

1. Conduct a class discussion to learn more about the interviews that students did with their parents about sleep.

During Lesson 1, students interviewed an adult about sleep with the following three questions:

- Do you get enough sleep?
- What are some things that help you get a good night's sleep?
- What are some things that keep you from getting a good night's sleep?

The results of these questions are in the teacher portal of MySleep to help guide the discussion. Teachers may wish to just address the enough sleep question and the students' additional interview questions and address responses to the helps and keeps as part of Lesson 4 (sleep quality), or they may display here but revisit as part of the later lesson.

Students were also asked to think of additional questions about sleep to ask the person they interviewed. The questions and the answers are available in MySleep to continue the discussion. Focus on whether the adults are perceiving that they get enough sleep and their explanations as well as other questions that the students asked.

2. Remind students that the last lesson addressed different ways to collect data. Ask them for examples of methods to collect data. They should easily name the diaries, interviews and watch.

3. Explain that each method creates a different kind of output to be analyzed. These data can let us see the big picture and compare several days to each other to find changes in our sleep patterns.

4. After the discussion about whether their interviewee felt they got enough sleep ask the students for suggestions about the other methods of collecting data that were discussed previously. (Sleep diary, Activity Diary, Sleep Watch).

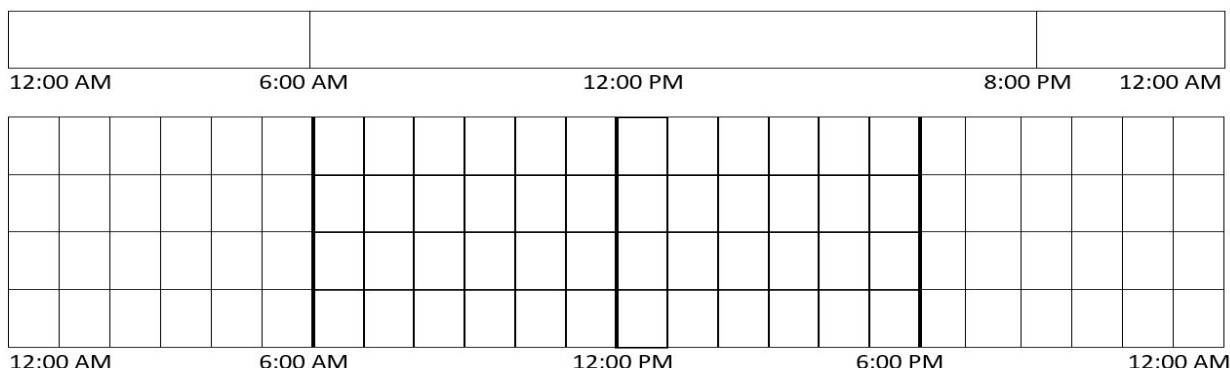
4. Each data collection method creates a unique way to review the data. In the case of the Sleep Watch, students will see an Actogram. Explain to students that they will be able to look at their own Sleep watch data, as well as their diary data, to learn about their own sleep patterns a little later in the lesson.

5. Explain to students that the Sleep watch gives a lot of data about a person's activity and surroundings. To help make it easier to learn how to analyze the data, they will first look at one type of data at a time.

If necessary, remind students that the Sleep watches collect data about a person's activity and the amount of light around them. The Sleep watch then uses a software program to predict when that person was sleeping and when the person was awake.

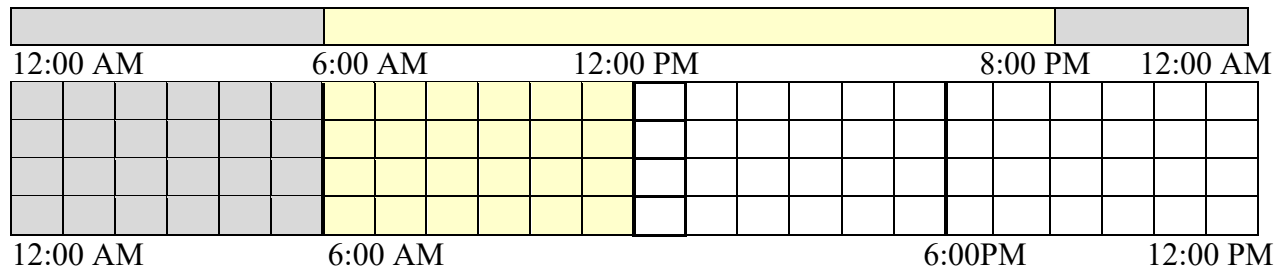
6. Give each student a set of colored pencils and a copy of Master 3, *The Key to Understanding an Actogram*. Display Master 4, *Understanding an Actogram: Example Case*, showing the basic template (the output of the Sleep watch for the sample case). Point to the grid (with the times below) and ask, "What do you see on the grid?"

