# 2.3: Reflection summary (physics)

We see objects when the objects either emit light or reflect light, and the **light travels into our eye**. The **light travels in straight lines**.

**Self-luminous**: Produce light. Eg fire, light bulb, sun, firefly, glow sticks

**Non-luminous**: Don't produce light. We see them when light from self-luminous sources reflects off them into our eyes. Eg pencil, aluminum, bicycle reflectors

**Transparent**: Allows light to pass through. Eg spectacles, window glass, contact lenses

**Opaque**: Does not allow light to pass through. Eg apple, eraser, rock

**Rectilinear propagation**: Travelling in a straight line. Rectilinear=straight line propagation=travel

**Reversibility**: The laws of light travel (eg angle of incidence=angle of reflection) are universal, so a point of light can be traced backwards to its source, ie the path of light works both forward and backward. So if 2 people are in a maze of mirrors and A can see B through multiple reflections, B can see A too.

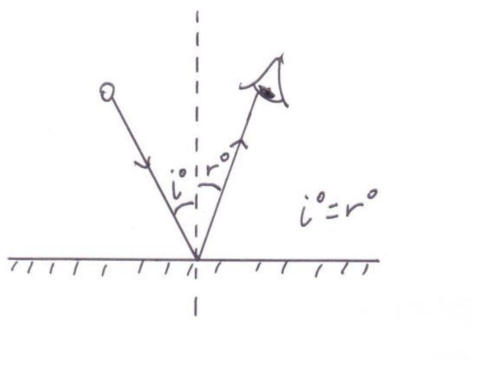
Terms:

**Normal**: The line $90^o$ from the plane.

**Angle of Incidence (i)**: The angle between incident ray and normal.

**Angle of Reflection (r)**: The angle between reflected ray and normal.

NOTE: The angle of incidence is **always equal** the angle of reflection. (i=r)

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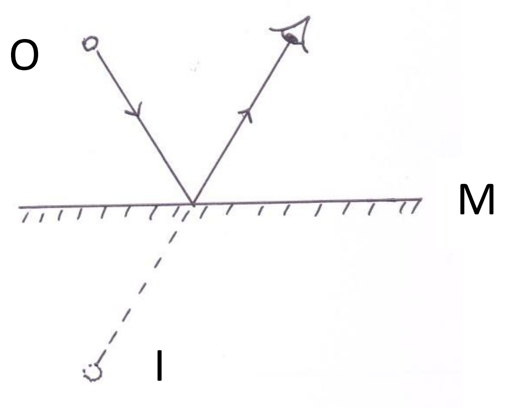
|---|
| Law of reflection: i=r<br>(Angle of incidence is always equal to the angle of reflection) |

**Real image**: An image that can be **caught on screen**. (Eg Projector shining images on the white screen)

**Virtual image**: An image that **cannot be caught on screen**. (Eg in the diagram below, O is the object and I is the image. **The eye sees the image of O in position I** due to the reflection, but **if a screen is placed behind the mirror M, the image I would not be captured**.)



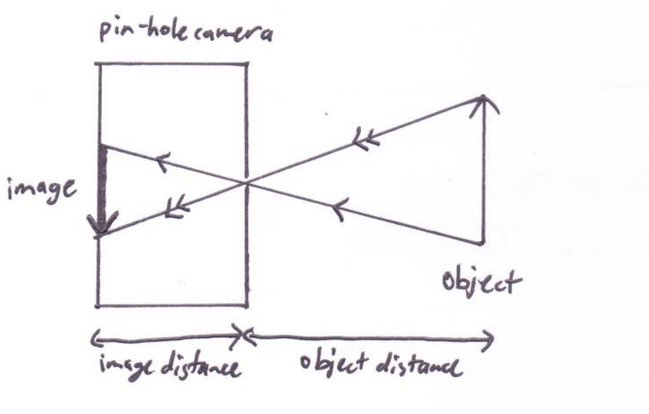

To **draw a ray diagram**, first draw a dot for **where the virtual image would be** (see the distance between original object and mirror perpendicular to the mirror, and then use that distance behind the mirror.) **Join the dot to the eye**, use straight line for between the mirror and the eye, and dotted line for between the mirror and the virtual image. And then **join the object** point to the **point where the previous line intersected the mirror**. Draw **arrows** on the straight lines to **indicate direction** of light travel, draw **normal**, and **label** if necessary.

**Regular reflection**: Occurs on **absolutely smooth surfaces**, like mirrors or glossed surfaces. All the light rays from generally the same direction would reflect in generally the same direction

**Diffuse reflection**: **Surface is not completely smooth** therefore the incident rays reflect in many directions even though they **still obey the i=r law**.

**Applications**:

- **Still water** reflects the moon as its original shape while **choppy water** reflects the moon as a column of light.
- Books with **matt pages** are easier to read as compared to books with **gloss pages**.




The diagram above shows a **pin-hole camera**. The light from the object (emitted or reflected) goes through the **small pin-hole**. Due to the **rectilinear propagation property** of light, the **image on the screen appears inverted**, both laterally and upside-down. (since the image is captured on a screen, it is a **real image**)

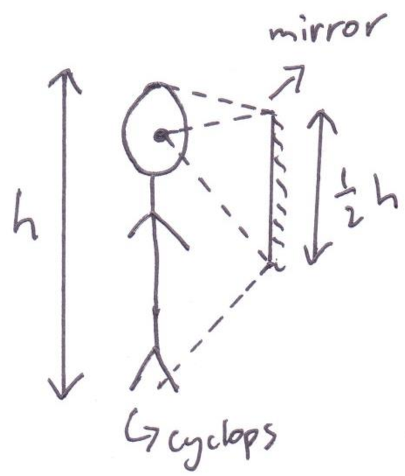
If a **larger pin-hole** were to be used, the image would be **brighter** (more light rays) and **blurrier** (more light rays overlap)

The **size of the image** on screen can be calculated with the following formula:

$$\frac{image\ distance}{object\ distance} = \frac{image\ height}{object\ height}\ (by\ similar\ triangles)$$

Key skills: use geometry, similar triangles, angles

Remember: looking at one's self always requires a mirror half the length. (due to i=r) and moving back and front, the size of one self's image remains the same.




Solar and Lunar eclipses are in syllabus, but optional.