49.5/50 Congratulations!

Name [redacted] Date 10/27/09

Fall 2009 Physics 111 Midterm

1. State the powerful ideas about light that we have developed and summarize the evidence that supports those ideas.

10/10 1. A light source projects light in many directions or light travels in many directions from the light source.

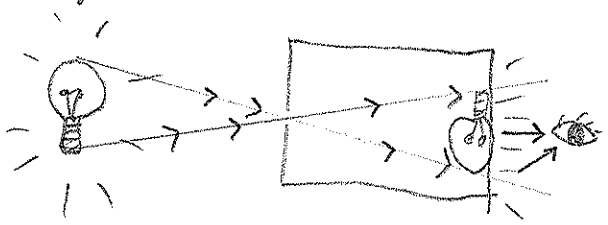
Evidence: When a light is on in a room, everything in reach is lit up from that single light source.

avoid the word "prove" in science, you can prove things in math but in science, we can only confirm or disconfirm a claim.

2. Light travels in a straight line until it hits another object.

Evidence #1: Shadows. When you have a light source in front of an object it leaves a shadow behind it that is sharp if the light is close and fuzzy when far away. Also, the fact that there is a shadow proves light moves in a straight line and does not bend around that object leaving no shadow.

Evidence #2: A pin hole camera. When a lit up light bulb is set up and you look at it through a pin hole camera the image is upside down. That is because the light from the top of the bulb travels in a straight line through the tiny hole in the camera and because it is at an angle, this image is shown at the bottom of the wax paper. The same thing happens to the bottom of the bulb except it goes to the top of the wax paper. This ends up inverting the image.



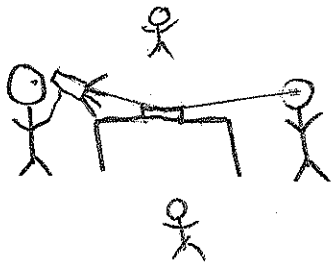
3. If the object is non-reflecting, light bounces off in all directions but if the object is reflective, light bounces off at the same angle at which it hits.

or

The angle of incidence equals angle of reflection

Evidence #1: Non-reflecting. Light comes from the light source and bounces off your nose in all directions, so we can see the whole lit up nose.

Evidence #2: Reflecting. set up a table with a mirror in the middle, and 1 person at each of the 4 sides and the person at one end of the table. If you turn out all the lights and that person shines the light onto the mirror only the person opposite them will see the light, not the other two people.



4. To see something, a light ray must go to the eye.
Evidence: We see things around us when a light is on.

2. At http://photo.net/pinhole/pinhole.htm, you can read about the history of the pinhole camera. This paragraph quotes from a book by John Hammond:

The Arabian physicist and mathematician Ibn al-Haytham, also known as Alhazen, experimented with image formation in the tenth century AD. He arranged three candles in a row and put a screen with a small hole between the candles and the wall. He noted that images were formed only by means of small holes and that the candle to the right made an image to the left on the wall. From his observations he deduced the linearity of light. (Hammond 1981:5).

