

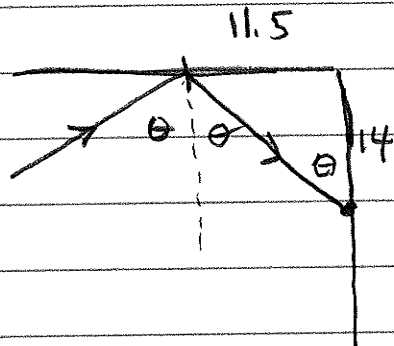
Physics 9B Fall 2013

Assignment 8

33-1, 3, 7, 13, 17, 48

34-3, 5, 27, 29

33-1



$$\tan \theta = 11.5/14$$

$$\Rightarrow \theta = 39.4^\circ$$

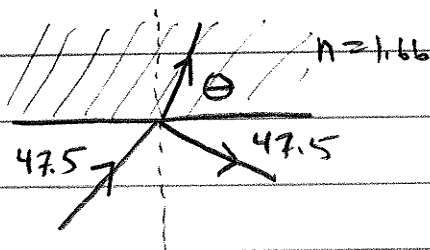
33-3

a) $v = c/n = 3 \cdot 10^8 / 1.47 = 2.04 \cdot 10^8 \text{ m/s}$

b) $\lambda = \lambda_0/n = 650 / 1.47 = 442 \text{ nm}$

NB f is unchanged

33-7



a) $\theta_{\text{reflection}} = \theta_{\text{incidence}} = 47.5$

b) $n_1 \sin \theta_1 = n_2 \sin \theta_2$

$$1 \sin(47.5) = 1.66 \sin \theta_2$$

$$\theta_2 = 24.5$$

$$\theta = 90 - \theta_2 = 65.5$$

2.//

33-13

f, λ, v in material index of refraction n

Vacuum speed = $c = v n$

$$\lambda_{vac} = n \lambda$$

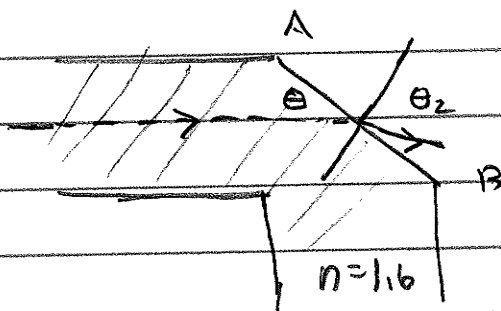
$$f_{vac} = f$$

material n' speed = $v n / n'$

$$\lambda' = n \lambda / n'$$

$$f' = f$$

33-17



$$n_1 \sin \theta_1 = n_2 \sin \theta_2$$

$$1.6 \sin (90 - \theta) = 1 \cdot 1$$

\uparrow
max $\sin \theta_2$

$$90 - \theta = 38.7$$

$$\rightarrow \theta = 51.3^\circ \text{ (a)}$$

(b)

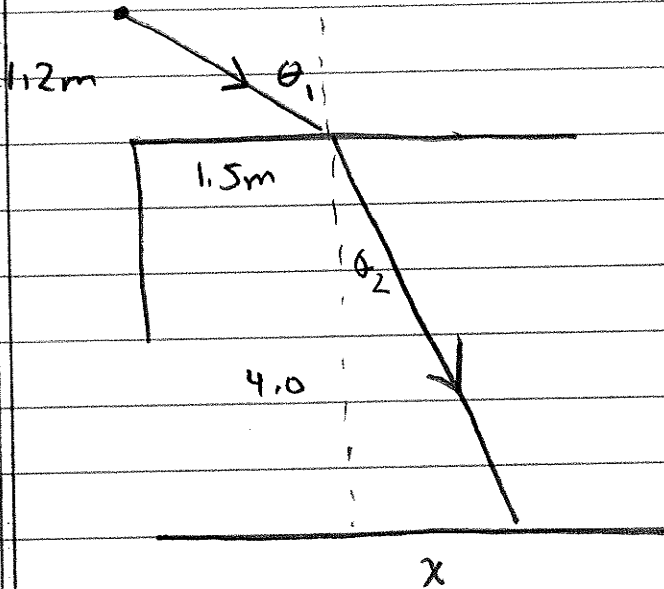
$$1.6 \sin (90 - \theta) = 1.33 \cdot 1$$

