

## O Level Physics

## Tutorial 12: Light

---

Syllabus :

(a) recall and use the terms normal, angle of incidence and angle of reflection to describe the reflection of light

---

1. A ray of light is incident on a mirror and gets reflected. Sketch a diagram of this and label the following :

- angle of incidence,
- angle of reflection and
- normal.

---

(b) state that, for reflection, the angle of incidence is equal to the angle of reflection and use this principle in constructions, measurements and calculations

---

2. A ray of light falls on a block of clear glass. Some gets reflected, but most of it goes through the glass. The part that enters the glass changes direction a bit and gets closer to the normal to the glass surface. Sketch a diagram to show and label these rays.

---

(c) recall and use the terms normal, angle of incidence and angle of refraction to describe the refraction of light

---

3. A ray of light falls on a block of clear glass. Some gets reflected, but most of it goes through the glass. The part that enters the glass changes direction a bit and gets closer to the normal to the glass surface. Sketch a diagram to show and label these rays.

---

(d) recall and apply the relationship  $\sin i / \sin r = \text{constant}$  to new situations or to solve related problems

---

4. A ray of light falls on a rectangular piece of glass. The angle of incidence is  $40^\circ$  to the surface normal.

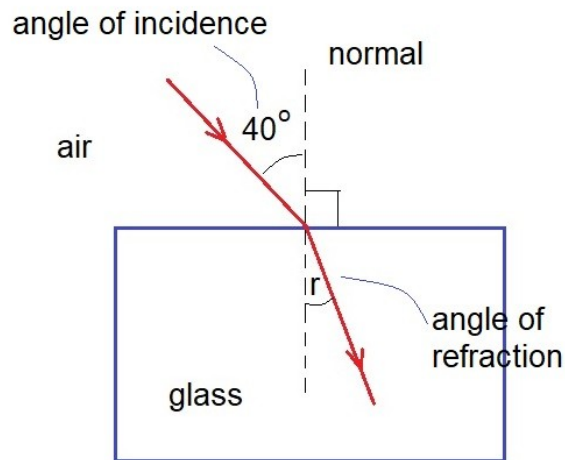


Figure 12-1

Most of the light goes through the glass.

The refraction index of the glass is 1.5. Find the angle of refraction  $r$ .

---

(e) define refractive index of a medium in terms of the ratio of speed of light in vacuum and in the medium

---

5. For the question above, find the speed of light in the glass.

---

(f) explain the terms critical angle and total internal reflection

---

6. A ray of light is incident at 3 different angles on a semi-circular glass block as shown.

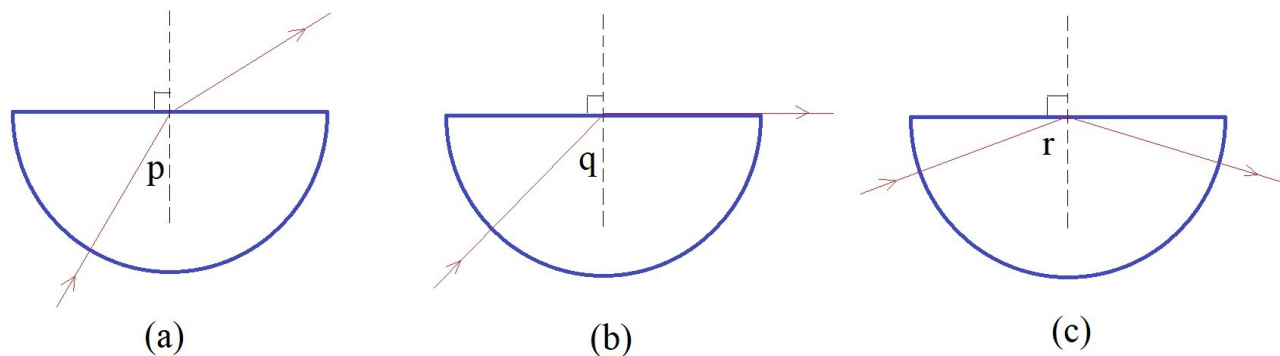


Figure 12-2

When the angle incident at the flat surface is too big, the ray cannot come out through the other side. It is totally reflected inside the glass.

The critical angle  $q$ , where the light can just emerge, is measured to be  $40^\circ$ . Find the refractive index of the glass.

---

(g) apply total internal reflection to the use of optical fibres in telecommunication and medicine, stating the advantages of such use

---

7. Optical fibre can carry light signals, and is widely used in telecommunication and medicine. Sketch a diagram to show how it uses total internal reflection to prevent light signal from leaking out of the fibre.

---

(h) describe the action of a thin converging lens on a beam of light

---

(i) define the focal length for a converging lens

---

8. (a) Describe what happens to a beam of light when it falls on a thin converging lens.

(b) State the definition for the focal length of a converging lens.

---

(j) draw ray diagrams to illustrate the formation of real and virtual images of an object by a thin converging lens

---

9. Draw a ray diagram to show the formation of

(i) a real image of an object by a thin converging lens,

(ii) a virtual image of an object by a thin converging lens.

---

(k) describe the characteristics of images (e.g. real/virtual, magnified/diminished, and upright/inverted) formed by a thin converging lens.

---

10. For each of the following types of images, explain the nature of the image and show using a diagram how it can be formed using a lens:

(i) real and diminished,

(ii) real and magnified,

(iii) virtual and magnified.