SCIENCE FOUNDATIONS

Mirrors and lenses

Difficulty level: Intermediate

Science Foundations

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Overview of the concept

This is how your bathroom mirror shows you upright, a car side mirror squeezes a wide view into a small glass, and your glasses focus the world onto your eyes. A dentist uses a small curved mirror to see behind a tooth without moving the patient. A photographer chooses a lens to make a distant subject look close or a wide scene fit in the frame. Knowing mirrors and lenses tells you how light is bent and bounced to form the images you rely on every day.



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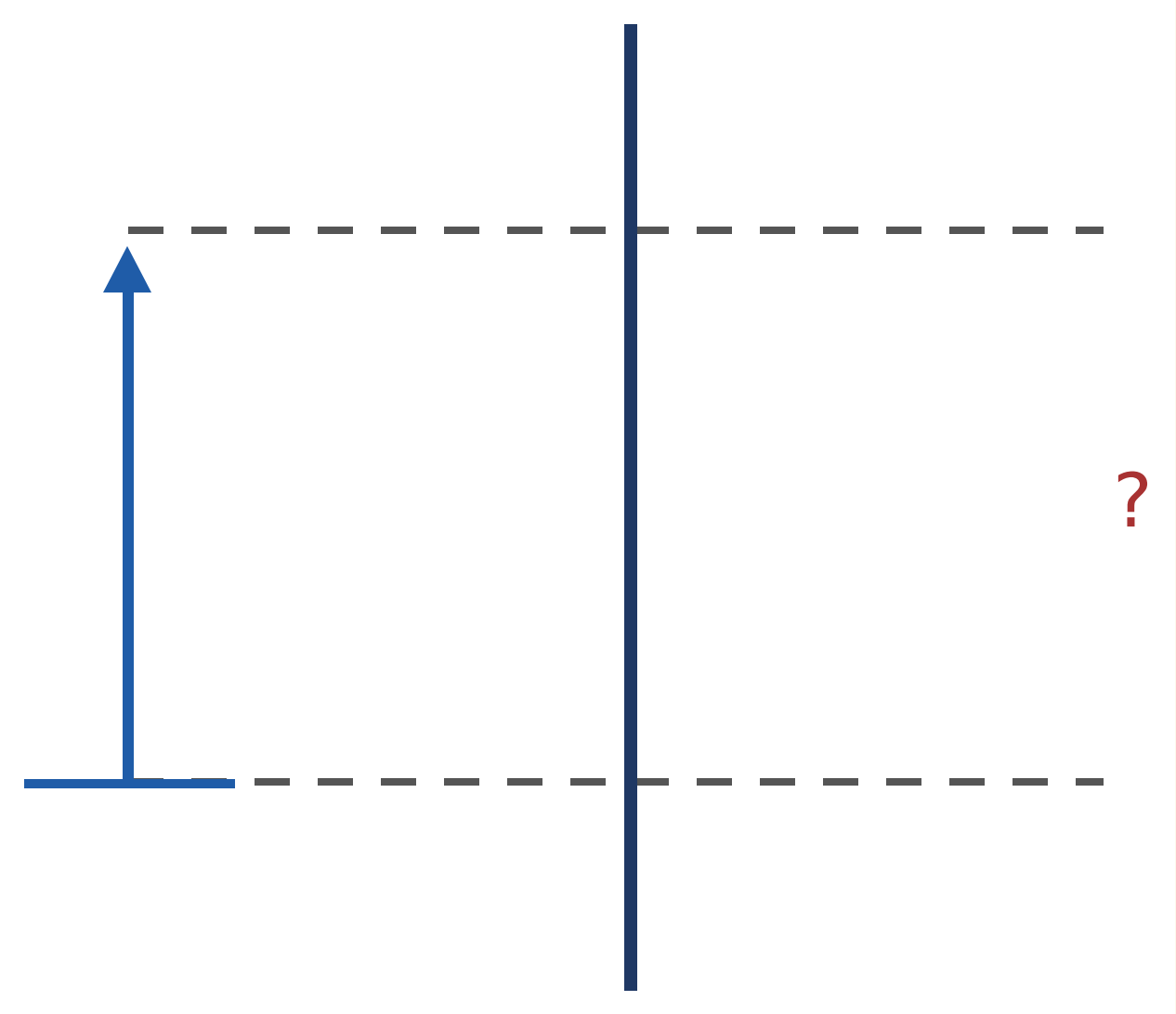
Worked examples

EXAMPLE 1

Q Describe the image in a plane mirror.



SOLUTION

Use the plane mirror rules: virtual and upright.

Size: same size as the object.

Position: as far behind the mirror as the object is in front.

The result is virtual, upright, same size, behind the mirror.

