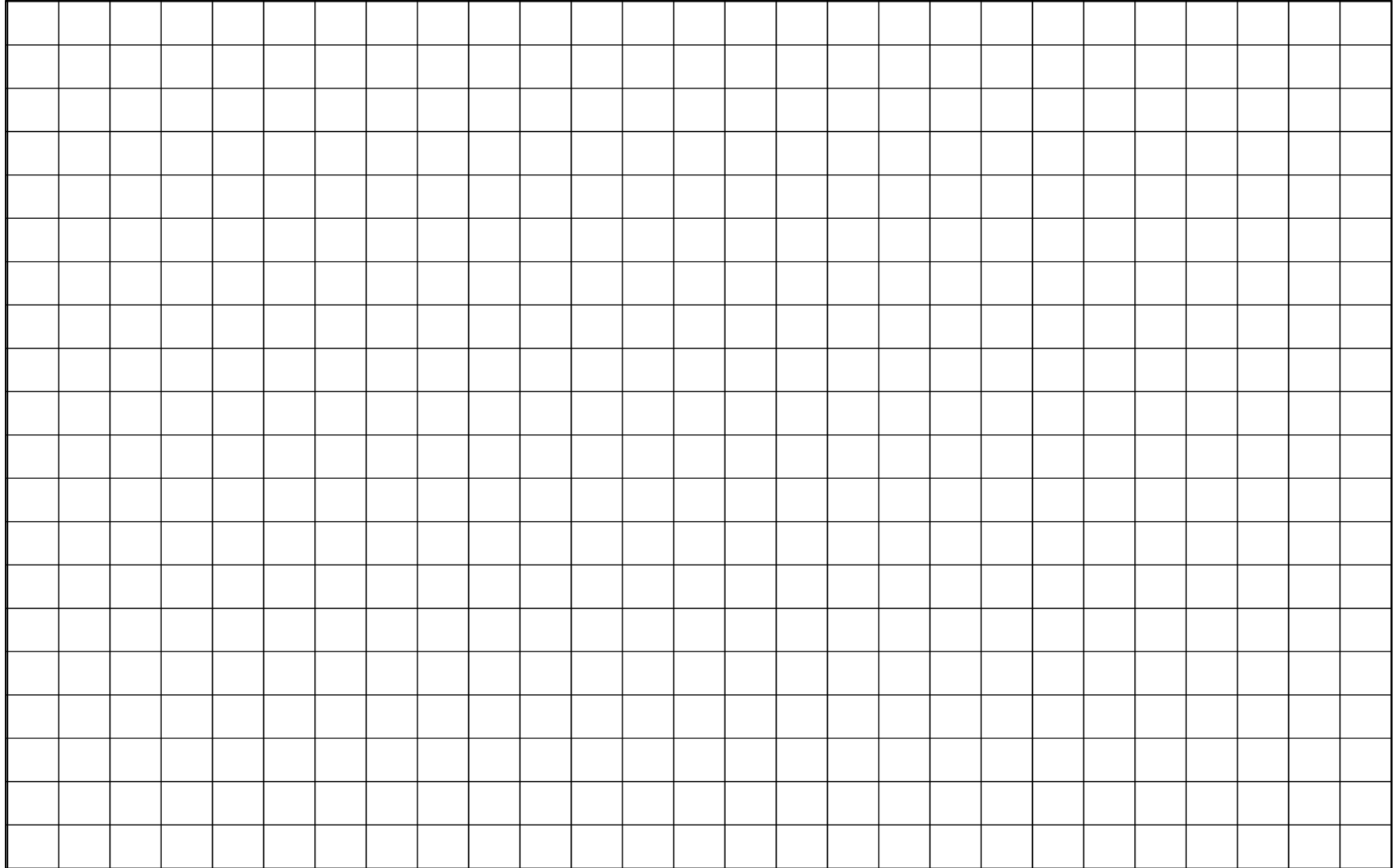
Distance [Meters]



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SQM Reading [mag/sq arcsec]



Distance [Meters]

