

Splitting light, coloured filters, lenses and the eye

Grade 8 science (Year 9 · Class 8) · Worksheet

Name: _____ Date: _____ Class: _____

These 20 problems train you to describe how white light splits into colours, predict what coloured filters and lamps do to the colour of an object, and use ray ideas and magnification for converging lenses and the eye. They move from recall to multi-step reasoning. The problems suit Grade 8, Year 9 and Class 8 students, and match the wave and light ideas in NGSS middle school science, KS3 and CBSE. Write units in every numerical answer.

Level: Grade 8 science (Year 9 · Class 8) · **Curriculum:** MS-PS4-2

Problem 1 Spectrum order (easy)

Aarav in Pune photographs a rainbow after the rain.

1. Name the effect that splits white light into colours.
2. List the six colours in order, starting with the colour that bends least.
3. State which colour bends most.

Problem 2 Mixing coloured lights (easy)

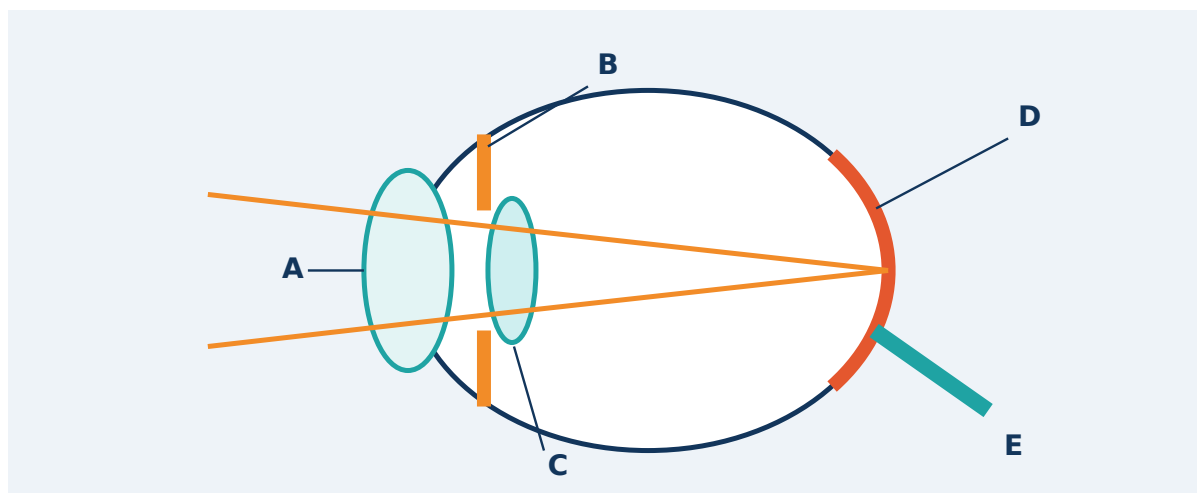
Three torches shine red, green and blue light on a white wall.

1. Name the colour where red and green overlap.
2. Name the colour where green and blue overlap.
3. Name the colour where all three overlap.

Problem 3 Parts of the eye (easy)

Study the diagram of the eye.

1. Name parts A, B, C, D and E.
2. State which part does most of the bending of the light.
3. State which part contains the light-sensitive cells.



The eye with five parts labelled A to E.

Problem 4 Blue torch filter (easy)

Wanjiru in Nairobi covers a white torch with a blue filter.

1. State the colour of the light that leaves the filter.
2. State what happens to the red and green light in the beam.
3. The blue light then meets a red filter. State what emerges.

Problem 5 Lens vocabulary (easy)

A converging lens has a focal length of 25 cm.

1. Convert 25 cm to metres.
2. State how far from the lens parallel rays meet.
3. Describe the shape of a converging lens.
4. State whether a fatter lens has a longer or shorter focal length.

Problem 6 Magnifying glass (easy)

Kofi in Accra looks at a seed through a magnifying glass. The seed is 2.5 cm long and its image is 7.5 cm long.

1. Calculate the magnification.
2. Calculate the image height of a 4.0 cm object at the same magnification.

Problem 7 Banana under coloured lamps (medium)

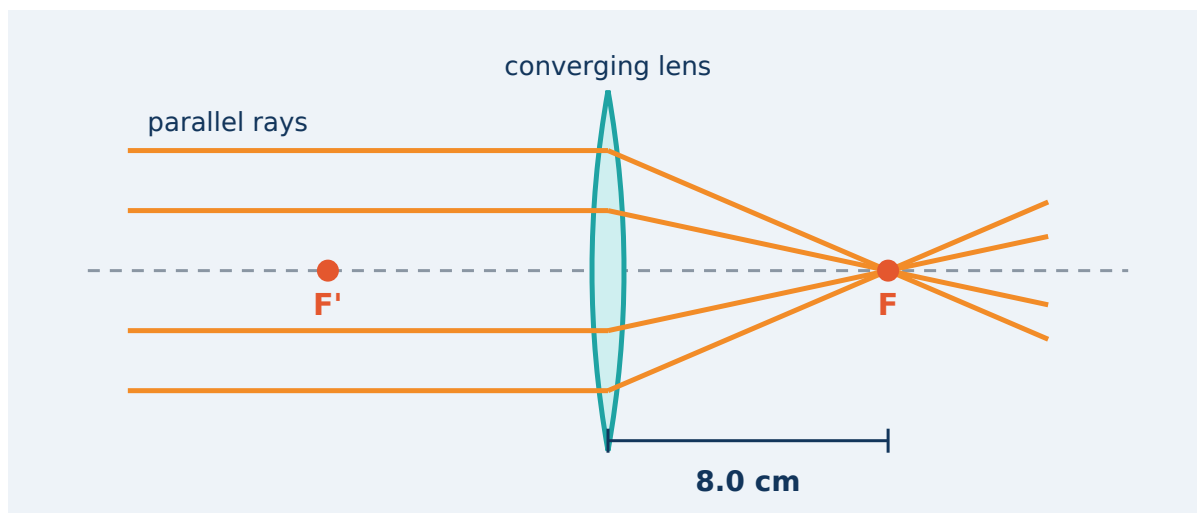
A yellow banana reflects red and green light and absorbs blue light.

1. State its colour in white light.
2. State its colour under a pure red lamp.
3. State its colour under a pure blue lamp, and explain.

Problem 8 Focal length and lens power (medium)

The diagram shows parallel rays meeting at F.

1. State the focal length.
2. Convert it to metres.
3. The power of a lens in dioptres (D) equals $1 \div$ focal length in metres. Calculate the power of this lens.
4. A second lens has $f = 5.0$ cm. Calculate its power and state which lens bends light more.



A converging lens with parallel rays. The distance from the lens to F is 8.0 cm.

Problem 9 Diminished image (medium)

A lens forms an image 2.4 cm tall of an object 6.0 cm tall.

1. Calculate the magnification.
2. State whether the image is enlarged or diminished.
3. The same lens, at the same magnification, forms an image of a 15 cm object. Calculate the image height.

Problem 10 Pupil in bright light (medium)

Chiamaka in Lagos walks from a dim classroom into bright sunshine.

1. Describe what happens to her pupils.
2. Name the part of the eye that causes this.
3. Explain why this change helps her.

Problem 11 Image types from a table (medium)

A lens has a focal length of 10 cm. A student places an object at four distances: 35 cm, 20 cm, 14 cm and 7 cm.

1. Describe the image for each distance (real or virtual, upright or inverted, size).
2. State which images can be caught on a screen.
3. State at which distance the lens works as a magnifying glass.

Problem 12 Spot the errors (medium)

Emma in Leeds writes two statements: (i) A red filter adds red light to white light, so the beam becomes brighter. (ii) Violet light bends least in a prism.

1. Identify the mistake in (i) and correct it.
2. Identify the mistake in (ii) and correct it.

Problem 13 Camera and eye (medium)

