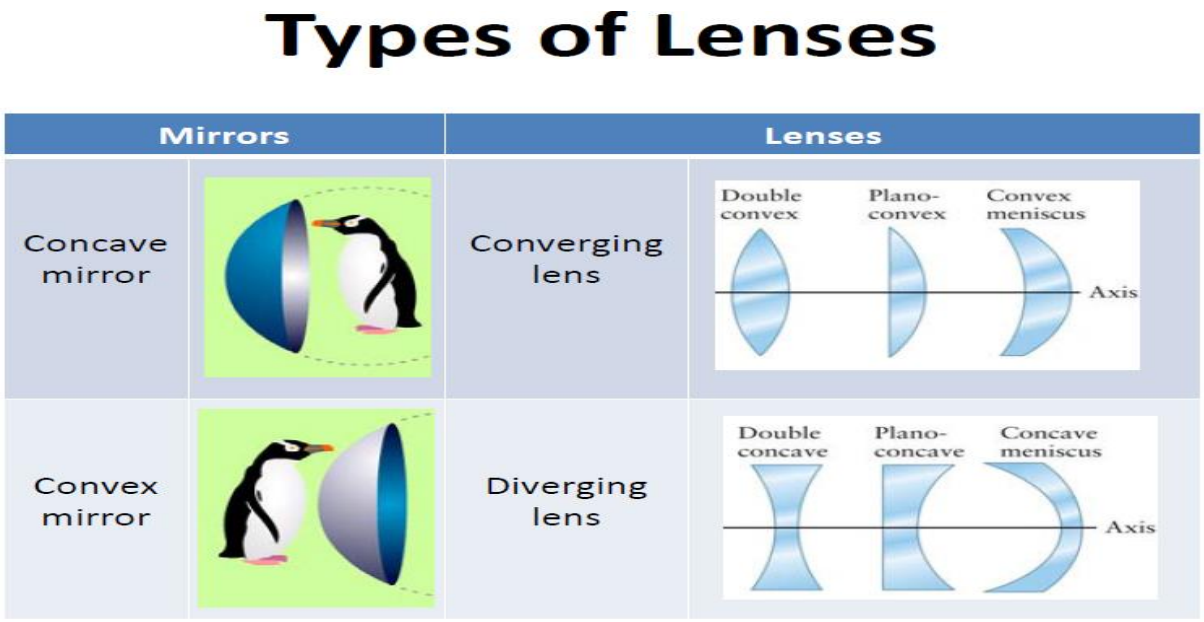
Experiment 6

Virtual experiment: Types of Lenses

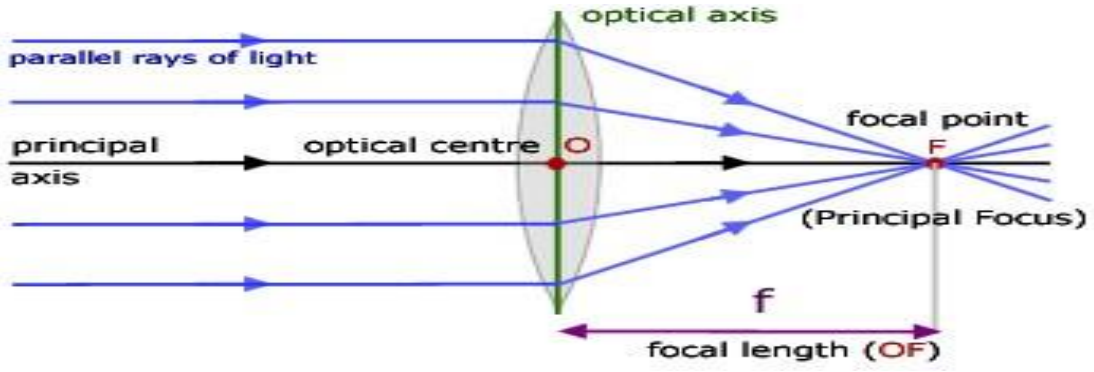
Aim

A virtual experience to learn about the types of mirrors and lenses and the conditions in which images are formed using PhET

