

How light bounces, bends and is absorbed

Grade 7 science (Year 8 · Class 7) · Worksheet

Name: _____ Date: _____ Class: _____

These problems train you to apply the law of reflection, to describe how plane mirrors form images and to explain refraction and absorption. You will measure angles from the normal, work out distances and times, and reason about everyday light effects. They suit Grade 7 science students, Year 8 learners and Class 7 pupils, following the NGSS idea that waves are reflected, absorbed or transmitted.

Level: Grade 7 science (Year 8 · Class 7) · **Curriculum:** MS-PS4-2

Problem 1 Seeing a football (easy)

Kofi in Accra watches a football on a sunny pitch.

1. State whether the football is luminous.
2. Name the luminous source that lets him see it.
3. Describe the path of the light from the source to Kofi's eye.

Problem 2 Naming the lines (easy)

A ray strikes a plane mirror.

1. Name the dashed line drawn at right angles to the mirror.
2. Name the ray that arrives at the mirror.
3. State which angles are equal in the law of reflection.

Problem 3 Angle of reflection (easy)

A ray reaches a mirror with an angle of incidence of 25° .

1. State the angle of reflection.
2. Calculate the angle between the incident and reflected rays.

Problem 4 Sorting surfaces (easy)

Say whether each surface gives regular or diffuse reflection.

1. A bathroom mirror
2. A sheet of kitchen paper
3. A calm pond
4. Crumpled aluminium foil

Problem 5 Bending towards or away (easy)

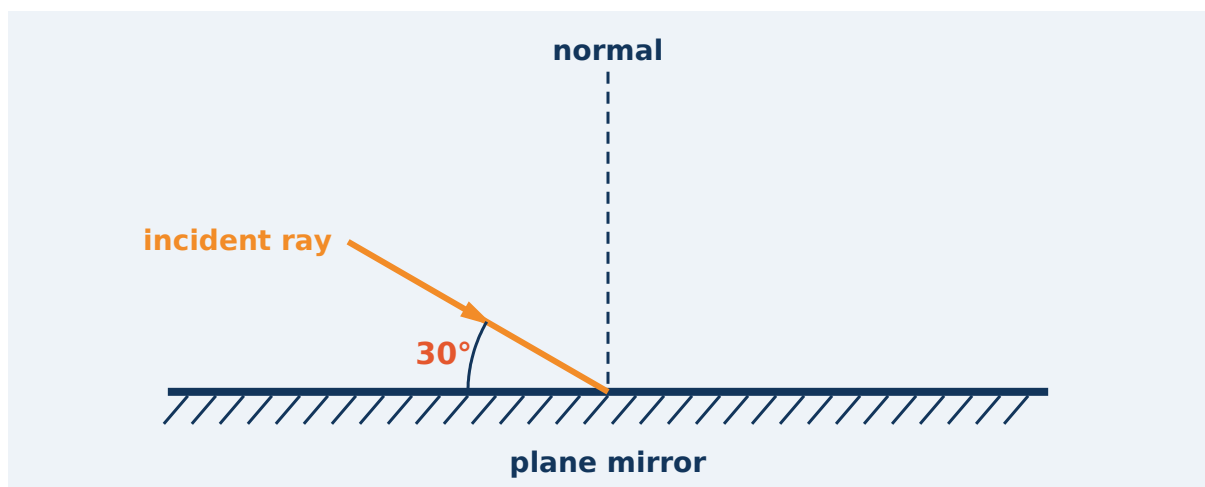
Choose towards the normal, away from the normal, or no bending.

1. A ray goes from air into glass at an angle.
2. A ray goes from glass into air at an angle.
3. A ray goes from air into water along the normal.

Problem 6 Reading a mirror diagram (easy)

The figure shows a ray reaching a mirror at 30° to the surface.

1. Calculate the angle of incidence.
2. State the angle of reflection.
3. Calculate the angle between the incident and reflected rays.



A ray hits a plane mirror at 30° to the surface.

Problem 7 A shallow ray (medium)

A ray makes an angle of 20° with a plane mirror.

1. Calculate the angle of incidence.
2. Calculate the angle of reflection.
3. Calculate the angle between the incident and reflected rays.

Problem 8 Distance to the image (medium)

Aarav in Pune stands 2.0 m in front of a plane mirror.

1. Calculate the distance between Aarav and his image.
2. Aarav walks 0.8 m towards the mirror. Calculate his new distance from the mirror.
3. Calculate the new distance between Aarav and his image.

Problem 9 Turning the mirror (medium)

A ray hits a mirror with an angle of incidence of 30° . The mirror is then tilted so that the angle of incidence becomes 40° .

1. Calculate the angle between the incident and reflected rays at 30° .

2. Calculate the angle between the incident and reflected rays at 40° .
3. Calculate how much the reflected ray has turned.

Problem 10 Why paper shows no face (medium)

Mei looks at a sheet of white paper and sees no reflection of her face, but she sees her face clearly in a steel spoon.

