

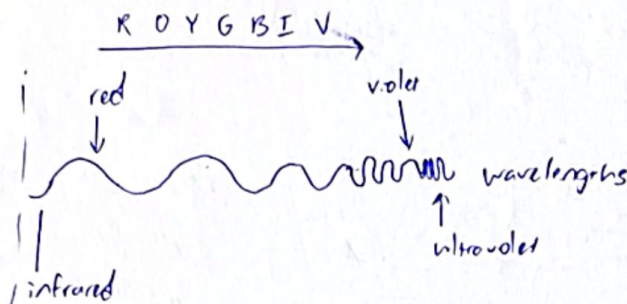
① Basic stuff

→ light ray

→ beam of light

→ convergent rays

→ divergent rays



★ Light:

- travels in straight line
- not matter

Opacity

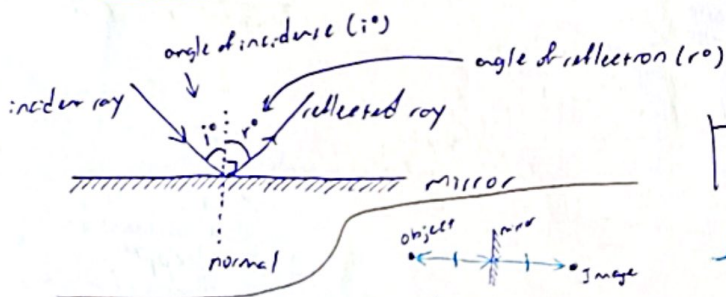
Transparent (see through)

Translucent

Opaque (cannot see through)

② Reflection

↳ Reflection is the rebounding of light at a surface.



$$i = r$$

normal $\perp$ plane

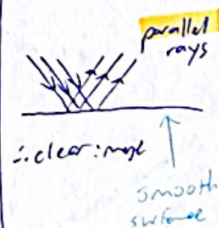
$\perp$ is the symbol for 'is perpendicular to'

★ Laws of reflection

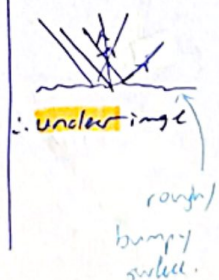
- ① The incident ray, reflected ray and normal all lie on the same plane.
- ② angle of incidence = angle of reflection

Types of Reflection

① Specular/Regular

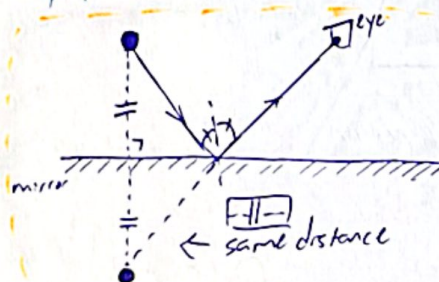


② Diffused/Irregular



★ Characteristics of a reflected image (plane mirror)

- virtual (cannot form on screen by itself)
 - laterally inverted
 - upright
 - same size
- Printed laterally inverted so they look correct on a car's side mirror



periscope

Applications → ambulance signs
→ mirrors for cosmetics, house, (log.??)

Mirror Types

③ Plane (totally flat)

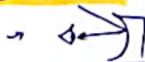
- full body
- any regular mirror
- rear-view mirror (cars)

① Convex



- surveillance, car park
- image: diminished
- Wider field of view

② Concave



- cosmetic mirrors
- image: magnified
- smaller field of view

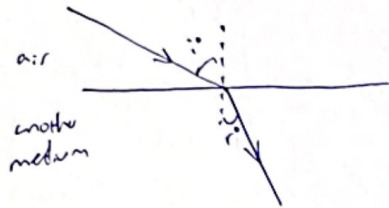
③ Refraction

→ Change in direction of light due to change in speed
 due to different optical densities

Speed of light in vacuum:

$$3.0 \times 10^8 \text{ m/s}$$

air also



$$i \neq r$$

★ If light is travelling into:

- optically denser: $i > r$

- optically less dense: $i < r$

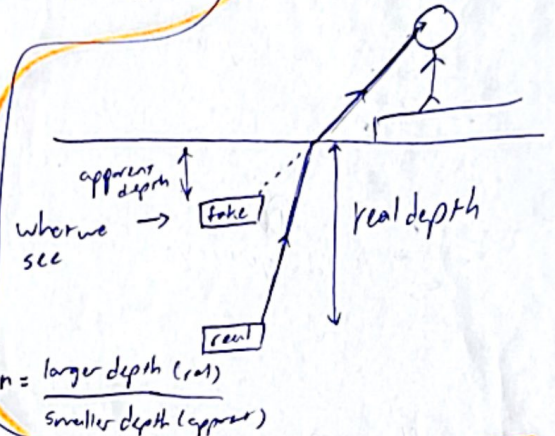
(due to electromagnetic wave collisions $\uparrow \downarrow$ in different mediums)

optically denser $\rightarrow$ slow down $\Rightarrow$ closer to normal

optically less dense $\rightarrow$ faster $\Rightarrow$ further from normal.

Essentially: as the **OPTICAL DENSITY INCREASES**, the light ray bends **CLOSER** to the normal.

Real vs Apparent Depth



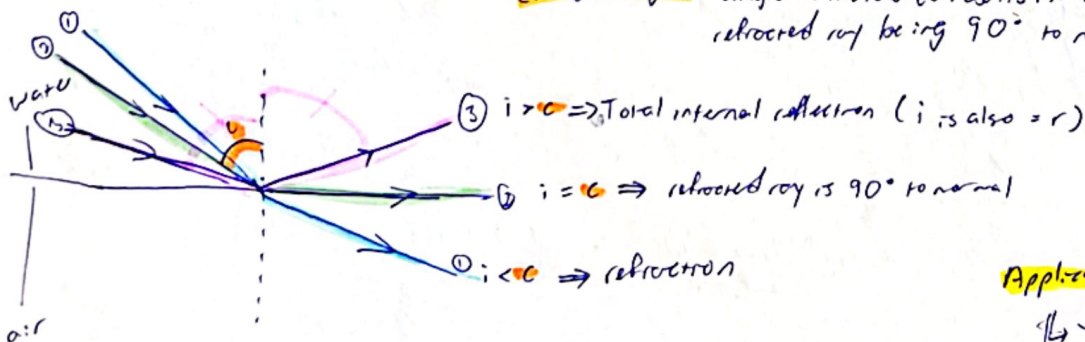
④ Dispersion of light

pretend the incident ray is white light



hence it bends **LESS** close to normal than other colours
 red $\leftarrow$ fastest; slows down least
 violet $\leftarrow$ slower; slows down more.
 hence it bends closest to normal amongst all the colours

⑤ Total internal Reflection



Critical angle: angle of incidence results in the refracted ray being 90° to normal.

★ For total internal Reflection:

$\rightarrow$ light must be travelling from an optically denser to the surface of optically less dense medium

$\rightarrow i > c$

Light pollution

$\downarrow$
 inefficient or unnecessary use of light

$\rightarrow$ disorientation of nocturnal animals

$\rightarrow$ misguide animals to their death

$\rightarrow$ disrupt sleep patterns.

Applications:

