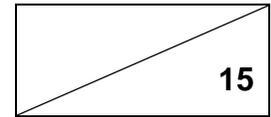




2020 Sec 3 Physics Assignment 8.1

Refraction



Name: Answers () Class: 3/

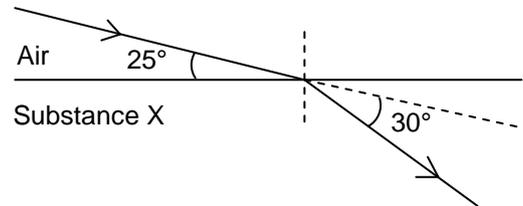
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1 The diagram shows the path of a ray of light travelling from air into a substance X.

(a) Determine the angle of incidence and the angle of refraction r .

$i = 65^\circ$

$r = 35^\circ$



(b) What is the refractive index of the substance X?

$$n_{air} \sin \theta_{air} = n_X \sin \theta_X$$

$$(1.00) \sin 65^\circ = n_X \sin 35^\circ$$

$$n_X = \frac{\sin 65^\circ}{\sin 35^\circ} = 1.58 \quad (3 \text{ s.f.})$$

Refractive index of X = 1.58

2 Two substances A and B have refractive indices of 1.90 and 1.25 respectively.

(a) For a light ray travelling from air into each substance,

(i) measure the angles of incidence and

(ii) calculate the angles of refraction. [2]

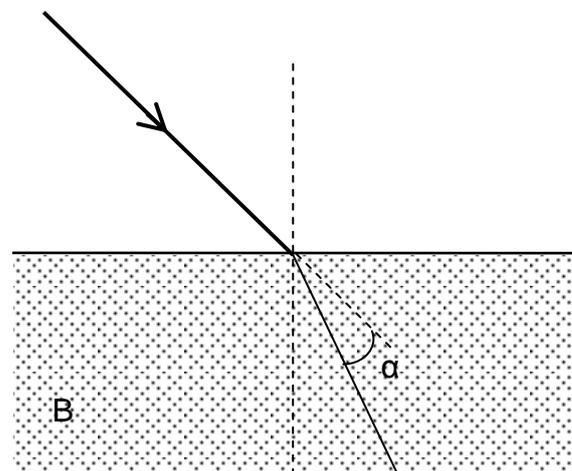
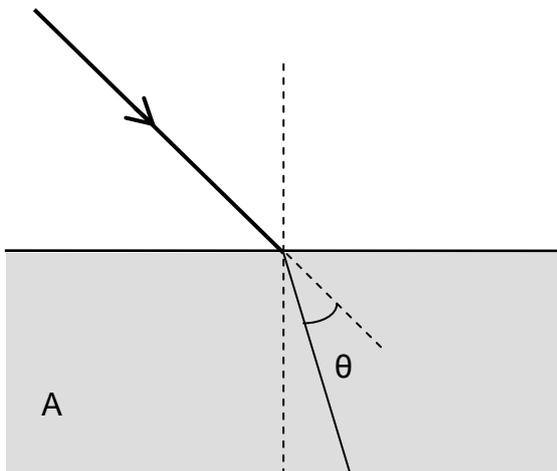
(b) Construct the refracted rays and label the angles of incidence and refraction below. [1]

$i = 45^\circ$

$r = 22^\circ$

$i = 45^\circ$

$r = 34^\circ$

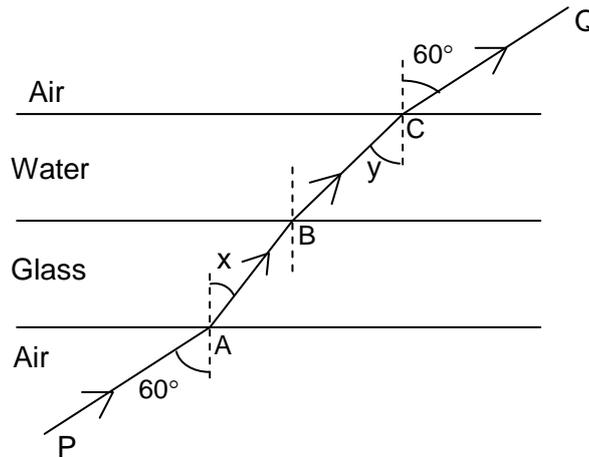


(c) Based on your calculations above, which substance would cause light to refract more? Explain your answers clearly.

In A, the change in direction for the ray, θ , is greater than that for B, α , for the same angle of incidence. Therefore, A causes light to refract more.

[2]

- 3 The diagram below shows a horizontal slab of glass of uniform thickness with a layer of water above it. A ray of light PQ is incident upwards on the lower surface of the glass and is refracted successively at A, B and C, the points where it crosses the interfaces.



Given that the refractive index of glass is 1.52 and that of water is 1.35, calculate:

- (a) angle x

Consider point A,

$$n_{air} \sin 60^\circ = n_{glass} \sin x$$

$$(1.00) \sin 60^\circ = (1.52) \sin x$$

$$\sin x = \frac{\sin 60^\circ}{1.52} \quad x = 34.7^\circ$$

$$x = 34.7^\circ [2]$$

- (b) angle y

Consider point C,

$$n_{air} \sin 60^\circ = n_{water} \sin y$$

$$(1.00) \sin 60^\circ = (1.35) \sin y$$

$$\sin y = \frac{\sin 60^\circ}{1.35} \quad y = 39.9^\circ$$

$$y = 39.9^\circ [2]$$

- 4 Construct cones of light to show how the eye E_1 sees the image P_1 and eye E_2 sees the image P_2 of a point P under the glass block. [4]