1. Explain why paper does not show an image.
2. State whether each ray of light on the paper obeys the law of reflection.

Problem 11 Headlights on wet roads (medium)

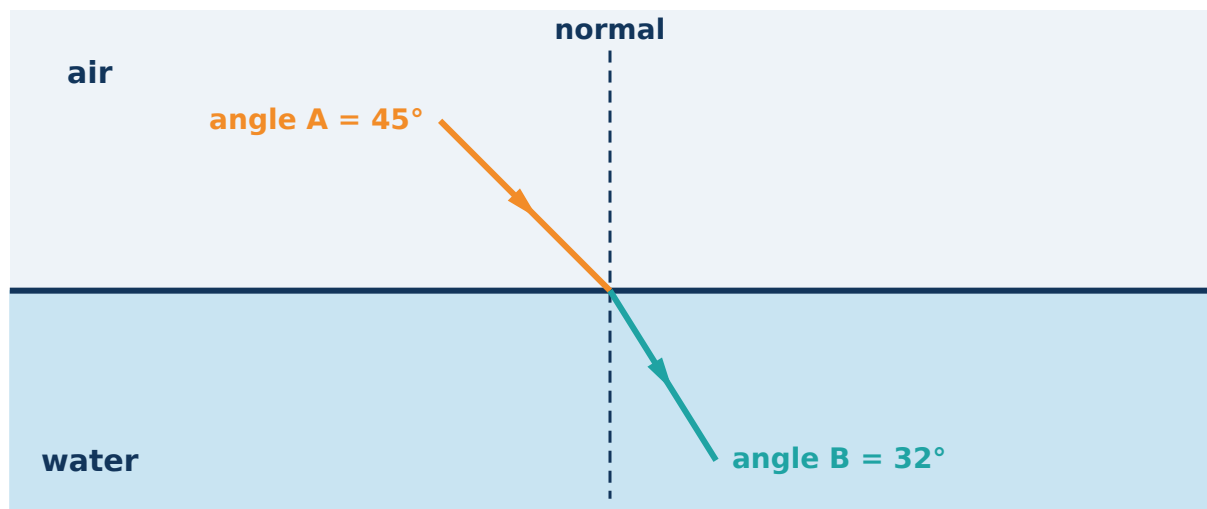
Diego drives at night in Texas after rain. The road ahead of him appears to glare in the headlights.

1. Explain why the wet road gives a stronger glare than a dry road.
2. State what type of reflection is happening on the wet road.

Problem 12 Ray entering water (medium)

The figure shows a ray going from air into water.

1. State which angle is the angle of incidence.
2. State whether the ray bends towards or away from the normal.
3. Compare the speed of light in water with its speed in air.



A ray entering water.

Problem 13 The broken straw (medium)

Bilal puts a straw in a glass of water in Lahore. Above the water the straw looks straight, but at the water surface it looks bent.

1. Name the effect that makes the straw look bent.
2. Explain in one or two sentences why it happens.

Problem 14 Light through water (medium)

Light travels at 3.0×10^8 m/s in air and 2.25×10^8 m/s in water. A fish tank is 0.45 m wide.

1. Calculate the time for light to cross 0.45 m of water.
2. Calculate the time for light to cross 0.45 m of air.
3. Calculate how much longer the water takes, in nanoseconds ($1 \text{ ns} = 10^{-9} \text{ s}$).

Problem 15 Find the error (medium)

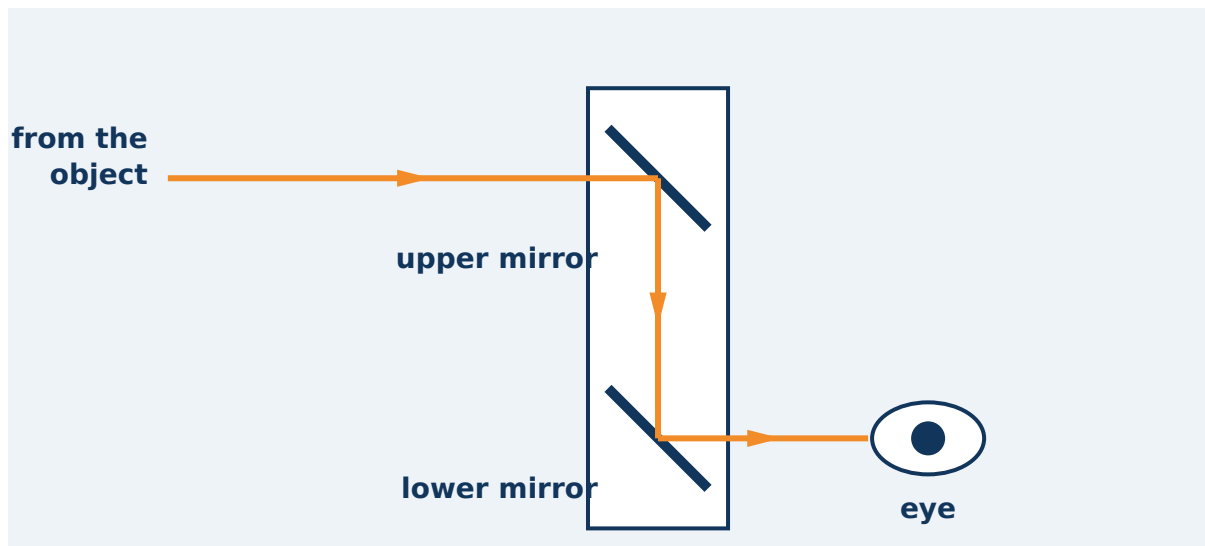
Chiamaka draws a ray at 30° to a mirror surface and writes: 'The angle of reflection is 30° , so the ray leaves 30° from the normal.'

