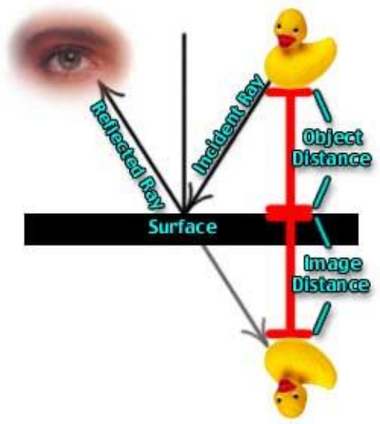
Name:_____ Div:_____ Date:_____

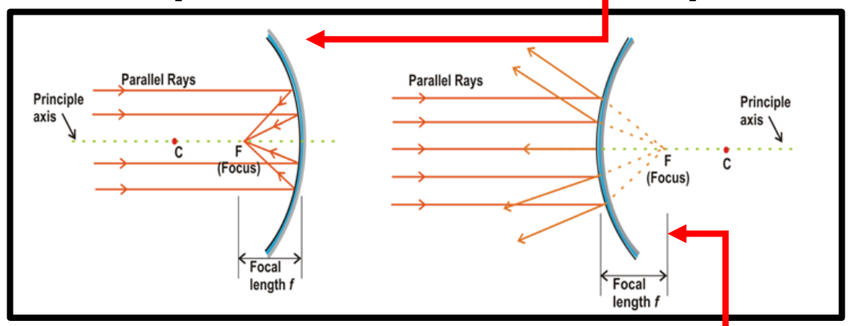
Refracting and Reflecting

Predicting behaviour of light and its rays:

Laws of Reflection:

1. The angle of incidence **equals** the angle of reflection
2. The incident ray, normal and reflected ray all lie in the **same** plane.





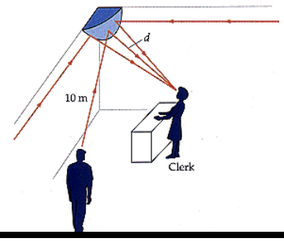
Principal axis: a line through the centre of the mirror that includes the principal focus.
Principal focus: the position where parallel light rags appear to reflect from
Focal length: the distance from the principal focus to the middle of the mirror

Mirrors:

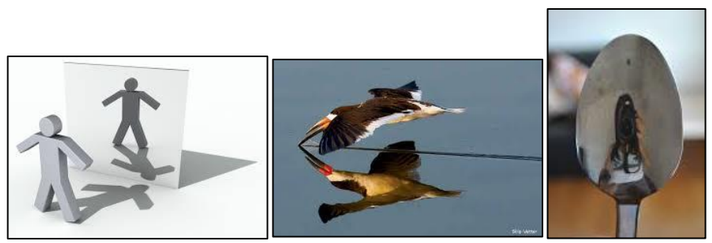
Concave mirrors: focuses parallel light rays

An upright, enlarged Image occurs in concave mirror when the person using it is **closer** to the mirror than the principal focus.
eg. telescope, dentists mirrors, make-up mirrors

Convex mirrors: spread the light rays out. Images are always **upright** and **smaller** than the object. Field of view is **increased**.
eg. surveillance mirrors in stores



Specular Reflection: - allows an **image** to be formed
- reflection of light off a smooth, shiny surface
ie. Mirrors, shiny metal, surface of still water

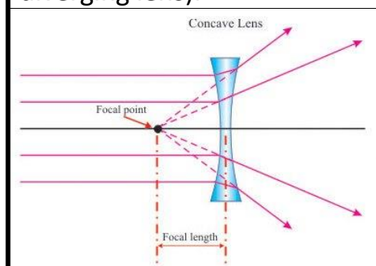


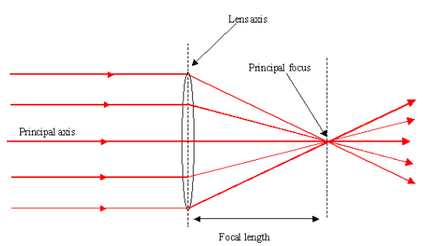
Diffuse Reflection: reflected light **scatters** in many directions
- reflection of light off irregular surfaces

Direct light and reflected light cant **strain** the eyes; therefore, in several places there is **diffusion of light by design**: stucco ceilings, lamps with frosted bulbs, lampshades. This **diffused** light is easier on the eyes.

Refraction and Lenses:
-light refracts when it travels from one material into another because it slows down. The change in speed causes you to change direction.

Concave Lens	Convex Lens
Curved **inward**, causing light rays to spread apart or diverge (aka diverging lens).	Bulges **outward**, causing light rays to come together, or converge (aka converging lens).





Describing Images:

Optical device: produces an **image** of an object Ie. Lens

Real image: can be placed on a **screen**

Virtual image: cannot be placed on a screen- can only be seen when looking at or through an optical device

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Check Your Understanding 11.2

1. In your own words, describe specular reflection and diffuse reflection.
2. Draw a diagram that shows a plane mirror and an incident ray with an angle of incidence of 37 degrees. Then, draw the reflected ray. Draw ray diagrams using angles of incidence of 77 degrees and 0 degrees, as well.
3. A. What is the largest possible angle of incidence for a light ray traveling toward a mirror?
   B. what is the smallest possible angle of incidence?
4. Give examples of how an interior designer might benefit from a knowledge of diffuse reflection. Choose an example of direct and an example of indirect light in your home. Briefly summarize their effectiveness.

Check your Understanding 11.3

1. Describe the characteristics of the image you see when your teacher uses an overhead projector.
2. The screen in a pinhole camera must be translucent rather than transparent or opaque. Why?

Check your Understanding 11.6

1. Briefly describe how the principal focus in a concave mirror is the same and how it is different from the principal focus in a convex mirror.
2. How do the characteristics of images in a convex mirror compare to those in a concave mirror?
   A. When the object is close to the mirror?
   B. When the object is far from the mirror?
3. For each situation, state whether the image produced is real or virtual. Explain how you know.
   a. A girl standing close to a cosmetic mirror.
   b. An astronomer is looking at an image of the moon through her telescope with a concave mirror.
   c. A clerk in a drugstore is looking at the image of a customer in a surveillance mirror.

Teacher notes:
11.1 activity

11.2 Intro to specular vs. diffuse reflection- metaphor of b-ball on pavement vs. grass in predictability

11.2 Demo: light shining on tinfoil- make predictions on each type p. 318

11.8 metaphor for refraction- bicycle on pavement vs. sand – change in speed causes change in direction

320 and 328 tables on back or separate sheet

Handouts: 2 on one double sided

light rays and concave lenses

light rays and convex lenses

reflection

refraction

11.6 con't

4. Rewrite the following false statements to make them true,

   a. The image of a convex mirror is always real and upright.
   b. When an object is inside the principal focus of a concave mirror, its image is inverted and real.
   c. real images are always located behind the mirror.

5. Curved mirrors can be used to gather light from the sun and focus it for solar heating. Draw a diagram that shows how this might work.

6. Do you think the focal length of a concave mirror would increase, decrease, or stay the same if the mirror were made flatter? Use a diagram to help illustrate your explanation.

Check your Understanding 10.8:

Omit 2