One of the things that student should notice is a grid with times. If students do not notice, ask them the time period represented by each box across the horizontal axis. They should notice that each box represents 1 hour.



7. Now, point to the shaded bar on the Actogram, and ask, “What do you think these colors represent?” After students recognize daytime and nighttime (or light and dark parts of a day), ask them to color these in on their copy of Master 3, similar to what is shown below.

Students should shade in yellow for the daytime hours and gray for the evening and nighttime hours. These may not be exact but should serve as reminders for the time. It may also help remind students that 12:00 AM is midnight and that 12:00 PM is noon.

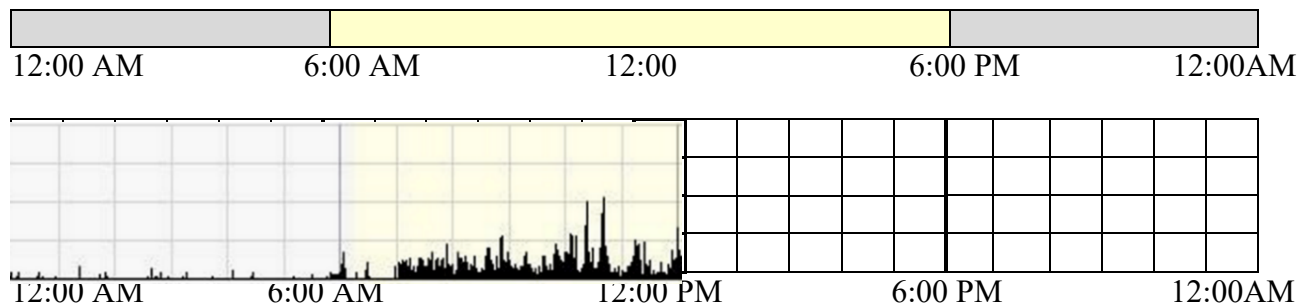


As you go through procedural steps 6–12, students will complete a key that they can use for interpreting the colors shown on an Actogram. Students can then refer to the key later in the lesson when they are analyzing different Actograms (including their own). A completed key is included following Step 12. Procedural steps 4–12 should be brief. It is not necessary for students to draw in lots of information on the actogram, but they should show an example that they can refer to later.

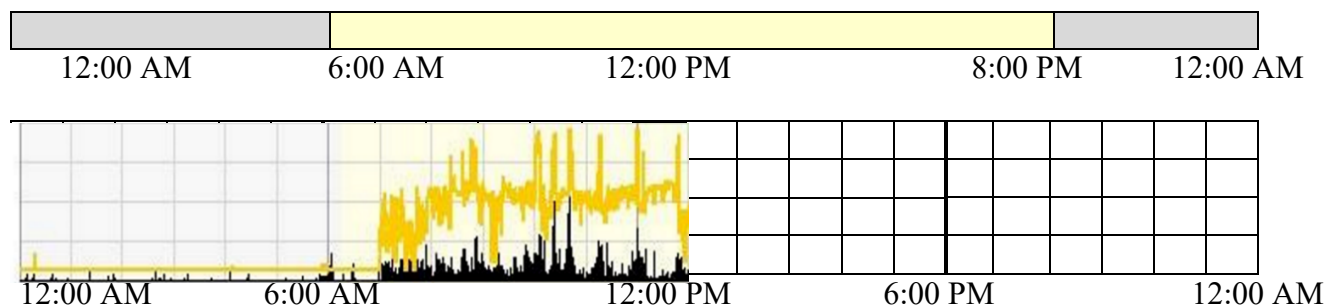
8. Now display Master 4b. Ask students, “What do you think about what these black lines represent?” Have them discuss some ideas at their table groups and then share their thoughts as a class. Once they identify that black lines mean activity, ask, “If these lines represent activity, what patterns of activity do you notice about this individual?” If students struggle with this question, ask, “If these lines represent activity, can you point out a few times (on the Actogram on Master 4b) when the person was active and times when

the person was not active?” Have students fill in their key to define what black lines mean and fill in the activity levels of the segment they are referencing.

On Master 4b, students should point out one or two places where the vertical black lines are present and times when there are few or no black lines. The magnitude and duration of the signal depends on the amount of motion. Activities that are more vigorous give higher spikes on the actogram. Activities that last longer result in an increased number of spikes within a short time period.