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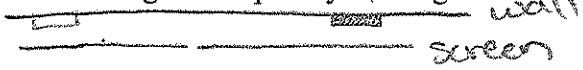
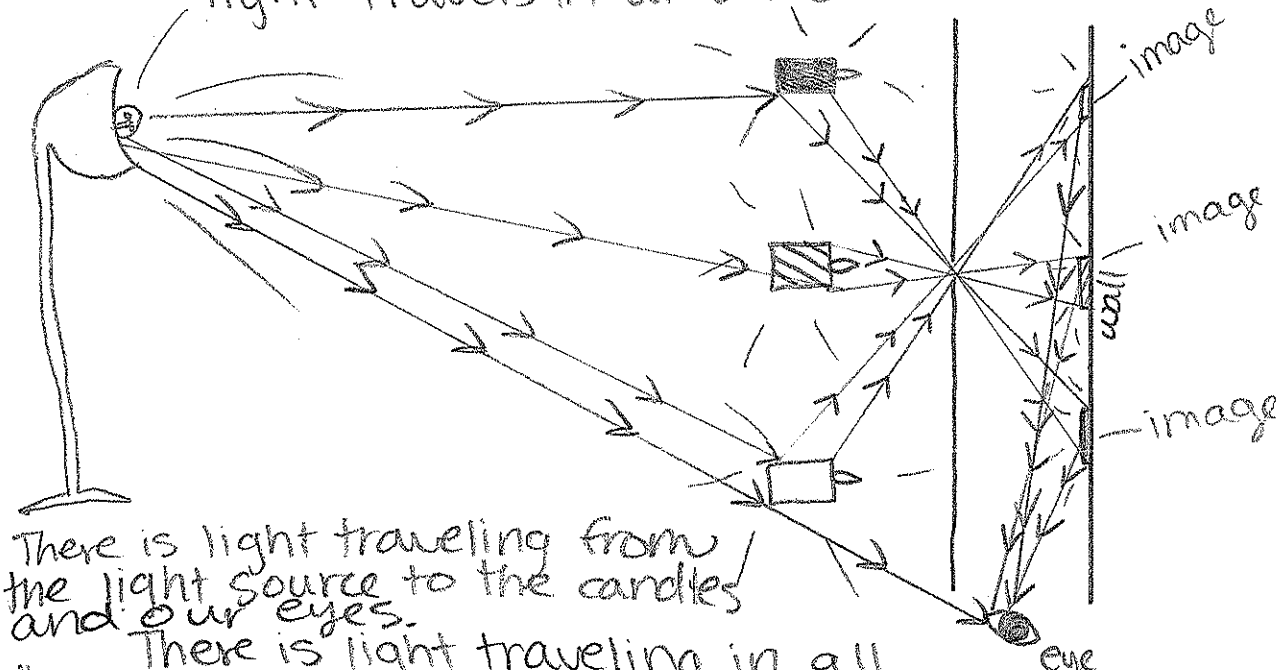
Hammond, John H. *The Camera Obscura. A Chronicle*. Bristol: Adam Hilger Ltd., 1981. 182 pages. ISBN 0-85274-451-X.

Sketch the set up described in this paragraph. State the relevant powerful ideas about light. Draw a ray diagram that illustrates "the candle to the right made an image to the left on the wall." Use the powerful ideas about light to explain your diagram.



Relevant ideas: light travels in a straight line.
• To see some thing, a light ray must go to the eye.
• light travels in all directions.



Is the image right side up or upside down?

There is light traveling from the light source to the candles and our eyes.

There is light traveling in all directions off the candles one of those directions is through the pinhole. the candle on the left has those light rays traveling to the right to the hole and because the light travels in a straight line it goes to the right side of the wall instead of bending around it. the same holds true for the right candle. Some of those rays are

traveling to the left through the hole causing the image to be shown on the left side of the wall. The middle candle is simply shown opposite it on the wall.
The light from the image travels in all directions once it hits the wall, one of those directions being to our eye.

3. How much of yourself can you see with a small hand-sized flat mirror held vertically about a foot away from your face? How much of yourself can you see if you move the mirror back to about two feet away from your face?
Sketch the situations, state the relevant powerful ideas about light, draw a ray diagram, and use the powerful ideas to explain your answer.