$$90 - \theta = 56.2$$

$$\theta = 33.8^\circ$$

3.11

33-48



$$\tan \theta_1 = 1.5/1.2$$

$$\theta_1 = 51.3$$

$$n_1 \sin \theta_1 = n_2 \sin \theta_2$$

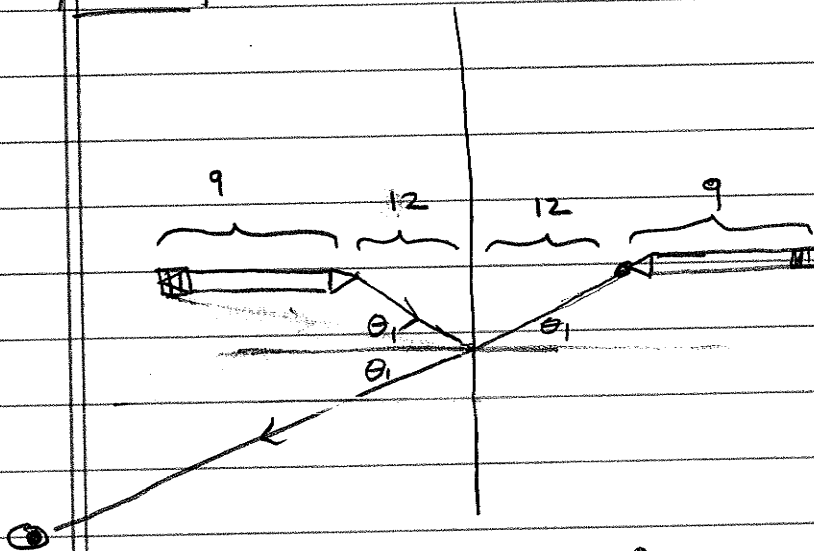
$$1 \sin 51.3 = 1.33 \sin \theta_2$$

$$\theta_2 = 36^\circ$$

$$x = 4 \tan \theta_2 = 2.9 \text{ m}$$

$$d = 1.5 + 2.9 = 4.4 \text{ m}$$

34-3



$$\text{length} = 9 \text{ cm}$$

eraser tip is closer to mirror surface + observer.

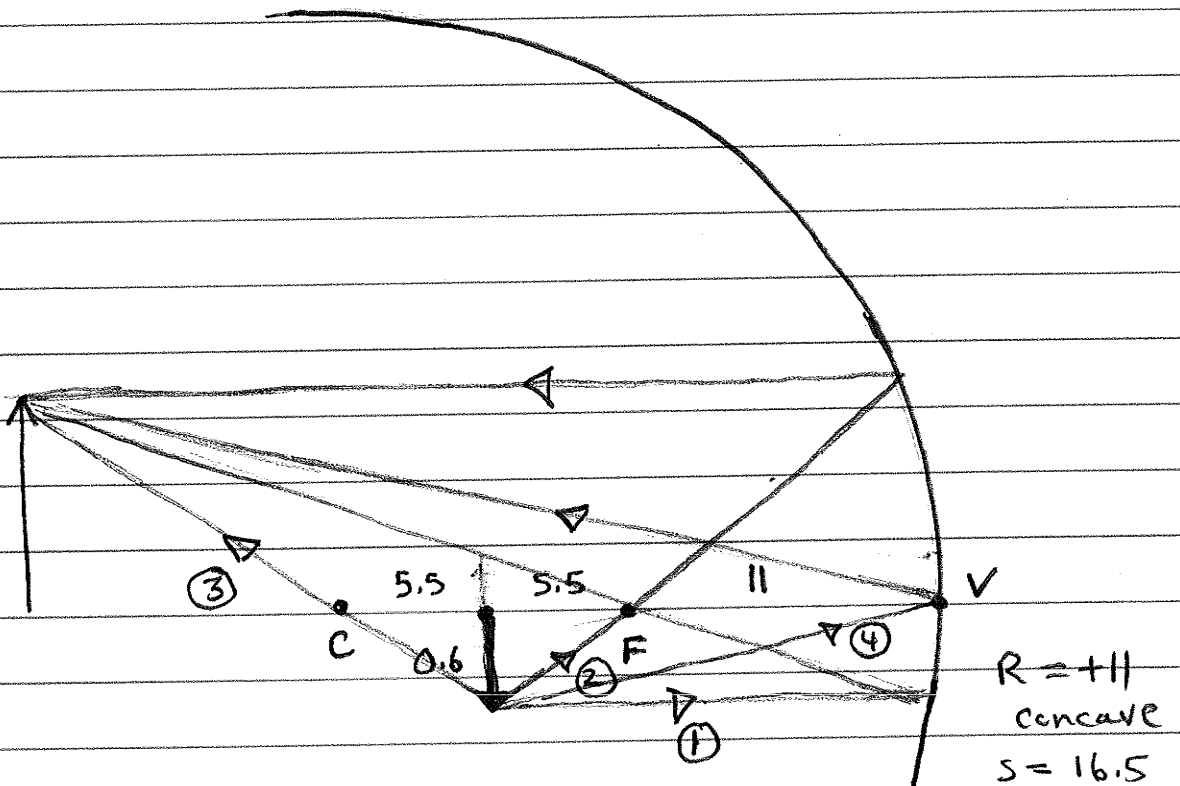
Similar construction for eraser

34.5

Principal Rays:

- (1) A ray parallel to axis, after reflection, passes through focal point F of concave mirror (or appears to come from virtual focal point of convex mirror)
- (2) A ray through (towards) focal point is reflected parallel to axis
- (3) A ray along radius through center of curvature C intersects normally and reflects back along original path
- (4) A ray to vertex V is reflected at equal angle (symmetric)

NB Focal point
 F is at $R/2$



$$\frac{1}{s'} + \frac{1}{s} = \frac{1}{f}$$

$$m = \frac{y'}{y} = -\frac{s'}{s}$$

$$\frac{1}{s} = \frac{1}{11} - \frac{1}{16.5} \quad s = 33.0 \text{ cm}$$

$$m = \frac{33}{16.5} = 2 \text{ inverted}$$

S.//

Lens Eqn

34-27

$$\frac{1}{s} + \frac{1}{s'} = \frac{1}{f} = (n-1) \left(\frac{1}{R_1} - \frac{1}{R_2} \right)$$

Lens maker's Eqn

$$R_1 = 4$$

$$R_2 = 7$$

$$n = 1.52$$

$$s = 24.0 \text{ cm}$$

converging $\Rightarrow f > 0$

$$\frac{1}{f} = (0.52) \left(\frac{1}{4} - \frac{1}{7} \right)$$

$$f = 17.95 \text{ cm}$$

$$\frac{1}{24} + \frac{1}{s'} = \frac{1}{17.95}$$

$$s' = 71.3 \text{ cm}$$

$$m = \frac{s'}{s} = \frac{71.3}{24} = 2.97$$

inverted

34-29

$$s' = 12 \text{ cm}$$

$$y = 8 \text{ mm}$$

$$y' = 3.4 \text{ cm} = 34 \text{ mm}$$

erect

image distance < 0
since object
inside focal
length

$$y'/y = -s'/s \quad \frac{34}{8} = -\frac{12}{s}$$

$$s = +2.82 \text{ cm}$$

$$\frac{1}{f} = \frac{1}{s} + \frac{1}{s'} = \frac{1}{12} + \frac{1}{2.82}$$

$$f = 3.69 \text{ cm}$$