Theory



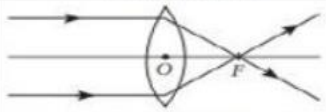
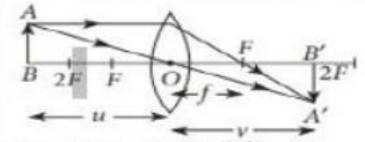
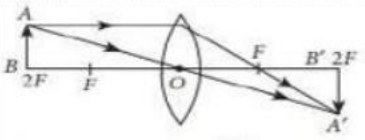
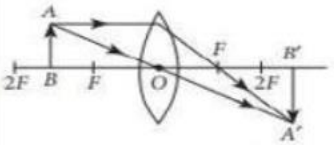
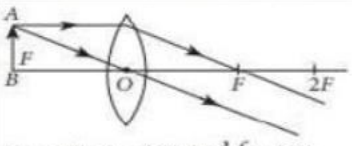
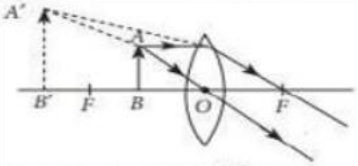
<u>Convex Lenses Basic ray diagram</u>

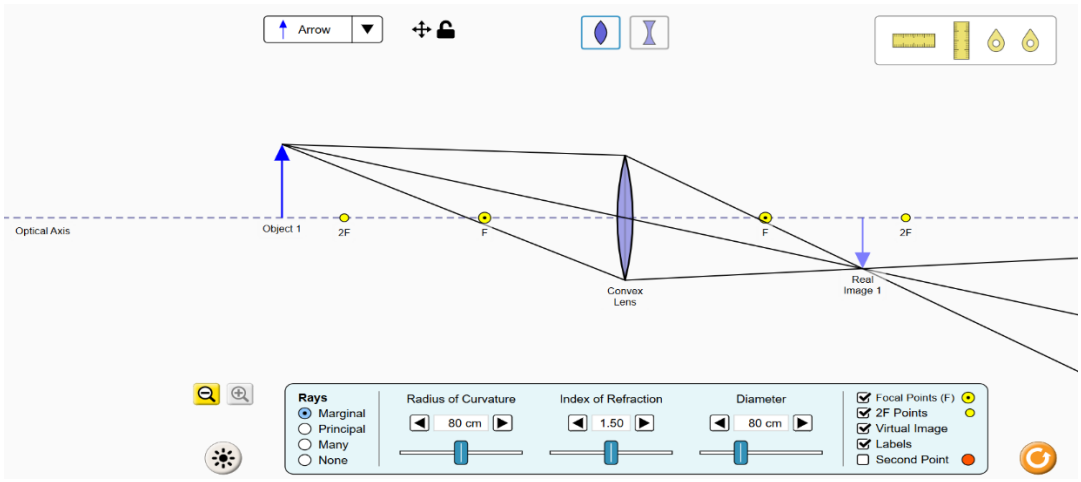


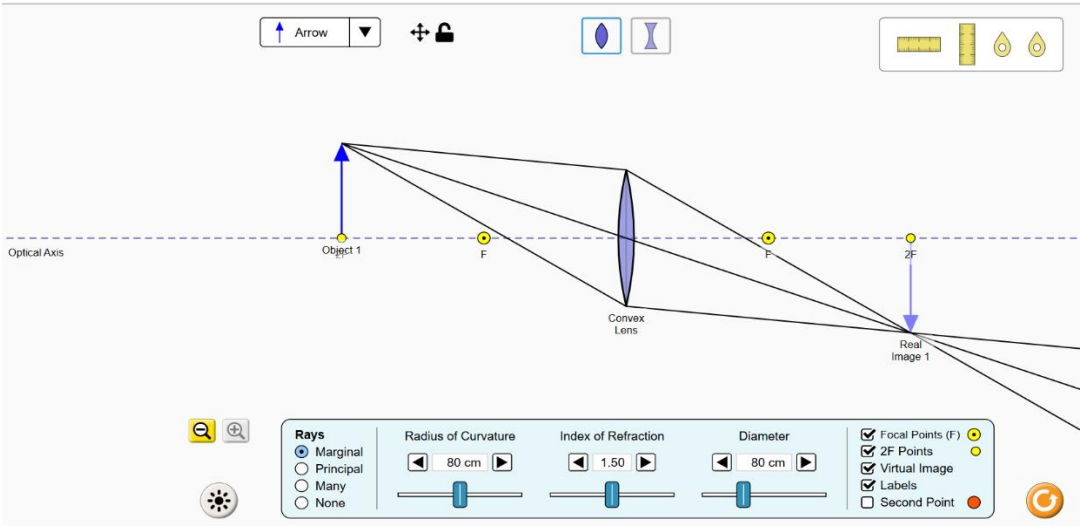
The basic ray diagram for a convex lens introduces a number of important terms

- principal axis - the line passing through the centers of curvature of the lens
- focal length - the horizontal distance between the principal focus and the optical center of the lens
- optical center - an imaginary point inside a lens through which a light ray is able to travel without being deviated
- center of curvature - the center of the sphere of which the lens surface is part**.**

► **Image formation by lenses :**

Convex lens				
	Ray diagram	**Position of object**	**Position of image**	**Nature of image**
