

Light sources and straight-line rays

Grade 6 science (Year 7 · Class 6) · Worksheet

Name: _____ Date: _____ Class: _____

These twenty problems train you to sort light sources, to describe how we see objects, and to classify materials by how they treat light. You will also use the speed of light to work out travel times and reason about rays and pinhole images.

The set starts with recall and sorting and ends with multi-step reasoning and data. It suits Grade 6, Year 7 and Class 6 science.

Level: Grade 6 science (Year 7 · Class 6) · **Curriculum:** MS-PS4-2

Problem 1 Two kinds of source (easy)

1. State what a luminous (primary) source does.
2. State what a non-luminous (secondary) object does.
3. Give one example of each.

Problem 2 Sort the sources (easy)

Write *primary* or *secondary* for each: the Sun, a candle flame, a bicycle reflector, a firefly, a glowing laptop screen, the planet Venus, a glow stick.

Problem 3 Light and materials (easy)

Write *transparent*, *translucent* or *opaque* for each: window glass, tracing paper, a brick, a clear plastic bottle, a frosted bathroom window, aluminium foil.

Problem 4 True or false (easy)

Write true or false, and correct each false statement.

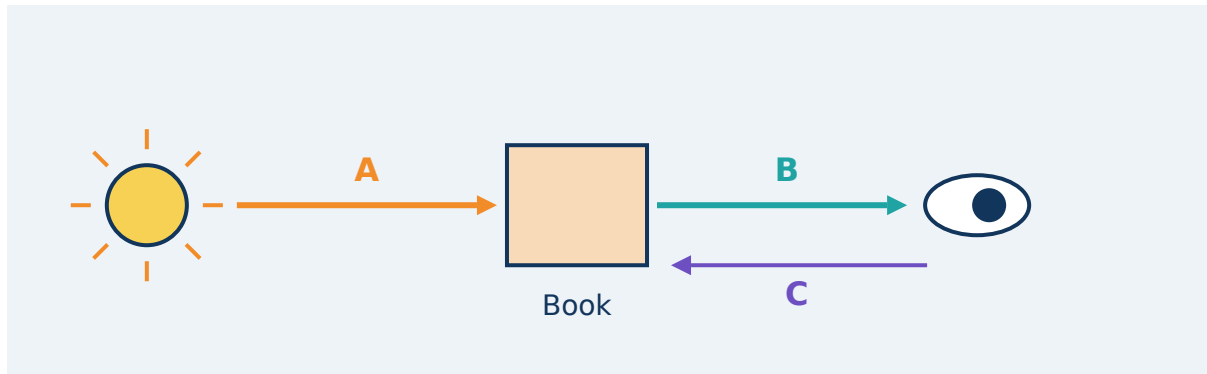
1. The Moon makes its own light.
2. We see a book because light bounces off it into our eyes.
3. Light travels in straight lines in air.
4. A translucent material lets no light pass.

Problem 5 Lamp, book and eye (easy)

Look at the diagram.

1. Which arrow shows light travelling from the source to the book?
2. Which arrow shows light reaching the eye?

3. Arrow C is drawn from the eye to the book. Explain why it is wrong.



The arrows for Problem 5.

Problem 6 Speed of light units (easy)

1. State the speed of light in m/s.
2. Convert it to km/s.
3. Convert the Sun's distance, 1.5×10^8 km, to metres.

Problem 7 Street lamp (medium)

Rahul in Jaipur looks at a street lamp 150 m away.

1. Write the formula for time.
2. Calculate the time light takes to reach him.

Problem 8 Sunlight delay (medium)

The Sun is 1.5×10^{11} m from Earth.

1. Calculate the time in seconds for sunlight to reach Earth.
2. Convert it to minutes, to one decimal place.
3. Explain what this means for the Sun we see.

