



Vision, Theory, Geometric Optics

Name _____

Concepts:

- 1) What is the difference between vision, theory and geometric optics?

- 2) What two organs of your body allow you to see?

- 3) Explain how an optical illusion works.

- 4) Explain how Aristotle viewed light and vision.

- 5) Who were the two individuals who came up with alternative views on the nature of light during the 17th century?

- 6) Explain both views.

- 7) Who developed the current concept of the nature of light and what was his concept?

- 8) Who was the French scientist (he has a strange pronunciation to his name) and how did he extend this concept even further?

- 9) Draw the Electromagnetic Spectrum including approximate wavelengths of different types of the waves.

- 10) What is the speed of light?

11) What equation allows us to figure out the related frequency for each wavelength?

12) What equation allows us to compute the energy of a photon?

13) List seven properties of light and explain each of the six properties.

14) What is color really?

15) What are the wavelengths of red light and violet light? (the ends of the visible spectrum)

16) What are the two parts of a shadow and what causes them?

17) Explain why some materials are opaque, some are transparent and other materials have the color that they have like red or blue.

18) What is the law of Reflection?

- 19) Why is silver such a good reflective material?
- 20) Draw and label all parts of a reflected image using a plane mirror as the surface.
(think the flat mirror lab)
- 21) What does convex mean?
- 22) What does concave mean?
- 23) What does convergent mean?
- 24) What does divergent mean?
- 25) What makes an image a real image?
- 26) What makes an image a virtual image?
- 27) Draw and label each part of a ray diagram for a converging mirror with the object at 2 focal lengths from the mirror.
- 28) What are two uses for a converging mirror?
- 29) What are two uses for a diverging mirror?

- 30) What is refraction?
- 31) What are the two relationships that define the index of refraction?
- 32) What equation do we use of computing the new angle after a ray of light has passed through the surface of a material? What is the name given to it?
- 33) Explain a mirage.
- 34) Explain a rainbow.
- 35) Explain total internal reflection and how this relates to Snell's law.

Exercises:

Show all work including the equation, substitution and answer with units

1. Air to water at 30 degrees
2. Water to glass at 42 degrees
3. Air to diamond at 10 degrees
4. Glass to water at 23 degrees
5. Find the angle that gives a refracted angle of 90 degrees for diamond (critical angle)
6. Find the angle that gives a refracted angle of 90 degrees for water (critical angle)
7. Find the index of refraction for a substance that is coming from air has an incident angle of 54 degrees and a refracted angle of 30 degrees

Given Indexes of refraction:

Air	$n = 1.00$
Water	$n = 1.33$
Diamond	$n = 2.419$
Glass	$n = 1.66$
Benzene	$n = 1.501$
Ethyl Alcohol	$n = 1.361$

For each problem write the equation, draw a picture, label the picture and show all your work.

- 8) While fishing out on a lake one afternoon, Amy spots a large fish just below the surface of the water at an angle of 60° to the vertical and she tries to scoop it out of the water, but misses. At what angle should have Amy aimed in order to catch the fish. Draw a picture, label the incident and refracted rays and angles and the normal.
- 9) Heather is looking through a window made of plate glass at an advertisement partly taped to the back side and realizes that the picture is distorted. If she is looking through the glass at an angle of 25° from the normal or vertical, at what angle will the picture appear to be?
- 10) A jeweler must decide whether the stone in Mrs. Smigelski's ring is a real diamond or a less-precious zircon. He measures shines a light at an angle of 30° into the stone and it bends to an angle of 20° from the normal. Is this a diamond or a fake. Draw a picture and label everything.

11) The water and ethyl alcohol have different indexes of refraction. a) Does light travel faster in the alcohol or in the water? b) What is the speed of light in each? (the speed of light in vacuum is 3×10^8 m/s)

12) In Sam's backyard he has a glass patio table. After it rains one day, he decides to test what he has learned in his physics class. From air he shines a light through the water and the glass at angle of 25° . At what angle will the light exit the glass back into the air.

6.) In which of the six materials listed above will light be travelling the slowest? What will its speed be while in the material?