Curved mirrors (concave and convex)

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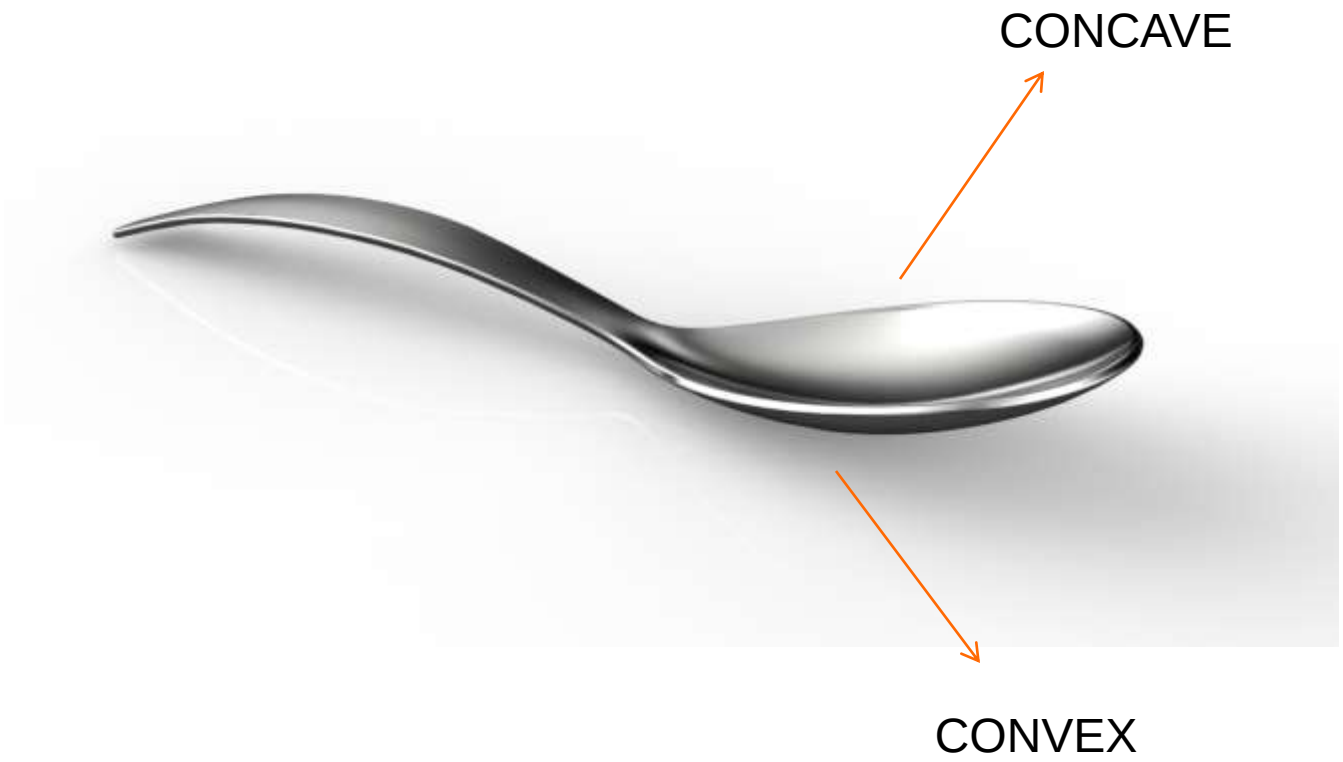
Grade 10-1 STE

Curved/Spherical mirror

- A **curved mirror** is a mirror with a curved reflecting surface. The surface may be either *convex* (bulging outward) or *concave* (bulging inward). Most curved mirrors have surfaces that are shaped like part of a sphere, but other shapes are sometimes used in optical devices.
- A curved mirror is a reflecting surface in which its surface is a section of sphere. There are two kind of a curved mirror, the concave and the convex mirrors.



- A spoon is a kind of a curved mirror with both concave and convex surfaces.

Concave "Converging" Mirror

- It is a curved mirror in which the reflective surface bulges away from the light source.