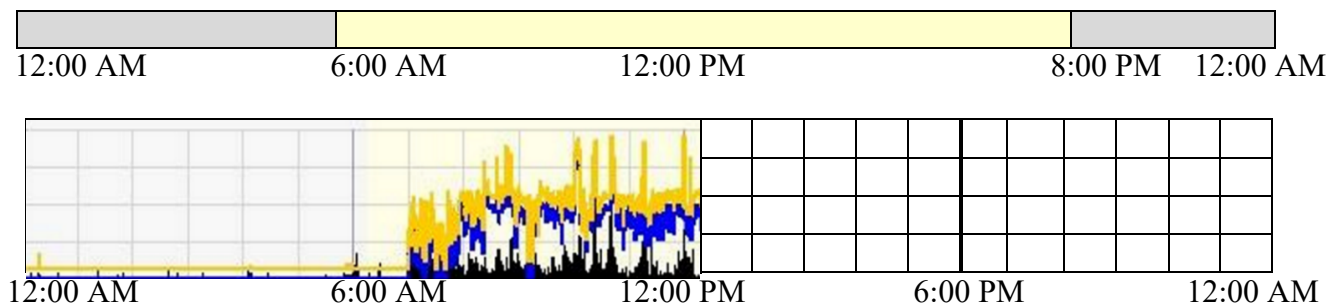
9. Display Master 4c which shows the levels of white light (i.e., all light regardless of color spectrum) recorded by the watch. Ask students, “What do you think these yellow lines represent?” Give students a chance to discuss with their table group. Once they identify that the yellow lines mean light, ask, “If these lines represent spectrums of light, what patterns of light exposure do you notice about this individual?” As before, have students use a darker yellow/gold colored pencil to fill in their key.



Students should see that the amount of light seems to vary quite a bit during the daytime hours and that it then drops away during the nighttime hours

10. Project Master 4d. Point out the blue lines on the Actogram. Ask students, “What do you think these blue lines represent?” Have students briefly discuss with their table group. Ask guiding questions until students are able to identify that it represents some type of light. Explain that blue light is part of the light spectrum. Blue light is short wavelength light. The main ways that people are exposed to higher levels of blue light are through electronics, such as the screens of cell phones, tablets, computers, or TVs. Once they recognize that blue light is technology, ask, “If these lines represent blue light, what patterns of technology usage do you notice about this individual?”

If students have seen a prism, they have seen how white light can be separated into the different colors of light. A rainbow is another example of how we can see the different colors of light. Blue light is part of the light spectrum. Blue light is short wavelength light.



11. Project Master 4e which adds new information about sleep to the actogram. Point out the light blue-shade and ask students, “What do you think (or remember) the light blue and light green shading mean?” To help the students connect the shaded areas with rest and sleep, ask, “Within these shaded regions, what patterns do you notice related to the black lines, yellow lines, and blue shaded areas?”

Students should notice that the yellow lines drop off indicating it is dark and there are few if any black lines, and blue light drops off indicating that there is few if any light being emitted from electronics. You will likely need to point out to students that sleep often starts at the end of 1 day on the Actogram template and continues in the morning on the next day of the actogram template. Assuming you go to bed before midnight, the sleep period spans across two days because the timeline covers a midnight-to-midnight 24-hour period.

If the light green shade appears, it represents a rest period, meaning they are likely in bed, but they have not fallen asleep yet. Depending on your computer monitor or printer, the color for rest may be only a subtle difference between the green (rest) color and the light blue color representing sleep.

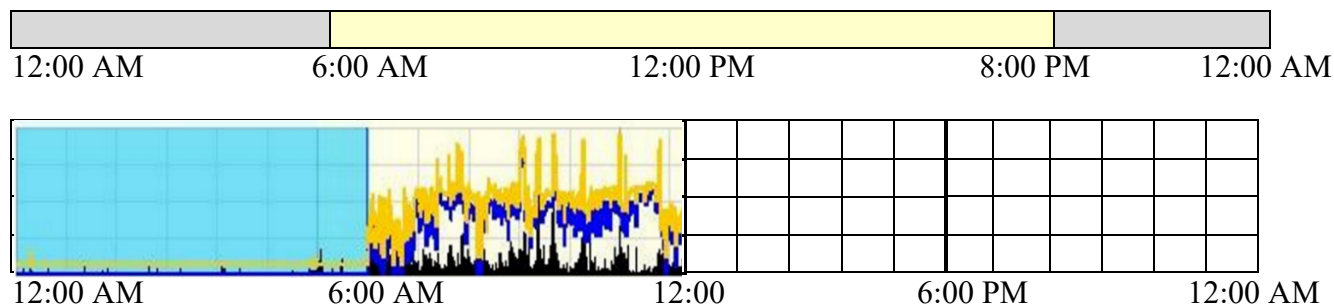
12. Explain to students that the Sleep watch cannot tell for sure if a person is actually sleeping. The Sleep watch software makes predictions about whether a person is asleep or not based on the person’s activity. Sleep Watch recording is based on the assumption that there is less movement during sleep compared with when the person is awake.

