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fine start on the moon paper!

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11/6/11
Physics 111
HW 6

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3. Introduction:

The moon has been a topic of interest for many generations. From plotting and observing the moon to trips and explorations of the moon, humans as a group continue to want to learn more. Throughout this paper, we will dive further into our investigations of the moon by expanding on observations, predictions for rising and setting times, patterns in the observations, development of an explanatory model, and reflections on learning about the sun and the moon, the nature of scientific explanations, and inquiry approaches to learning and teaching. After studying the moon with these topics in mind, one can have a better understanding of why it has been so fascinating to humans since the beginning of time.

2/2

4: Observations:

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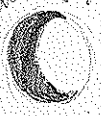
The new moon is a phase in which we cannot see the moon. ~~This is because the sun's light is shining on the back of the moon, creating a shadow on the portion visible to us on earth.~~ The angle the sun and the moon create is at zero degrees. I experienced the new moon sometime between the 24th and 28th of October. As this is a time when one is unable to see the moon, it is sometimes hard to pinpoint the exact date. This means we must search for other clues, like experiencing a change in shape from waning ~~gibbous~~ crescent to waxing ~~gibbous~~ crescent when the moon is visible.



waxing crescent is lit on right side

During the waxing crescent stage, the moon started to increase in visibility. The curvatures of the moon go in the same direction, while being open to the right. This phase creates angles between 0 and 90 degrees with the sun and occurred between the 29th of October and the 1st of November.

lit side?

The first quarter moon is when exactly half of the moon can be seen. It is still increasing in visibility. Only the right side can be seen, making it look like a semicircle. This phase creates a 90-degree angle with the sun and occurred on the 2nd of November.

waxing gibbous is lit on right side

During the waxing gibbous stage, the moon continues to increase in visibility. The curvatures of the moon go in opposite directions, with the right side being fully visible and the left side continuing to become more visible. This phase creates angles between 90 and 180 degrees with the sun and occurred between the 7th and 10th of October.

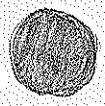
The full moon is the time when the moon is at it's fullest. It occurs at a time when it has the most direct sunlight, and therefore appears as a full circle. This

want to explain until later in the paper

need to draw a stick figure, define angle, state acute

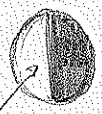
draw a stick figure, state right angle

draw a stick figure, state obtuse angle

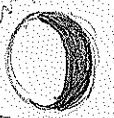


means that a 180-degree angle is formed between the sun and the moon. The full moon occurred on the 11th of October.

During the waning gibbous stage, the moon starts to get smaller. The curvatures of the moon go in opposite directions, with the left side being fully visible and the right side beginning to reduce in visibility. This phase creates angles between 180 and 90 degrees with the sun and occurred between the 12th and 18th of October.



The third quarter moon occurs when exactly half of the moon can be seen. It is still reducing in visibility. Only the left side can be seen, making it look like a semicircle. This phase creates a 90-degree angle with the sun and occurred on the 19th of October.



During the waning crescent stage, the moon continues to decrease in visibility. The curvatures of the moon go in the same direction, while being open to the left. This phase creates angles between 90 and 0 degrees with the sun and occurred between the 20th and 24th of October.

5. Predictions of When and Where to Look for the Moon

At times, both the moon and the sun are visible during the same time. We can then point a hand at both to determine the angle the two create. This angle allows us to predict the rising, setting and high in the sky times of the moon based on the position of the sun and the current phase of the moon. When considering this angle, it is important to remember that the timeline, or clock, for the sun-moon relationship is divided into 24 hours. This clock begins with the sunrise at 6 AM with the sunset occurring at 6 PM. Therefore, when the angle formed by your arms is horizontal (180°), you are pointing to 6 and 6 as opposed to the 3 and 9 you would expect on a wall clock.