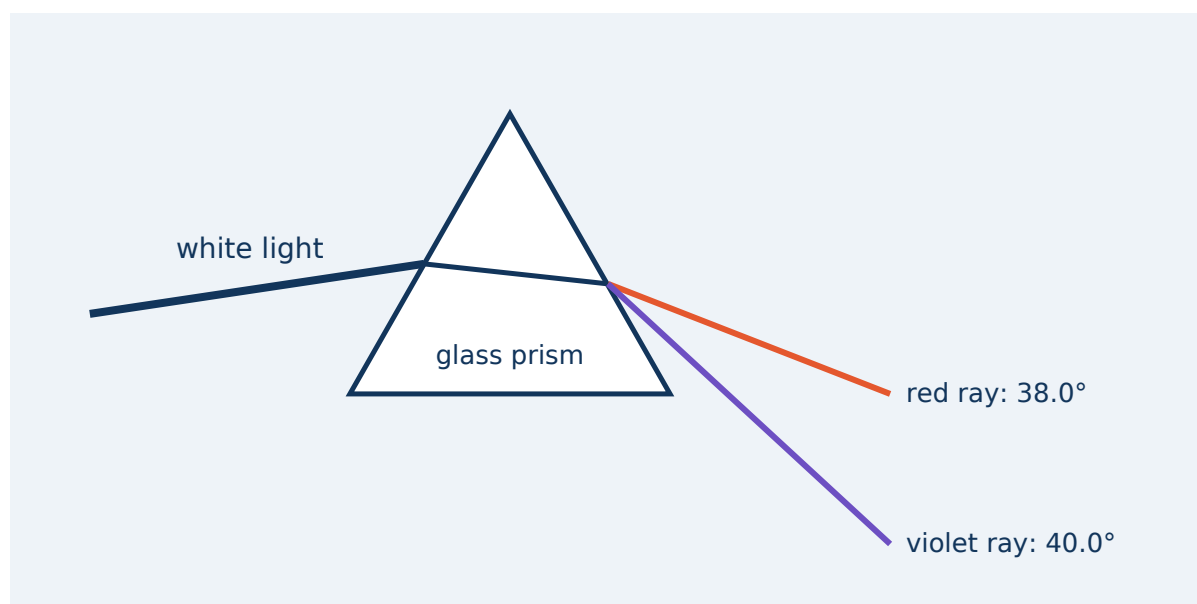
A simple camera and the eye both make a picture.

1. Name the part of the eye that matches the camera's sensor.
2. Name the part that matches the camera's adjustable opening.
3. State two features of the image on the sensor and on the retina.

Problem 14 Measuring the spread of a spectrum (medium)

A prism turns a red ray by 38.0° and a violet ray by 40.0° from the original beam direction.

1. State which colour is turned more.
2. Calculate the angle between the red and violet rays.
3. On a screen 2.0 m away, each 1.0° of spread makes a gap of about 3.5 cm. Calculate the width of the spectrum.



Two rays leaving the prism. The angles show how far each ray is turned from the original direction of the beam.

Problem 15 Two filters in a row (hard)

White light passes through a yellow filter, then a cyan filter.

1. State the colours that pass the yellow filter.
2. State the colour that passes both filters.
3. A magenta filter is then added. State what emerges, and explain.

Problem 16 Stage lights (hard)

Diego in Texas runs the lights for a school play. A red and a green spotlight overlap on a white backdrop. A blue shirt reflects only blue light.

1. State the colour of the overlap on the backdrop.
2. State the colour of the blue shirt in this yellow light, and explain.
3. A blue spotlight is also switched on. State the colour of the shirt and of the backdrop.

Problem 17 Slide projector (hard)

A projector shows a slide 3.0 cm tall as a picture 1.20 m tall on a screen 6.0 m from the lens. Use $M = h_i \div h_o$ and $M = \text{image distance} \div \text{object distance}$.

1. Convert 1.20 m to cm.
2. Calculate the magnification.
3. Calculate the distance from the slide to the lens.
4. State whether the slide is between F and 2F, and give your reason.

Problem 18 Short sight (hard)

Mei in Singapore finds distant road signs blurred. The image of a distant object forms in front of her retina.

1. Give two possible causes.
2. Name the type of lens in glasses that corrects this.
3. Explain how the glasses help.

Problem 19 Burning paper with sunlight (hard)

Bilal in Lahore uses a magnifying glass with $f = 12$ cm to focus sunlight on paper. At the focus the spot has a diameter of 1.0 mm. With the paper closer to the lens, the spot is 8.0 mm across.

1. State the best distance from the lens to the paper.
2. Calculate how many times larger the spot area is when the diameter is 8.0 mm. Use $\text{area} \propto d^2$.
3. Explain why the paper burns only near the focus.

Problem 20 Image on the retina (hard)

A person 1.70 m tall stands 5.1 m from an eye. Treat the lens-to-retina distance as 2.0 cm. Use $M = \text{image distance} \div \text{object distance}$.

1. Convert 2.0 cm to metres.
2. Calculate the magnification.
3. Calculate the height of the image on the retina in millimetres.
4. State two features of this image.