College Prep Physics II – Video Lecture Notes – Chapter 14
Video Lecture #1 – Chapter 14.1 - Introduction to Light, Visible Light, Electromagnetic Waves and the Speed of Light
Thank You, Puja Patel, for these notes.

Light:

visable light = very small portion of the electromagnetic spectrum

– alternating electric fields & magnetic fields

Video Lecture #2 – Chapter 14.2 - Introduction to Reflection of Light - Specular and Diffuse

$$v = f\lambda$$

Speed of light/electromagnetic waves

$$c = 3.00 \times 10^8 \ \tfrac{m}{s}$$ in a vacumn &/or in air
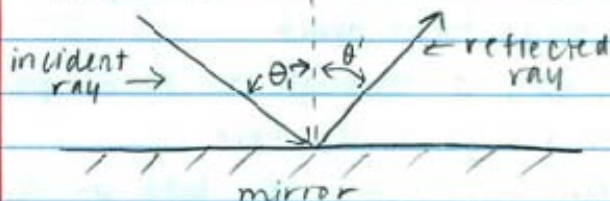
Video Lecture #3 – Chapter 14.1 - A tour of the Electromagnetic Spectrum (no lecture notes)

Video Lecture #4 – Chapter 14.2 - Specular Reflection off a Plane Mirror - Incident and Reflected Rays

reflection of light: 90% – 95% of light reflected

– diffuse: many different directions, rough surface

– specular: in one direction, smooth surface

incident ray →   reflected ray

θ_i = with the normal to the mirror (perpendicular to the surface)

θ' = the angle of the reflected ray.

mirror

$$\theta_i = \theta' \quad \text{always!!}$$

Video Lecture #5 – Chapter 14.3 - The Basics of Reflection off a Concave Spherical Mirror

Concave Spherical mirror

the focal length

radius of curvature

$$f = \frac{R}{2}$$

*concave = in the cave
*convex = not in cave

P = object distance

q = image distance

if $q > 0$, the image is infront of the mirror & is real

if $q < 0$, the image is behind the mirror, & it is virtual

real image = reflected rays intersect & can focus on a screen

virtual image = the reflected rays do not intersect & an image cannot be focused on a screen

$$\frac{1}{q} + \frac{1}{p} = \frac{1}{f}$$

Magnification : M

$$M = \frac{h'}{h} = -\frac{q}{p}$$

$h' = $ image height

$h = $ object height

$m > 0$ upright

$m < 0$ inverted

image characteristics

$\begin{cases} |m| > 1 & \text{enlarged} \\ |m| = 1 & \text{same size} \\ |m| < 1 & \text{reduced} \end{cases}$

Video Lecture #7 – Chapter 14.3 - (Part a) Example - Learning how to Draw a Ray Diagram of a Concave Spherical Mirror - Diagram Only

ex) $f = 2.5$ cm   concave mirror

h = 1.5 cm $q = ??$

P = 6.5 cm   3 image characteristics

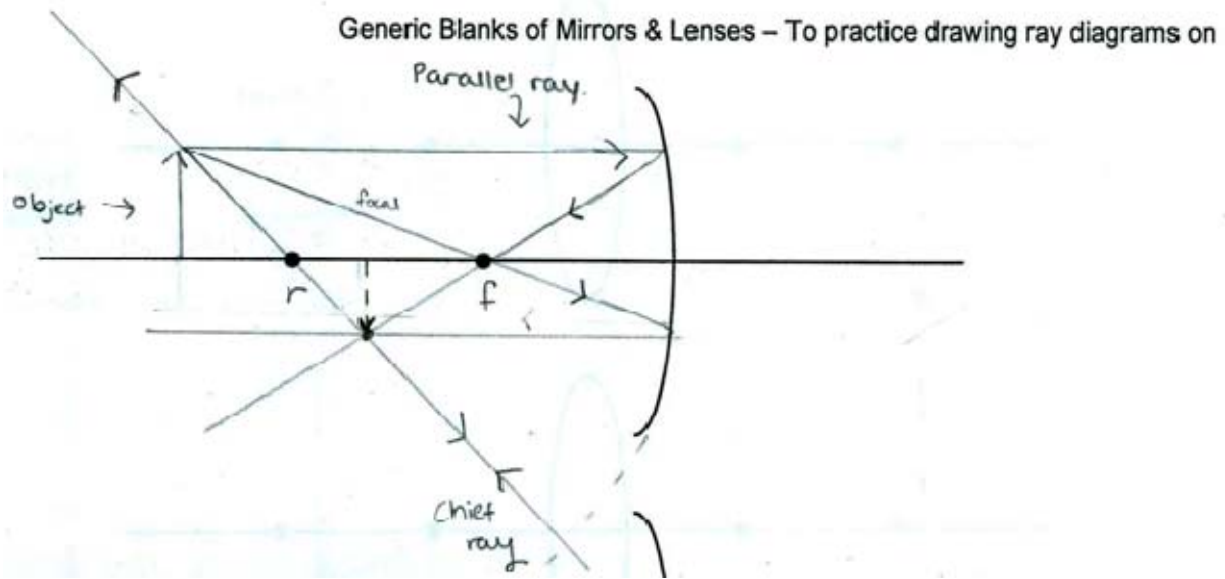Parallel Ray = incident ray is ‖ to principle axis reflected ray is through focal point

Focal Ray = incident ray is through the focal point reflected ray is ‖ to the principle axis

Chief ray = the incident & reflected ray both go through the center of curvature (undeflected Ray)

* image = real, all rays intersect   *

*   inverted, reduced   *

*   *

Generic Blanks of Mirrors & Lenses – To practice drawing ray diagrams on

Parallel ray.