Problem 9 Lighthouse beam (medium)

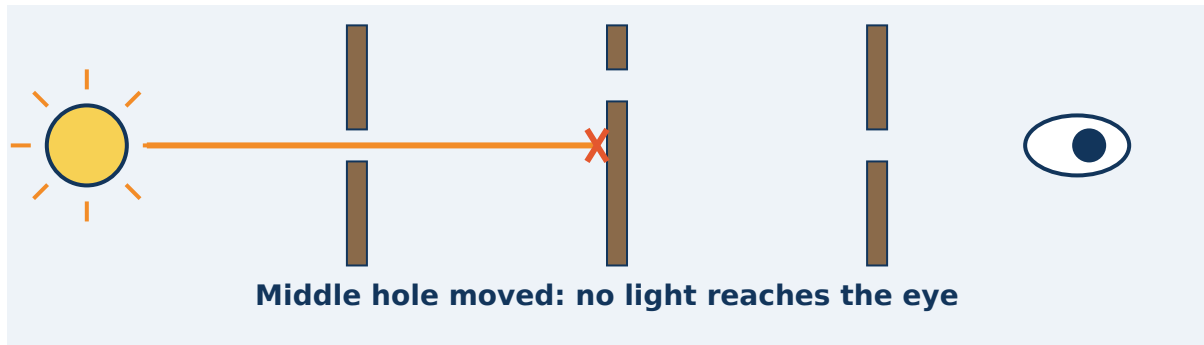
A lighthouse beam reaches a ship 24 km away.

1. Convert 24 km to metres.
2. Calculate the time for the light to arrive.
3. Give the answer in microseconds.

Problem 10 Cards in a row (medium)

Kofi in Accra holds three cards with holes in front of a torch, as shown.

1. State whether he sees the torch.
2. Explain your answer.
3. Describe how to move the middle card to see the torch.

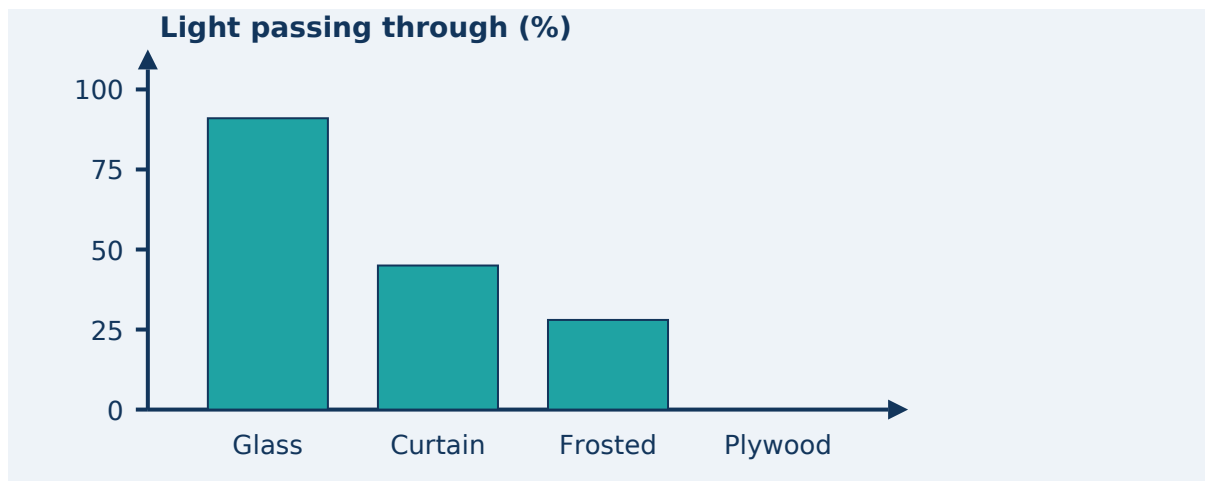


The cards for Problem 10 (the middle hole is raised).

Problem 11 Four materials (medium)

The bar chart shows the percentage of light passing through four materials.

1. Classify each as transparent, translucent or opaque.
2. Calculate how many percentage points more light passes through glass than frosted glass.
3. Name the best material for a greenhouse roof.



Light passing through four materials.

Problem 12 Dark room (medium)

Sofia in Manchester switches off every light in a windowless cupboard.

