

Prevention is always better

SUMMARY INFORMATION

Keywords

Curved mirrors, reflection, focal point

Topics Covered

Physics

Target Grade(s)

6, 7

Estimated Time Required

45 minutes – 1 hour

LESSON

Goals and Pre Requisites

Goals

- To derive from students the methods to prevent accidents in hilly regions
- To derive from students a greater understanding of how types of mirrors can be practically applied

Pre Requisites

Knowledge on the characteristics of Concave and Convex mirrors.

Instructional Objectives

Through this activity, students would be able to:

- Demonstrate critical thinking
- Engineering problem solving

Instructional Resources

Problem Statement

Accidents are a major cause of concern. A lot of two/four wheel collisions happen in sharp hairpin bends over a hilly terrain or on blind spots on roads. How can we come up with a solution to prevent such occurrences?

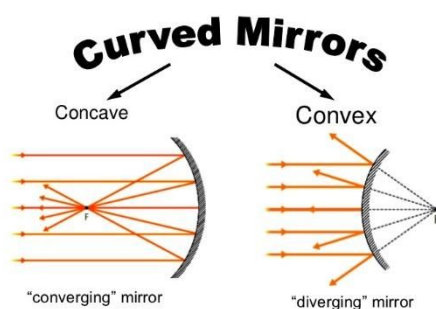
Background

Road accidents are undoubtedly the most frequent, thereby causing heavy damage. The reasons for this being the extremely dense traffic and the relative freedom of movement given for drivers. Thus, prevention of road accidents is extremely important and should be ensured by strict laws, ongoing training for drivers and if need be, legal and administrative penalties for those responsible.



Curved Mirrors

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.



Convex Mirror

A **convex mirror**, **fish eye mirror** or **diverging mirror**, is a curved mirror in which the reflective surface bulges toward the light source. Convex mirrors reflect light outwards, therefore they are not used to focus light. Such mirrors always form a virtual image, since the focal point (F) and the centre of curvature ($2F$) are both imaginary points "inside" the mirror that cannot be reached. As a result, images formed by these mirrors cannot be projected on a screen, since the image is inside the mirror. The image is smaller than the object, but gets larger as the object approaches the mirror.

A collimated (parallel) beam of light diverges (spreads out) after reflection from a convex mirror, since the normal to the surface differs with each spot on the mirror.

Concave Mirror

A **concave mirror**, or **converging mirror**, has a reflecting surface that bulges inward (away from the incident light). Concave mirrors reflect light inward to one focal point. They are used to focus light. Unlike convex mirrors, concave mirrors show different image types depending on the distance between the object and the mirror.

These mirrors are called "converging" because they tend to collect light that falls on them, refocusing parallel incoming rays toward a focus. This is because the light is reflected at different angles, since the normal to the surface differs with each spot on the mirror.

Procedure

1. Introduce the **Problem Statement** to students.
2. Form students into groups of four.
3. Allow them to brainstorm with their groups, on the given **Problem Statement**.
4. Each group must come up with their unique solution(s) to the given problem.
5. Each group can compare their solutions with fellow groups and with their teacher to check on the feasibility of their solution.
 - In order to check on feasibility, instruct students to discuss with their team mates and have a rough sketch of their plan before constructing it. Students must be able to provide justification for their choice of materials.
6. Ask students to build a timeline (within the estimated amount of time provided under summary information) and ensure that all members of each group are involved in planning the project in terms of availability and cost of materials.

7. Students must make sure that the design incorporated in their process would address the existing problem.
8. Each group can present their solution and evaluate feasibility with peer groups and the teacher.

Sample Methodology

Note: The following is an example of how the given **Problem Statement** might be addressed. **For Teacher Reference only.**

Materials Required

Reflecting sheet (e.g. Aluminium foil)

A spherical object (e.g. rubber ball)

Ice Cream sticks/ wooden sticks

Vehicle models

Procedure

1. Take a spherical object; either a rubber ball cut it into two halves.
2. With the help of an aluminium reflecting foil, cover the bulged out surface of the ball, such that it forms a convex mirror.
3. Roughly calculating the curvature of the road, choose an appropriate height at which the convex mirror must be placed, using the sticks.
4. Using vehicle models, a blind spot can be replicated and tested using the mirror.



Extension

- Students may take existing blind spots/hairpin bends in hilly areas and come up with ways to implement their ideas. Models made from thermocol and other materials can be used to recreate the setting and test out the placement of the mirror to minimize the occurrence of accidents.



Assessment and Rubric

Define the need or problem – Did students identify the need to resolve this problem? Were they able to relate the problem to their own environment?

Come up with ideas - Did students weigh various possibilities brainstorm on various ideas before arriving at a solution? Did each group collaborate effectively to (1) work within the time given (2) give equal opportunity for participation (3) consolidate relevant information (4) provide rationale for their decisions and choices.

Select the most promising idea or design - Were students able to evaluate the feasibility of their solution to the given problem statement? On what basis was the feasibility of the solution determined?

Communicate and plan the project – Were groups able to provide justification for their choice of materials? Were students able to see completion of the activity within the estimated time?

Create/Build and test a design –Were all members of the team participative during the course of the activity?

Evaluate and revise the design – Were student groups able to present their solutions in a clear and distinct manner with other groups? Were they keen on improving their model further?

Credits

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- <http://www.slideshare.net/OhMiss/curved-mirrors>
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