

Light sources and straight-line rays

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

Use these answers to check your work. For calculations, write the formula, substitute with units and give the result in a sensible unit. For explanations, check that you named the source of light and the path it takes to the eye.

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

Problem 1 Two kinds of source

1. It **makes its own light**.
2. It **reflects light** from a source.
3. Example: the Sun (luminous), a book (non-luminous).

Problem 2 Sort the sources

Primary: Sun, candle flame, firefly, laptop screen, glow stick. **Secondary:** bicycle reflector, Venus.

Problem 3 Light and materials

Transparent: window glass, clear plastic bottle. **Translucent:** tracing paper, frosted window. **Opaque:** brick, aluminium foil.

Problem 4 True or false

1. **False:** the Moon reflects light from the Sun.
2. **True.**
3. **True.**
4. **False:** it lets some light through but scatters it.

Problem 5 Lamp, book and eye

1. **A.**
2. **B.**
3. The eye does not send out light. Light must travel **from the book into the eye**, so C points the wrong way.

Problem 6 Speed of light units

1. **3.0×10^8 m/s.**
2. $3.0 \times 10^8 \div 1000 = 3.0 \times 10^5$ km/s.

3. $1.5 \times 10^8 \times 1000 = 1.5 \times 10^{11} \text{ m}$.

Problem 7 Street lamp

1. $t = d \div v$.

2. $150 \div 3.0 \times 10^8 = 5.0 \times 10^{-7} \text{ s}$.

Problem 8 Sunlight delay

1. $1.5 \times 10^{11} \div 3.0 \times 10^8 = 500 \text{ s}$.

2. $500 \div 60 = 8.3 \text{ minutes}$.

3. We see the Sun as it was about 8 minutes ago.

Problem 9 Lighthouse beam

1. $24 \times 1000 = 2.4 \times 10^4 \text{ m}$.

2. $2.4 \times 10^4 \div 3.0 \times 10^8 = 8.0 \times 10^{-5} \text{ s}$.

3. $8.0 \times 10^{-5} \text{ s} = 80 \mu\text{s}$.

Problem 10 Cards in a row

1. **No**.

2. The middle hole is not on the straight line between the other two, and light travels only in straight lines.

3. Lower the middle card by 2 cm so that **all three holes line up**.

Problem 11 Four materials

1. Glass: **transparent**; curtain and frosted glass: **translucent**; plywood: **opaque**.

2. $91 - 28 = 63 \text{ percentage points}$.

3. **Glass**, because it lets the most light through.

Problem 12 Dark room

1. She can see **nothing**.

2. With no source, there is no light to reflect off objects, so no light reaches her eyes.

Problem 13 Torch through a glass

1. Clear water: **transparent**; cloudy water: **translucent**; black card: **opaque**.

2. $84 \div 90 \times 100 = 93 \%$.

3. $36 \div 90 \times 100 = 40 \%$.

Problem 14 One minute of light

- $3.0 \times 10^8 \times 60 = \mathbf{1.8 \times 10^{10} \text{ m.}}$
- $1.8 \times 10^{10} \div 1000 = \mathbf{1.8 \times 10^7 \text{ km.}}$

Problem 15 Choosing materials

(a) **Transparent**: students need a clear view and daylight. (b) **Translucent**: light enters but nobody can see in. (c) **Opaque**: it blocks the view. (d) **Translucent**: it spreads soft light without glare.

Problem 16 Pinhole camera

- Rays from the top of the flame cross at the hole and reach the bottom of the screen, so the image is **inverted**.
- Image height = $6.0 \times 10 \div 30 = \mathbf{2.0 \text{ cm.}}$
- The image becomes **larger**.

Problem 17 Signal from Mars

- $2.25 \times 10^{11} \div 3.0 \times 10^8 = \mathbf{750 \text{ s.}}$
- $750 \div 60 = \mathbf{12.5 \text{ minutes.}}$
- $2 \times 12.5 = \mathbf{25 \text{ minutes.}}$

Problem 18 Fair test for materials

- A: $(82 + 80 + 84) \div 3 = \mathbf{82 \text{ lux}}$; B: $(31 + 29 + 30) \div 3 = \mathbf{30 \text{ lux}}$; C: $\mathbf{0 \text{ lux}}$.
- 82 %, 30 % and 0 %**.
- For example the torch distance and the torch brightness, and the position of the meter.
- A transparent, B translucent, C opaque.

Problem 19 Headlights in fog

- Water droplets scatter some of the light sideways into his eyes, so the path of light shows up.
- The droplets scatter and weaken the light from distant objects.
- Translucent**: some light passes, but it is scattered.

Problem 20 Laser rangefinder

- $3.0 \times 10^8 \times 2.0 \times 10^{-7} = \mathbf{60 \text{ m.}}$
- $60 \div 2 = \mathbf{30 \text{ m.}}$
- The light went to the wall **and back**, so it covered the distance twice.