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Assignment (Pg-228)

12.)

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

(b) Calculate the relative refractive index of light going from crown glass to flint glass.

(a) (Ans.) $n_{flint} = \frac{\text{speed of light in vacuum}}{\text{speed of light in flint glass}}$

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

(b) (Ans.) $n_{crown} = \frac{\text{speed of light in vacuum}}{\text{speed of light in crown glass}}$

$= \frac{3 \times 10^8}{1.97 \times 10^8} = 1.52$

(b) $_{crown}n_{flint} = \frac{\text{speed of light in crown glass}}{\text{speed of light in flint glass}} = \frac{1.97 \times 10^8}{1.86 \times 10^8}$

$= 1.059$

18) 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) $_{air}n_{x}$ (b) $_{air}n_{y}$

(c) $_{x}n_{y}$

Ans) (a) $_{air}n_{x} = \frac{\text{speed of light in air}}{\text{speed of light in X}}$

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

(b) $_{air}n_{y} = \frac{\text{speed of light in air}}{\text{speed of light in Y}}$

$= \frac{3 \times 10^8}{2.5 \times 10^8} = \frac{30}{25} = 1.2$

(c) $x\,n\,y = \frac{\text{speed of light in X}}{\text{speed of light in Y}}$

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

14) Speed of light in air, given = 300000 km/s

Refractive index = 6/5 = 1.2

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

$1.2 = \frac{300000}{X}$

$X = \frac{3000000}{12}$

$X = 250000$ km/s

15) Refractive index = 1.5

Speed of light = (3×10^8) m/s

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

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

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

$$\Rightarrow X = 2 \times 10^8 \text{ m/s}$$

16.) Speed of light in vacuum = 3.0×10^8 m/s

Speed of light in water = 2.25×10^8 m/s

Refractive index of water

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

$$= \frac{3.0 \times 10^8}{2.25 \times 10^8} = \frac{\overset{1}{\cancel{300}}\overset{4}{}}{\underset{3}{\cancel{225}}} = \frac{4}{3} = 1.33$$

17.)

1.)

(a)

2.)

(c)

17.) Refractive index of diamond = 2.42

Speed of light in air = 3.0×10^8 m/s

Let the speed of light in diamond be x

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

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

$$\Rightarrow x = 1.239 \times 10^8$$

MCQs

19) (d) S

As the object is ~~minim~~ maximum speed will have minimum refractive index as refractive index is the ratio of speed of light in vacuum / air to speed of light in ~~wood~~ the medium.

20) (c) Material C

As the object has maximum refractive index the light will refract the most. in that medium. The ratio is greatest in material C.

21) (d.) 2/3

$${}^{a}\mu_{g} = \frac{n_g}{n_a} = \frac{3}{2} \qquad {}^{g}\mu_{a} = \frac{n_a}{n_g} = \frac{2}{3}$$

22) (d) In medium D

The ~~object~~ medium with higher density will have lesser or minimum refractive index

Refractive index is the ratio of speed of light in air / vacuum to the speed of light in any medium. So higher the speed of medium will be, the lesser will be the ratio.

23) (a) 2.4

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

$$\frac{3 \times 10^8 \text{ m/s}}{1.25 \times 10^8 \text{ m/s}} = \frac{300}{125} = \frac{240}{100} = 2.4$$

(60, 25)

24) (c) Substance R

As the refractive index is highest in substance R the angle of refraction is the highest.

25) (a) 1.33

The Refractive Index of water is 1.33.

26) (c) 0.75

Refractive index of air with respect to water

$= 1 \div 4/3 = 1 \times 3/4 = 3/4$

$\frac{3}{4} = \frac{3 \times 25}{4 \times 25} = \frac{75}{100} = 0.75$

27) (d) Carbon disulphide

~~water~~ light ~~travells~~ travels slowest in Carbon disulphide as it has a high refractive index.

28) (d) 1.125

Refractive index of glass with respect to air

$$= \frac{3}{2}$$

$${}^{a}\mu_{g} = 3/2$$

$${}^{a}\mu_{w} = 4/3$$

$${}^{w}\mu_{g} = \frac{3/2}{4/3} = 3/2 \times 3/4 = 9/8$$

$$\frac{9}{8} = \frac{1125}{1000} = 1.125$$