Unit 1: Reflection

Learning Outcomes

Students should be able to:

1. Understand that light travels in a straight line
2. Define the terms used in reflection, including normal, angle of incidence and angle of reflection.
3. State that, for reflection, the angle of incidence is equal to the angle of reflection and use this principle in constructions, measurements and calculations.
4. Describe the image formed by a mirror.

The Speed Of Light!

Snail
0.04 m/s

Cheetah
31.0 m/s
(116km/h)

Sound waves
330 m/s

Aeroplane
350 m/s

Earth orbit
round the sun
29780 m/s

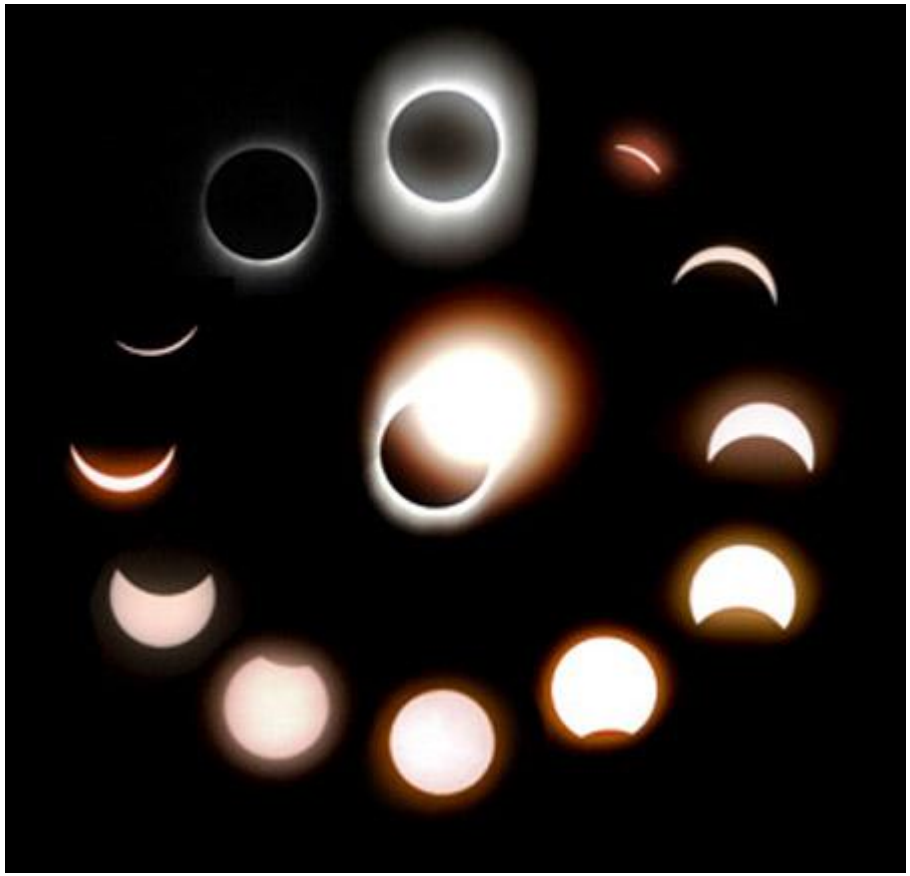
Speed of light in
vacuum
300000000 m/s
(3×10^8 m/s)

light travels in straight lines

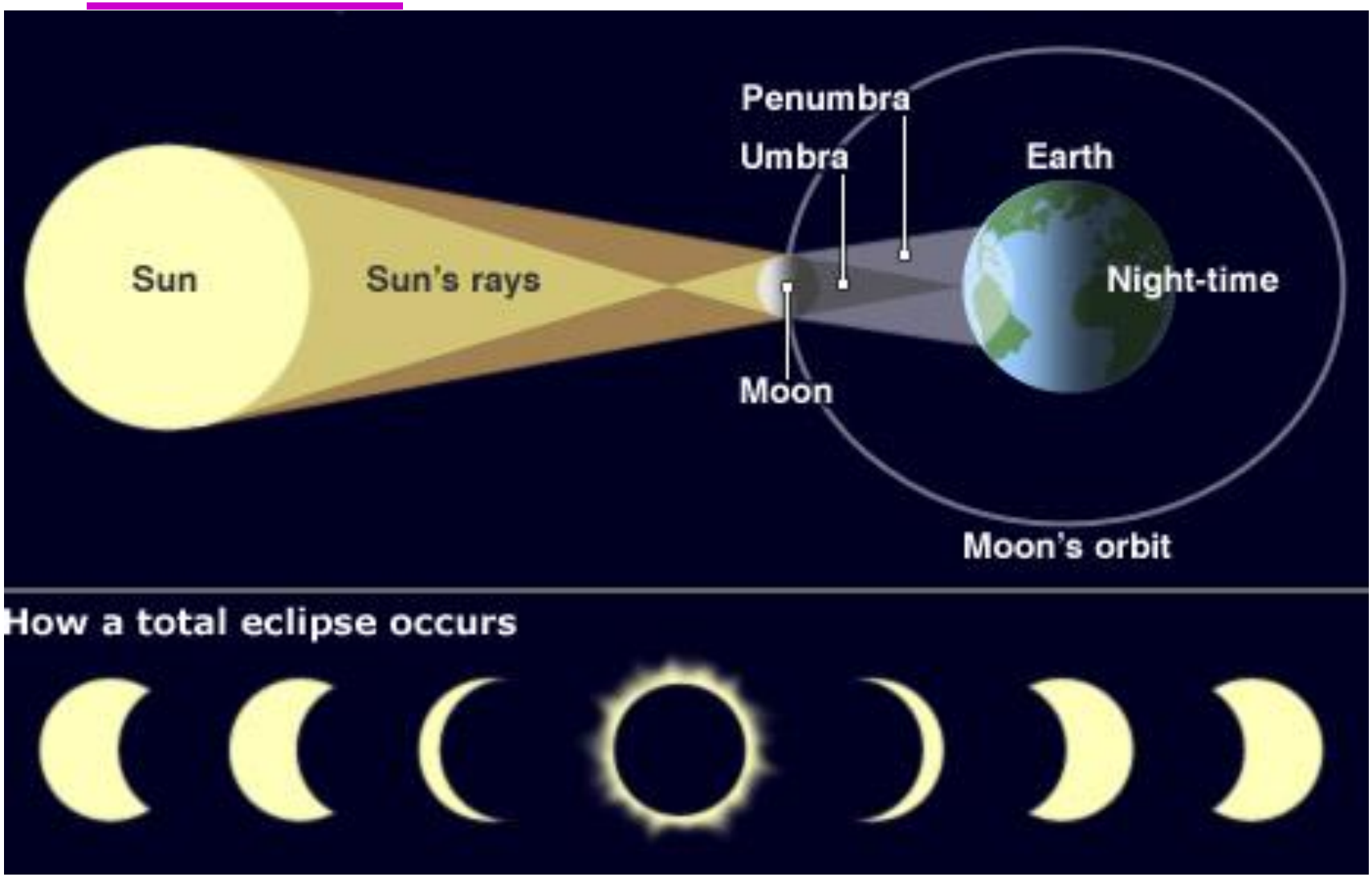
Do you agree?

How do you know?

Why or How does Solar Eclipse occurs?



