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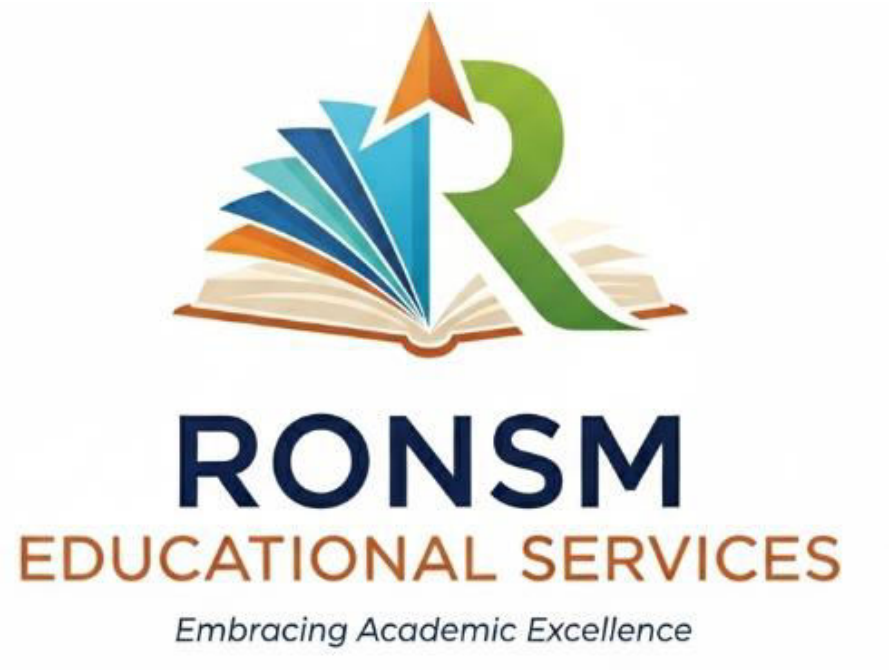

ONLINE LESSON A LEVEL (UACE)

TOPIC: REFLECTION OF LIGHT

SUB-TOPIC : REFLECTION ON PLANE AND CURVED MIRRORS

SUBJECT: PHYSICS

ASSIGNMENT 1

Topic 14:REFLECTION OF LIGHT

Sub-topic 14.1:Reflection at Plane Surfaces

Scenario 1

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A regional hospital in Fort Portal is redesigning its outpatient examination rooms to improve natural lighting and patient comfort. Architects are using principles of reflection at plane surfaces to position large mirrors that can redirect sunlight into darker areas of the room without causing glare. They need to calculate precise angles of incidence and reflection to ensure optimal illumination throughout the day as the sun's position changes. The design must also consider seasonal variations in sun path and the specific architectural constraints of the existing hospital building. This innovative approach aims to reduce electricity consumption for lighting while creating a more healing environment for patients, particularly in the pediatric and recovery wards where natural light has been shown to improve patient outcomes and reduce hospital stay duration.

Task:

As a learner of physics;

(a)State the two laws of reflection at plane surfaces.

(b)A light ray strikes a plane mirror at an angle of 30°to the normal. Calculate the angle between the incident and reflected rays.

(c)Explain why multiple images are formed when two plane mirrors are placed at an angle to each other.

(d)Describe one practical application of plane mirrors in medical facilities.

Scenario 2

A security company in Kampala is installing surveillance systems in shopping malls using multiple plane mirrors to eliminate blind spots in corridors and parking areas. Engineers must calculate the exact placement of mirrors to ensure complete coverage while maintaining clear images. The system design must account for the minimum mirror size needed to view entire areas and the optimal angles to prevent image distortion. This comprehensive approach has significantly improved security in public spaces, reducing incidents of theft and providing clearer evidence for investigations when needed.

Task:

As a learner of physics;

(a)Explain why the image formed by a plane mirror is always virtual and erect.

(b)A person 1.8 m tall stands 2 m from a plane mirror. Calculate the minimum height of mirror required for the person to see their full image.

(c)Describe the characteristics of images formed by plane mirrors.

(d)Why are plane mirrors preferred over curved mirrors for security surveillance in some applications?

Scenario 3

A traditional dance troupe in Busoga region uses strategically placed plane mirrors during rehearsals to help dancers monitor their formations and synchronize their movements. The choreographer positions mirrors at specific angles to allow dancers to see both their own reflections and those of other performers without turning their heads. This technique has improved the precision of traditional dances performed during cultural festivals and tourist events, preserving Uganda's cultural heritage while enhancing performance quality.

Task:

As a learner of physics;

(a)Two plane mirrors are inclined at 60°to each other. Calculate the number of images formed of an object placed between them.

(b)Explain the concept of lateral inversion in plane mirrors.

(c)A dancer moves towards a plane mirror at 2 ms'.Calculate the speed at which their image approaches them.

(d)How does understanding reflection help in performing arts?