Reinforce this idea by pointing out on the Actogram that the sleep period is shaded at times when there is much less activity. Students may see some black activity lines on the actogram during a sleep period, but much less than during the day. Black lines during a sleep period may reflect a person waking up for a brief period.

13. Continue projecting Master 4e which adds two more pieces of information to the Actogram. Review the meaning of these additional pieces of information with students. Ask students to add this information to their key.

Light green/teal = rest (periods of less movement)

Dark blue shading = time during which Sleep watch data is not available (such as watch not being worn)



Depending on your computer monitor or printer, the color for rest may be only a subtle difference between the green (rest) color and the light blue color representing sleep. Students may not have a colored pencil that exactly matches the color on the Actogram, but they can use a color that is the closest match.

At the end of this step, students should have completed their keys. They should keep these so they can refer to them for the rest of this activity and for the next activity.

14. Inform students that they learned about the different data on the actogram by focusing on one 24-hour period (one day and night) at a time. When scientists study sleep, they usually look at data recorded over several days to get a better picture of how well a person sleeps. Reveal the full set of data on Master 6e and tell students that this is the set of data for 6 days (5 nights).

The darker gray and dark blue shown on Day 1 (Monday) and Day 6 (Saturday) are times when the Sleep watch was not recording (not being worn). (Students do not need to know this, but the information is included should questions arise.)

15. Give each student one copy of Master 7, *Estrella's Actogram* OR have students enter MySleep -> Lesson 2 -> Activity 1 Estrellas Actogram. Point out that MySleep shows Estrella's sleep patterns over a week. Tell students that they should work individually to follow the directions and mark Estrella's Actogram as indicated in the questions at the top of the page. When a question is answered, click "Next".

It may help to walk students through the first two, which are not specific to the sleep patterns.

16. Walk students through finding the time that Estrella put the watch on AND the time she took it off. They should recognize the gray areas as dead zones for the watch prior and after use.

1. Times Estrella put the watch on and when she took it off at the end of the data collection period.
2. One of the times that Estrella may have taken her watch off her wrist and no data were collected.

3. The sleep period that began at 11pm.
4. The START of Tuesday night's Sleep.
5. The time Estrella woke up on Wednesday.
6. Latest Bedtime
7. The sleep period with the shortest Total Sleep Time
8. The sleep period with the longest Total Sleep Time
9. The sleep period with the longest time it took to fall asleep
10. On Friday night sleep period (Saturday), mark the halfway point (5 hours) into the night's sleep.

17. Encourage students to locate the rest of the numbered items, they can come up front and point to it on the smartboard or projection. As needed, point out the way time wraps into the row below if Estrella did not go to bed before midnight. Point out the tiny sun and moon at the top of the actogram to help students distinguish day and night on the timeline.

18. Hold a class discussion so teams can explain how they answered their questions about Estrella's sleep. Rather than just showing an answer key, if time permits, have students come up front and point to it on the smartboard or projection. Support discussion that allows them to explain their logic.

As teams share their answers, make sure that they can identify evidence to support their ideas.