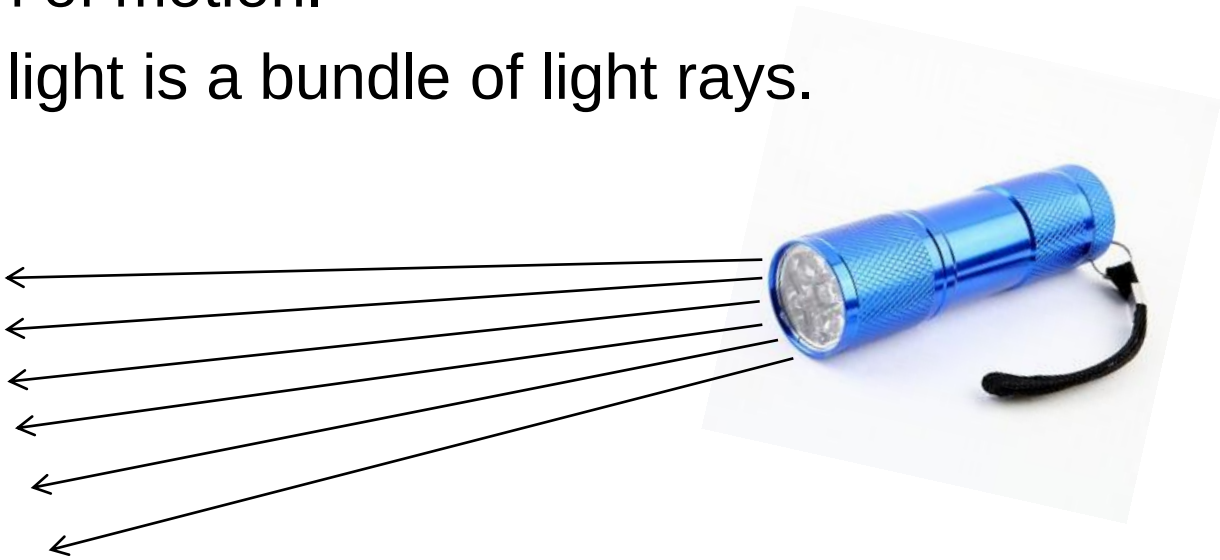
Therefore .....



http://www.microscopy.fsu.edu/primer/java/scienceopticsu/solar/index.html

light travels in straight lines

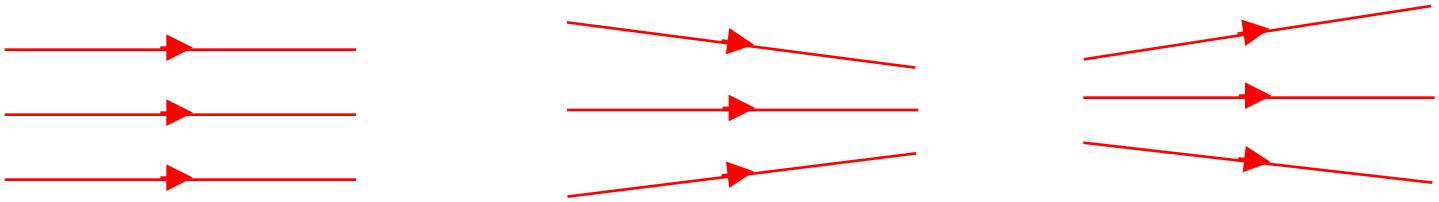
- The path along which light energy travels is called a ray.
- Represented by a straight line with an arrow to show its direction of motion.
- A beam of light is a bundle of light rays.



Question: How many light rays can we have from a beam of torch light?

light travels in straight lines

- A beam of light is a bundle of light rays.



parallel beams **converging beams** **diverging beams**

- Formation of sharp shadows and eclipses are evidence that light travels in straight lines.

Test Yourself!

1. What is the speed of light?

2. How does light travel?

3. Name three kinds of light beams.

Reflection

Is Simon correct?

My name is Simon,

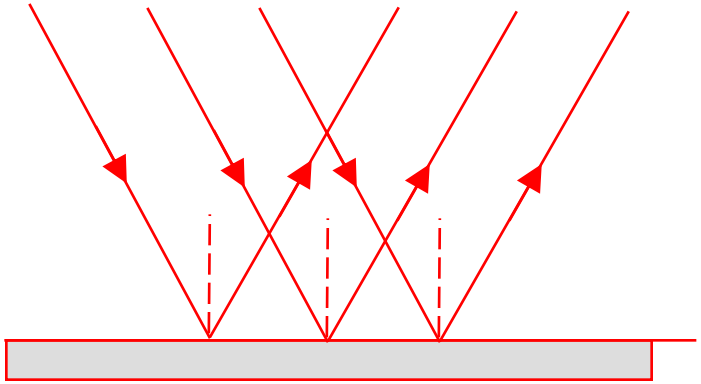
My mummy says that light only gets reflected by mirror. I think…

SHE BLUFFED ME!

diffused and regular reflection

parallel incident rays

parallel reflected rays



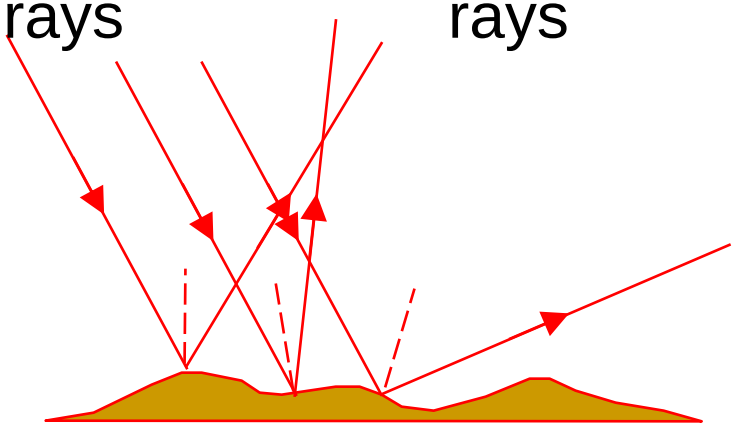
smooth surface

regular reflection

An image is formed

parallel incident rays

scattered reflected rays



rough surface

diffused reflection

No image is formed

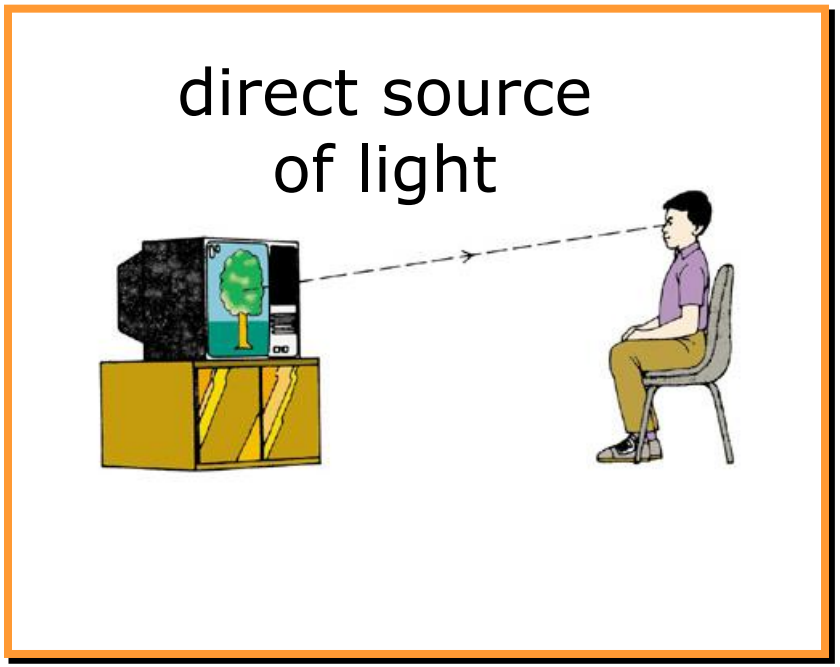
Reflection

When you look into a mirror, you see a picture of yourself. What you see is called an image.

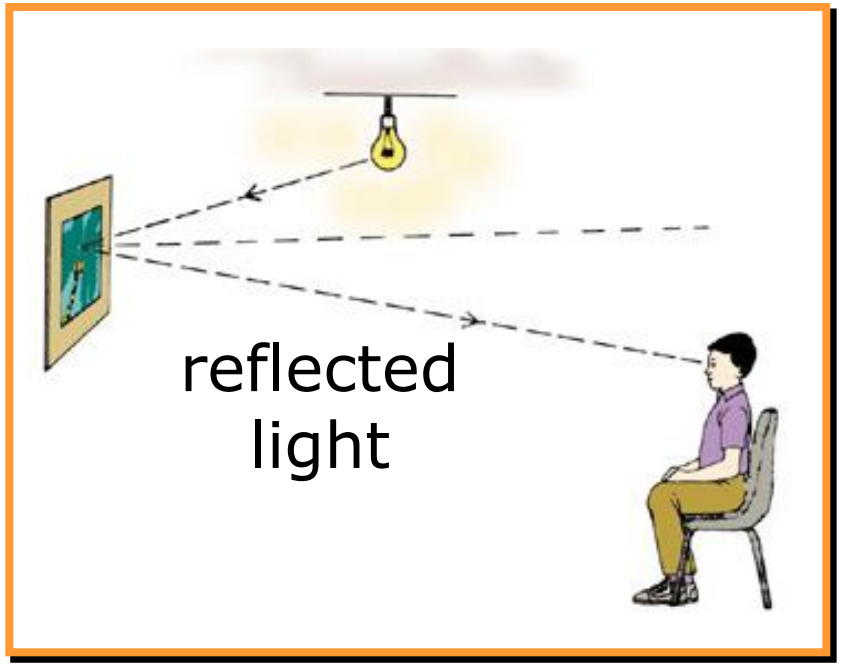
Where do you think the light originates from?

