UNIT 12: MIRRORS

1. INTRODUCTION

VOCABULARY: object, image, mirror, optic axis, real image, virtual image, upright, inverted.

If you place an object in front of a mirror you will see an image. In order to learn how this image is you have to answer three questions:
- Is the image real or virtual?
- Is the image upright or inverted?
- Is the image smaller, the same size or bigger than the object?

RAY-DIAGRAMS

In order to obtain an object's image we have to draw at least two incident rays. Each incident ray has its reflected ray (remember that angle of incidence equals angle of reflection). The incident rays must emerge from the same point. The image is placed at the point where the reflected rays meet.

2. IMAGE GIVEN BY A PLANE MIRROR

When you look at a plane mirror you will see yourself, but how is your image? Your image is virtual, upright and the same-size image. Let's see.

In Figure-1 we can see a diagram with three incident rays and their reflected rays. The reflected rays don't meet at a point because they diverge. We have to extend the reflected rays (dashed lines) to obtain a meeting point. Then a virtual image is formed. Virtual images are formed behind the mirror.

As we can see in Figures 1 & 2 the object's image in a plane mirror is a same-size, virtual and upright image.
3. SPHERICAL MIRRORS

There are two types of spherical mirrors: concave mirrors and convex mirrors. Every spherical mirror has two important points:

- **Centre of curvature** (C) is the centre of the sphere. Any incident ray crossing C will be reflected without changing its direction.

- **Focus** F is the point placed at half the distance between the centre of curvature and the mirror.

Any incident ray parallel to the optic axis will be reflected crossing the focus:

Any incident ray crossing the focus will be reflected parallel to the optic axis:

Before studying concave and convex mirrors you should visit ‘Physics Animations Collection’ and check ‘A Spherical Concave Mirror’ and ‘A Spherical Convex Mirror’ and make a comparison.

4. IMAGE GIVEN BY A CONCAVE MIRROR.

We can see three types of images in a concave mirror:

- **1st case**: Object on the left side. Image is real, inverted and smaller than the object.
- **2nd case**: Object between C and F. Image is real, inverted and bigger than the object.
- **3rd case**: Object between F and the mirror. Image is virtual, upright and bigger than the object.

**1st CASE**: The object O is placed on the left.

After drawing the ray diagram we can see that the image is real, inverted and smaller than the object. It is a real image because it has been obtained by the actual reflected rays, not their prolongations.
ACTIVITY: An object placed between the centre and the focus (2nd case) has a real, inverted and bigger image. Demonstrate it with a diagram of rays.

3rd CASE: The object is placed between the focus and the mirror. In this case the image is **virtual, upright** and **bigger** than the object.

Concave mirrors are used to provide a magnified image of the face for applying make-up.

**5. IMAGE GIVEN BY A CONVEX MIRROR.**

Convex mirrors always give the same kind of image: **virtual, upright** and **smaller** than the object. Let's check it.

We draw a horizontal incident ray and its reflected ray. Its prolongation must cross the focus.

Then we draw the second ray in the C direction. The image is placed in the point where both prolongations meet.

Convex mirrors are used in streets, car parks and supermarkets to see around corners. They are used as car’s side mirrors. Can you guess why?