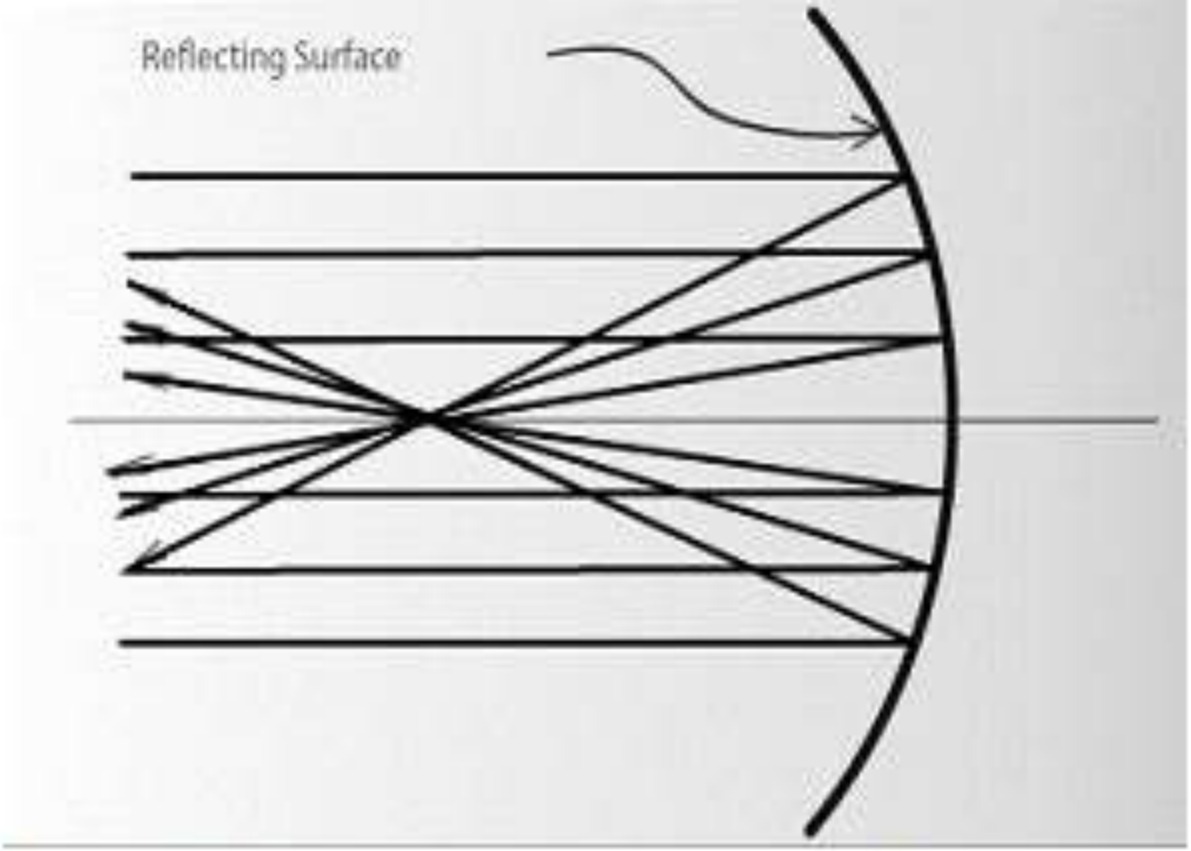
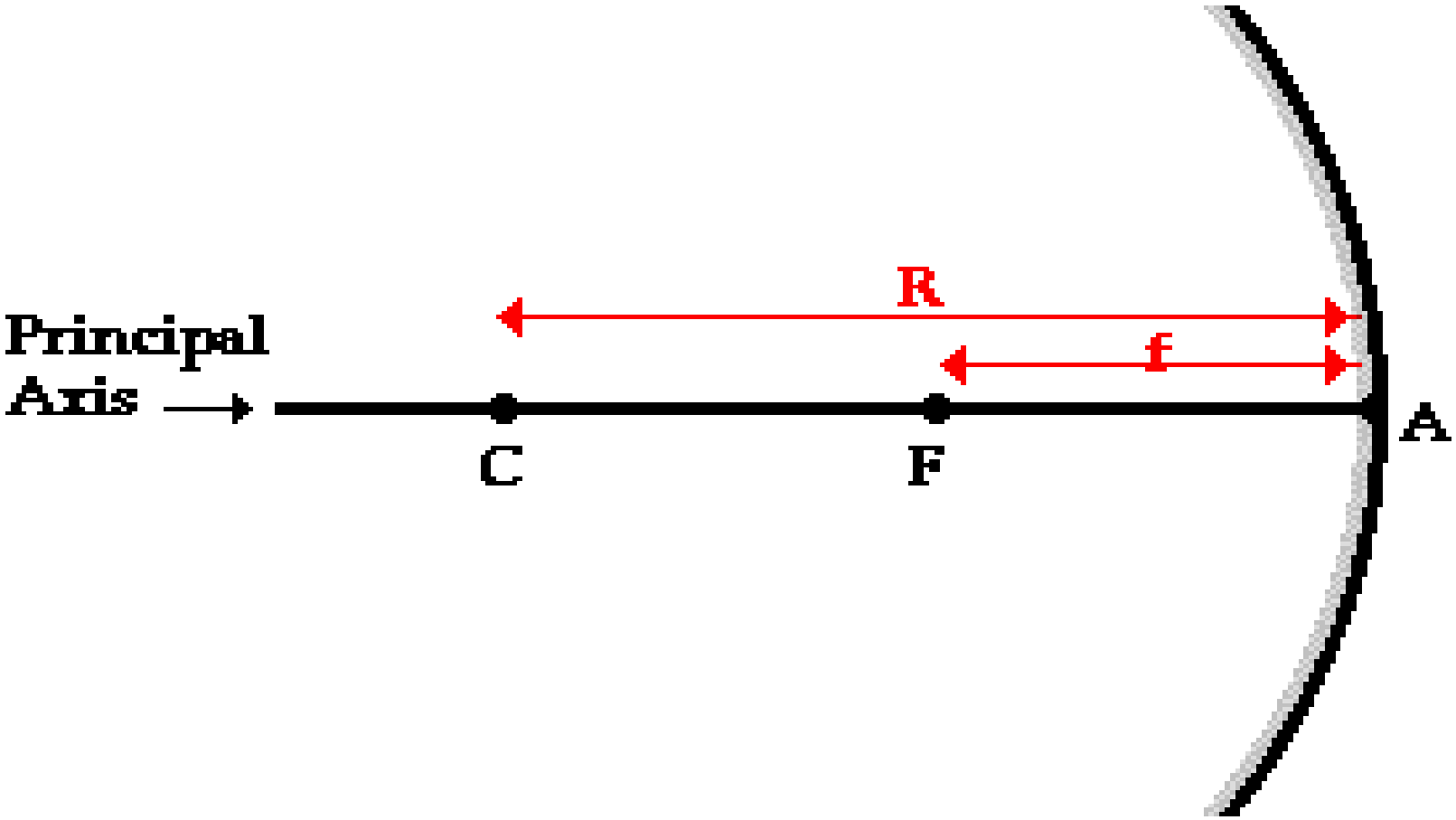