To predict the rising, setting, and high in the sky times for the moon, we must first know the angles that the sun and the moon create at each different phase. Between the new moon and the first quarter, the moon and the sun create an acute angle on the sun clock, so we know that when the sun rises at 6 AM, the moon will rise around 9 AM. During the first quarter, the sun and the moon create a right angle on the sun clock, so if the sun rises at 6 AM we know that the moon rises at 12 PM. Between the first quarter and the full moon, the moon and the sun create an obtuse angle on the sun clock, so if the sun rises at 6 AM the moon will rise around 3 PM. During the full moon, the sun and the moon create an angle of 180°, or a straight line on the sun clock. This means that if the sun rises at 6 AM, the moon will rise at 6 PM. Between the full moon and the third quarter, the moon will again create an obtuse angle on the sun clock, but this time it will be open to the bottom half of the sun clock. If the sun rises at 6 AM, the moon will consequently rise around 9 PM. During the third quarter, the moon and the sun will create another 90° angle, but will again be open to the lower half of the sun clock. The sun will rise at 6 AM and the moon will rise at 12 AM. Lastly, between the third quarter and an entirely new moon, the

formed by pointers at the moon and sun

angle will again be acute, but open to the bottom portion of the sun clock. When the sun rises at 6 AM, the moon will rise around 3 AM. The moon, like the sun, rises and sets in 12 hours, and is high in the sky at approximately the midpoint of these 12 hours. This is why when you know the angles formed on a sun clock, you can predict the rising, setting, and high in the sky times of every phase.

about

This chart can be used as a guide when looking for the moon. It helps predict when the moon will be most visible to you. Although we often think that the moon should always be most visible at night, it is not always the case. The contrast of the night sky helps when searching for the moon, but the best way to determine visibility is to know when each particular phase will be at its highest.

very nicely stated

Name of Phase	Shape	Angle Formed by Sun and Moon	Predicted Rising Time	Good Time to Look	Predicted Setting Time
New Moon		0°	6 AM	12 PM	6 PM
Waxing Crescent		0-90°	6AM-12PM ≅ 9 AM	12PM-6PM ≅ 3 PM	6PM-12AM ≅ 9 PM
1st Quarter		90°	12 PM	6 PM	12 AM
Waxing Gibbous		90-180°	12PM-6PM ≅ 3 PM	6PM-12AM ≅ 9 PM	12AM-6AM ≅ 3 AM
Full Moon		180°	6PM	12 AM	6 AM
Waning Gibbous		180-90°	6PM-12AM ≅ 9 PM	12AM-6AM ≅ 3 AM	6AM-12PM ≅ 9 AM
3rd Quarter		90°	12 AM	6 AM	12 PM
Waning Crescent		90-0°	12AM-6AM ≅ 3 AM	6AM-12PM ≅ 9 AM	12PM-6PM ≅ 3 PM

reverse order of these

waxing phases are left waning phases on the left

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11/13/11
Physics 111
Homework 7

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1. Revising

Introduction:

The moon has been a topic of interest for many generations. From plotting and observing the moon to trips and explorations of the moon, humans as a group continue to want to learn more. Throughout this paper, we will dive further into our investigations of the moon by expanding on observations, predictions for rising and setting times, patterns in the observations, development of an explanatory model, and reflections on learning about the sun and the moon, the nature of scientific explanations, and inquiry approaches to learning and teaching. After studying the moon with these topics in mind, one can have a better understanding of why it has been so fascinating to humans since the beginning of time.

Observations:

The new moon is a phase in which we cannot see the moon. The angle the sun and the moon create is at zero degrees. I experienced the new moon sometime between the 24th and 28th of October. As this is a time when one is unable to see the moon, it is sometimes hard to pinpoint the exact date. This means we must search for other clues, like experiencing a change in shape from waning crescent to waxing crescent when the moon is visible.

During the waxing crescent stage, the moon started to increase in visibility. The curvatures of the moon go in the same direction, while being open to the left. If we point one hand at the sun and the other at the moon, this phase creates an acute angle between 0 and 90 degrees with the sun and occurred between the 29th of October and the 1st of November.

The first quarter moon is when exactly half of the moon can be seen. It is still increasing in visibility. Only the right side can be seen, making it look like a semicircle. If we point one hand to the sun and the other at the moon, this phase creates a right or 90-degree angle with the sun and occurred on the 2nd of November.

