# Lens

**Exercise 33:**

**Solution 1(a):**

| Concave lens | Convex lens |
|---|---|
| A concave lens has both its surfaces curved inwards, i.e. they are bent inwards in the middle. | A convex lens has both its surfaces curved outwards, i.e., they bulge out in the middle. |
| A concave lens diverge the light rays falling on it and hence is also called a diverging lens. | A convex lens converge the light rays falling on it and hence it is also called a converging lens. |
| The point from which parallel rays of light appear to diverge after passing through a concave lens is called its focal point. | The point where parallel rays of light converge after passing through a convex lens is called its focal point. |

**Exercise 34:**

**Solution 1(a):**

When a light ray is incident on a prism, it bends towards the base of the prism. When the ray of light emerges, it further bends towards the base of the prism

**Solution 1(b):**

When ray PQ and ray AB pass through the prism they bend due to refraction.

**Exercise 38:**

**Solution 1(a):**

Large

**Solution 1(b):**

Lenses are typically made of transparent plastic or glass.

**Exercise 40:**

**Solution 1(a):**

| **Position of the object** | **(Observation of Image)** | | | |
|---|---|---|---|---|
| | **Position of image** | **Small/Large/ Point like object / Same size as compared to the object** | **Type of image**<br><br>**Real / Virtual** | **Image**<br><br>**Inverted / Vertical** |
| At infinte distance | On the focal point F | Point like object | Real | Inverted |
| At 2F | At 2F | Same size as compared to the object | Real | Inverted |
| Between F and 2F | Beyond 2F | Large | Real | Inverted |
| At the focal point F | At infinte distance | Highly enlarged | Real | Inverted |

**Exercise 41:**

**Solution 1(a):**

A convex lens forms a magnified image of close objects. Hence, it is used as a magnifying glass.Convex lenses are also used in making spectacles, cameras, telescopes, microscopes, binoculars, etc.

**Solution 1(b):**

A telescope is an optical instrument used to bring distant objects closer and magnify them so that they can be seen clearly as compared to when seen by the naked eye.

**Exercise 41:**

### Solution 1(a):

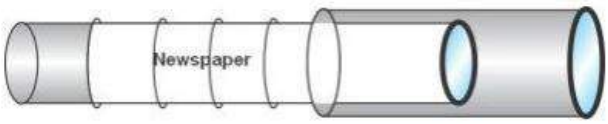
An episcope is an optical instrument which projects an enlarged image of an opaque object on a screen. It can be used to see an enlarged image of a printed page or any photographic print.

### Solution 1:

Lenses play an important role in our daily life.
The magnifying glass used to see very small objects is a type of lens.
The peep hole or the door viewers through which we look is also a type of lens.
Lenses are most commonly used to make spectacles which are used to correct eye defects.
They are also used for making telescopes, cameras, microscopes, film projectors, binoculars, episcopes, etc.

### Solution 2:

**Instrument:** Telescope
**Materials required:** Thick black paper, Two convex lenses, Adhesive, Newspaper.
**Procedure:** Take black paper and make a cylindrical tube of length 30 cm and diameter 25 mm. Fix the tube with the help of adhesive. Take a convex lens of the same size and fix it to one of its end.
Similarly make one more cylindrical tube of length 40 to 45 cm and diameter 18 mm. Fix a convex lens to one of its end.
Insert the cylindrical tube having the smaller diameter into the tube having the larger diameter with their lens facing the same side as shown in the given image.

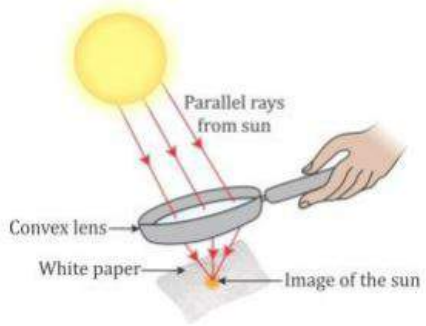



Wrap a newspaper around the inner cylindrical tube such that the two tubes can easily slide over each other.
The telescope is now ready to use.
Move the inner tube and to focus distant objects.

### Solution 3:

We know that the Sun is a source of light which is placed away from us. Thus, to obtain point like object of the Sun, we use the Sun as an object.

This can be done as follows: Take a convex lens. Hold the lens facing the Sun such that the Sun's rays falls on it. Hold a paper on the other side of the lens at some distance as shown in the figure. The paper acts as a screen.




Focus the light coming from the Sun on the paper by adjusting the distance between the convex lens and the paper till a bright and sharp spot of light is obtained on the paper. This bright spot obtained on the paper is the image of the Sun formed by the convex lens.

If the convex lens is held in the same position for a few minutes, the paper catches fire at the spot where the image of the Sun was formed. This is because the convex lens converge the parallel rays of light coming from the Sun at the bright spot where the image is formed on the paper. As the concentration of the Sun's rays increases, the paper gets heated and catches fires.

**Solution 4:**

The image formed by a concave lens is always virtual, erect and smaller than the object or diminished.
Concave lens are used in making spectacles to correct eye defects.
It is used in making optical instruments like the telescope. The peep hole or door viewers through which we look is also a type of a concave lens. It helps to see an image of the person standing outside the door.