Reflection

We are able to see an object only when the light rays coming from it enter our eyes.



luminous objects emit light and we are able to see them directly



non-luminous objects are seen only because they reflect light from a source

Reflection

Definition:

The image in a mirror is formed when light rays bounce off the mirror and travel to your eyes. This bouncing of light off a mirror is called reflection.

Let's Think!

When we look into an image of our own into the mirror, what are the properties of the image can we observe?

1. Upright

image on mirror

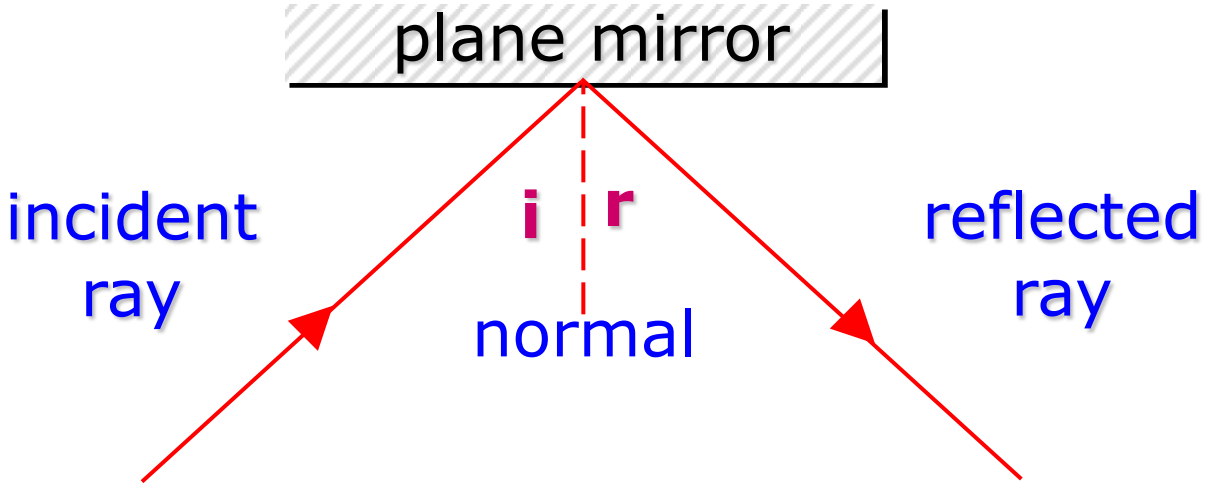
The characteristics of the image formed in the plane are:

- virtual
- upright
- same size as object
- same distance behind the mirror as the object is in front
- laterally inverted

Some random thoughts...

Film makers always thwart the laws of Physics to achieve some creepy effects for ghost stories!

Tracing the reflected rays

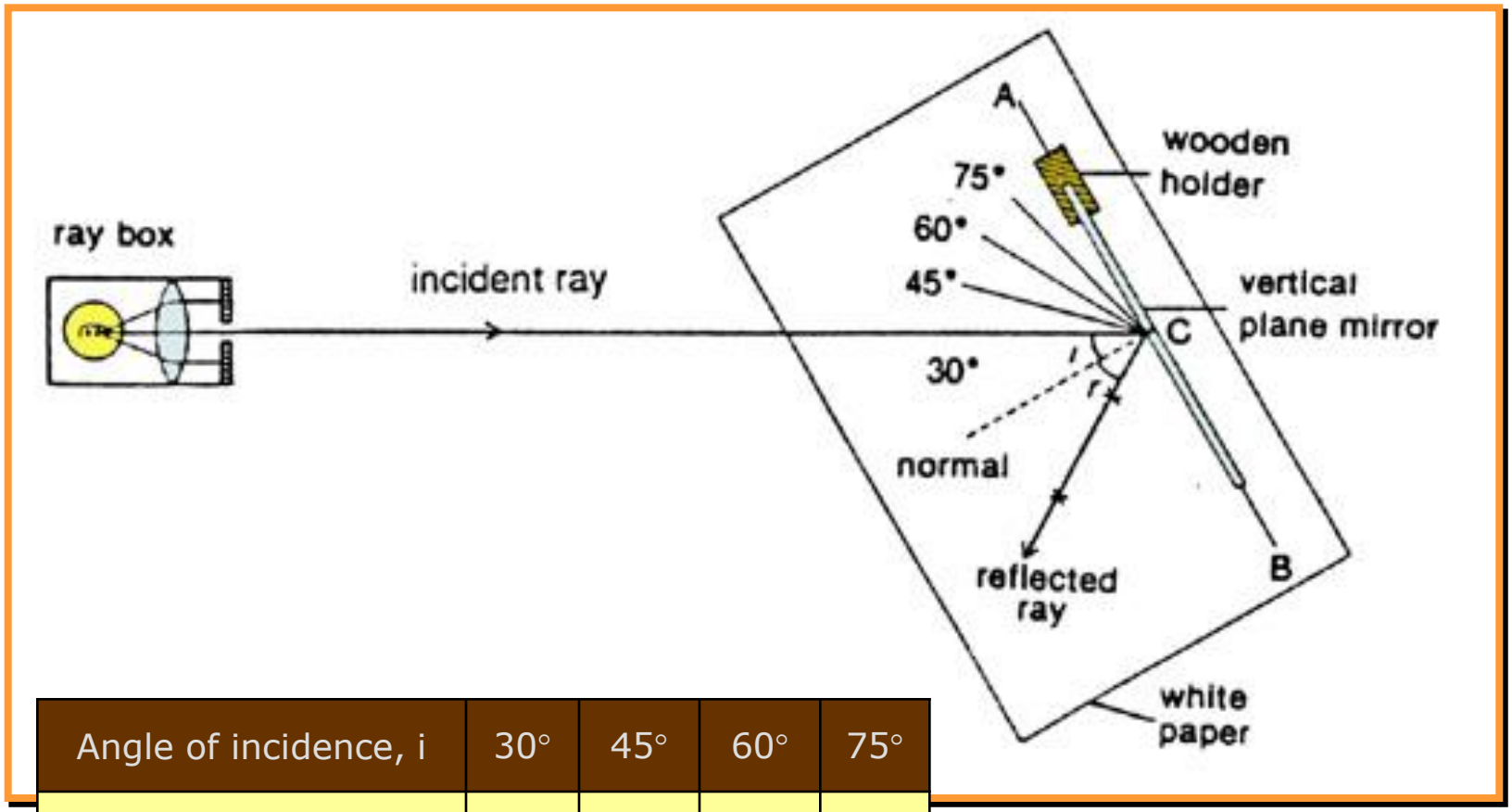


Laws of reflection

The angle of incidence is equal to the angle of reflection.

The incident ray, the reflected ray and the normal at the point of incidence all lie on the same plane.

