# Unit 14 · Reflection at Curved Mirrors

WORKSHEET

Full marks 37

Name _____ Class _____ Roll no. _____ Date _____ Marks _____ / 37

## 1 Key words [4]

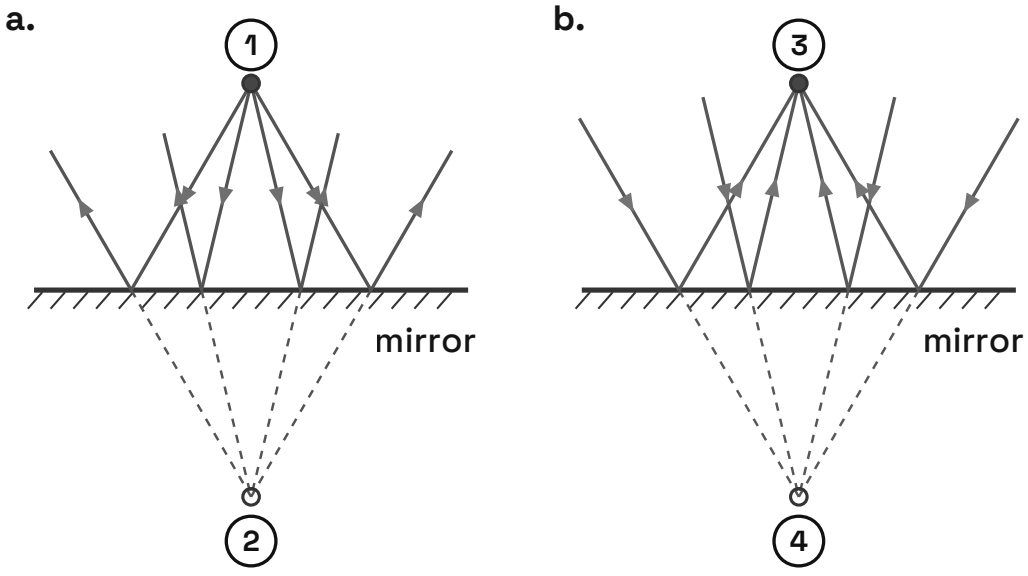
Fill in the blanks with words from the box. Two words in the box are not needed. Each blank carries 0.5 mark.

| | | | | | | |
|---|---|---|---|---|---|---|
| **center of curvature** | **concave** | **convex** | **focal length** | **magnification** | **paraxial** | **pole** |
| **principal axis** | **real** | **spherical aberration** | | | | |

A spherical mirror whose reflecting surface caves in, like the bowl of a spoon, is a _____ mirror. The middle point of its surface is the _____, and the center of the sphere it is part of is the _____. The straight line through these two points is the _____. Rays that stay close to this line and make small angles with it are called _____ rays. For a mirror of small aperture, the _____ is half the radius of curvature. An image that can be caught on a screen is a _____ image. A spherical mirror of wide aperture has no single sharp focus, a blur called _____.

## 2 Label the diagram [2]

The drawings show a plane mirror forming two kinds of image. Write the words that belong in place of 1 to 4. Each carries 0.5 mark.




1. _____ 2. _____

3. _____ 4. _____

## 3 Multiple choice [5]

Choose the correct option for each of the following questions.

**i.** In the "real is positive" sign convention, a convex mirror of radius of curvature 30 cm has a focal length of: [1]

**a.** −15 cm **b.** +15 cm
**c.** −30 cm **d.** +60 cm

**ii.** An object stands at the center of curvature of a concave mirror. Its image is: [1]

**a.** virtual, upright and the same size, behind the mirror
**b.** real, inverted and the same size, at the center of curvature
**c.** real, inverted and enlarged, beyond the center of curvature
**d.** at infinity

**iii.** A mirror forms an image with magnification m = +2. The image is: [1]

**a.** virtual, upright and twice the size **b.** real, inverted and twice the size
**c.** real, upright and half the size **d.** virtual, inverted and half the size

**iv.** Which of these is **not** assumed in deriving the mirror formula? [1]

**a.** the rays are paraxial
**b.** the object is small and on the principal axis
**c.** the mirror has a wide aperture
**d.** distances are measured from the pole

**v.** Light from a distant tree falls on a concave mirror, and a sharp image of the tree forms on a sheet of paper 18 cm from the mirror. The radius of curvature of the mirror is about: [1]

**a.** 9 cm **b.** 18 cm
**c.** 36 cm **d.** 72 cm

## 4 Very short answers [3]

Write very short answers to the following questions.

**a.** Define the principal focus of a convex mirror. [1]

**b.** What is meant by the aperture of a spherical mirror? [1]

**c.** Why does a satellite dish or a car's headlamp use a paraboloid instead of a piece of a sphere? [1]

## 5 Short answers [6]

Write short answers to the following questions.

**a.** One mirror forms an image with $m = -1$ and another an image with $m = +1$. Describe each image, and name a mirror and an object position that gives it. [2]

**b.** Give two reasons why the largest astronomical telescopes collect light with a concave mirror and not with a lens. [2]

**c.** A driver sees a car behind in the convex side mirror. Explain why the car seems farther away than it really is, and why the driver also uses the plane inside mirror. [2]

## 6 Long answer [4]

Write a long answer to the following question.

With a labelled ray diagram, prove that the focal length of a concave mirror of small aperture is half its radius of curvature.

## 7 Numerical problems [10]

Solve the following problems. Show your working. Use the "real is positive" sign convention.

**a.** Pragya holds a concave make-up mirror of radius of curvature 50 cm with her face 15 cm from it. Find the position of the image, the magnification and the nature of the image. **[3]**

**Answer:** _____

**b.** A convex mirror of focal length 1.0 m stands on a hairpin bend of a hill road. A bus 3.0 m tall is 20 m in front of it. Find where the image of the bus is formed and how tall it is. **[3]**

**Answer:** _____

**c.** A concave mirror has a focal length of 12 cm. Find the two positions of an object for which the image is twice as tall as the object, and describe the image in each case. **[4]**

**Answer:** _____

## 8 Think [3]

Sujan stands far from a large concave mirror and walks slowly towards it. Describe how his image changes (where it is, its size, which way up) as he passes the center of curvature, the focus, and then comes closer than the focus.

## 9 Activity: The focal length of a concave mirror (not marked)

Use a concave mirror, a candle and a sheet of white card. First catch the image of a distant window or tree on the card and measure its distance from the mirror. Then put the candle at five distances u and find, each time, the distance v where its image is sharp on the card.

| u (cm) | v (cm) | f = uv ÷ (u + v) (cm) |
|---|---|---|
| | | |
| | | |
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| | | |
| | | |

How far from the mirror was the image of the distant window or tree? Do your values of f agree with it, and with one another?