H.W
24/6/21

12.(a) Calculate the absolute refractive indexes of flint glass and crown glass.

Ans $n_{flint} = \frac{\text{Speed of light in vacuum}}{\text{Speed of light in flint glass}}$

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

$n_{crown} = \frac{\text{Speed of light in vacuum}}{\text{Speed of light in crown glass}}$

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

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

Ans n^{flint}_{crown} = $\frac{\text{speed of light in crown glass}}{\text{speed of light in flint glass}}$

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

13. Given:

speed of light in air is 3×10^8 m/s.

~~Speed~~ speed in medium X is 2×10^8 m/s

speed in medium Y 2.5×10^8 m/s.

(a) $air^n x$ = $\frac{\text{speed of light in air}}{\text{speed of light in X medium}}$

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

(b) $air^n y$ = $\frac{\text{speed of light in air}}{\text{speed of light in Y medium}}$

$= \frac{3 \times 10^8}{2.5 \times 10^8} = \frac{3}{2.5} = 3 \times \frac{10}{25}^2 = \frac{6}{5} = 1.2$

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

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

14. Given:-

Speed of light in a medium of refractive index $\frac{6}{5} = 1.2$

Speed of light in air $= 3,00,000$ km/s

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

$1.2 = \frac{3,00,000}{\text{speed of light in medium}}$

Speed of light in medium $= \frac{300000}{1.2}$

$= 250000$ km/s.

15. Given:-

Refractive index of glass $= 1.5$

Speed of light in air $= 3 \times 10^8$ m/s.

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

$1.5 = \frac{3 \times 10^8}{\text{speed of light in glass}}$

Speed of light in glass $= \frac{3 \times 10^8}{1.5} = 2 \times 10^8$ m/s.

16. Given:-

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

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

Refractive index of water $= \frac{3 \times 10^8}{2.25 \times 10^8} = 1.33$

17. Given:

Refractive index of diamond = 2.42

The speed of light in air $= 3 \times 10^8$ m/s.

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

$2.42 = \frac{3 \times 10^8}{\text{speed of light in diamond}}$

speed of light in diamond $= \frac{3 \times 10^8}{2.42}$

$= 1.239 \times 10^8$ m/s

MCQs

19. (d) S

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

Speed of light will be maximum when a substance whose refractive index is minimum.

So, speed of light will be maximum in S.

20. (c) Material C

Refraction depends on refractive index
Refractive index $= \frac{\sin i}{\sin r}$

so, C material has the maximum ratio so, it produces maximum refraction.

21. (c) $\frac{4}{6}$

The refractive index of glass w.r.t air is $\frac{3}{2}$, then refractive index of air w.r.t glass will be $\frac{2}{3}$.

$\frac{2}{3} = \frac{4}{6}$ (Multiplied 2 both in numerator and denominator)

22. (c) In medium C
The angle of reflection is minimum in the medium with more refractive index so, medium C is the minimum angle of refraction.

23. (a) 2.4

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

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

24. (d) substance S

The angle of refraction will be maximum for minimum refractive index and substance S has minimum refractive index.

25. (a) 1.33

Velocity of light in water = 225,563,010 m/s

Velocity of light in air = 3×10^8 m/s

Refractive index = $\frac{3 \times 10^8}{225563010} = 1.33$

26. (c) 0.75

Refractive index of air with respect to water = Reciprocal of refractive index of water w.r.t to air

$\frac{3}{4} = 0.75$.

27. (d) Carbon disulphide

Speed of light in the medium is slowest; therefore refractive index will be maximum as the speed of light in air is constant. So, slowest substance with refractive index 1.63

28. (d) 1.125

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

Refractive index of glass w.r.t air $= \frac{3}{2}$

Refractive index of water with respect to glass $= \frac{\text{Refractive index of water}}{\text{Refractive index of glass}}$

$= \frac{4}{3} \div \frac{3}{2} = \frac{4}{3} \times \frac{2}{3} = \frac{8}{9}$

Refractive index of glass with respect to water $= \frac{1}{\frac{8}{9}} = \frac{9}{8} = 1.125.$