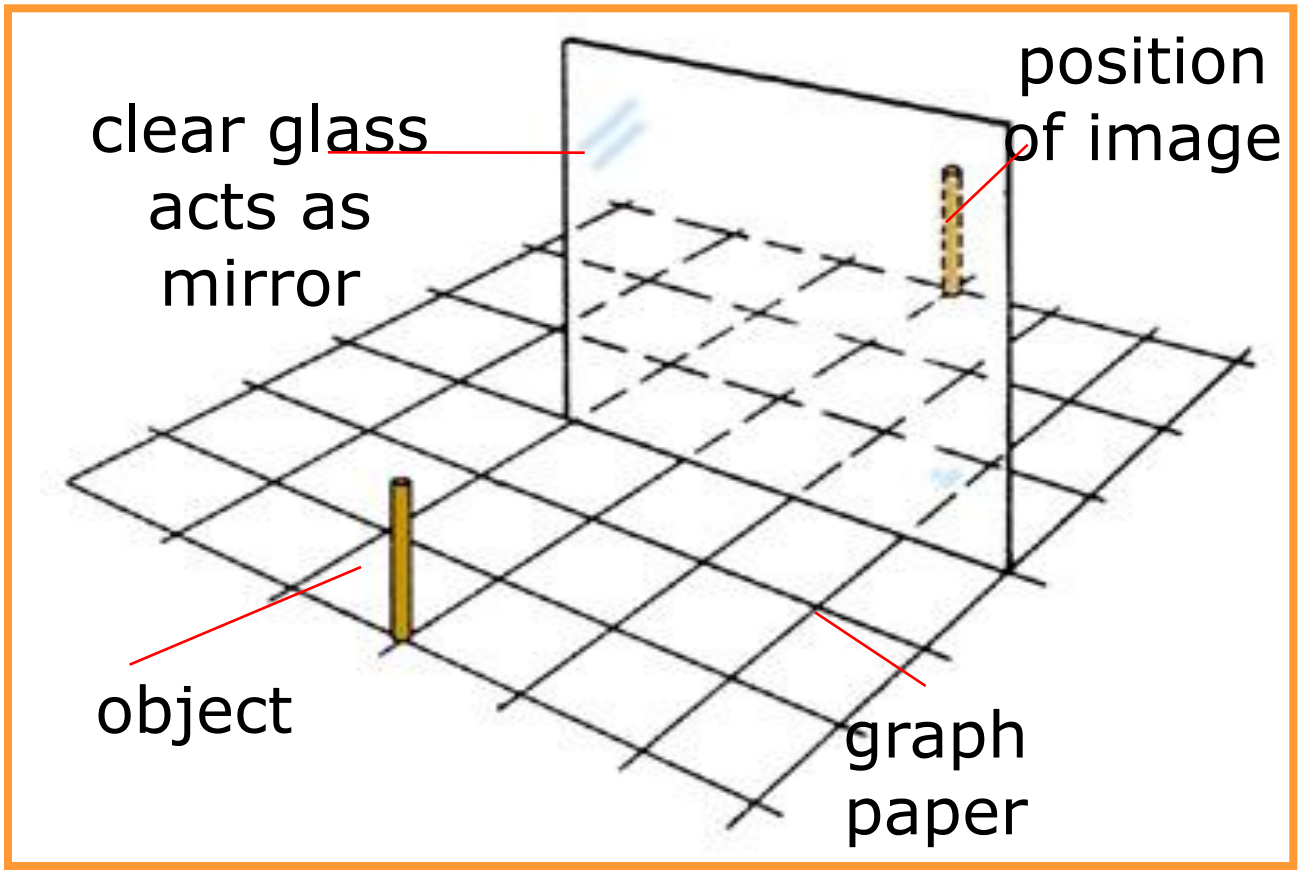
Laws of reflection



Angle of incidence, i	30°	45°	60°	75°
Angle of reflection, r				

image on mirror

The laws of reflection are true for all reflecting surfaces (plane mirrors and curved mirrors).



The image formed in a plane mirror has same distance behind the mirror as the object is in front.

image on mirror

The image formed in a plane mirror is laterally inverted.

Lesson Summary

We learnt about:

The speed of light

Light travels in a straight line

Diffused and regular reflection

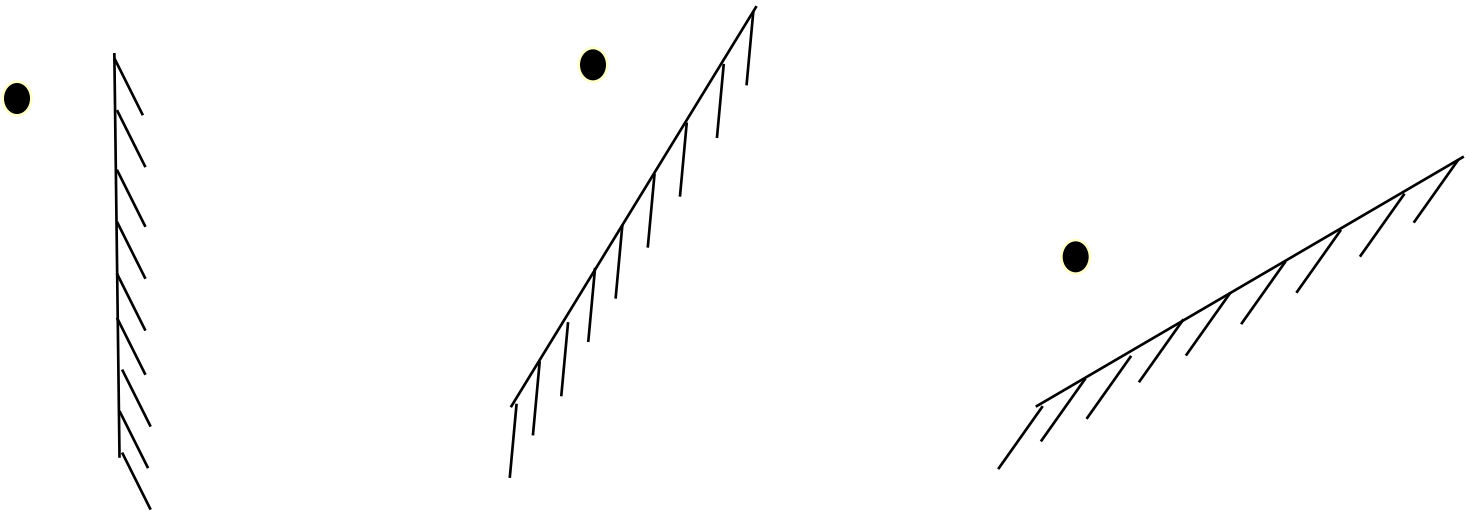
Properties of image

Tracing of the reflected ray

Constructing Ray Diagrams

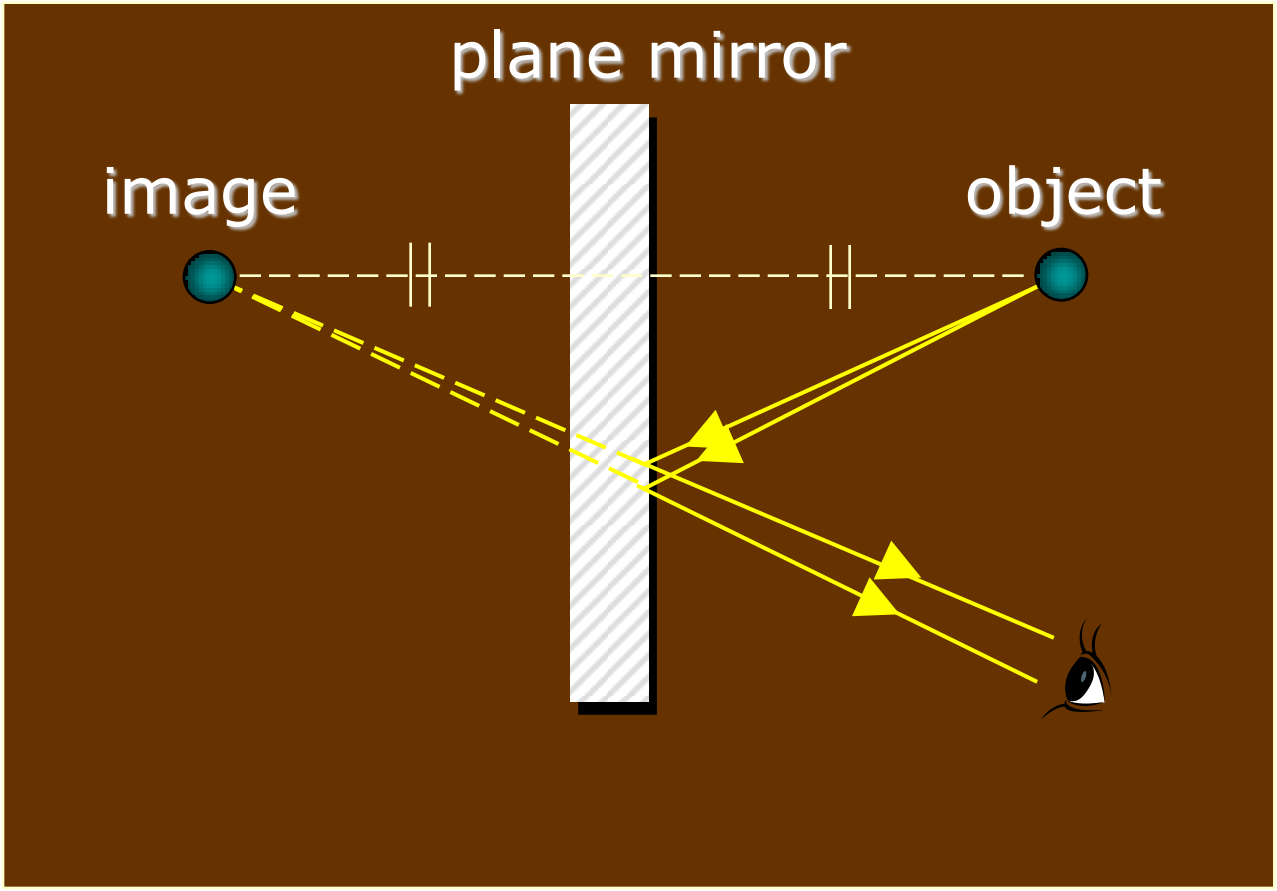
Behavior of an image

- An image is always found behind the mirror.
- The distance away from the mirror is always the shortest distance that it can find itself towards the mirror.



ray diagrams and images

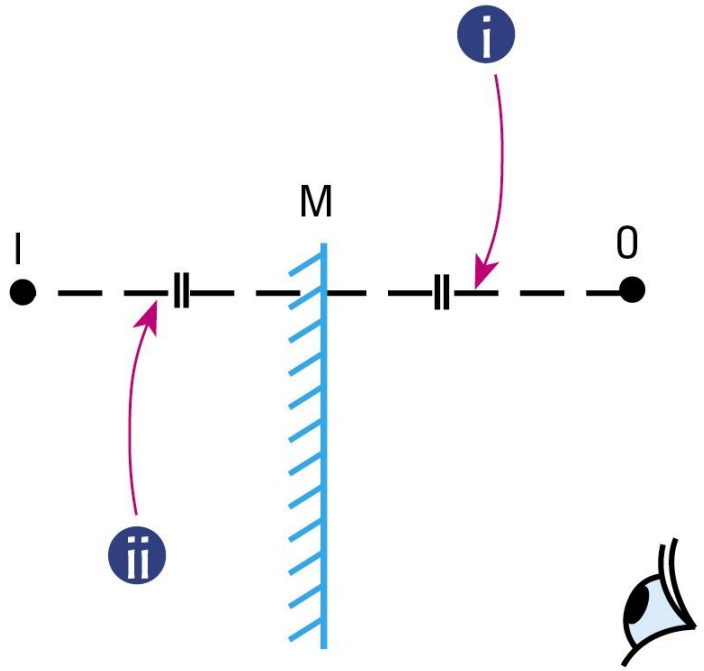
Usually, we do not use protractor to construct a ray diagram by a mirror.



Constructing Ray Diagrams

Step 1: Image distance from mirror = object distance from mirror

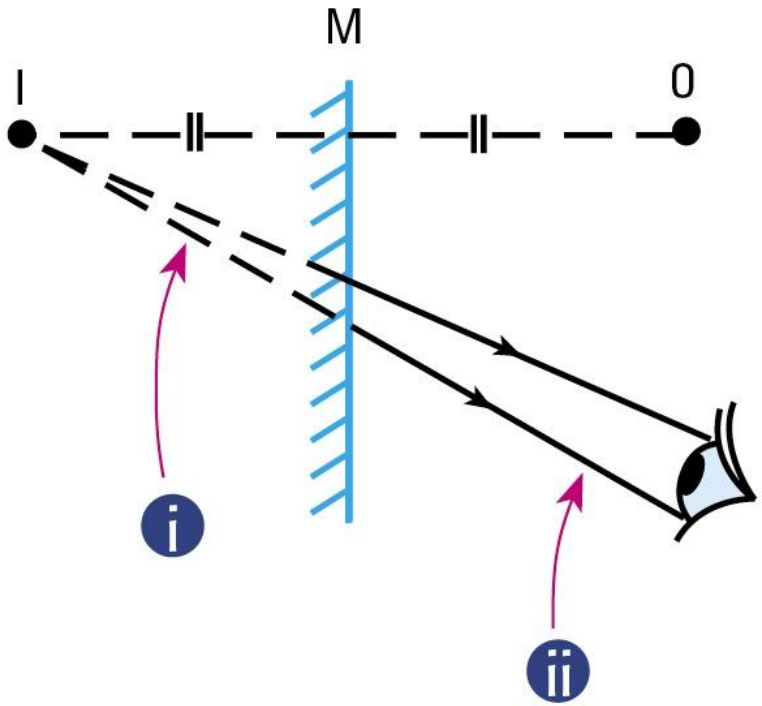
- Measure accurately the perpendicular distance between object O and the mirror surface.
- Mark off the same distance behind the mirror to locate image I



Constructing Ray Diagrams

Step 2: Draw the light rays from the image to the eye

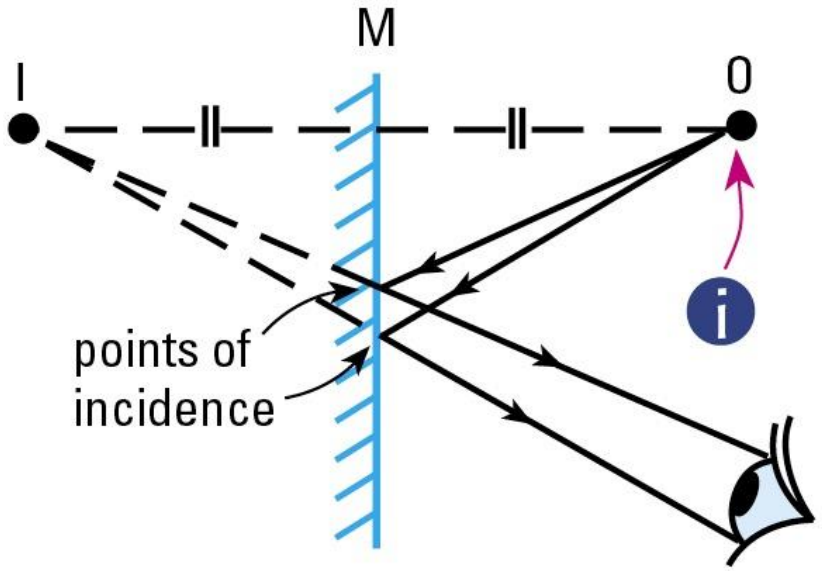
- Use dotted lines behind the mirror
- Use bold lines in front of the mirror surface.



Constructing Ray Diagrams

Step 3: Draw the incident rays from object O to the point of incidence on the mirror surface.

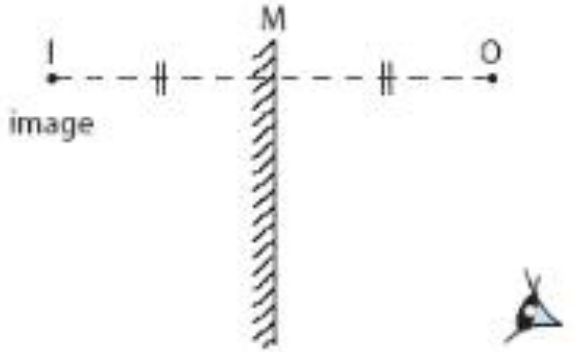
- Note that the angle of incidence = angle of reflection



Constructing Ray Diagrams

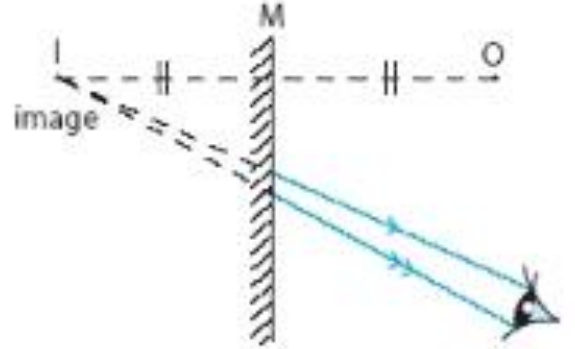
Step 1 *To locate the image position*

Draw a dotted line from the object O, perpendicular to the mirror M, and extend the line into the mirror. The position of the image I is marked so that IM = OM.