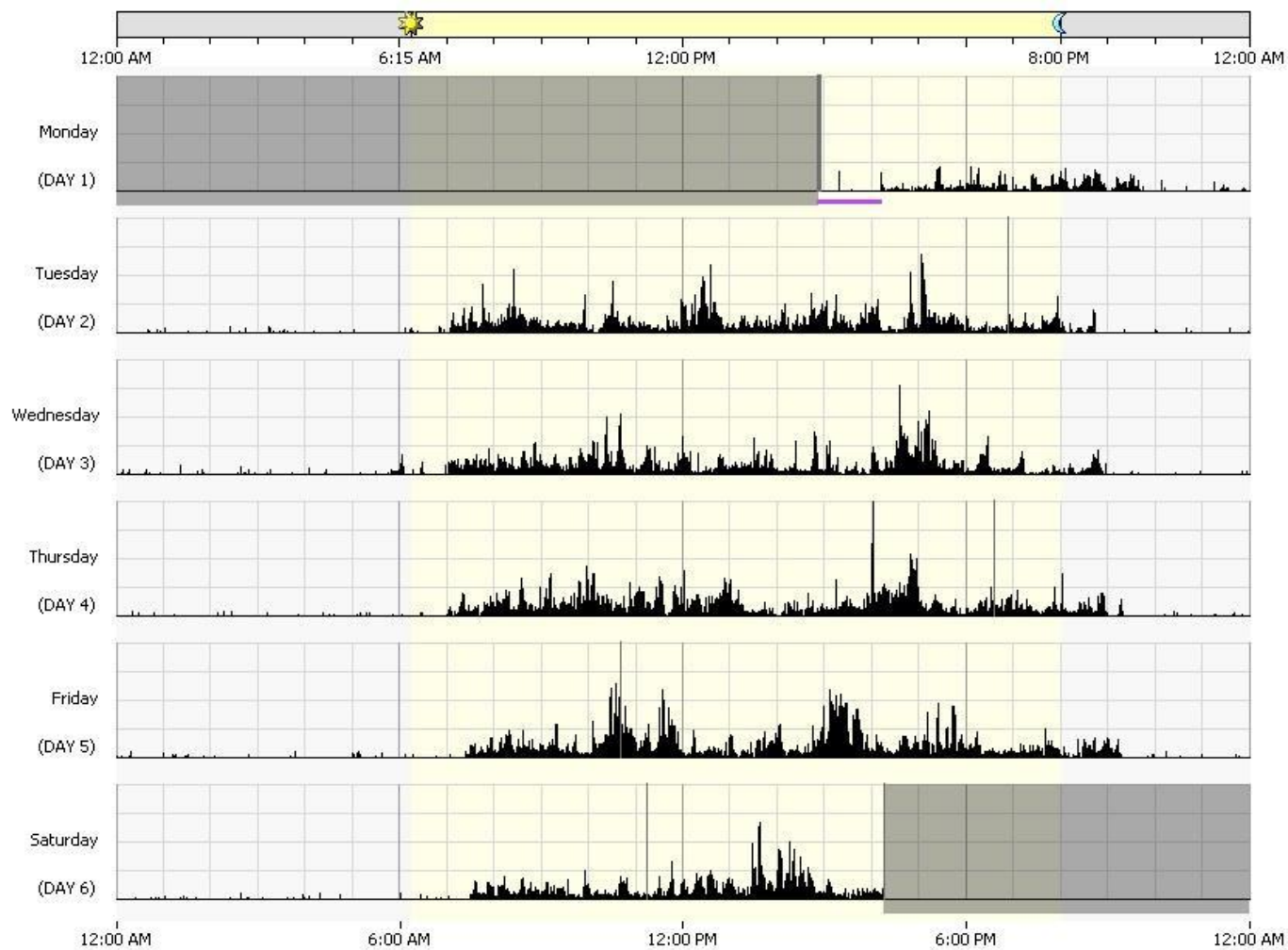
The way that teams mark up Estrella's Actogram can provide you with a way to check students' understandings about interpreting Actograms. If students have trouble interpreting one or more of the statements—and marking the Actogram appropriately—you may need to spend more time reviewing the different colors and shadings on Actograms with students before moving forward.

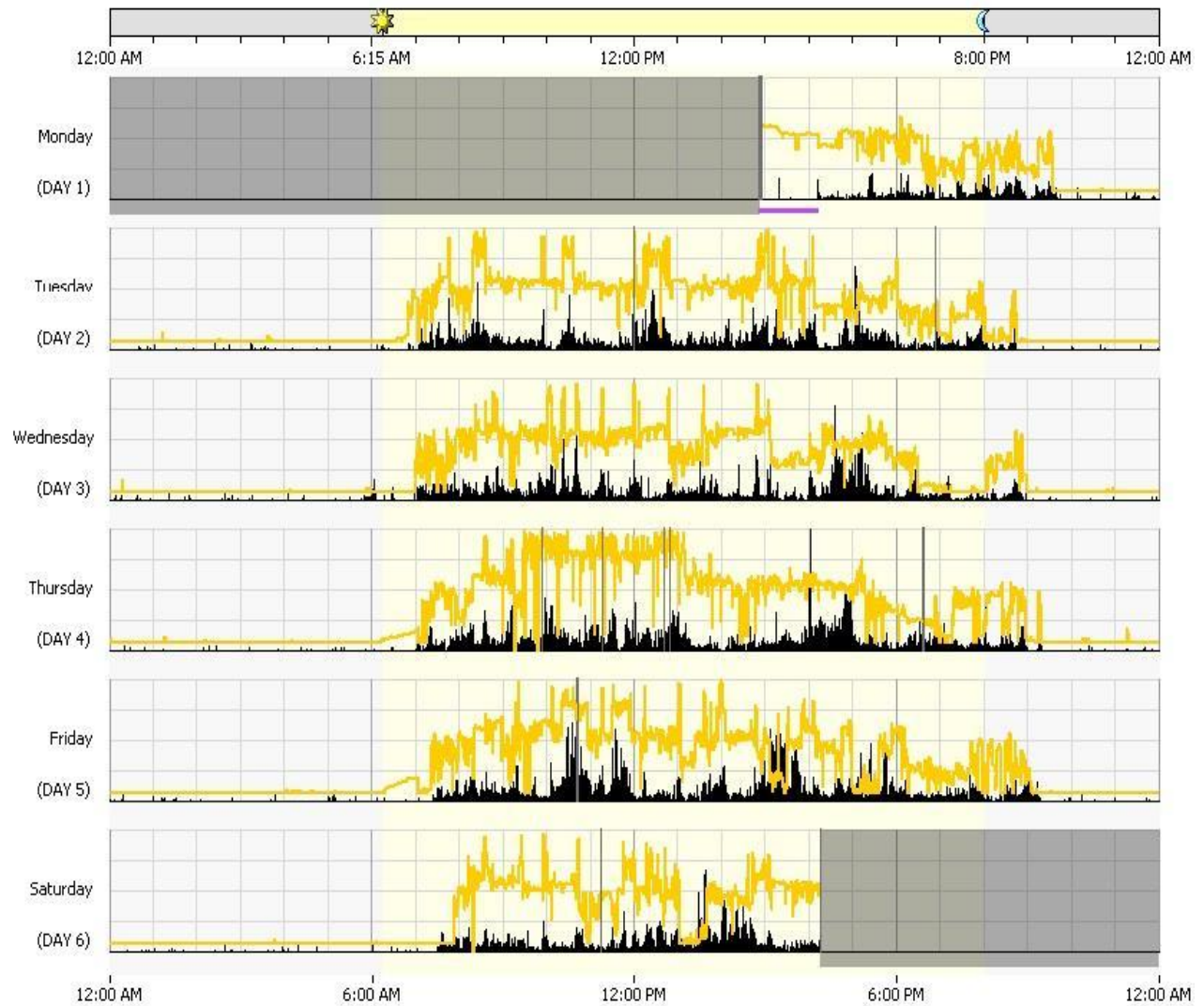
19. Now that students have learned how to analyze Actogram data, ask them if they have any questions about the Actograms or what scientists can learn about sleep from Actograms.

