

Home Assignment

12. The speed of light in vacuum and in two different glasses is given in below.

Medium	Speed of light
Vacuum	$3.00 \times 10^8 \text{ m/s}$
Flint glass	$1.86 \times 10^8 \text{ m/s}$
Crown glass	$1.97 \times 10^8 \text{ m/s}$

- (a) Calculate the absolute refractive index of flint glass and crown glass?

Absolute refractive index of flint glass =

$$\frac{\text{velocity of light in vacuum}}{\text{Velocity of light in the flint glass}} =$$

$$\frac{3 \times 10^8}{1.86 \times 10^8} = 1.61$$

Absolute refractive index of crown glass

$$\frac{\text{Velocity of light in vacuum}}{\text{velocity of light in the crown glass}}$$

$$= \frac{3.00 \times 10^8}{1.97 \times 10^8} = 1.52$$

(b) Relative refractive index for light going from crown glass to flint glass is given by

$$\frac{\text{Speed of light in crown glass}}{\text{Speed of light in flint glass}}$$

$$= \frac{1.97 \times 10^8}{1.86 \times 10^8} = 1.059$$

13. The speed of light in air is 3×10^8 m/s. In medium X its speed is 2×10^8 m/s and in medium Y the speed of light is 2.5×10^8 m/s. Calculate:

(a) $a_{yx} = \frac{\text{Speed of light in air}}{\text{Speed of light in medium Y}}$

$$= \frac{3 \times 10^8}{2.5 \times 10^8} = 1.2$$

(b) $a_{xy} = \frac{\text{Speed of light in air}}{\text{Speed of light in medium X}}$

$$= \frac{3 \times 10^8}{2 \times 10^8} = 1.5$$

(c) $x_{xy} = \frac{\text{Speed of light in medium X}}{\text{Speed of light in medium Y}}$

$$= \frac{2 \times 10^8}{2.5 \times 10^8} = 0.8$$

14. What is the speed of light in a medium of refractive index $\frac{6}{5}$ if its speed in air is 300000 km/s ?

Speed of light in air = 300000 km/s

refractive index of medium = $\frac{6}{5}$

refractive index of a medium =

$$\frac{\text{Speed of light in air}}{\text{Speed of light in medium}}$$

$$\Rightarrow \text{Speed of light in medium} = \frac{\text{Speed of light in air}}{\text{Refractive index of medium}}$$

$$= \frac{300000}{\frac{6}{5}} = \frac{50000}{\cancel{300000} \times 5}$$

$$= 250000 \text{ km/s}$$

15. Speed of light in water is $2.25 \times 10^8 \text{ m/s}$. If the speed of light in vacuum be $3 \times 10^8 \text{ m/s}$, Calculate the refractive index of water?

Speed of light in water = $2.25 \times 10^8 \text{ m/s}$

Speed of light in vacuum = $3 \times 10^8 \text{ m/s}$

$$\frac{\text{Speed of light in vacuum}}{\text{speed of light in water}}$$

$$= \frac{3 \times 10^8}{1.33 \times 10^8}$$

$$= 2.25$$

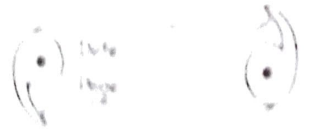
16. The speed of light in water is $2.25 \times 10^8 \text{ m/s}$.
If the speed of light in vacuum be $3 \times 10^8 \text{ m/s}$,
calculate the refractive index of water.

$$\text{Speed of light in water} = 2.25 \times 10^8 \text{ m/s}$$

$$\text{Speed of light in vacuum} = 3 \times 10^8 \text{ m/s}$$

$$\text{Refractive index} = \frac{\text{Speed of light in vacuum}}{\text{Speed of light in water}}$$

$$= \frac{3 \times 10^8 \text{ m/s}}{2.25 \times 10^8 \text{ m/s}} = 1.33$$



Light enters from air into diamond which has a refractive index of 2.42. Calculate the speed of light in diamond. The speed of light in air is 3.0×10^8 m/s.

A refractive index: 2.42

Speed of light in air: 3×10^8 m/s.

$$\text{Speed of light in medium} = \frac{\text{Speed of light in vacuum}}{\text{Refractive index}}$$

$$= \frac{3 \times 10^8}{2.42}$$

$$= \frac{3 \times 10^8 \times 100}{242}$$

$$= 1.24 \times 10^8 \text{ m/s}$$

MCQs

19. The refractive ~~medium~~ indices of four substances P, Q, R and S are 1.5, 1.36, 1.97, 1.91. The speed of light is the maximum in the substance:

Ans - S

20. The refractive indices of four materials A, B, C, D are 1.33, 1.43, 1.71 and 1.92. When the light pass ~~from~~ from air into these materials, they refract maximum in

Ans - Material C

1. The refractive index of glass for light going from air to glass is the refractive index for light going from glass to air will be

$$\frac{4}{6}$$

2. The refractive indices of four media A, B, C and D are 1.44, 1.52, 1.65, 1.36. When light travelling in air is incident in these media at equal angles, the angle of refraction will be the minimum:

$$1.65$$

23. The speed of light in substance x is 1.25×10^8 m/s and that in air is 3×10^8 m/s. The refractive index of this substance will be,

2.4

24. The refractive indices of four substances P, Q, R and S are 1.77, 1.5, 2.42 and 1.31 respectively. When light travelling in air is incident on these substances at equal angles, the angle of refraction will be the maximum in:

Substance S

25. The refractive index of water is

1.33

26. The refractive index of water with respect to air is $\frac{4}{3}$. The refractive index of air with respect to water will be:

0.75

27. Refractive indices of water, Sulphuric acid, glass and carbon dioxide disulphide are 1.33, 1.43, 1.53 and 1.63 respectively.

The light travels slowest in:

Carbon disulphide.