



# Hilla University Collage

## Department of Prosthetics Dental Technology



## Lecture Four

The Mirrors

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# Introduction

- We know that light is reflected from different objects when it falls on them, and that its reflection is regular when it falls on smooth surfaces, including mirrors.
- What are the types of mirrors? And what are the characteristics of each of them?
- Mirrors are classified according to the geometric shape of their reflective surface, and the images formed by the mirror differ according to the type of mirror. In this lecture, we will study plane and spherical mirrors.

# Plane mirror

A plane mirror is a smooth, flat surface from which light is reflected in a regular manner.

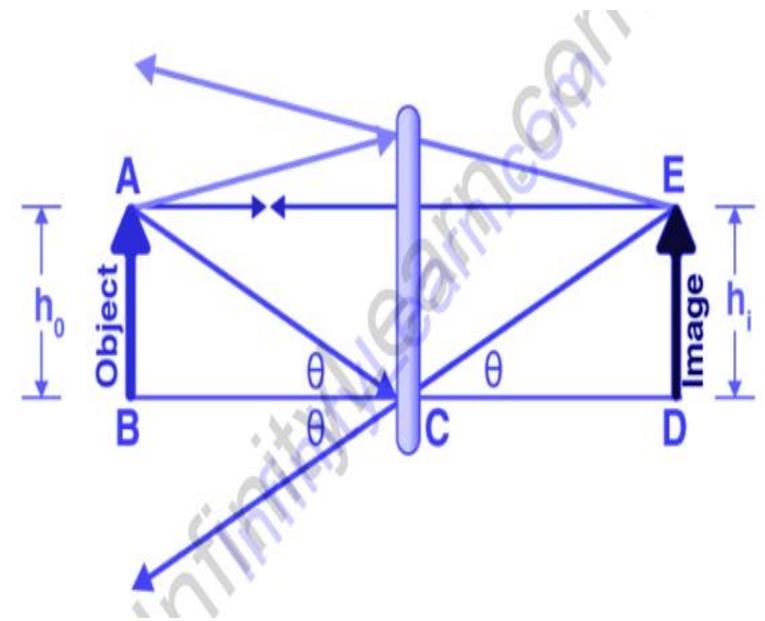
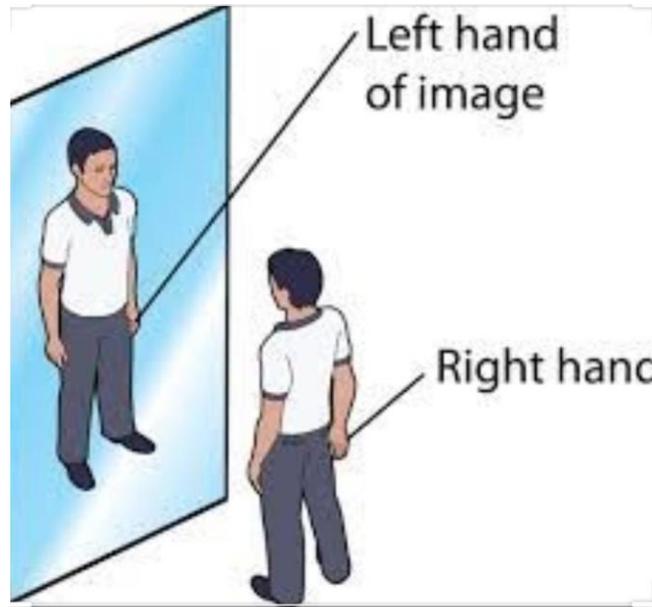
The surface of the mirror must be at a high degree of smoothness and its absorption of light is very little, this is available in minerals.

The plane mirror that is used in our daily life is made of a well-polished glass plate, one of its sides is coated with compounds of silver or aluminium, and it is considered the reflective surface.

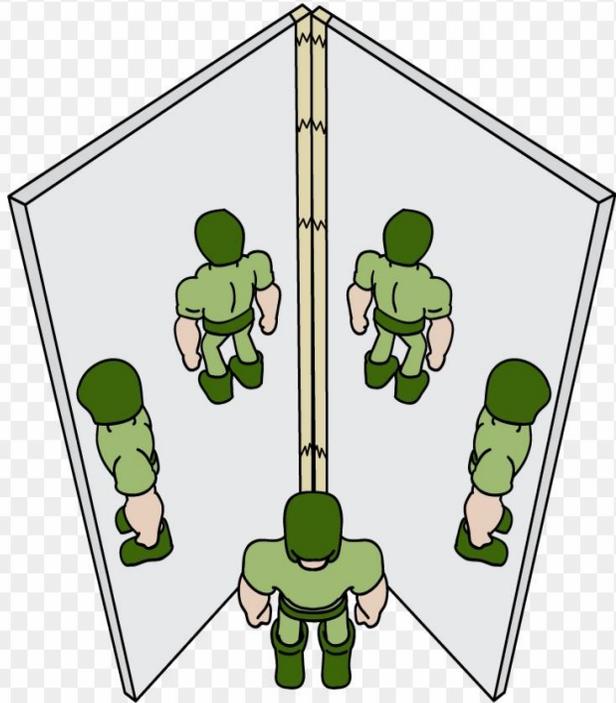
The quality of the mirror depends on the *type of glass, metal used* and *degree of polishing*

# Images formed by plane mirrors

1. The image is upright in terms of top and bottom and upsides.
2. The image and object are the same size.
3. The distance of the image from the mirror is equal to the distance of the object from the mirror.
4. The image is imaginary (estimated) and not real, i.e. it cannot be received on a screen (barrier).



