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42 Refraction ♡

Light bends as it enters a glass block because the light travels **slower** in glass. This causes the wavelength of the light to get **smaller**, and causes the direction of the light to change.

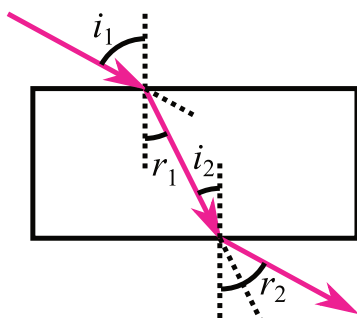
We say light bends 'towards the normal' when it **slows down**, and bends 'away from the normal' when it **speeds up**.

*Remember 'Light goes **FAST**.'*

When it goes **Faster**
it bends **Away** from the normal

When it goes **Slower**
it bends **Towards** the normal.

Formulae for refraction are explained in Refractive Index & Snell's Law ♡ - P138.



The direction can be correctly predicted by viewing the incoming light as a car whose wheels travel more slowly once they've crossed the boundary. If the front right wheel hits the boundary and slows down first, the car will turn right until the front left wheel also reaches the boundary.

$$\text{refractive index} = \text{speed of light in air} / \text{speed of light in material}$$

The refractive index is always greater than or equal to 1.

- 42.1 The table shows some data for five materials. Calculate the refractive index for each one.

Material	Speed of light (m/s)	Refractive Index
Air	3.0×10^8	(a)
Glass	1.9×10^8	(b)
Water	2.3×10^8	(c)
Diamond	1.2×10^8	(d)
Turpentine	2.0×10^8	(e)

- 42.2 Does light *never*, *not usually*, *usually* or *always* bend towards the normal when going into a material with a higher refractive index with $i \neq 0$?
- 42.3 Would light with $i = 20^\circ$ bend towards (T) or away from (A) the normal when passing from:
- (a) air into water; (e) diamond into air;
 (b) water into glass; (f) turpentine into glass;
 (c) water into turpentine; (g) turpentine into diamond;
 (d) glass into turpentine; (h) glass into water.
- 42.4 Violet light is slower in glass than red light. All colours of light travel at the same speed in air. A narrow, white beam of light enters a glass block with $i = 30^\circ$. Which colour bends the most on refracting as it enters the glass block?
- 42.5 Different colours of light have different refractive indices in glass.
- (a) Which has the lower refractive index - violet or red light?
- (b) A wide beam of white light shines at an angle on a rectangular glass block, refracting on entry and on exit. Will the beam be parallel or diverging on leaving the block?
- (c) The wide beam of white light now shines on a glass block that is triangular when viewed from above. Will the beam be parallel or diverging on leaving the block?