(a)	 u = −ve, v = +ve and f = +ve	At infinity	At F	Real, inverted and highly diminished
(b)	 u = −ve, v = +ve and f = +ve	Between infinity and $2F$	Between F and $2F$	Real, inverted and diminished
(c)	 u = −ve, v = +ve and f = +ve	At $2F$	At $2F$	Real, inverted and same sized
(d)	 u = −ve, v = +ve and f = +ve	Between F and $2F$	Beyond $2F$	Real, inverted and enlarged
(e)	 u = −ve, v = +ve and f = +ve	At F	At infinity	Real, inverted and enlarged
(f)	 u = −ve, v = −ve and f = +ve	Between F and O	On the same side of the lens	Virtual, erect and enlarged


Arrow
Optical Axis
Object 1
2F
F
F
2F
Convex Lens
Real Image 1
Rays
Marginal
Principal
Many
None
Radius of Curvature
80 cm
Index of Refraction
1.50
Diameter
80 cm
Focal Points (F)
2F Points
Virtual Image
Labels
Second Point


Arrow
Optical Axis
Object 1
F
F
2F
Convex Lens
Real Image 1
Rays
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Virtual Image
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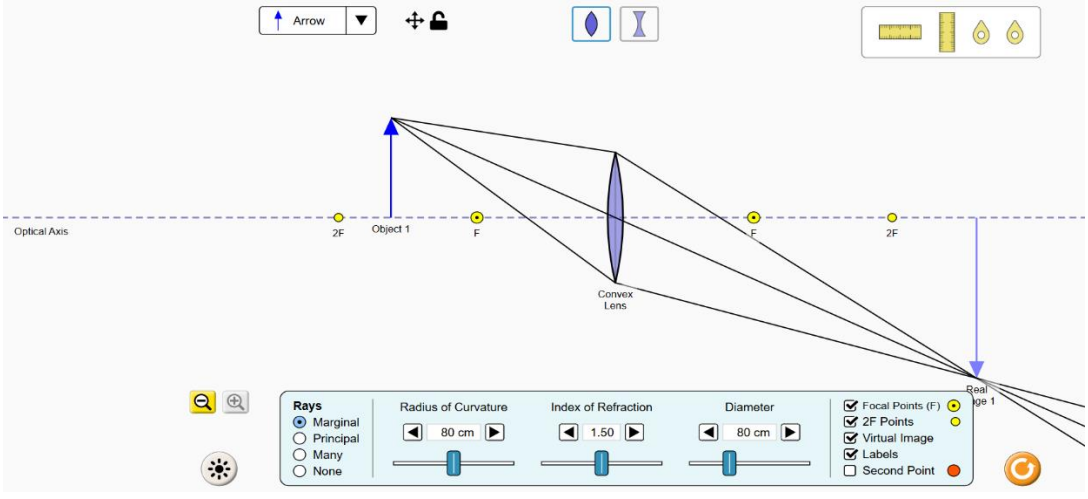
Second Point


