# Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Hour: \_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_

# Physics: *Refraction and Lenses HW*

***Indices of Refraction for Various Substances***

**SUBSTANCE n SUBSTANCE n**

benzene 1.501 glass, crown 1.52

carbon tetrachloride 1.461 glass, flint 1.66

cubic zirconia 2.20 glycerin 1.473

diamond 2.419 ice (at 0oC) 1.309

ethyl alcohol 1.361 quartz, fused 1.458

fluorite 1.434 water 1.333

**Set 1: Snell’s Law**

1. Light traveling in air enters a slab of a transparent substance. The incident ray makes an angle of 41.3o with the normal, and the refracted ray makes an angle of 25.9o with the normal. Find the index of refraction of the transparent substance.

2. Find the angle of refraction for light that enters water from air at an angle of 28.4o to the normal.

3. Fill in the missing spaces in the table.

**from (medium) to (medium) i r**

a. crown glass flint glass 29.5o

b. air 17.4o 12.7o

c. quartz diamond 34.2o

ANSWERS: 1. 1.51 2. 20.9o 3a. 26.8o 3b. ethyl alcohol 3c. 19.8o

**Set 3: Lenses**

11. A bottle is placed 23.4 cm in front of a converging lens with a focal length of magnitude 18.2 cm. Find the image distance and the magnification. Decide real/virtual and inverted/upright.

12. A detective examines a clue by holding his magnifying glass (a converging lens) 7.73 cm away from an object. The magnifying glass has a focal length of magnitude 11.6 cm. Find the image distance and the magnification. Decide real/virtual and inverted/upright.

13. A key is placed 24.0 cm in front of a diverging lens having a focal length of magnitude 10.6 cm. Find the image distance and the magnification. Decide real/virtual and inverted/upright.

**Set 4: Critical Angle**

14. Find the critical angle for light traveling from benzene into air.

15. Determine the critical angle for light traveling from glycerin into ice.

16. Calculate the critical angle for light traveling from diamond into fluorite.

17. Which has a smaller critical angle in air, carbon tetrachloride or cubic zirconia? Show your work.

ANSWERS: 11. q = 81.9 cm, M = –3.50, R, I 13. q = –7.35 cm, M = +0.306, U, V 15. 62.71o 17. cubic

12. q = –23.2 cm, M = 3.00, U, V 14. 41.78o 16. 36.36o zirconia