Name: Key

Unit 8 – Optics Study Guide Conceptual Physics Period: _____ Date: _____

Vocabulary:

Wave-Particle Duality
Speed of light
Electromagnetic waves
Transparent
Opaque
Polarization
Reflection
Refraction
Mirrors
Lens
Concave Mirror
Convex Mirror
Concave Lens
Convex Lens
Real Image
Virtual Image
Law of Refraction
Incidence
Snell's Law
Index of refraction
Critical angle
Total internal reflection
Ray diagram
Farsighted
Nearsighted
Astigmatism

Potential Questions:

1. Water waves in a shallow dish are 6.0 cm long. At one point, the water oscillates up and down at a rate of 4.8 Hz. a. What is the speed of the water waves? b. What is the period of the water waves?

a) $v = \frac{cm}{s} = 6\,cm \cdot 4.8\,\frac{1}{s} = 28.8\,\frac{cm}{s}$

b) $T = \frac{1}{f} \quad \frac{1}{4.8\,\frac{1}{s}} = 0.208\,s$

2. Water waves in a lake travel 5.6 m in 2.3 s. The period of oscillation is 1.32 s. a. What is the speed of the water waves? b. What is their wavelength?

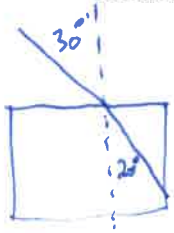
a) $\frac{5.6\,m}{2.3\,s} = 2.43\,m/s$

b) $v = f \cdot \lambda \rightarrow \frac{2.43\,m/s}{0.75} = \lambda$

$T = \frac{1}{f} \rightarrow \frac{1}{1.32} = f = 0.75$

$\lambda = 3.2\,m$

3. A ray of light has an angle of incidence of 30.0° on a block of quartz and an angle of refraction of 20.0°. What is the index of refraction for this block of quartz?



$n_i(\sin\theta_i) = n_r(\sin\theta_r)$

n_r = ?

$\frac{1 \cdot \sin 30}{\sin 20} = n_r = 1.46$

4. When you go out in the sun, it is the UV light that gives you your tan. The pigment in your skin called melanin is activated by the enzyme tyrosinase, which has been stimulated by UV light. What is the wavelength of this light if it has a frequency of 7.89×10^{14} Hz?

$c = \lambda \cdot f \rightarrow 3.0 \cdot 10^{8} = \lambda \cdot 7.89 \cdot 10^{14}$

$\lambda = 3.8 \cdot 10^{-7}\,m$

5. You are looking at a concave mirror whose focal length is 18cm. If you are 12cm away, a) how far is your image from the mirror? B) Does it matter whether your face is closer or farther than one focal length? Explain.

$\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$ a) $\frac{1}{18} - \frac{1}{12} = \frac{1}{d_i}$ $d_i = -36cm$

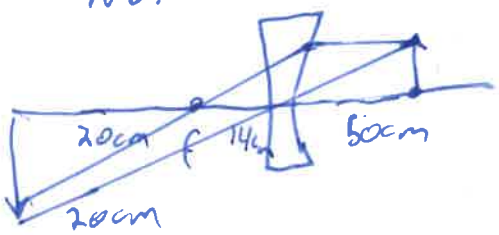
b) yes, if you are closer, the image is virtual

6. You look at your friend's face through a diverging lens. A) is the image real or virtual? B) If her friend's face is 50.0cm from the lens that forms an image at a distance of 20.0cm, what is the focal length of the lens? C) Draw a ray diagram of the situation.

A) Diverging lenses = always virtual

B) $\frac{1}{f} = \frac{1}{50} + \frac{1}{20}$ $F = 14.3cm$

Not Drawn to scale!!

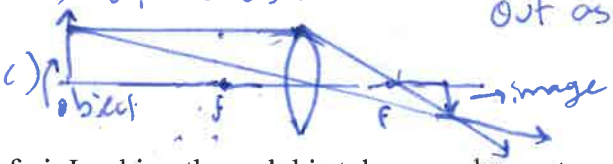


7. A photographer is clicking shots of a famous fashion model as she walks toward him across the studio. His camera contains a lens with a focal length of 0.0500m. a) How far back must the film be located when the model is 3.00m from the camera. B) should the lens be moved in or out as she gets closer? C) draw a ray diagram of the situation with the model 3.00m and 1.00 m from the camera.

$\frac{1}{0.050} = \frac{1}{3.0} + \frac{1}{d_i}$ a) $d_i = 0.051$

b) lens should be moved out as she gets closer

c)



8. Marlin is out on a safari. Looking through his telescope, he spots a giraffe in the distance. The telescope has an objective lens of 40cm focal length and an eye piece of 2cm focal length. A) What is the magnification of the giraffe? B) how large is the image formed by the telescope if the giraffe appears to be 1.5 cm to the naked eye?

a) $m = \frac{f_o}{f_e} = \frac{40cm}{2cm} = 20\times$

b) $m = \frac{h_i}{h_o} \rightarrow h_i = m \cdot h_o$

$= 20 \cdot 1.5$

$= 30cm$