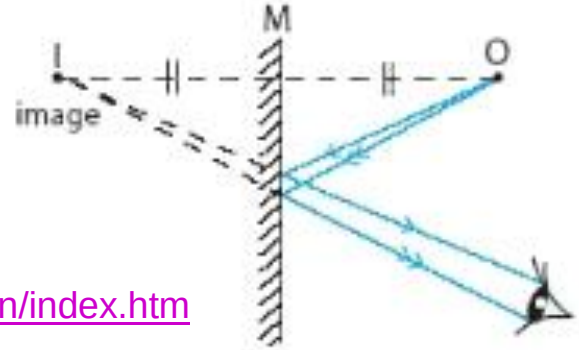
Step 2 *To draw the reflected rays*

Draw lines from the image to the eye. Draw dotted lines behind the mirror and solid lines in front of the mirror. (Solid lines represent real rays.)



Step 3 *To draw the incident rays*

Draw lines from the object to the reflected rays on the mirror.

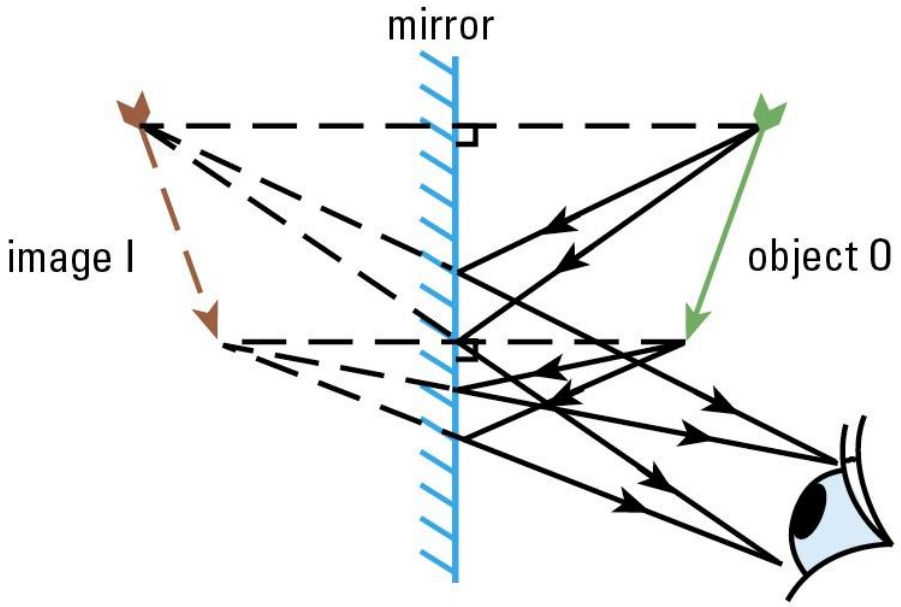


http://www3.moe.edu.sg/edsoftware/ir/files/physics-reflection/index.htm

Constructing Ray Diagrams

Drawing ray diagram for extended object

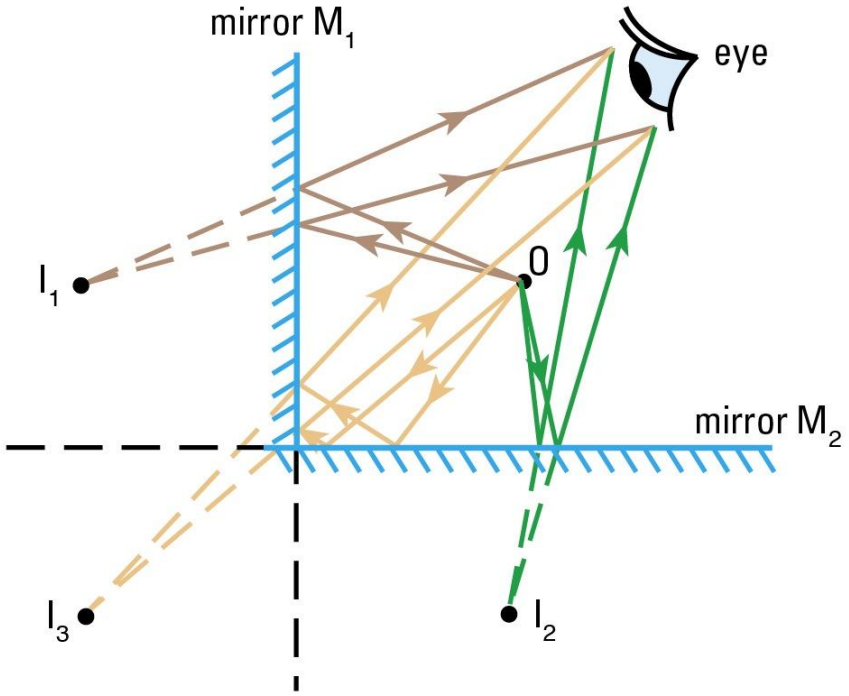
By considering the extended object as a number of points, we apply the same 3 steps to locate the image.



Constructing Ray Diagrams

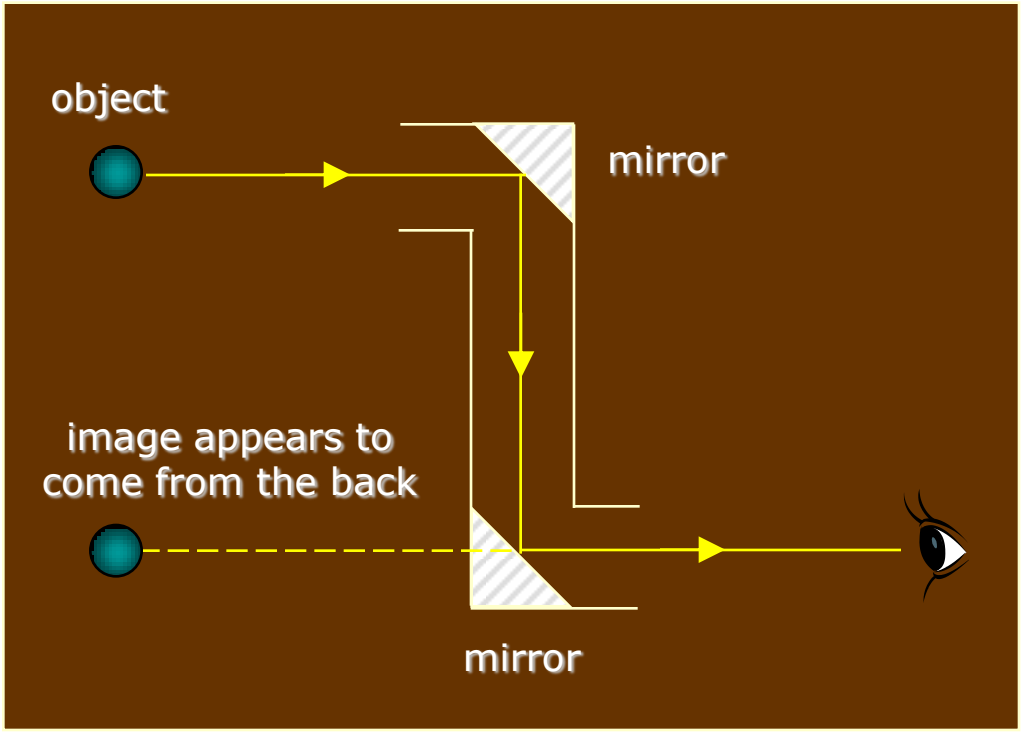
Multiple images in plane mirrors

When two mirrors are placed 90^{o} to each other, and an object O is placed between them, 3 images are formed.