During the waxing gibbous stage, the moon continues to increase in visibility. The curvatures of the moon go in opposite directions, with the right side being fully visible and the left side continuing to become more visible. If we point one hand at

the moon and the other at the sun, this phase creates an obtuse angle between 90 and 180 degrees with the sun and occurred between the 7th and 10th of October.

The full moon is the time when the moon is at its fullest. It occurs at a time when it has the most direct sunlight, and therefore appears as a full circle. If we point one hand to the moon and the other at the sun, a straight line or 180-degree angle is formed between the sun and the moon. The full moon occurred on the 11th of October.

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During the waning gibbous stage, the moon starts to get smaller. The curvatures of the moon go in opposite directions, with the left side being fully visible and the right side beginning to reduce in visibility. If we point one hand at the moon and the other at the sun, this phase creates obtuse angles, or angles between 180 and 90 degrees with the sun and occurred between the 12th and 18th of October.

The third quarter moon occurs when exactly half of the moon can be seen. It is still reducing in visibility. Only the left side can be seen, making it look like a semicircle. If we point one hand at the sun and the other at the moon, this phase creates a right or 90-degree angle with the sun and occurred on the 19th of October.

During the waning crescent stage, the moon continues to decrease in visibility. The curvatures of the moon go in the same direction, while being open to the right. If we point one hand at the moon and the other at the sun, this phase creates angles acute angles, or angles between 90 and 0 degrees with the sun and occurred between the 20th and 24th of October.

Predictions of When and Where to Look for the Moon:

At times, both the moon and the sun are visible during the same time. We can then point a hand at both to determine the angle the two create. This angle allows us to predict the rising, setting and high in the sky times of the moon based on the position of the sun and the current phase of the moon. When considering this angle, it is important to remember that the timeline, or clock, for the sun-moon relationship is divided into 24 hours. This clock begins with the sunrise at 6 AM with the sunset occurring at 6 PM. Therefore, when the angle formed by your arms is horizontal (180°), you are pointing to 6 and 6 as opposed to the 3 and 9 you would expect on a wall clock.

To predict the rising, setting, and high in the sky times for the moon, we must first know the angles that the we create by pointing one arm at the sun and the other at the moon for each different phase.

Between the new moon and the first quarter, our arms pointing at the moon and the sun create an acute angle on the sun clock, so we know that when the sun rises at 6 AM, the waxing crescent moon will rise around 9 AM.

During the first quarter, our arms pointing at the sun and the moon create a right angle on the sun clock, so if the sun rises at 6 AM we know that the moon rises at 12 PM.

Between the first quarter and the full moon, the moon and the sun create an obtuse angle on the sun clock, so if the sun rises at 6 AM the waxing gibbous moon will rise around 3 PM.

During the full moon, our arms pointing at the sun and the moon create an angle of 180°, or a straight line on the sun clock. This means that if the sun rises at 6 AM, the full moon will rise at 6 PM.

Between the full moon and the third quarter, our arms pointing at the sun and the moon will again create an obtuse angle on the sun clock, but this time it will be open to the bottom half of the sun clock. If the sun rises at 6 AM, the waning gibbous moon will consequently rise around 9 PM.

During the third quarter, our arms pointing at the moon and the sun will create another 90° angle, but will again be open to the lower half of the sun clock. The sun will rise at 6 AM and the third quarter moon will rise at 12 AM.

Lastly, between the third quarter and an entirely new moon, the angle formed by pointing at the moon and the sun will again be acute, but open to the bottom portion of the sun clock. When the sun rises at 6 AM, the waning crescent moon will rise around 3 AM.

The moon, like the sun, rises and sets in about 12 hours, and is high in the sky at approximately the midpoint of these 12 hours. This is why when you know the angles formed on a sun clock, you can predict the rising, setting, and high in the sky times of every phase.

This chart can be used as a guide when looking for the moon. It helps predict when the moon will be most visible to you. Although we often think that the moon should always be most visible at night, it is not always the case. The contrast of the

night sky helps when searching for the moon, but the best way to determine visibility is to know when each particular phase will be at its highest.