Arrow
Optical Axis
2F
Object 1
F
F
2F
Convex Lens
Rays
Marginal
Principal
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Radius of Curvature
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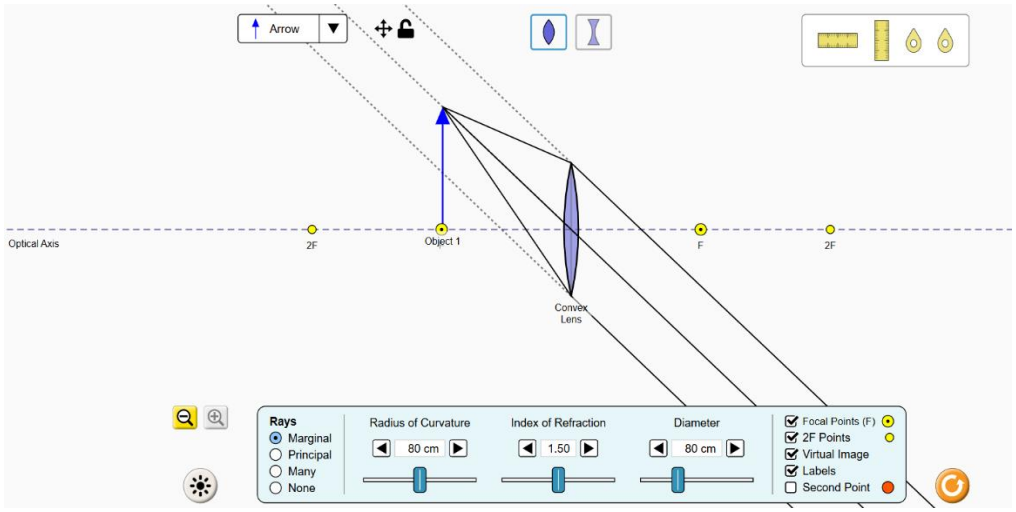
80 cm
Focal Points (F)
2F Points
Virtual Image
Labels
Second Point