using reflection: the periscope

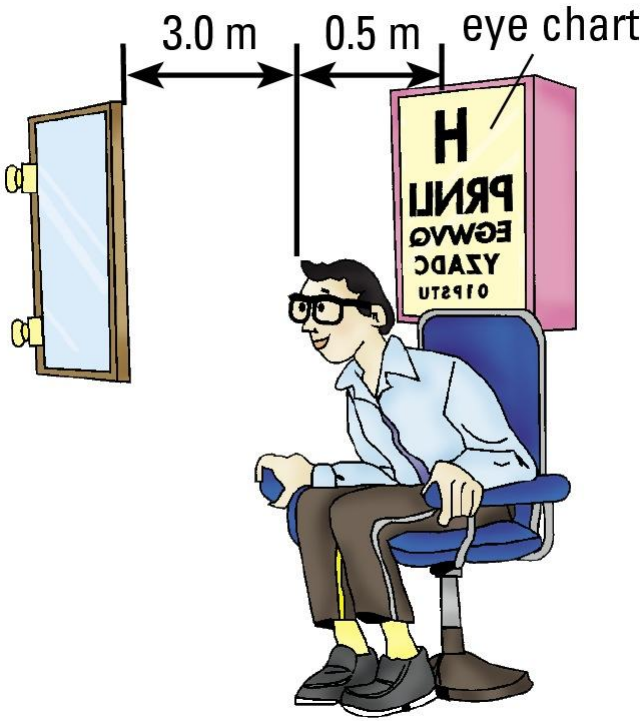
A periscope can be used to ‘look’ over high obstacles such as a wall.



Final image appears without lateral inversion.

using reflection: Optical Testing

Optical Testing

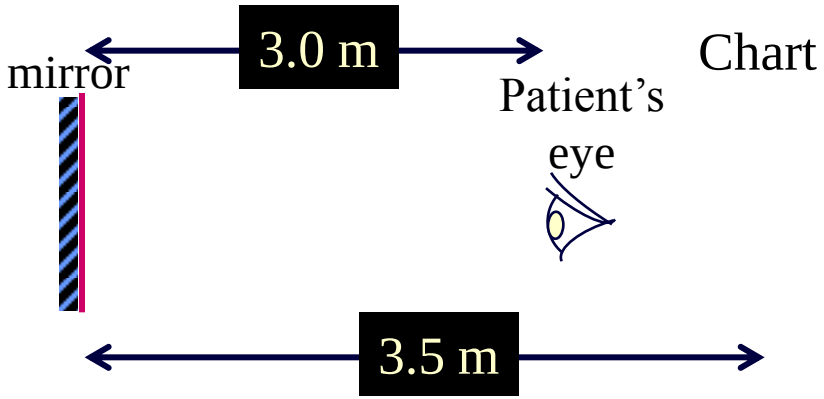


Plane mirrors are used to reduce the distance required for optical testing

using reflection: Optical Testing

Test Yourself

An optician's eye chart is fixed 0.5 m behind the eyes of a patient looking into a mirror placed 3.0 m in front of him. Find the distance of the chart as seen by his eyes.

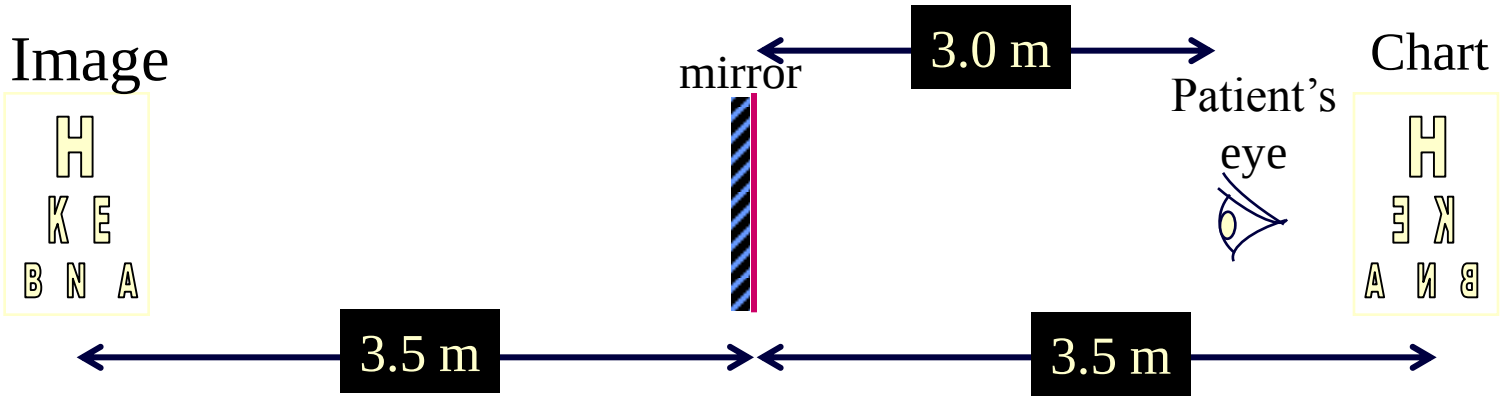


using reflection: Optical Testing

Test Yourself

An optician's eye chart is fixed 0.5 m behind the eyes of a patient looking into a mirror placed 3.0 m in front of him. Find the distance of the chart as seen by his eyes.

Answer:
The distance of the eye chart is 3.5 m from the mirror.
Hence the image of the eye chart is 3.5 m in the mirror.
Therefore chart's image is 6.5 m away from the patient's eyes.