1. Identify the mistake.
2. Give the correct angle of reflection.

Problem 16 Inside a periscope (hard)

A periscope has two parallel plane mirrors, each at 45° to the vertical tube. A horizontal ray hits the upper mirror.

1. Calculate the angle of incidence at the upper mirror.
2. Calculate the angle through which the upper mirror turns the ray.
3. Describe the direction of the ray that leaves the lower mirror compared with the entering ray.



Ray path through a periscope.

Problem 17 Two mirrors at right angles (hard)

Two plane mirrors meet at 90° . A ray hits the first mirror, making 30° with its surface, and then reaches the second mirror.

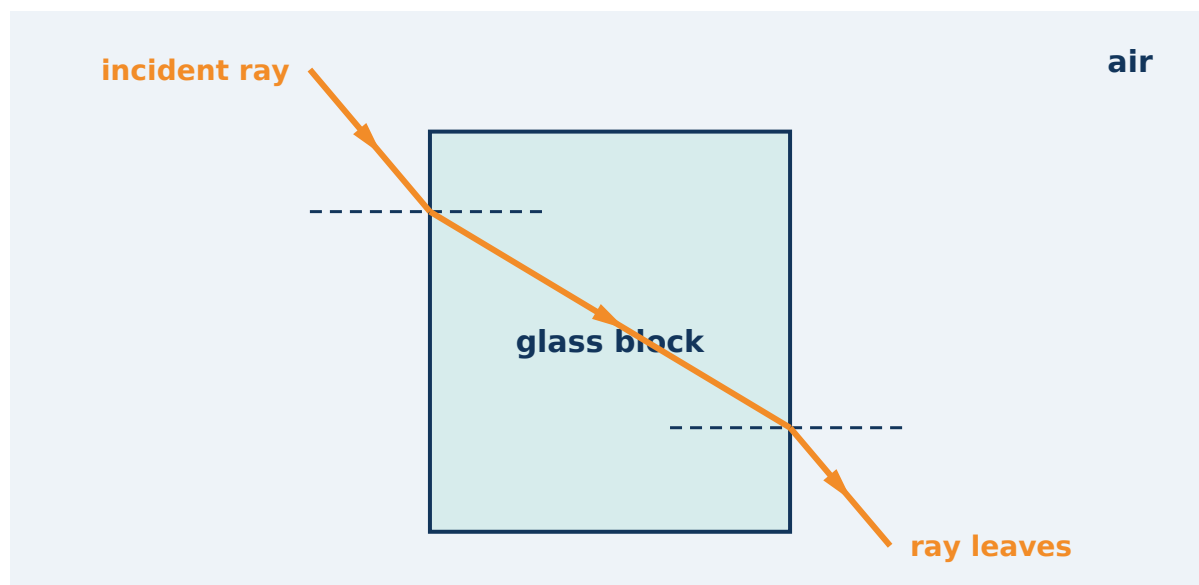
1. Calculate the angle of incidence at the first mirror.
2. State the angle between the reflected ray and the first mirror.
3. Calculate the angle of incidence at the second mirror.

- Describe the direction of the final ray compared with the original ray.

Problem 18 Through a glass block (hard)

A ray enters a rectangular glass block with an angle of incidence of 50° and an angle of refraction of 31° . The two faces are parallel.

- State the angle of incidence at the second face inside the glass.
- Predict the angle of the ray after it leaves the glass.
- Compare the direction of the leaving ray with the entering ray, and explain.



Ray through a glass block.

Problem 19 Checking the law (hard)

Students measure the angles for a ray reflecting in a mirror.

i (°)	10	20	30	40	50	60
r (°)	11	19	31	40	49	61

- Calculate $r - i$ for each reading.
- Calculate the mean of the six values of $r - i$.
- Decide whether the results support the law of reflection.

Problem 20 White roof, black roof (hard)

Sunlight delivers 1000 W to each square metre of a roof in Karachi. A white roof reflects 80 % of the light and a black roof reflects 10 %. Each roof has an area of 40 m².

- Calculate the power absorbed per square metre by the white roof.
- Calculate the power absorbed per square metre by the black roof.
- Calculate the total power absorbed by each roof.
- Calculate the difference in kilowatts and say which roof stays cooler.