Name of Phase	Shape	Angle Formed by Sun and Moon	Predicted Rising Time	Good Time to Look	Predicted Setting Time
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2. Development of an Explanatory Model for the Phases of the Moon

There are many questions we have about the moon, as well as many ways to answer these questions. Some questions can be answered by observing the moon and its patterns while keeping in mind the relevant powerful ideas about light and shadows. Other questions need to be answered with explanatory models or inferences. Through a combination of these methods, one should be able to gain a better understanding of the moon and its interactions with Earth and the sun.

Questions about the moon. There is an infinite amount of questions that one could ask concerning the moon. Some of the most prevalent questions are: "What is the relationship between the apparent shape of the moon and the angle formed by pointing one arm at the moon and one arm at the sun?" "How does the moon appear to move during a 24-hour period?" "On which side of the moon will the sun be for each phase? Who appears to be chasing whom across the sky?" and "How does the moon appear to move over several 24-hour periods?" If we consider these questions individually, we can see how they can each be answered by observing the moon over several 24-hour periods.

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When considering the relationship between the apparent shape of the moon and the angle formed by pointing one arm at the moon and the other arm at the sun, we must first be presented with a day that both the sun and the moon are visible at the same time. While observing, we take one arm and point it at the sun while the other arm is pointed at the moon, and then measure the angle formed by our arms. Also, record the shape of the illuminated portion of the moon. If this is done multiple times, a person will observe that

as the illuminated portion of the moon grows, the corresponding angle created by pointing at the sun and the moon will also grow.

If you were to observe the moon multiple times during a 24-hour period, you would notice that it does not remain in the same location. Much like the sun, the moon appears to rise in the east and set in the west. Based on the phase of the moon, its location can be found using the angular relationship with the sun during that phase.

To determine whether the sun is chasing the moon or the moon is chasing the sun, one must observe the moon several times during a 24-hour period in which the sun and the moon are visible. We must do this over several 24-hour periods to answer this question relative to the phases of the moon. If you watch the moon over a full lunar cycle, you will observe that from the new moon through the waxing crescent, first quarter, and waxing gibbous phases, the moon appears to be chasing the sun, as the moon is located to the left of the sun. From the full moon through the waning gibbous, third quarter, and waning crescent phases, the sun appears to be chasing the moon, as the moon is located to the right of the sun.

If you observe the moon over several 24-hour periods at the same time, you will notice that it will not be in the same location each night. An easy way of determining the location of the moon is using other things such as stars or trees as a comparison. Observing from the same location is key for using these comparisons. From night to night, the moon appears to be moving from west to east. This observation is again supported by the angles created between the sun and the moon during each phase.

Some questions cannot be answered simply by observing the moon. Questions such as "Why does the moon appear to move in these ways?" and "Why does the moon seem to have different shapes at different times?" are questions that must instead be answered using an explanatory model of the Earth, moon, and sun relationship.

Using powerful ideas about light and shadows. From a source, light travels in all directions and in a straight line. Light also reflects off of objects in straight lines and in all directions. In order to see something, light must reach your eyes. In this case, light travels from the sun in straight lines and all directions, reflects off of the moon in straight lines and all directions, and then eventually reaches your eyes. This explains why we are able to see the moon from Earth.

Explaining day and night. There are two explanatory models for day and night. The first explanatory model is the idea that the sun moves around the earth in a 24-hour period. This would explain why it is light during part of that day and dark during the other part of the day, because during the dark part of the day, the earth would create a shadow on its side opposite the sun. If the sun revolved around the earth, it would explain why we experience day and night as well as why the sun rises each day. This model is represented by the sun clock used previously to predict where and when to look for the moon.

The other explanatory model would be that the earth rotates on its axis in a 24-hour period. This would also explain the shadow cast by the earth itself on the portion of the earth experiencing night, along with why the sun rises each day. If the earth does in fact rotate on its axis, it would also explain why the moon rises and sets each day.

Modeling the Sun/Earth/Moon system: To answer some important "why" questions about the moon, it is easiest to create a model of the sun/Earth/moon system. This can be

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Discuss two explanatory models for day and night and the evidence that supports each of these explanations. (What appears to be the case if you observe the sky? What is an alternative explanation?). In what ways are both useful in developing an explanatory model for the phases of the moon? .