## Multiple images in mirrors



Mathematical relationship to calculate the number of images in mirrors

$$n = \left( \frac{360^\circ}{\theta} \right) - 1$$

(n) the number of images. ( $\theta$ ) the angle between the two mirrors

Ex: An object is placed between two plane mirrors, the angle between them is ( $24^\circ$ ). What is the number of images formed for the

$$n = \left( \frac{360^\circ}{\theta} \right) - 1$$

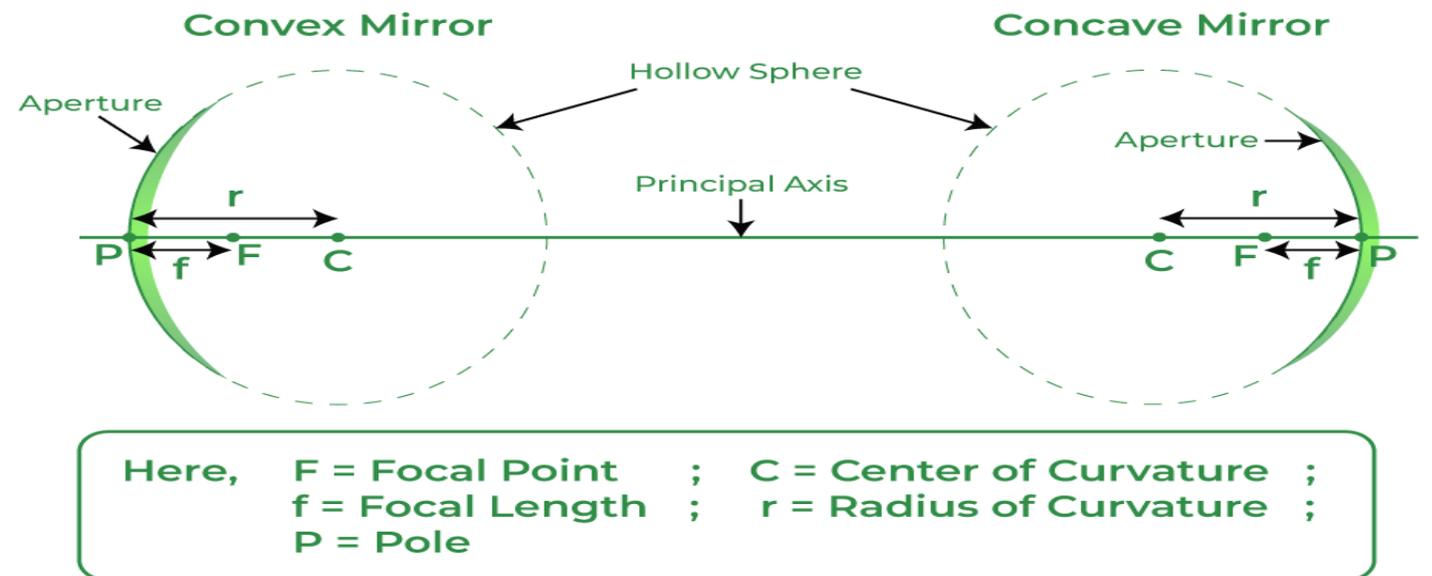
$$n = \left( \frac{360^\circ}{24^\circ} \right) - 1$$

$$n = 15 - 1$$

$$n = 14$$

# Spherical mirrors

Are mirrors whose reflecting surface is part of the surface of a hollow sphere. If the reflecting surface is the inner surface, it is called a concave mirror, and if the reflecting surface is the outer surface, it is called a convex mirror.



## Concepts related to spherical mirrors

- 1- The mirror's center of curvature (c): Is the center of the sphere from which the mirror's surface is cut.
- 2- The mirror pole (P): Is the point in the middle of the spherical mirror surface.
- 3- The principal axis of the mirror: It is the line connecting the center of the mirror's curvature and its pole.
- 4- The radius of the mirror's curvature (r): Which is the radius of the sphere from which the mirror's surface was cut.
- 5- The focus of the mirror (F): Is a point located on the principal axis of the mirror, resulting from the convergence of the rays reflected from the surface of the mirror (or its extensions).
- 6- The focal length (f): Is the distance between the pole of the mirror and its focus.

$$(f = \frac{1}{2} r).$$

## General equation for spherical mirrors

A mathematical equation that shows the relationship between the distance of the object and the distance of the image through which the characteristics of the formed image can be determined.

$$\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$$

( f ) is the focal length.

( u ) is the distance of the object on the pole.

( v ) is the distance of the image on the pole.

# Magnification

The ratio between the length of the image formed in spherical mirrors to the length of the object is called *magnification* and is denoted by  $M$ .

It is also equal to the ratio of the image's distance to the object's distance from the mirror.

$$M = \frac{h'}{h} = -\frac{v}{u}$$

(  $M$  ) magnification.

(  $h$  ) object length.

(  $h'$  ) image length.

## General rules

- The focal length ( $f$ ) is positive for a concave mirror and negative for a convex mirror.
- The magnification signal is negative when the image is real and upside down with relation to the object.
- The magnification signal is positive when the image is imaginary and upright in relation to the object.
- If the magnification is  $M > 1$ , the image is magnified relative to the object.
- If the magnification is  $M < 1$ , the image is reduced in relation to the object.
- If the magnification is  $M = 1$ , the image is equal to the object.

# Questions

- Concave mirror with focal length (20 cm) Find the position of the formed image, its characteristics, and the amount of magnification of an object placed at a distance (30 cm) in front of the mirror.
- A convex mirror has a radius of curvature of (8cm) and an object is placed in front of it at a distance of (6cm) from its pole. Find the position of the formed image and the magnification
- Two plane mirrors, the angle between them is  $120^\circ$ , count the number of images formed in the two mirrors?



**THANK YOU FOR LISTENING**