Figure 10. Parallel rays converge after reflection on a concave mirror

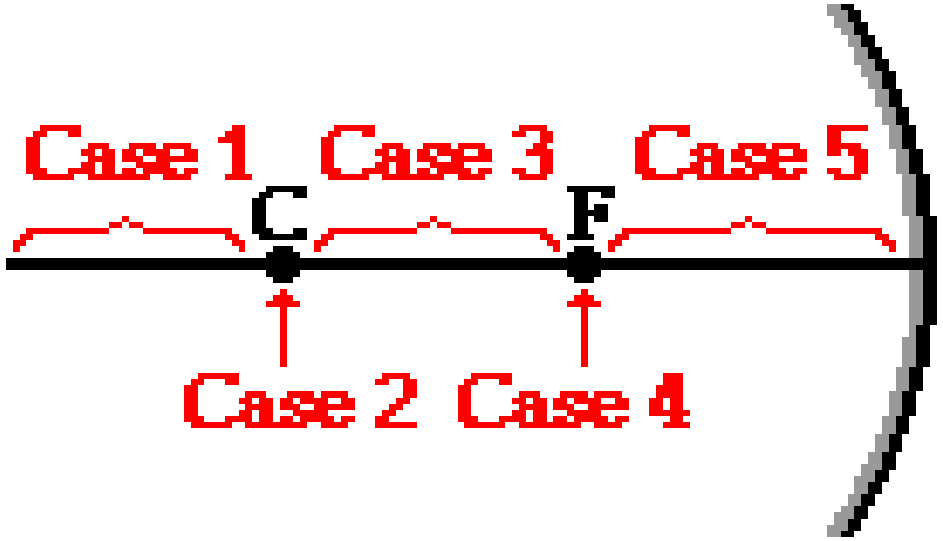


C=Center of Curvature
F=Focal Point/Focus
A=Vertex
R=Radius of Curvature
F=Focal Length

Definition Of Parts:

- **Center of Curvature-** the point in the center of the sphere from which the mirror was sliced.
- **Focal Point/Focus-** the point between the vertex and the center of curvature.
- **Vertex-** the point on the mirror's surface where the principal axis meets the mirror.
- **Principal Axis-** line passing through the center of the sphere and attaching to the mirror in the exact center of the mirror.
- **Radius of Curvature-** the distance from the vertex to the center of curvature.
- **Focal Length-** the distance from the mirror to the focal point.

Graphical Method/Ray Diagramming



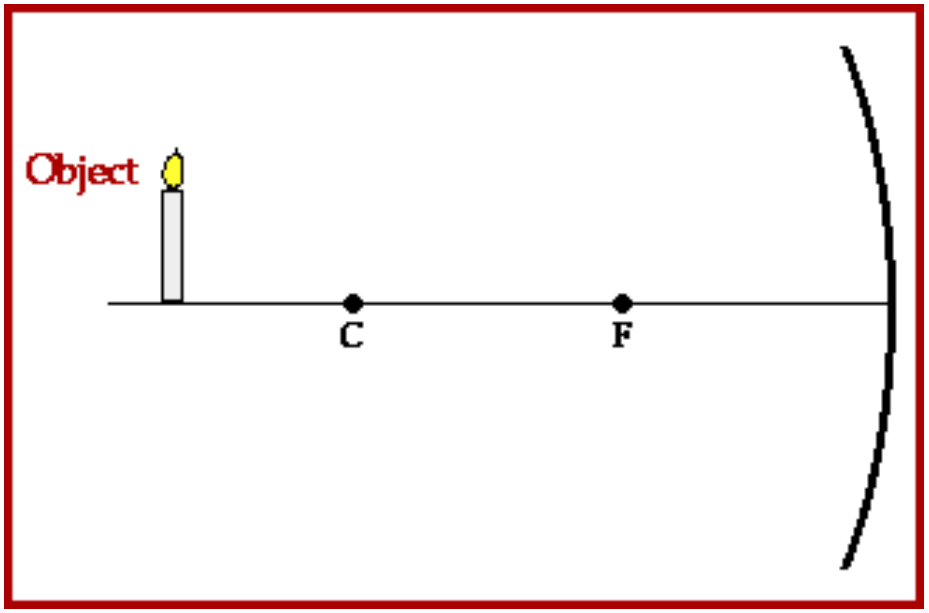
Case 1: Object beyond C
Case 2: Object at C
Case 3: Object between C and F
Case 4: Object at F
Case 5: Object between f and V

CASE 6: Infinitely far distance object

Graphical Method/Ray Diagramming

- Case 1: Object beyond C

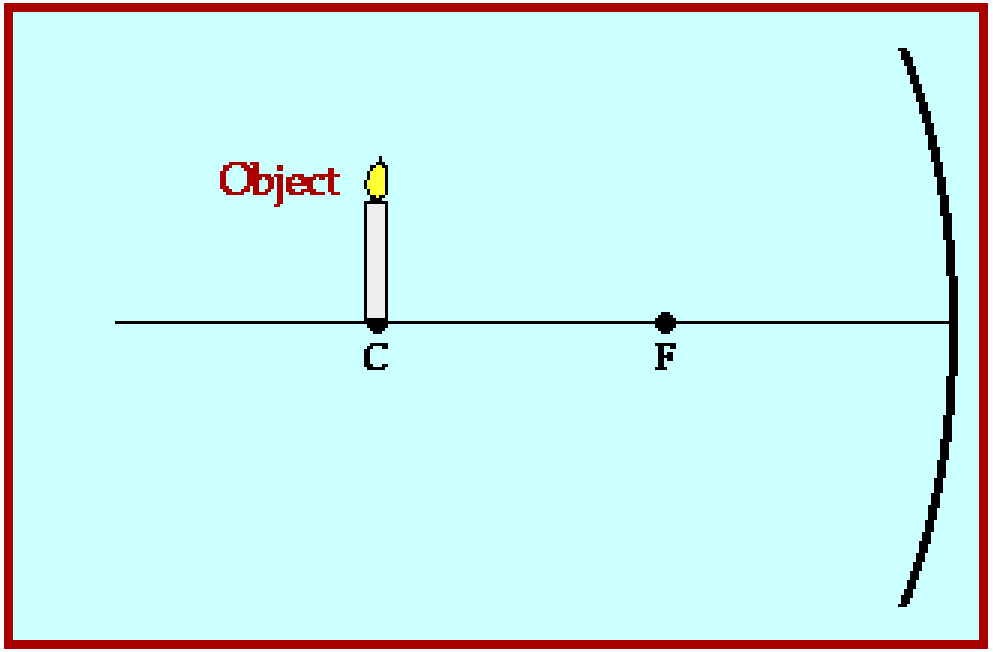
Remember the LOST!
L-Location (in front or behind)
O-Orientation (upright or inverted)
S-Size (smaller or bigger)
T-Type (real or virtual)



L- in front of the mirror
O- inverted
S- smaller
T- real

Graphical Method/Ray Diagramming

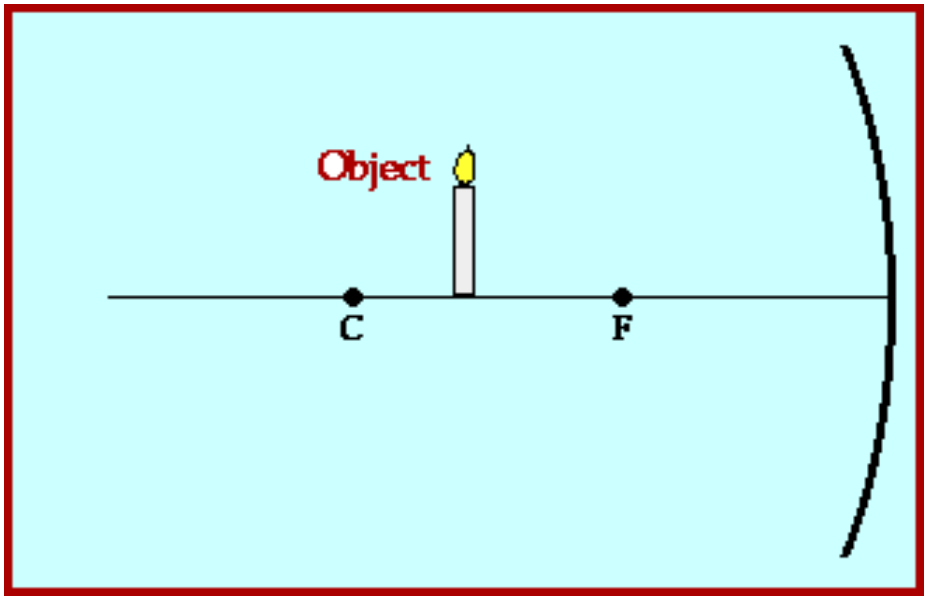
- Case 2: Object at C



L- in front of the mirror
O- inverted
S- same
T- real

Graphical Method/Ray Diagramming

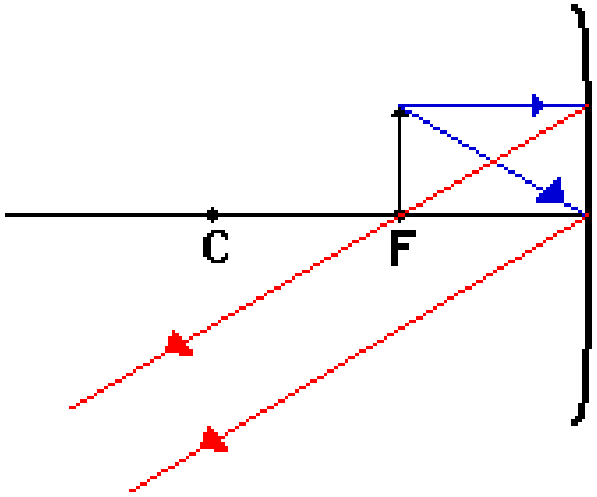
- Case 3: Object in between C and F



L- in front of the mirror
O- inverted
S- bigger
T- real

Graphical Method/Ray Diagramming

- Case 4: Object at F
- NO IMAGE FORMED!!!

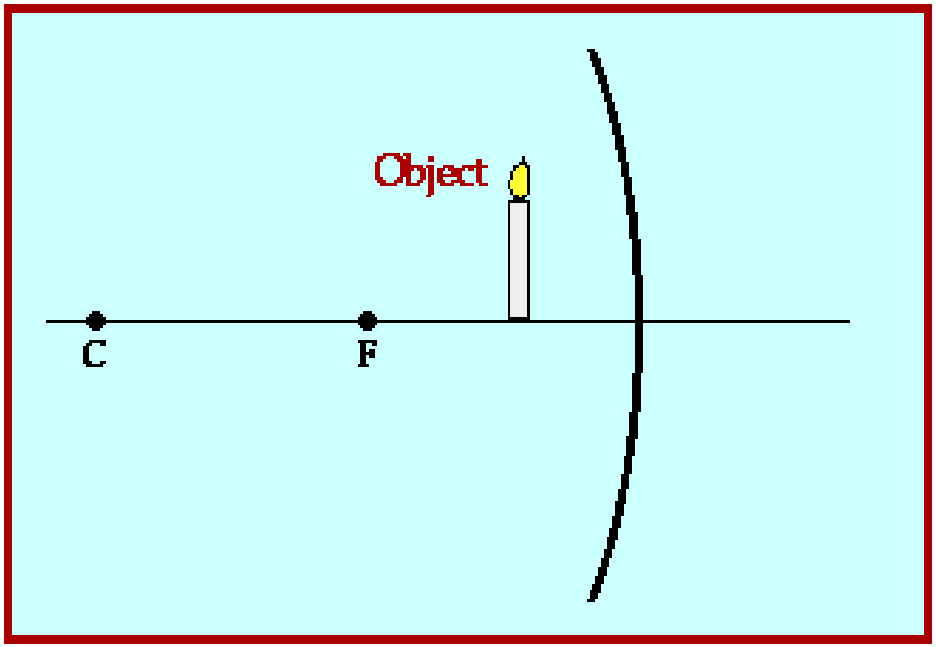


Ray Diagram for Object Located at F
(an image is not formed)

- For the case of the object located at the focal point (F), the light rays neither converge nor diverge after reflecting off the mirror. As shown in the diagram above, the reflected rays are traveling parallel to each other. Subsequently, the light rays will not converge on the object's side of the mirror to form a real image; nor can they be extended backwards on the opposite side of the mirror to intersect to form a virtual image.

Graphical Method/Ray Diagramming

- Case 5: Object in between F and V



L- behind the mirror
O- upright
S- bigger
T- virtual

Graphical Method/Ray Diagramming

- Case 6: Infinitely far distance object

L- at I

O- inverted

S- infinitely small

T- real image

(Concave image is distance dependent)

Convex "Diverging" Mirror

- It is a curved mirror in which the reflective surface bulges towards the light source.

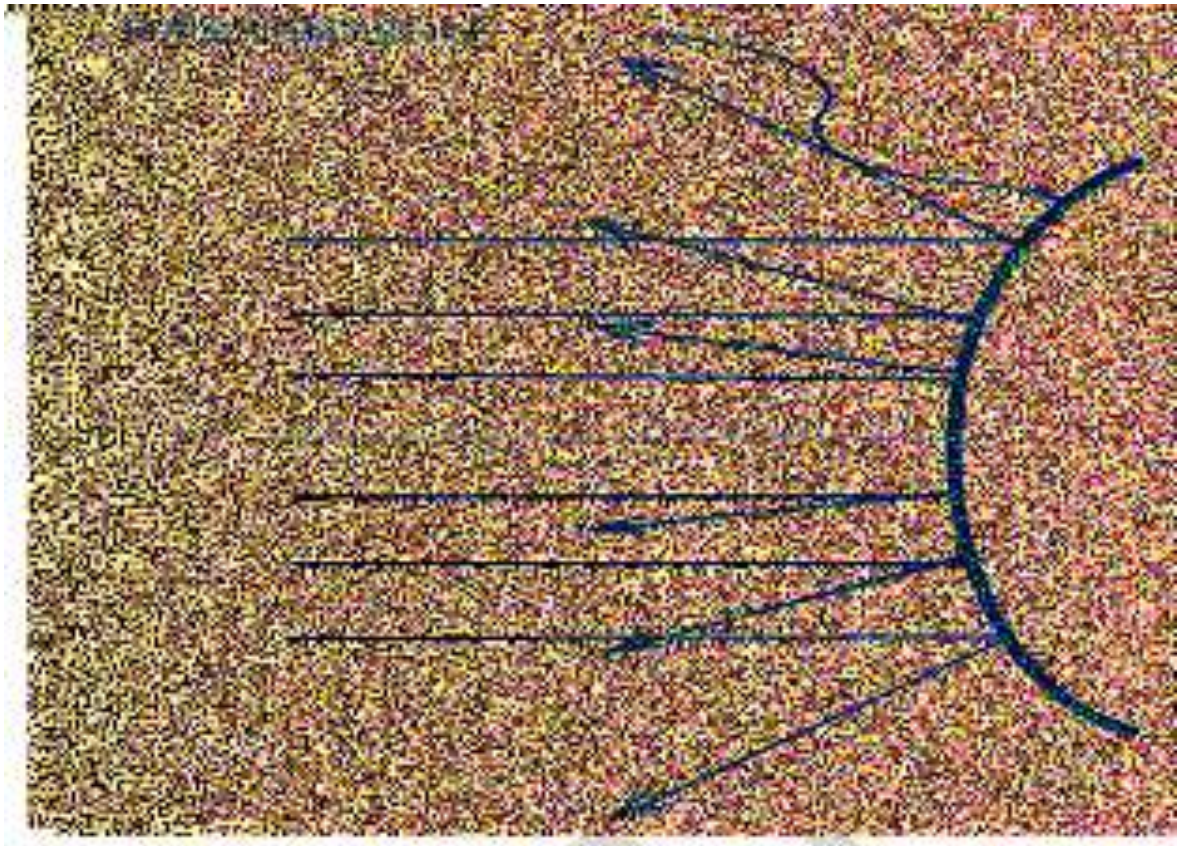
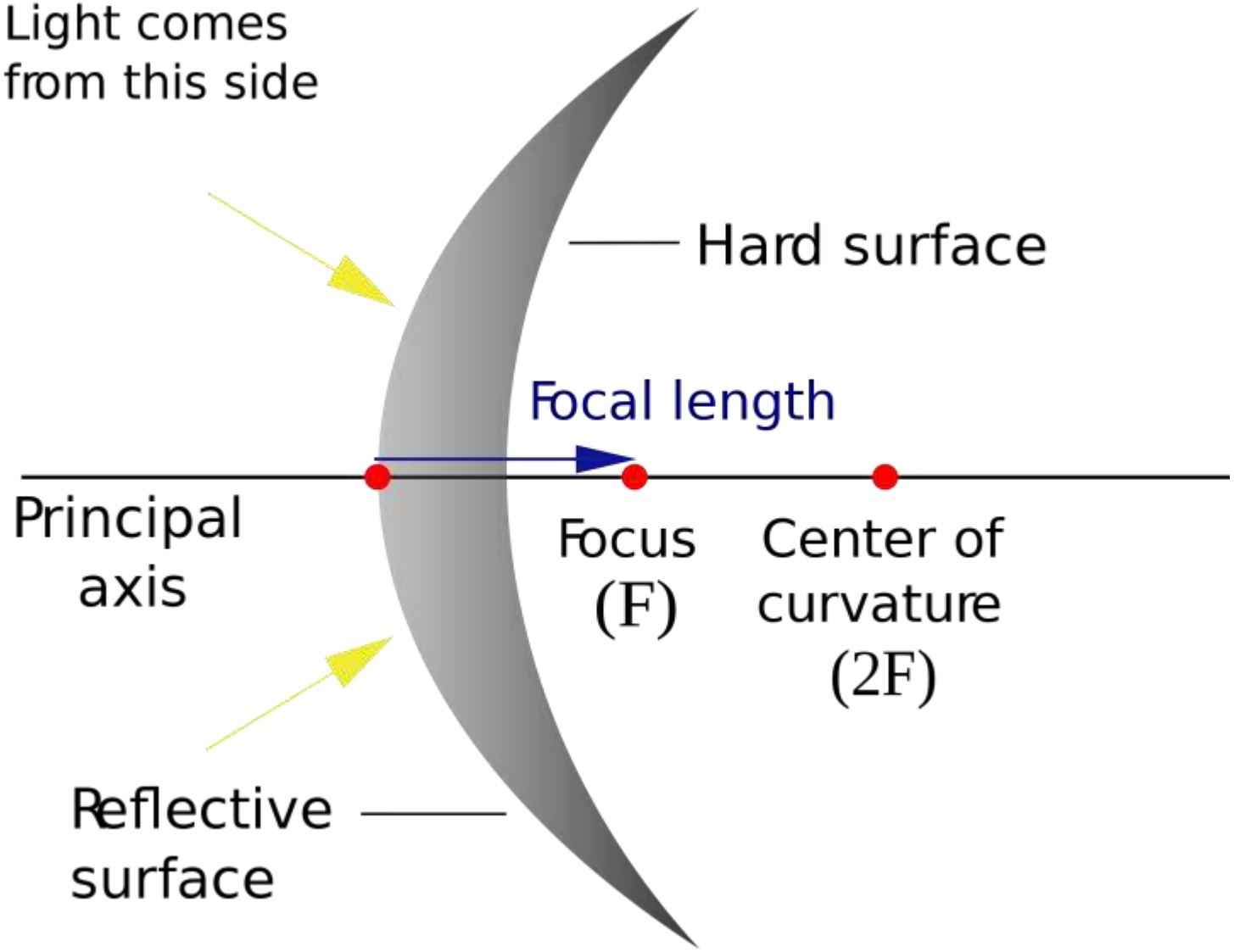


Figure 11. Parallel light rays diverge after reflection on a convex mirror

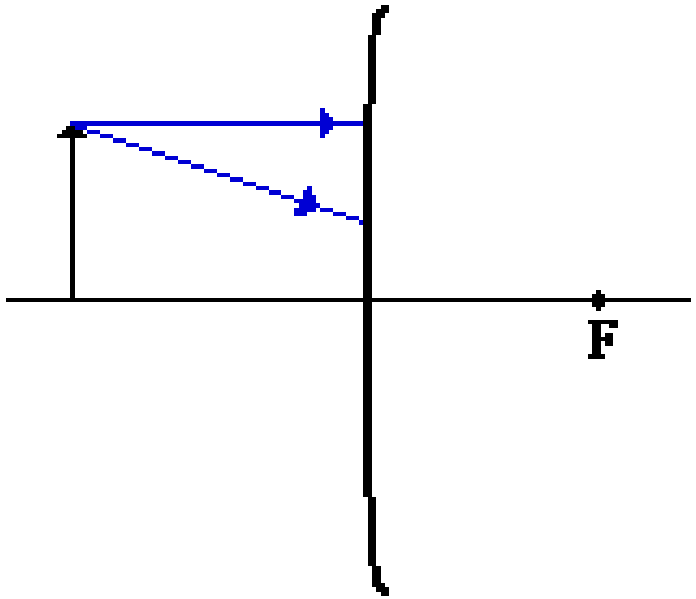

Light comes from this side
Hard surface
Focal length
Principal axis
Focus (F)
Center of curvature (2F)
Reflective surface

Definition Of Parts:

- **Center of Curvature-** the point in the center of the sphere from which the mirror was sliced.
- **Focal Point/Focus-** the point between the vertex and the center of curvature.
- **Principal Axis-** line passing through the center of the sphere and attaching to the mirror in the exact center of the mirror.
- **Focal Length-** the distance from the mirror to the focal point.

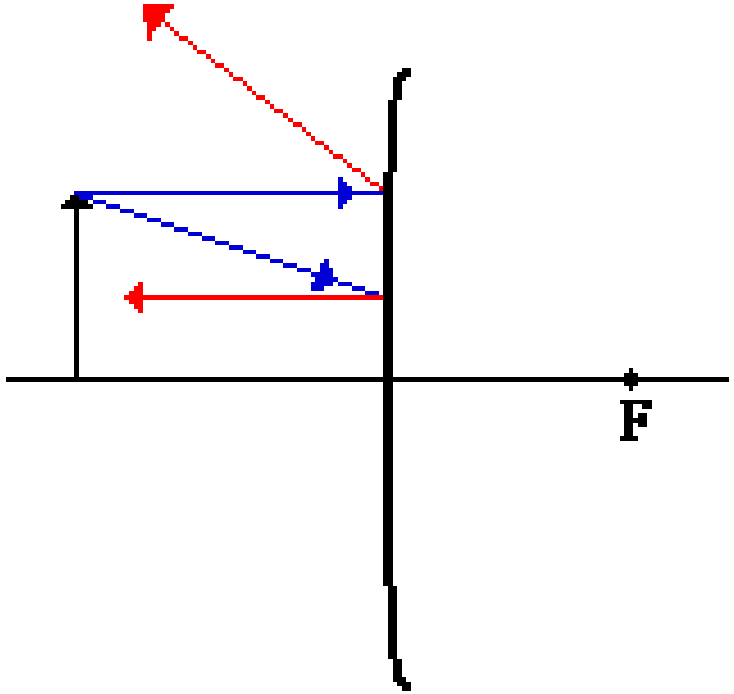
Step-by-Step Procedure for Drawing Ray Diagrams

- The method of drawing ray diagrams for convex mirrors is described below.
- 1. Pick a point on the top of the object and draw two incident rays traveling towards the mirror.