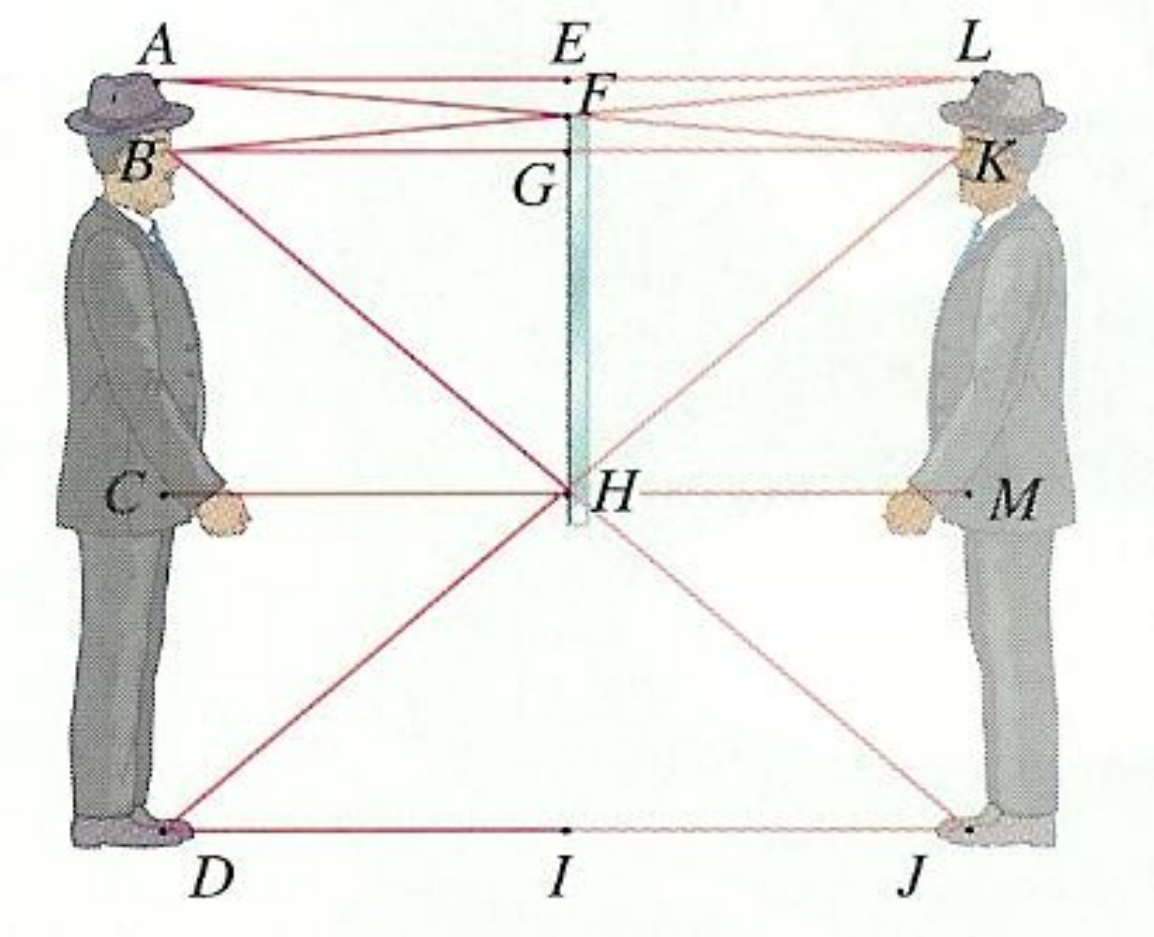


diffused and regular reflection

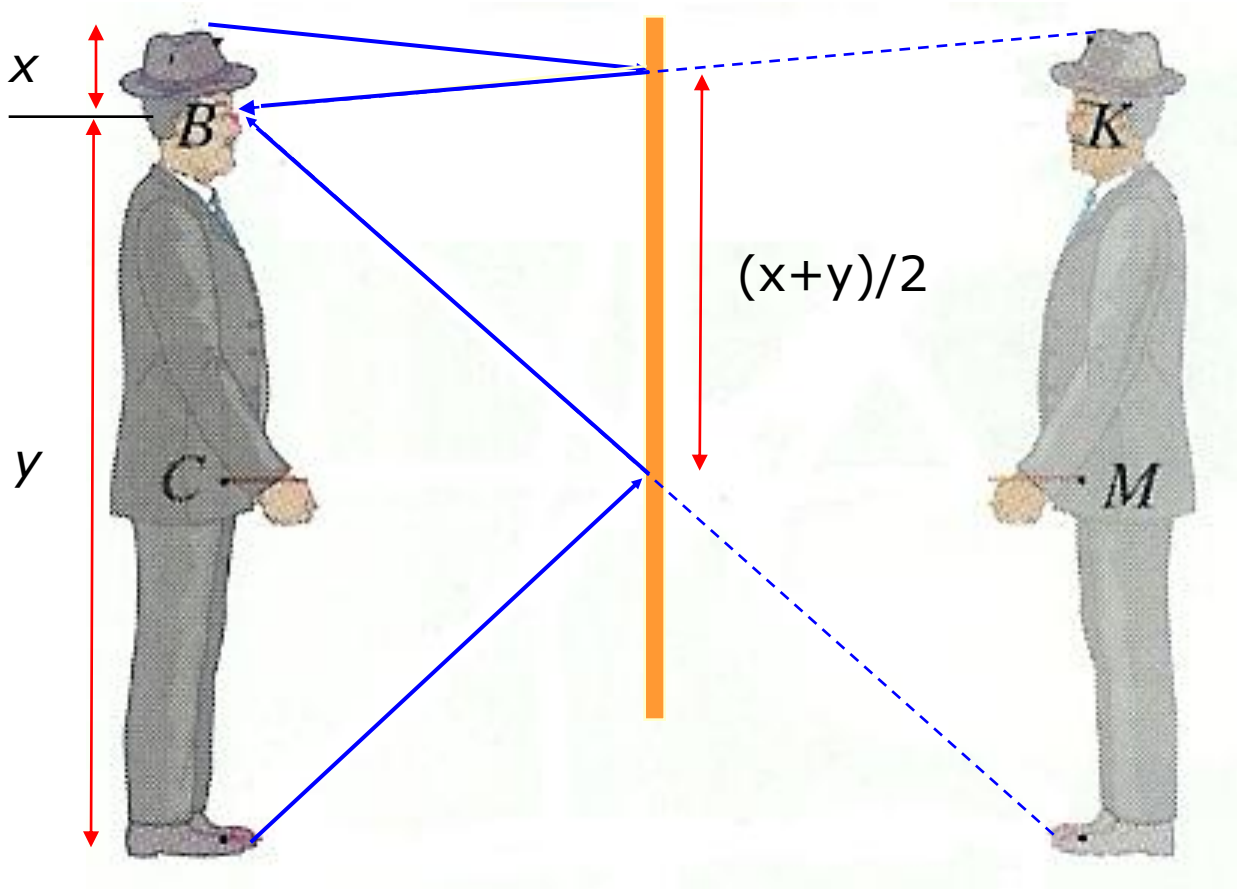
In photography, light is sometimes reflected off a rough white surface to diffuse light.

- the shadows that form are less sharp
- the picture is more pleasant to the eye

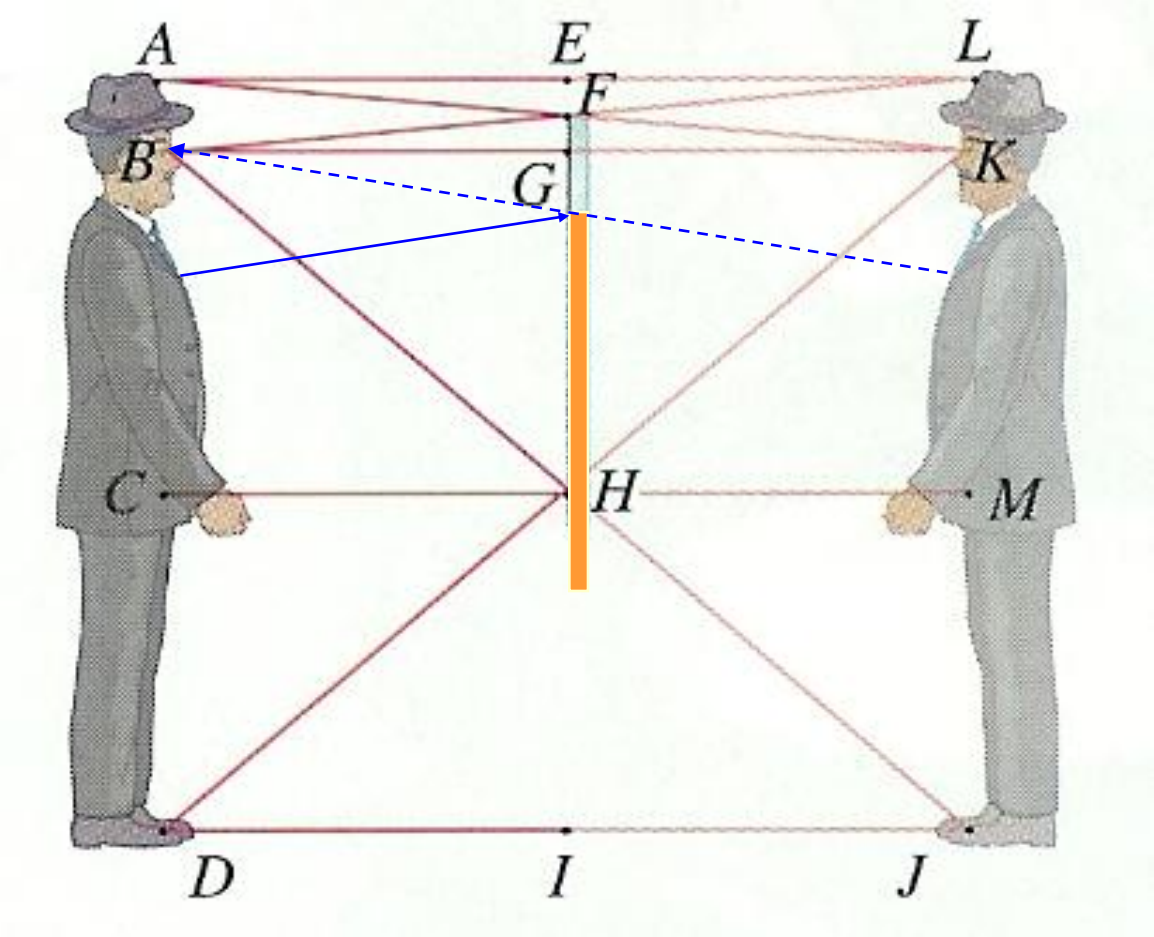
What is the minimum length of a mirror to see one's own full image?



Does the image size change as the object distance changes?


x
y
B
C
K
M
(x+y)/2

What is the minimum length of a mirror to see one's own full image?



Does the image size change as the object distance changes?

Making use of mirror to make rooms look bigger