

Light : Reflection & Refraction

Short Answer Type Questions
(From S Chand: Page-228 Q No. 12-17
and MCQS)

12. (a) Absolute refractive index of flint glass
$$= \frac{\text{speed of light in vacuum}}{\text{speed of light in flint glass}}$$
$$= \frac{3 \times 10^8}{1.86 \times 10^8} = 1.61$$

Similarly, absolute refractive index
of crown glass = $\frac{3 \times 10^8}{1.97 \times 10^8} = 1.52$

(b) Relative refractive index for light
going from crown glass to flint glass = $\frac{1.61}{1.52} = 1.059$

13. Given: The speed of light in air,
 $v_a = 3 \times 10^8$ m/s.

Speed in medium X, $v_x = 2 \times 10^8$ m/s
and in medium Y, the speed of light,
 $v_y = 2.5 \times 10^8$ m/s

(a) $n_x = \frac{v_a}{v_x} = \frac{3 \times 10^8}{2 \times 10^8} = 1.5$

(b) $n_y = \frac{3.0 \times 10^8 \text{ m/s}}{2.50 \times 10^8 \text{ m/s}} = 1.2$

(c) $n_{xy} = \frac{v_x}{v_y} = \frac{2 \times 10^8}{2.5 \times 10^8} = 0.8$

14. Refractive index of medium = $\frac{6}{5} = 1.2$
 Speed of light in air = 3,00,000 km/s.
 We know that,

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

$$\Rightarrow 1.2 = \frac{300000}{\text{speed of light in medium}}$$

$$\text{Speed of light in medium} = 250,000 \text{ km/s}$$

15. We know that refractive index
 $n = \frac{\text{speed of light in medium}}{\text{speed of light in vacuum}}$

$$\text{where } c = 3 \times 10^8 \text{ m/s}$$

$$\frac{c}{v} = 1.5$$

$$v = \frac{3 \times 10^8}{1.5} \Rightarrow v = 2 \times 10^8 \text{ m/s}$$

16. Here, speed of light in water $v = 2.25 \times 10^8$ m/s
 and speed of light in vacuum $c = 3 \times 10^8$ m/s

$$\therefore \text{Refractive index of water } n = \frac{c}{v}$$

$$= \frac{3 \times 10^8 \text{ m/s}}{2.25 \times 10^8 \text{ m/s}} = \frac{4}{3} = 1.33$$

17. Given, Speed of light $c = 3.0 \times 10^8 \text{ m/s}$
 Refractive index of the diamond $n = 2.42$
 velocity of the light in diamond $v = ?$
 Refractive index $n = \frac{c}{v}$
 $\therefore v = \frac{c}{n}$

substituting the respective values in the above equation, we get

$$v = \frac{3.0 \times 10^8}{2.42} = 1.24 \times 10^8 \text{ m/s}$$

MCQS

19. We know that :

$$\text{Refractive index } (n) = \frac{\text{Speed of light in air}}{\text{speed of light in a medium}}$$

According to this formula, speed of light will be maximum in a substance whose refractive index is minimum. Therefore, speed of light will be maximum in substance whose refractive index is 1.31. (d) S (ans)

20. (c) material c :

The refraction of light rays will be maximum in the substance having highest refractive index. Now, out of A, B, C and D, C has the highest refractive index. So, the refraction of light will be maximum in material C.

21. Putting the values in the formula

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

$$n_{ga} = \frac{3}{2} \Rightarrow n_{ag} = \frac{2}{3} \Rightarrow n_{ag} = \frac{2 \times 2}{2 \times 3} = \frac{4}{6}$$

So, refractive index for light going from glass to air is $\frac{4}{6}$.

(c) $\frac{4}{6}$ (ans)

22. When light travelling in air is incident in these medium at equal angles, the angle of refraction will be ^{the} minimum in medium with highest refractive index.

∴ From given highest refractive index is 1.65.

∴ minimum Refraction angle is in medium c.

(c) medium c (ans)

23.
$$\text{Refractive index} = \frac{\text{speed of light in air}}{\text{speed of light in medium}}$$

$$= \frac{1.25 \times 10^8 \text{ m/s}}{3 \times 10^8 \text{ m/s}} = 2.4$$

(a) 2.4 (ans)

24. The lower is the refractive index the more the angle of refraction will be.

(d) substance S

25. (a)
$$\text{Refractive index of water} = \frac{\text{speed of light in air}}{\text{speed of light in water}}$$

$$\text{Refractive index of water} = \frac{300 \text{ million m/s}}{225 \text{ million m/s}}$$

$$= 1.33$$

(a) 1.33 (ans)

26. Putting the given values in the formula Refractive index

$$= \frac{\text{speed of light in air}}{\text{speed of light in medium}}$$

We get, $\frac{n_2}{n_1} = \frac{4}{3}$ and refractive

index of air w.r.t water = $\frac{n_1}{n_2} = \frac{3}{4}$
 $= 0.75$

(c) 0.75 (ans)

27. Refractive index is given by $n = \frac{c}{v}$.

Here, c = speed of light in vacuum
 and v = speed of light in the medium

$\therefore n \propto \frac{1}{v}$

Refractive index of carbon disulphide is the largest among the given materials, therefore we can say that speed of light is slowest in carbon disulphide.

(d) carbon disulphide (ans)

28. $\frac{\text{Refractive index of glass w.r.t air}}{\text{Refractive index of water w.r.t air}} = \frac{\left(\frac{3}{2}\right)}{\left(\frac{4}{3}\right)} = \frac{9}{8} = 1.125$

(d) 1.125 (ans)

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