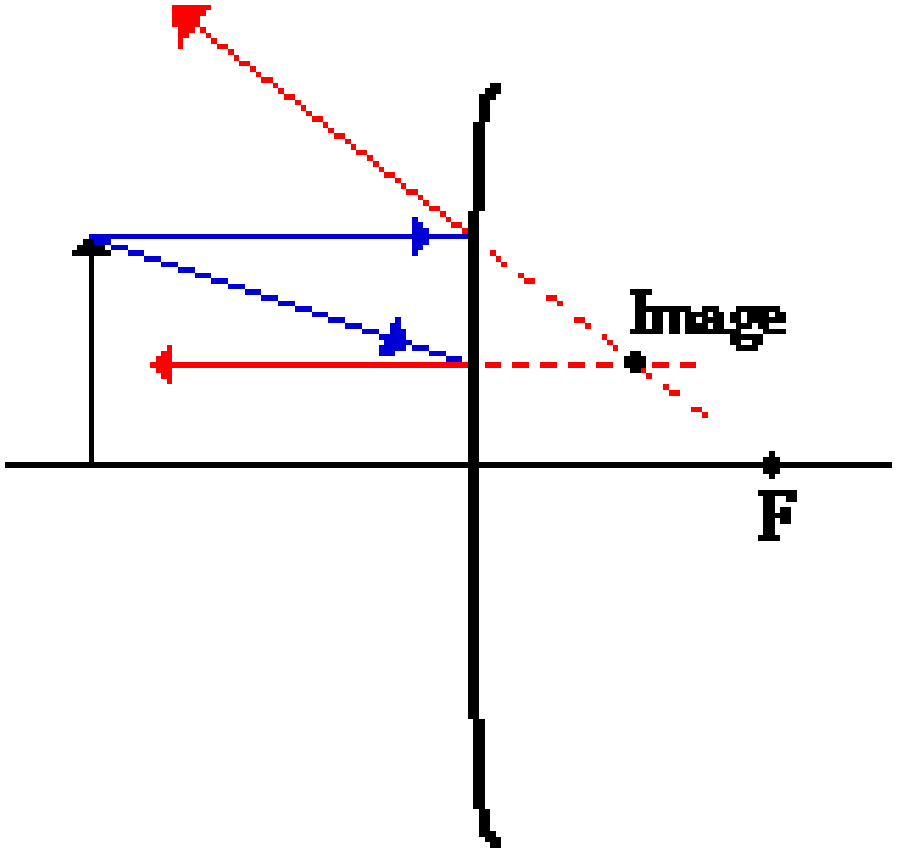
Step-by-Step Procedure for Drawing Ray Diagrams

- 2. Once these incident rays strike the mirror, reflect them according to the two rules of reflection for convex mirrors.



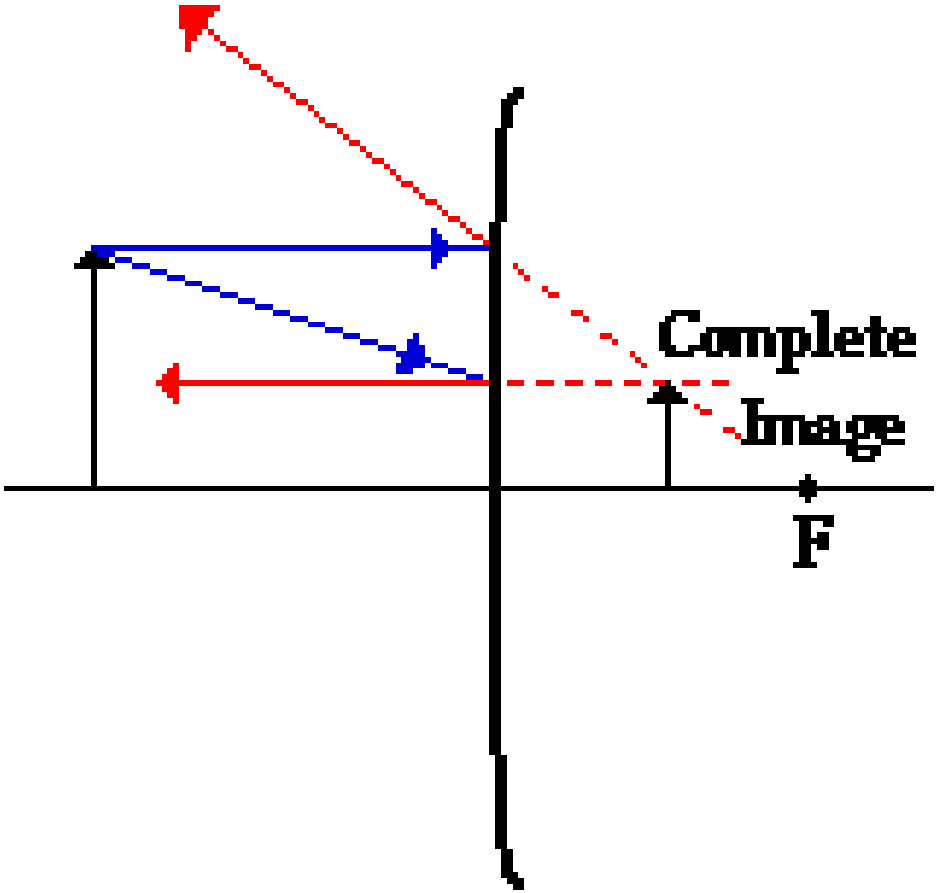
Step-by-Step Procedure for Drawing Ray Diagrams

- 3. Locate and mark the image of the top of the object.



Step-by-Step Procedure for Drawing Ray Diagrams

- 4. Repeat the process for the bottom of the object.



Graphical Method/Ray Diagramming

- The image formed in a convex mirror is ALWAYS:

- L- behind the mirror
- O- upright
- S- smaller
- T- virtual