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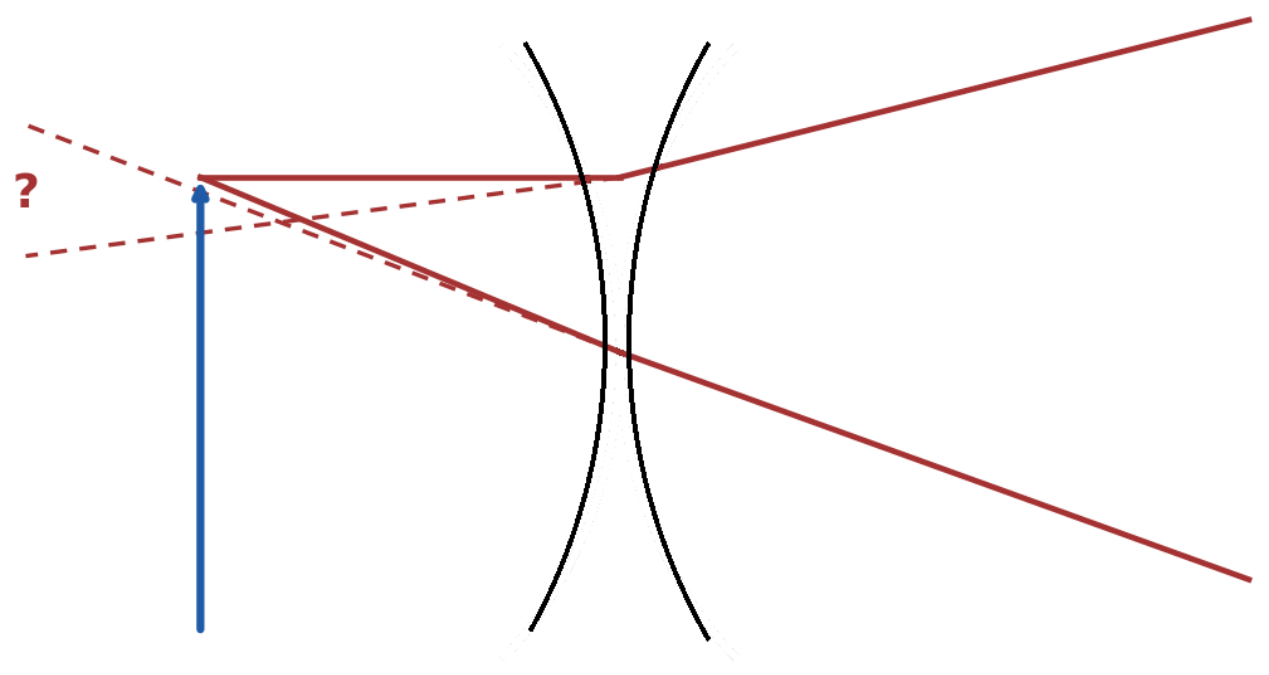
EXAMPLE 2

Q Describe the image in a concave lens.



SOLUTION

Use the concave lens rules: virtual and upright.

Size: smaller than the object.

Position: on the same side as the object.

The result is virtual, upright, smaller.

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Practice questions

1 **Describe the image in a concave mirror when the object is far away: real or virtual, upright or inverted, size, and position.**

- **A** Virtual, upright, same size, behind the mirror
- **B** Real, inverted, smaller, in front of the mirror
- **C** Virtual, upright, smaller, behind the mirror
- **D** Real, upright, larger, in front of the mirror

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2

An object stands 3 m in front of a plane mirror. Describe its image fully.

A. Virtual, upright, same size, 3 m behind the mirror

B. Virtual, upright, same size, 3 m in front of the mirror

C. Real, inverted, same size, 3 m behind the mirror

D. Virtual, upright, smaller, 3 m behind the mirror

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3

Describe the image in a convex lens when the object is inside the focal length: real or virtual, upright or inverted, size, and position.

A. Real, inverted, smaller, on the far side of the lens

B. Virtual, upright, larger, on the same side as the object

C. Virtual, upright, smaller, on the same side as the object

D. Real, inverted, larger, on the far side of the lens

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4

Describe the image in a convex lens when the object is far away (beyond twice the focal length): real or virtual, upright or inverted, size, and position.

A. Real, inverted, smaller, on the far side of the lens

B. Virtual, upright, larger, on the same side as the object

C. Virtual, upright, smaller, on the same side as the object

D. Real, inverted, larger, on the far side of the lens

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5

What kind of image can a convex lens make?

A Only a real image

B A real image (or a virtual image if the object is very close)

C Only a virtual image

D No image at all

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6 What kind of image can a concave mirror make?

- A Always virtual and upright
- B Usually real and inverted, but virtual and upright when the object is inside the focal length
- C Always real and inverted
- D Usually virtual and inverted, but real and upright inside the focal length

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7 Which lens is thinner in the middle: convex or concave?

- A Concave lens
- B Convex lens

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8

Which mirror bulges outward: convex or concave?

A Convex mirror

B Concave mirror

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9

Describe the image in a convex mirror.

A Real, inverted, smaller, in front of the mirror

B Virtual, upright, smaller, behind the mirror

C Virtual, upright, same size, behind the mirror

D Real, upright, larger, behind the mirror

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10

An object is 2 m in front of a plane mirror. How far behind the mirror is its image?

A 2 m in front of the mirror

B 4 m behind the mirror

C 2 m behind the mirror

D 1 m behind the mirror

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ANSWER KEY

1. Real, inverted, smaller, in front of the mirror

2. Virtual, upright, same size, 3 m behind the mirror

3. Virtual, upright, larger, on the same side as the object

4. Real, inverted, smaller, on the far side of the lens

5. A real image (or a virtual image if the object is very close)

6. Usually real and inverted, but virtual and upright when the object is inside the focal length

7. Concave lens

8. Convex mirror

9. Virtual, upright, smaller, behind the mirror

10. 2 m behind the mirror

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