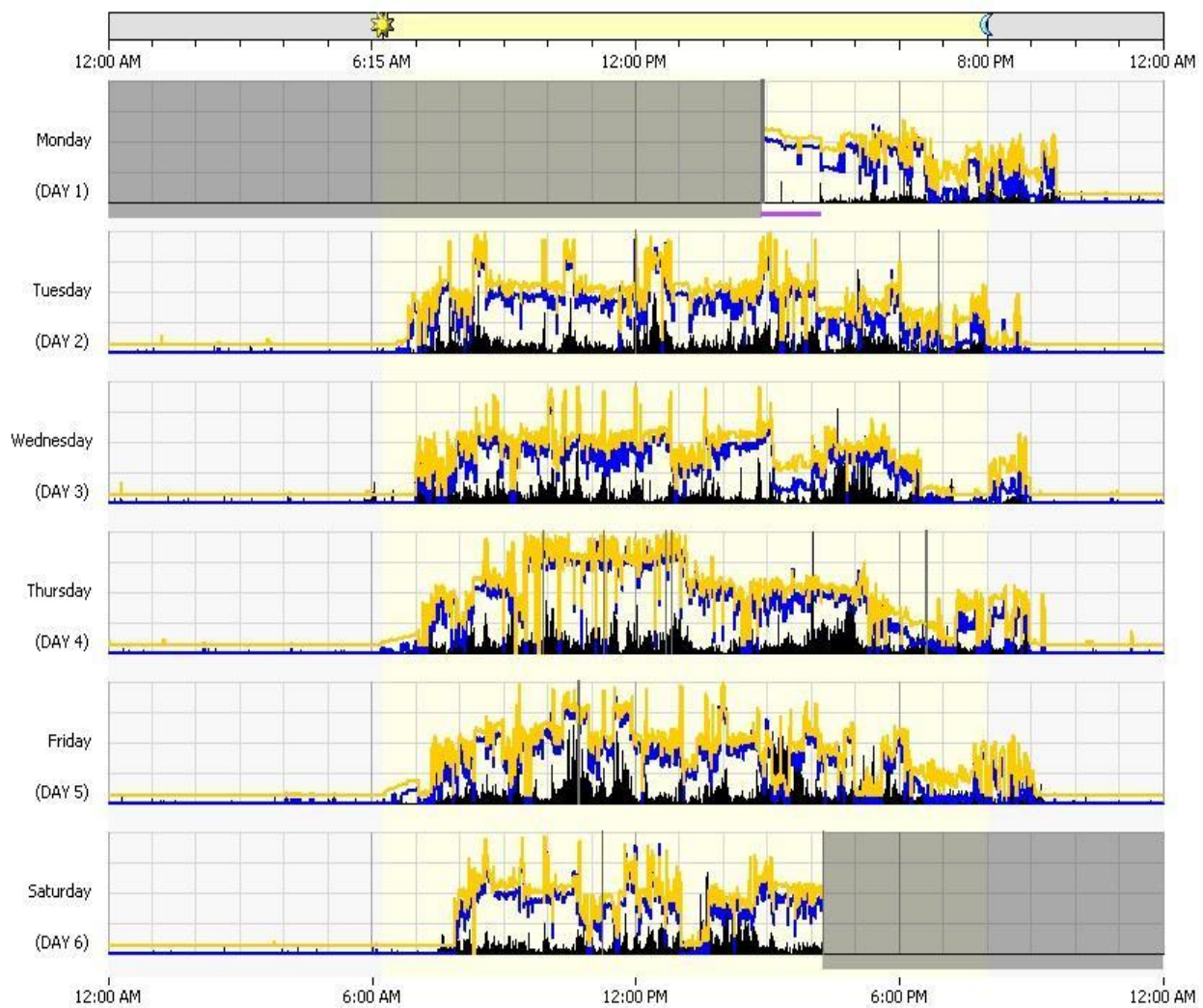
Students may comment that a person's sleep is not exactly the same from one night to the next. They may be surprised that someone would wake up that many times during the night, or they may have noticed that different things in their environment seem to affect a person's sleep.

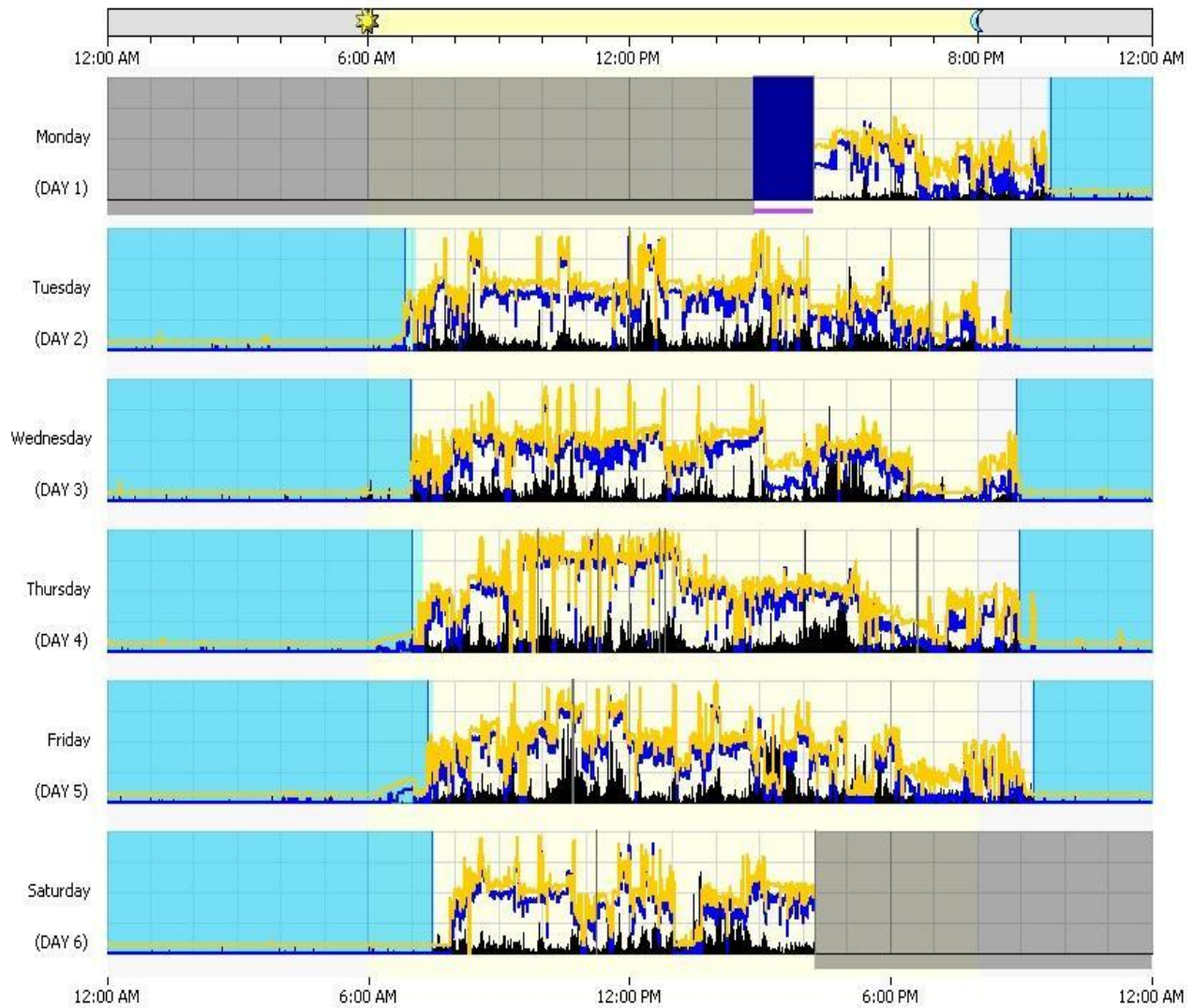
This is an opportunity to refer back to the list of questions that students raised during Lesson 1 (and are posted in the classroom). Place a check by any questions that students can now answer. Add any new questions that students raise at this time.