1. State what she can see.
2. Explain your answer using the idea of how we see objects.

Problem 13 Torch through a glass (medium)

Aisha in Karachi shines a torch through different objects onto a light meter. With nothing in the way the meter reads 90 lux. Through a glass of clear water it reads 84 lux, through cloudy water 36 lux and through black card 0 lux.

1. Classify each object.
2. Calculate the percentage of light passing through clear water, to the nearest per cent.
3. Calculate the percentage passing through cloudy water.

Problem 14 One minute of light (medium)

1. Calculate how far light travels in 1 minute, in metres.
2. Convert your answer to kilometres.

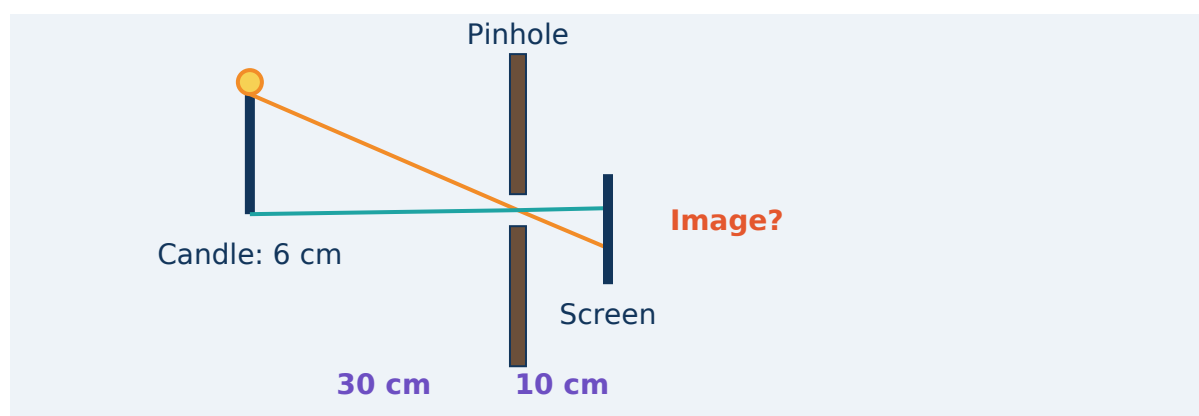
Problem 15 Choosing materials (medium)

Choose transparent, translucent or opaque for each use and give a reason: (a) a classroom window, (b) a bathroom window, (c) a garden wall, (d) a lampshade.

Problem 16 Pinhole camera (hard)

A candle 6.0 cm tall stands 30 cm from a pinhole. The screen is 10 cm behind the pinhole.

1. Explain why the image is upside down.
2. Use the idea that the ratio image height : object height equals 10 : 30 to calculate the image height.
3. State what happens to the image height if the screen moves further from the hole.



Rays from the top of the candle cross at the pinhole and reach the bottom of the screen.

Problem 17 Signal from Mars (hard)

A rover on Mars is 2.25×10^{11} m from Earth. A radio signal travels at the speed of light.

1. Calculate the time for a signal to reach the rover, in seconds.
2. Convert to minutes.
3. Calculate the time for a message and its reply (a round trip).

Problem 18 Fair test for materials (hard)

Ethan in Auckland tests three materials A, B and C with a torch and a light meter. With no material the meter reads 100 lux. He repeats each test three times. A: 82, 80, 84 lux. B: 31, 29, 30 lux. C: 0, 0, 0 lux.

1. Calculate the mean reading for each material.
2. Calculate the percentage of light passing through each.
3. Name two variables he should keep the same.

4. Classify A, B and C.

Problem 19 Headlights in fog (hard)

On a foggy night, Jomo in Mombasa sees the beams of car headlights as bright columns in the air. On a clear night he cannot see the beams from the side.

1. Explain why the beam is visible in fog.
2. Explain why fog makes it hard to see far ahead.
3. State what kind of material the fog is, transparent, translucent or opaque.

Problem 20 Laser rangefinder (hard)

A laser rangefinder sends a pulse to a wall and measures a round-trip time of 2.0×10^{-7} s.

1. Calculate the total distance the light travelled.
2. Calculate the distance to the wall.
3. Explain why the answer to part 1 is not the distance to the wall.