Name KEY Per

Review Sheet: Reflection and Refraction

1. Read chapter 13 & 14

2. **Terms to know:** plane mirror, Law of Reflection, normal, focal point, focal length, radius of curvature, center of curvature, principal axis., refraction, Snell's Law, total internal reflection, critical angle

3. **Define:** *a) virtual image*

   b) real image

   a) dispersion

   b) index of refraction

   c) critical angle

4. State: *The Law of Reflection*

   $n_1 \sin\theta_1 = n_2 \sin\theta_2$ or $\frac{n_1}{n_2} = \frac{\sin\theta_2}{\sin\theta_1}$

5. Be able to measure and calculate angles of incidence, reflection, and refraction and draw reflected and refracted rays. ✓

6. What is the relationship between the radius of curvature and the focal point for a spherical mirror?

   $R = 2F$

7. Where do parallel light rays converge after reflecting off a concave mirror or refracting through a convex lens?

   Focal pt.

8. Be able to draw ray diagrams to locate and describe images for concave and a convex mirrors and lenses and use the mirror/lens equation and the magnification equation to calculate the location and size of images. ✓

9. As the object moves toward a concave mirror, the image . . .

   gets farther away / larger, until $d_o = f$. when $d_o < f$, image comes closer to mirror.

10. State two differences between real images and virtual images.

    1) real = inverted, virtual = upright

    2) real = can be projected
       virtual = cannot be projected

    3) real → light rays actually meet
       virtual → light rays only appear to meet

11. Complete the chart below by checking the optical instrument(s) that have the following properties:

	Concave Mirror	Convex Mirror	Plane Mirror	Concave Lens	Convex Lens
Optical instrument that causes light to converge	✓				✓
Optical instrument that causes light to diverge		✓	✓	✓	
Has a real focal point (focal length is positive)	✓				✓
Has a virtual focal point (focal length is negative)		✓		✓	
Can form real images	✓				✓
Can form virtual images	✓	✓	✓	✓	✓
Can form larger images	✓				✓
Can form smaller images	✓	✓		✓	✓
Can form same size images	✓		✓		✓
Can form upright images	✓	✓	✓	✓	✓
Can form inverted images	✓				✓

12. As a light ray passes at an angle from a substance with a low index to a substance with a high index, what happens to its:

a) frequency? b) wavelength? c) speed? d) period?

decrease slows constant

13. Which way will a light ray bend when crossing a boundary at an angle from:

a) a low index substance to a high index substance?

towards normal line

b) a high index substance to a low index substance?

Away from

14. Under what two conditions will a light ray **not** bend when it crosses a boundary?

1) same index of refraction

2) $\theta_i = 0°$

15. What is the relationship between the index of refraction and the speed of light in the substance?

$n = c/v$

16. Why does dispersion occur?

different colors/frequencies of light slow different amounts

17. a) Which color of light slows down the most when white light shines through a glass prism?

violet (or blue)

b) Which color bends the most from its straight-line path?

violet

c) Which color has the highest index of refraction?

violet

18. What is total internal reflection?

all light reflected back from interface between to different media

19. What two conditions are necessary for total internal reflection to occur?

1) $\theta_i > \theta_{critical}$

2) $n_i > n_r$

20. What are some applications of refraction?

lenses, projectors, cameras,

21. What are some applications of total internal reflection?

fiber optic cables

22. What is the formula for the critical angle? Be able to calculate with this formula.

$n_1 \sin\theta_1 = n_2 \sin\theta_2$ ($\theta_2 = 90°$)

θ_c

$\theta_c = \sin^{-1}(n_2/n_1)$

23. Describe briefly how the focal length of a convex lens can be found.

parallel rays (from far away) will converge there

24. How can you determine whether a lens is converging or diverging by looking at its shape?

thicker in middle -> converging

25. As the object moves toward a convex lens, the image . . .

gets farther away, larger, until $d_o = f$. (When $d_o < f$, image is virtual & comes closer to lens

26. What will happen to the focal length of a lens if:

a) its curvature increases? decrease

b)its index of refraction increases? decrease

c)the wavelength of light passing through it increases? increase

27. What type of lens is used as a magnifying glass? Where is the object located? What are the properties of the image? convex between lens & f

virtual, upright, enlarged

28. What type of lens is used in a camera? Where is the object located? What are the properties of the image? outside 2F

converging. → real, inverted, reduced

29. What type of lens is used in a projector? Where is the object located? What are the properties of the image? converging between f & 2F

inverted, real, enlarged