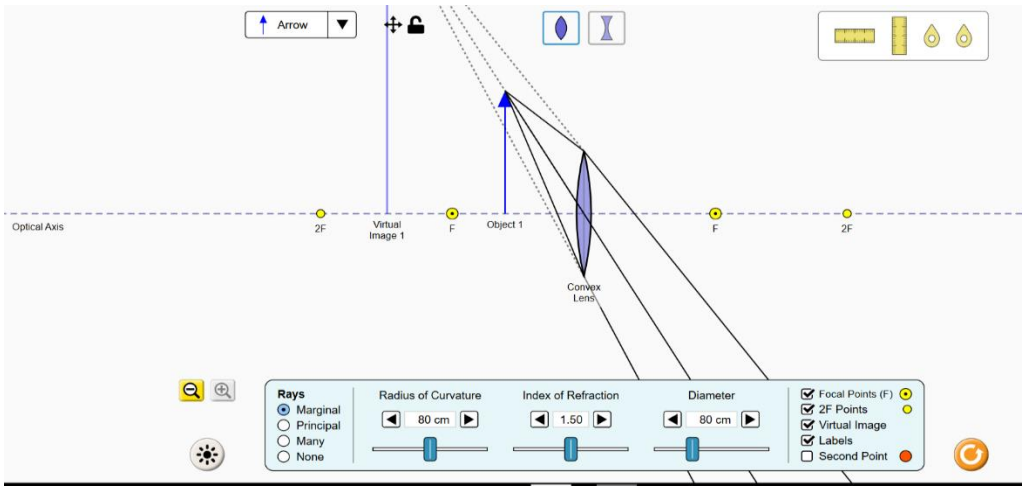
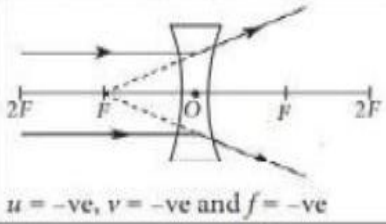
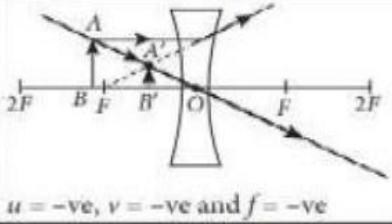
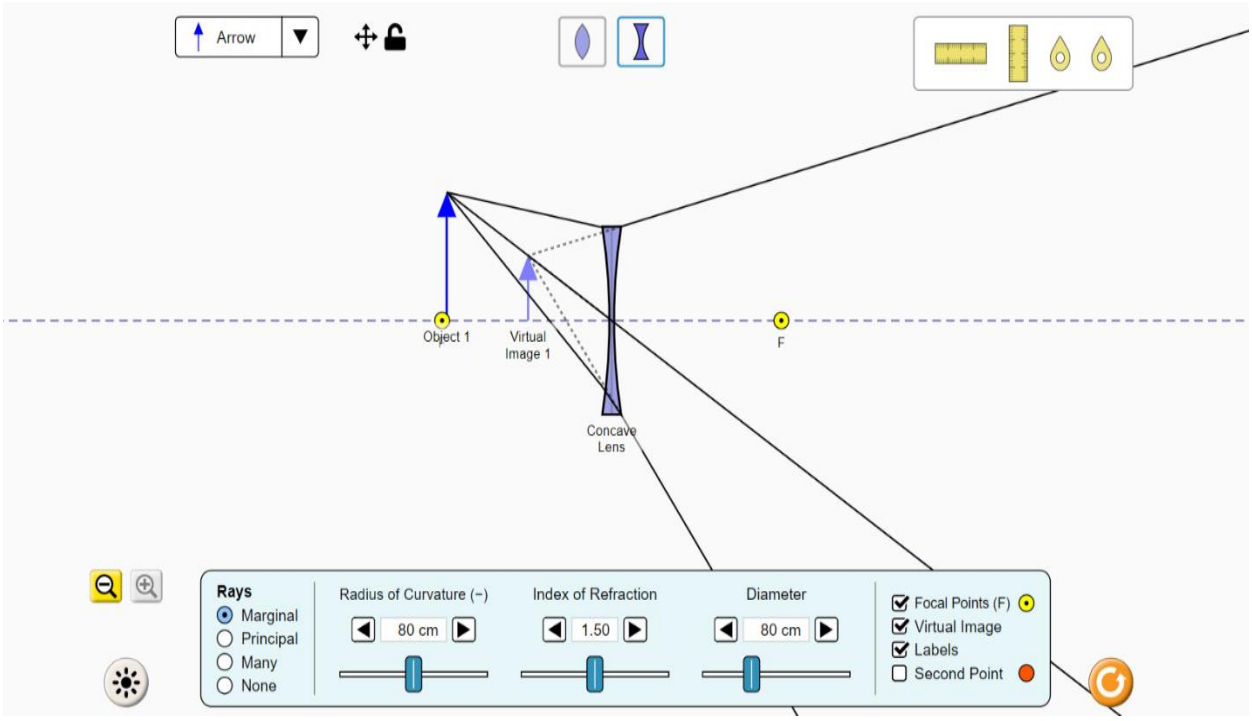
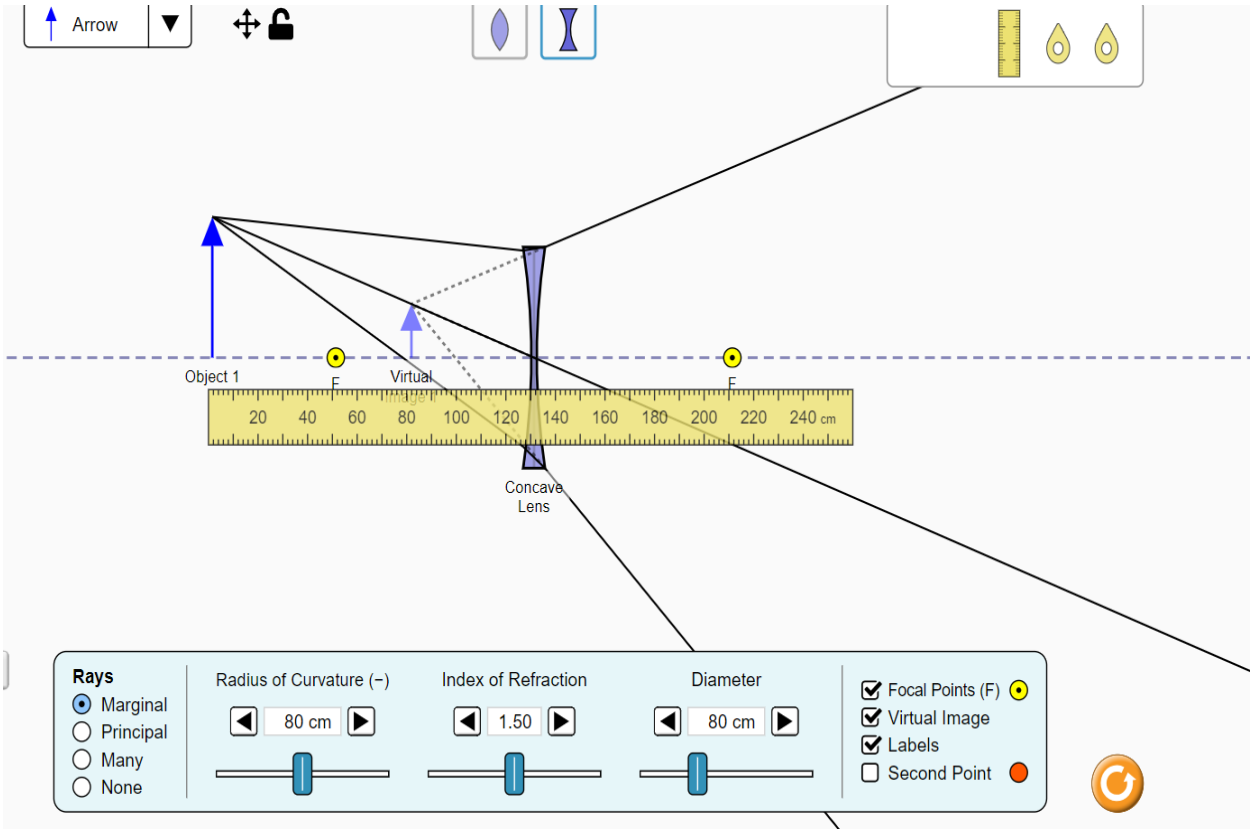


Image formation by a concave lens :

Concave lens				
	Ray diagram	**Position of object**	**Position of image**	**Nature of image**
(a)	 u = –ve, v = –ve and f = –ve	At infinity	At F	Virtual, erect and highly diminished
(b)	 u = –ve, v = –ve and f = –ve	Between infinity and O	Between F and O	Virtual, erect and diminished


Arrow
Object 1
Virtual Image 1
F
Concave Lens
Rays
Marginal
Principal
Many
None
Radius of Curvature (−)
80 cm
Index of Refraction
1.50
Diameter
80 cm
Focal Points (F)
Virtual Image
Labels
Second Point


Arrow
Object 1
F
Virtual Image
F
20 40 60 80 100 120 140 160 180 200 220 240 cm
Concave Lens
Rays
Marginal
Principal
Many
None
Radius of Curvature (−)
80 cm
Index of Refraction
1.50
Diameter
80 cm
Focal Points (F)
Virtual Image
Labels
Second Point