UNIT 10: LIGHT -- THE STUFF WE SEE WITH

Upon completion of this unit, the student should be able to:

1. Describe the electromagnetic spectrum and how visible light fits into it.

2. Define parallax and its application to the real world. Explain how to determine the position of an object or image using two lines of sight.

3. Define terms associated with visible light sources, including scattering, reflection, intensity, illuminance, opaque, translucent, and transparent.

4. State the basic law of reflection and apply it to plane and curved mirrors.

5. Given a plane mirror and an object's position and size, find the image's position and size.

6. Given an object and a curved mirror, find the location, size, and type of image formed using both a ray diagram and the proper formula.

7. Contrast between virtual and real images.

8. Use the wave equation to solve for velocity, wavelength, or frequency given two of the quantities.

9. Apply the inverse square law to predict the change in apparent brightness of a luminous object given the change in distance to the object.

10. Explain how scattering causes such phenomena as blue sky, blue moon, and red sunset.

11. Distinguish between specular and diffuse reflection and explain the cause of each.

12. Explain how 3D glasses work.

13. Distinguish between divergence and convergence.

Reference: Holt Physics (Serway/Faughn), Chapter 13

Homework: Light Study Sheets 1 & 2, Magic Cylinder

Labs: Images/Draw Your Face, Reflection, Ripple Tank

Name:_____
Due:_____

LIGHT UNIT STUDY SHEET #1

These questions are intended to guide you through important concepts in this unit. Classroom discussions, supplemented by reading Chapter 13, will help you answer them.

1. What is the difference between transparent and translucent? Give an example of each.

see images through it

allows light through but not image

opaque

cannot see through opaque object

2. Why is the sky blue? The sunset red?

3. What is parallax? Give two practical examples of where it is used.

4. Why are the insides of a camera or binoculars black?

5. To what is the illumination of a surface by a light source directly proportional? Inversely proportional?

$E_x \propto \frac{P}{d^2}$ (inverse square)

6. What is the difference between a specular and diffuse reflector? Draw a diagram to supplement your explanation. Which type of reflector are you more likely to be able to see in a room?

like a mirror — smooth surface

like all the other objects in room (rough surface)

diffuse reflector

7. White light consists of what 7 colors? Which of these has the longest wavelength? Shortest?

ROY G BIV

Red

Violet

8. Two students want to improve the lighting of their desks. Jim wants to add a second light bulb of equal strength, while Julia wants to move the one bulb twice as close. Whose desk will be brighter, by how much (relative to the other), and why?

$E \propto \frac{I}{d^2}$ $E \propto \frac{2}{(1)^2} = 2$

double

twice

9. Calulate the required luminous flux from ceiling light fixtures onto school desks 2.3 m away if a minimum illuminance of 160 lx is required.

$E = \frac{P}{4\pi d^2}$ so $P = 4\pi E d^2 = 4\pi (160)(2.3)^2 = 10^{63} lm$

10. How far does light travel in a vacuum in one second? One nanosecond?

$V = 3 \times 10^8 m/s$ $V = \frac{\Delta s}{\Delta t}$ $s = v\Delta t = (3\times10^8 m/s)(1 s)$ $s = 3\times10^8 m$

$(3\times10^8 m/s)(10^{-9} s) = 3\times10^{-1} m = .3 m$