object →

focal

r   f

Chief ray

Video Lecture #8 – Chapter 14.3 - (Part b) Example - Learning how to Draw a Ray Diagram of a Concave Spherical Mirror - Using Math

$$\frac{1}{p} + \frac{1}{q} = \frac{1}{f}$$

$$\frac{1}{q} = \frac{1}{f} - \frac{1}{p}$$

$$q = \left(\frac{1}{f} - \frac{1}{p}\right)^{-1}$$

$$q = \left(\frac{1}{2.5} - \frac{1}{6.5}\right)^{-1}$$

$$q = 4.0625 \text{ cm}$$

$$\boxed{q \approx 4.1 \text{ cm}}$$

$$q > 0 = \text{real}$$

$$m = -\frac{q}{p} = \frac{-(4.0625)}{6.5}$$

$$m = -0.625$$

$$\boxed{M \approx -0.62}$$

$$m < 0 = \text{inverted}$$

$$|m| < 1 = \text{reduced}$$

$$M = \frac{h'}{h} \qquad h' = M(h)$$

$$h' = (-0.625)(1.5)$$

$$h' = -0.9375$$

$$\boxed{h' \approx -0.94 \text{ cm}}$$

Video Lecture #9 – Chapter 14.3 - Identifying the Image Characteristics in a Concave Spherical Mirror via a Video (no lecture notes)

Video Lecture #10 – Chapter 14.3 - Identifying the Image Characteristics in a Convex Spherical Mirror via a Video
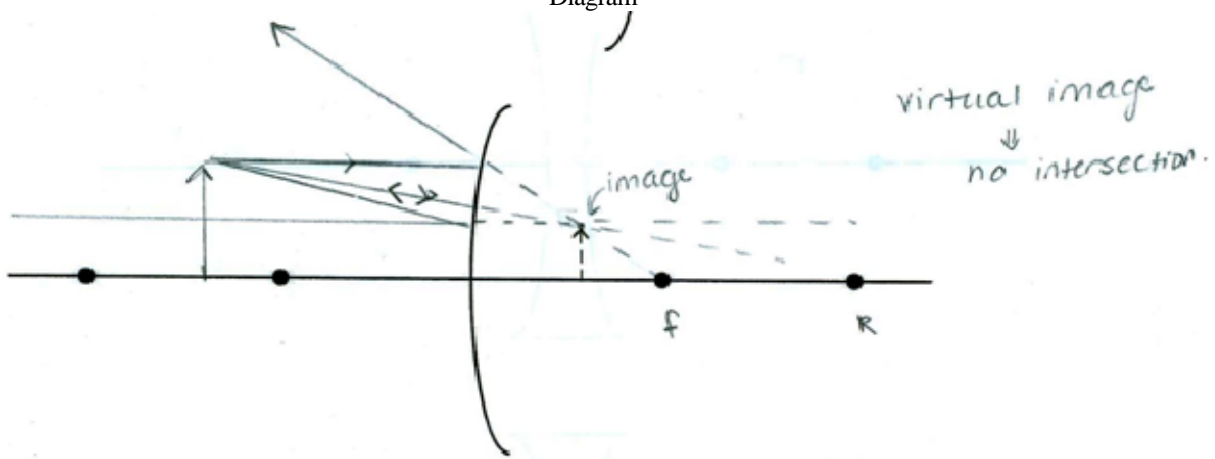
* real objects

convex mirror

upright
reduced > image characteristics
virtual   *ALWAYS!!

$$f < 0$$

Video Lecture #11 – Chapter 14.3 - (Part a) Example - Learning how to Draw a Ray Diagram of a Convex Spherical Mirror - Using Math

ex) $f = -2.5$ cm

$p = 3.5$ cm

$h = 1.5$ cm

$\frac{1}{p} + \frac{1}{q} = \frac{1}{f}$

$\frac{1}{q} = \left(\frac{1}{f} - \frac{1}{p}\right)$

$q = \left(\frac{1}{f} - \frac{1}{p}\right)^{-1}$

$q = \left(\frac{1}{-2.5} - \frac{1}{3.5}\right)^{-1}$

$q = -1.458$

$\boxed{q \approx -1.5 \text{ cm}}$

$q < 0 = $ virtual

$M = -\frac{q}{p}$

$M = -\frac{(-1.458)}{(3.5)}$

$M = 0.4166$

$\boxed{M \approx 0.42}$

$|M| < 1 = $ reduced

$M > 0 = $ upright

Video Lecture #12 – Chapter 14.3 - (Part b) Example - Learning how to Draw a Ray Diagram of a Convex Spherical Mirror - Ray Diagram

virtual image
⇓
no intersection.

image

f

R

Video Lecture #13 – Chapter 14.3 - Table of Friends – Mirrors (no lecture notes)

Video Lecture #14 – Chapter 14.3 - Review of the Basics of Mirrors, Image Characteristics and Ray Diagrams
Thank You, Stephanie Hong, for these notes.

| real | $q > 0$ |
| virtual | $q < 0$ |

enlarged	$	M	> 1$
same size	$	M	= 1$
reduced	$	M	< 1$

| upright | $M > 0$ |
| inverted | $M < 0$ |

Convex mirrors
  - virtual
  - upright   real   virtual
  - reduced   (object)
  - $f < 0$
                        mirror

	Incident ray	Reflected ray
Parallel ray	$\parallel$	thru focal pt.
Focal ray	thru focal pt.	$\parallel$
Chief ray	thru radius of curvature	thru radius of curvature

Video Lecture #15 – Chapter 14.3 - I Am A Mirror - A Song about the Physics of Mirrors - Performed Live in Class!

Lyrics, Chords, mp3 posted @ mrthomaspalmer.com