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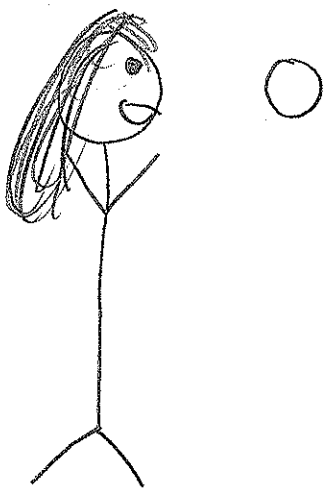
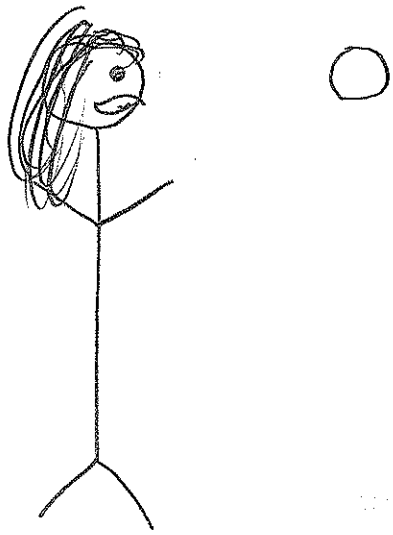
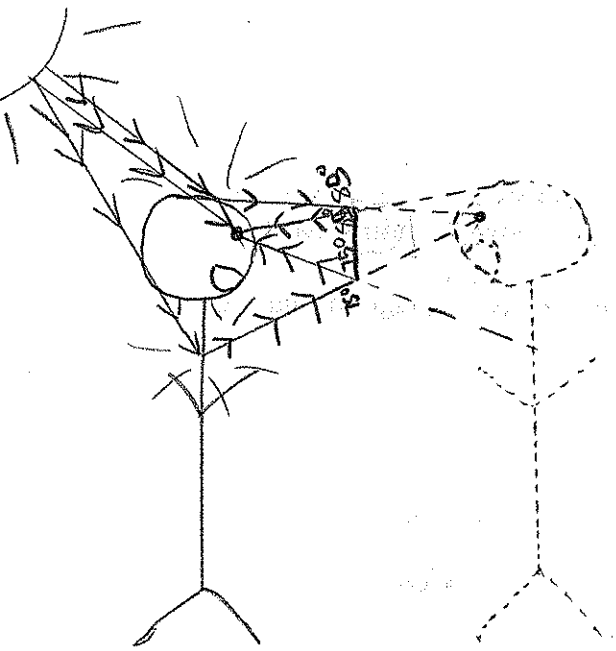




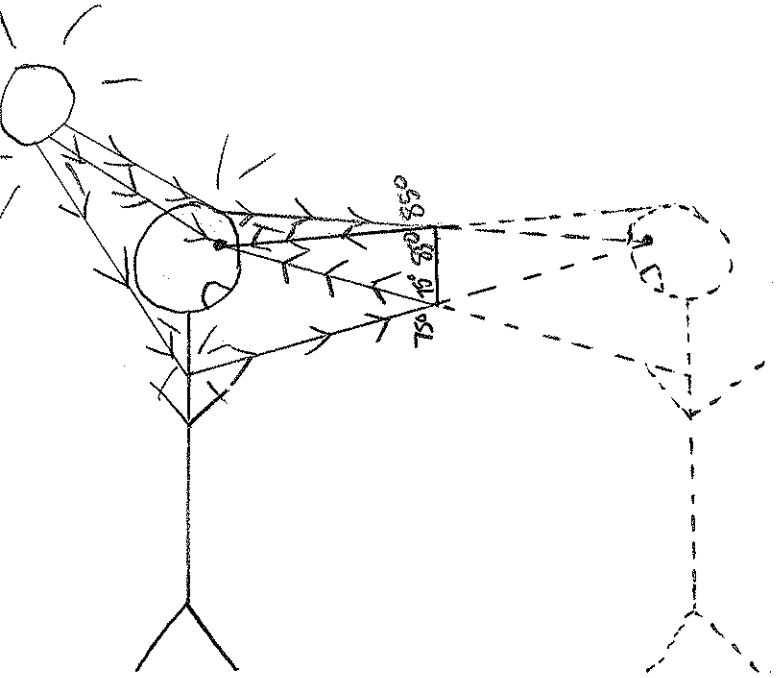
Powerful ideas: light travels in many directions from a light source.

- light travels in a straight line until it hits another object.
- If light hits a reflective object it bounces off at the same angle at which it hits it.
  - angle of incidence equals angle of reflection.
- To see some thing, a light ray must go to the eye.



sees about 90 the neck from 1 ft away.

Angle of 85° and 75°



sees the same from about 2 ft away.

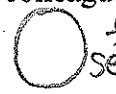
Angle of 85° and 75°

angles literally are different but amount you is same

- The light source projects light in all directions, one of those being to the eye, one to the top of the head and one to the neck. the light bounces off the head and onto the mirror. It then bounces off of the mirror at the same angle that it it. this continuous light ray then travels to the eye. The light from the light source also travels to the neck in a straight line, bounces onto the mirror then back off at the same angle it hit and to the eye. Because the angle of incidence must be the same as the angle of reflection, the eye can only see to the neck because any lower down and the angles would be much different.