Scenario 4

An automotive repair workshop in Mbale uses plane mirrors mounted on extendable poles to inspect hard-to-reach areas of vehicle undersides. Mechanics

must understand reflection principles to interpret the mirrored images accurately when diagnosing exhaust system problems, brake line issues, or structural damage. This method has reduced inspection time by 40%and improved diagnostic accuracy, particularly for complex repairs on public service vehicles that operate on Uganda's rough rural roads.

Task:

As a learner of physics;

(a)Explain why the image in a plane mirror appears to be as far behind the mirror as the object is in front.

(b)A mechanic uses a mirror to read a serial number that is 50 cm from the mirror. How far from the mirror does the image appear to be?

(c)Describe how mirrors help in inspecting inaccessible areas.

(d)Why is understanding image formation important in automotive repair?

Scenario 5

A physics teacher in Gulu demonstrates the principle of periscopes using simple plane mirrors to students interested in optical instruments. Students construct basic periscopes from cardboard tubes and mirrors to understand how reflection enables seeing over obstacles. This hands-on activity helps students grasp practical applications of reflection principles while developing skills that could be useful in fields like construction, wildlife observation, and security services in Uganda's diverse environments.

Task:

As a learner of physics;

(a)Describe the arrangement of mirrors in a simple periscope.

(b)Explain how a periscope uses the laws of reflection to enable viewing over obstacles.

(c)Calculate the minimum length of a periscope needed to see over a 1.5 m wall if the observer's eye is 1.2 m above ground.

(d)Design a simple periscope using locally available materials.

Sub-topic 14.2:Reflection at Curved Surfaces

Scenario 6

A solar energy company in Soroti is developing parabolic solar cookers that use curved reflective surfaces to concentrate sunlight onto cooking pots. Engineers must calculate the focal lengths of different parabolic designs to achieve optimal temperature for cooking while ensuring safety. The research aims to create affordable solar cooking solutions for rural households, reducing dependence on firewood and addressing deforestation issues in Uganda's dry regions. Field tests show that properly designed parabolic cookers can reach temperatures sufficient for boiling water and cooking staple foods within minutes during sunny days.

Task:

As a learner of physics;

(a)Define the principal focus and focal length of a concave mirror.

(b)A concave mirror has a radius of curvature of 40 cm. Calculate its focal length.

(c)Explain why parabolic mirrors are used in solar concentrators rather than spherical mirrors.

(d)Describe one safety precaution needed when using curved mirrors for solar cooking.

Scenario 7

An optometry clinic in Kampala uses concave mirrors in ophthalmoscope to examine the interior of patients'eyes.Optometrists must understand how curved mirrors form images to correctly interpret what they see during retinal examinations. The precise use of these instruments helps in early detection of eye diseases like glaucoma and diabetic retinopathy, which are becoming more

prevalent in Uganda's aging population and among people with changing lifestyle diseases.

Task:

As a learner of physics;

(a)An object is placed 30 cm from a concave mirror of focal length 15 cm. Calculate the image position.

(b)Describe the nature of the image formed in part (a).

(c)Explain why concave mirrors are used in medical instruments for examining body cavities.

(d)What would be the effect on the image if the object is moved closer to the mirror than the focal point?

Scenario 8

A vehicle manufacturing plant in Jinja uses convex mirrors as side-view mirrors in their buses and trucks. Engineers must determine the appropriate curvature to provide the widest possible field of view while maintaining usable image size. This design consideration is particularly important for public service vehicles operating on Uganda's busy roads, where improved visibility can prevent accidents and enhance road safety for all users.

Task:

As a learner of physics;

(a)Explain why convex mirrors are used as rear-view mirrors in vehicles.

(b)A convex mirror has a focal length of 20 cm. An object is placed 30 cm from the mirror. Calculate the image position.

(c)Compare the images formed by concave and convex mirrors.

(d)Why do convex mirrors show a wider field of view than plane mirrors of the same size?

Scenario 9

A beauty salon in Entebbe uses concave mirrors for precise facial treatments and makeup application. Stylists need to understand how image magnification works at different distances to provide the best service to clients. The salon has trained its staff in basic optics to help them choose the right mirror positions for different beauty procedures, enhancing customer satisfaction and service quality in Uganda's growing beauty industry.

Task:

As a learner of physics;

(a)An object is placed 10 cm from a concave mirror of focal length 15 cm. Calculate the magnification.

(b)Explain what happens to the image when an object is placed between the focus and pole of a concave mirror.

(c)Describe one practical use of concave mirrors in daily life.

(d)Why are concave mirrors sometimes called "converging mirrors"?

Scenario 10

A physics laboratory at Makerere University is studying image formation using curved mirrors of different radii. Students investigate how object position affects image characteristics in both concave and convex mirrors. The experiments help students understand real-world applications of curved mirrors, from astronomical telescopes to security systems, preparing them for careers in Uganda's developing technology sector where optical principles are increasingly important.

Task:

As a learner of physics;

(a)Derive the mirror formula for curved mirrors.

(b)An object 4 cm tall is placed 20 cm from a concave mirror of focal length 12 cm. Calculate the image height.

(c)Explain the difference between real and virtual images with reference to curved mirrors.

(d)Design an experiment to determine the focal length of a concave mirror.

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