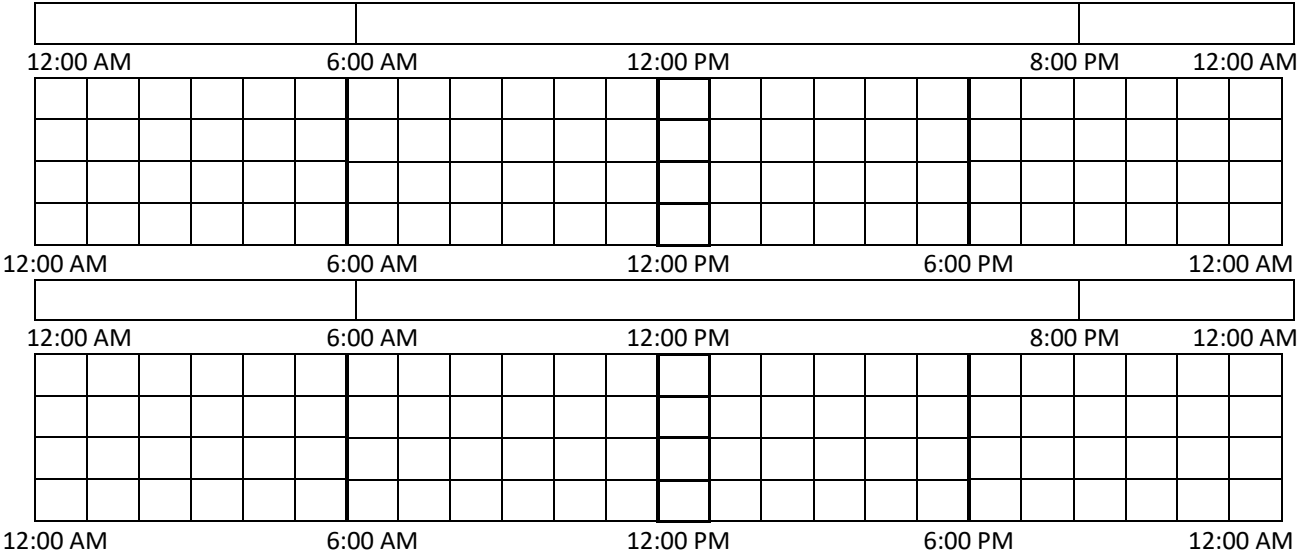






The Key to Understanding an Actogram

As your teacher directs, you will use a colored pencil to draw parts of an Actogram below. You will use this key when you analyze other Actograms later in this activity.



As you learn about the Actogram, color in the boxes below with the appropriate color and write what the color represents on the line next to it. The first two have been filled in for you.

<div></div>	Color	Meaning
<div></div>	Light yellow	daylight
<div></div>	Gray	dark outside
<div></div>	Black lines	_____
<div></div>	Darker yellow/gold lines	_____
<div></div>	Blue lines	_____
<div></div>	Light blue lines	_____
<div></div>	Green lines	_____