So, the person can see from the top of their head to their neck with a hand-held mirror.

4. Report at least three observations of the moon over the past three weeks (draw the shape of the lit portion of the moon, state the date (and if possible the time) of the observation. Indicate which of these observations you made yourself and which you have drawn from reports by colleagues.


full moon on Oct. 4th seen by colleagues


waxing half moon on Oct. 26th at 11:30pm seen by myself.


waning half moon on Oct. 11th at midnight. seen by myself and colleagues.

What pattern(s) are evident in these observations?

I see that in one week we went from a full moon to a half moon, so it's getting larger. Then two weeks later I saw another half moon but now it's getting larger. I can only assume that a week ago it was a new moon.

What do you predict the moon's shape will be next if we are able to see the moon?

I am guessing that it will be slightly larger than a half moon, though not by much.

On what basis are you making that prediction?

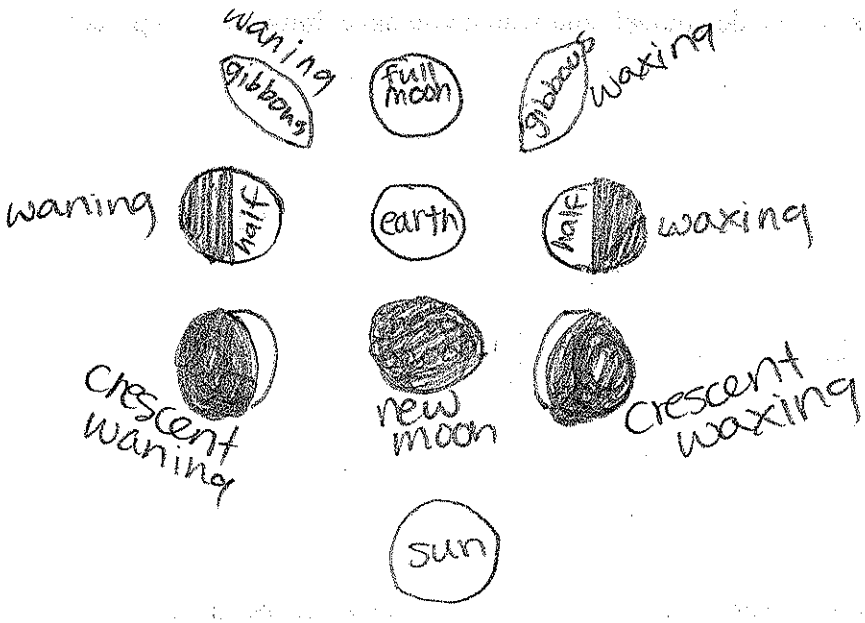
That last night it was a half moon, or close to it.

Why does the moon's shape appear to change?

Because it is revolving around us (the earth) and the sun is lighting up half the moon at a time. But because it is moving we are only seeing parts of the lit section until it is facing the sun and we are lined up w/ them both

On what evidence and logic are you basing that explanation?

I know the moon is revolving around us so I know it's moving. we are looking at the same part of the moon because we are rotating. so we are able to see only the sections that are lit by the sun because only half of the moon is facing the sun at a time.


waning gibbous
full moon
gibbous waxing
waning half
earth
half waxing
crescent waning
new moon
crescent waxing
sun

5. Compare your initial and final responses to the diagnostic questions about light. Use the evidence in these responses to comment upon your progress in learning about light.

My initial responses: I knew that
- when we were looking at reflection of light how the 3rd person saw the object had to do with the angle at which they were seeing it. I did think that it just had to be a bigger angle though
- when we were looking at the basketball I used the word "exposed" to the light. It did not seem I had any knowledge of light traveling in straight lines.

Final responses: When looking at final responses I understood that w/ reflections angles do matter. But it's that the angle of incidence equals the angle of reflection, not just a bigger angle. (when an object is reflective) So because that 3rd person was standing w/in the right angles (min. & max. angles) they were able to see the light.
- With the basketball I now understand that light does not bend around this object so it will create a shadow because it travels

in a straight line.
The shaded section of the ball represents the section that the light cannot bend to meet.

I have a mucha better understanding of light now b/c I understand it's properties and what it can and can't do. It helps me to understand situations better and why light affects different objects in different ways.