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done outside using the sun or inside using a lamp, along with a ball or your fist. The sun and the lamp represent the sun, the ball or fist represents the moon, and your eyes represent your eyes here on Earth. If you allow the ball or fist to revolve around you, the lit portions change shape in the same way that the moon's lit shapes change. By creating this model, we can infer that the moon revolves around the Earth, causing the moon's changing shapes as we see the moon from here on Earth.

Inferring the arrangement of the Sun/Earth/Moon System.

Draw three possible arrangements of the Sun/Earth/Moon system.

Because we have already inferred that the moon revolves around the earth, we can therefore infer that it is closer in proximity than the sun to the earth. This means that the moon is thus much closer to earth than it is to the sun. With this in mind, you can also infer that the earth is much closer to the moon than it is to the sun.

Further evidence of this is found in the angles created by pointing one arm at the sun and the other at the moon. On October 20th at 9:45 A.M., we were fortunate enough to be able to go up to the roof and observe the sun and the moon. We found that the sun and the moon created a 90-degree angle, something that would only be possible if the moon is revolving around the earth. We also used a pinhole camera to determine the diameter of the sun. Given that the image of the sun was proportionate to the sun itself, we were able to set up an equation (after being told the distance of the sun from the earth). If used with a full moon, the image of the moon projected would have been about the same size as the sun, but the distance from the moon to the earth would have been much smaller. After comparing the two proportion equations, we can see that though the sun and the moon appear to be similar in size, their relative distances from the earth are what cause this.

Sketch two perspectives for each phase:

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4. Writing

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Comment: This is interesting but not what I intend here. I would like to see three diagrams (sun and moon same distance from earth, sun close to earth, moon far away; moon close to earth, sun far away; and then the argument that to replicate what we have seen in the sky (half lit moon, 90 degree angle formed by ointing at the sun and moon) here on earth with a lamp for the sun and a ball for the moon, one can not stand with the lamp and moon an equal distance away and see a half lit ball. To see a half lit ball, one has to back away from the lamp. . . Discuss this analogy for justifying the inference that the sun is far away and the moon close. Then discuss the inference that the sun is big and the moon small.

What do you see here on earth? For each phase, draw a stick figure showing one arm pointing to the Sun and one arm pointing to the Moon:

What would you see if you were to look down upon the Sun, Earth, and Moon from way above the solar system? For each phase, draw the arrangement we have inferred for the Sun, Earth, and Moon with their relative sizes and distances from one another. Represent the shape of the moon as it would appear to someone looking down on the Sun/Earth/ Moon system from above.

Considering the role of the Earth: We see that the moon rises in the east and sets in the west during a 24-hour period; we can explain this by Earth rotating on its axis. We see that over several 24-hour periods the moon appears to move across the sky from west to east, we can explain this by moon revolving around the earth. (add the role of gravitational force by the Earth on the Moon).

Using the explanatory model to answer other questions about the moon:

There are many more questions about the moon that can be answered using the explanatory model of the sun/earth/moon system. These questions include but are not limited to: "Why is it that sometimes we can not see the Moon even if the sky is clear all

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day and all night?" "What is an eclipse of the moon and what is its cause?" and "What is an eclipse of the sun and what is its cause?"

To explain why it is that sometimes we cannot see the moon even if the sky is clear all day and night has to do with the revolution of the moon around the earth. From our perspectives on earth, we can only see the portions of the moon that are illuminated. If the shadow is cast by the moon on itself is on the portion nearest to earth, it will not matter how clear the skies are, we still will not be able to see it. This occurs when the moon is in between the sun and the earth, as the sun illuminates the portion of the moon facing away from the earth.

An eclipse of the moon is when the moon travels directly through the earth's shadow. The earth shields the moon from the light of the sun. On earth, we are unable to see the fully lit moon for a short time (sometimes an hour or more).

An eclipse of the sun is when the moon travels directly between the sun and the earth, causing a shadow of the moon to fall on earth. From our perspective on earth, we are unable to see the sun for a short time. Solar eclipses are caused by shadows cast by either the the earth on the moon.

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