S. Chand - Refraction

(2) Absolute refractive Index of flint =

n_{flint} =

$$= \frac{\text{Speed of light in Vaccum}}{\text{Speed of light in Crown Glass Flint}}$$

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

$$= \frac{300}{186}$$

$$= 1.612$$

$n_{crown\ glass}$ =

$$= \frac{\text{Speed of light in Vaccum}}{\text{Speed of light in Crown glass}}$$

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

$$= \frac{300}{197} = 1.52$$

b) $_{crown}n_{flint}$ =

$$= \frac{\text{Speed of light in Crown glass}}{\text{Speed of light in flint glass.}}$$

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

$$= \frac{197}{186} = 1.05$$

(13) Speed of light in air = 3×10^8 m/s
Speed of light in X = 2×10^8 m/s
Speed of light in Y = 2.5×10^8 m/s

a) $_{air}n_X$ =

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

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

$$= 1.5$$

b) air n_y

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

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

$$= \frac{30}{25}$$

$$= 1.2$$

c) $x n_y$

$$= \frac{\text{Speed of light in medium } x}{\text{Speed of light in medium } y}$$

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

$$= \frac{20}{25}$$

$$= 0.8$$

(14) Speed of light in air - 3,00,000 km/s

Absolute refractive index = $\frac{6}{5}$

Let the speed of light in the medium be y km/s.

A/Q - $\frac{\text{Speed of light in air}}{\text{Speed of light in the other medium}} = \frac{6}{5}$

$\Rightarrow \frac{300000}{y} = \frac{6}{5}$

$\Rightarrow 300000 \times 5 = 6y$

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

$\Rightarrow y = 2,50,000$

$\therefore$ Speed of light in other medium = 2,50,000 km/s

Speed of light in air = $3 \times 10^8 \, ms^{-1}$

Refractive Index of glass = 1.5

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

$= \frac{3 \times 10^8}{1.5} \, ms^{-1}$

$= 2 \times 10^8 \, m/s$

∴ Speed of light in glass = 2×10^8 m/s

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

Speed of light in air = 3×10^8 m/s

R.I of Water = air/water =

$= \frac{3 \times 10^8}{2.25 \times 10^8}$

$= \frac{300}{225}$

$= 1.33$

(17) Speed of light in air - ~~2.4~~ 3×10^8 m/s
Refractive index of Diamond = 2.42

~~an Ocean~~

Speed of light in diamond

$$= \frac{\text{Speed of light in air}}{\text{R.I of Diamond}}$$

$$= \frac{3 \times 10^8}{2.42} \text{ m/s}$$

$$= \frac{1.24}{\cancel{300} \times 10^8} \text{ m/s}$$

$$= 1.24 \times 10^8 \text{ ms}^{-1}$$

MCQ:

Q19

R.I of P - 1.50
R.I of Q - 1.36
R.I of R - 1.77
R.I of S - 1.31

Speed of light in $P = \frac{3.0 \times 10^8}{1.50}\ ms^{-1}$

$= 2 \times 10^8\ ms^{-1}$

Speed of light in $Q = \frac{3.0 \times 10^8}{1.36}\ ms^{-1}$

$= 2.205 \times 10^8\ ms^{-1}$

Speed of light in $R = \frac{3.0 \times 10^8}{1.77}\ ms^{-1}$

$= 1.69\ ms^{-1}$

$= 1.69 \times 10^8\ ms^{-1}$

Speed of light in $S = \frac{3 \times 10^8}{1.31}\ m/s$

$= 2.29\ m/s$

Max speed

Option d → S

(20)

- A = 1.33
- B = 1.43
- C = 1.71
- d = 1.52

Max. Refraction ⟶ Min. Speed of light in that Medium.

Speed of light in

$A = \frac{3 \times 10^8}{1.33} ms^{-1} = 2.25 \times 10^8 ms^{-1}$

$B = \frac{3 \times 10^8}{1.43} ms^{-1} = 2.09 \times 10^8 ms^{-1}$

$C = \frac{3 \times 10^8}{1.71} ms^{-1} = \frac{1.75 \times 10^8 ms^{-1}}{1 \text{ Min.}}$

$D = \frac{3 \times 10^8}{1.52} ms^{-1} = 1.97 \times 10^8 ms^{-1}$

Option C → Material C

(21)

$$\text{air } \eta \text{ glass} = \frac{3}{2}$$

Let the speed of light in glass be x

$$\Rightarrow \frac{3 \cdot 10^8}{x} = \frac{3}{2}$$

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

$$\Rightarrow x = 2 \times 10^8$$

$$\text{glass } \eta \text{ air} = \frac{2 \times 10^8}{3 \times 10^8}$$

$$= \frac{2}{3} = \frac{2 \times 2}{3 \times 3} = \frac{4}{6}$$

Option C → $\frac{4}{6}$

(22)

$\mu A \rightarrow 1.44$

$\mu B \rightarrow 1.52$

$\mu C \rightarrow 1.67$

$\mu D \rightarrow 1.36$

minimum angle of Refraction ⟶ Max speed of light in that medium.

Speed of light in the medium -

$A = \frac{3 \times 10^8}{1.44} ms^{-1} = 2.083 \text{ m/s}$

$B = \frac{3 \times 10^8}{1.52} ms^{-1} = 1.97 \text{ m/s}$

$C = \frac{3 \times 10^8}{1.65} ms^{-1} = 1.81 \text{ m/s}$

$D = \frac{3 \times 10^8}{1.36} ms^{-1} = \underbrace{2.205}_{\text{Max}} \text{ m/s}$

Option d → Medium D

(23) Speed of light in substance X = $1.25 \times 10^8 ms^{-1}$

air n_X = ~~3.01~~ $\frac{3 \times 10^8}{1.25 \times 10^8}$ = ~~2.01~~ 2.4

Option A → 2-4

(24) $\mu_P = 1.77$
$\mu_Q = 1.50$
$\mu_R = 2.42$
$\mu_S = 1.31$

~~Angle of Refraction~~ ∝ $\frac{1}{\text{Angle of Refraction}}$

Max. Angle of Refraction ⟶ Min. Speed of light in that medium.

Clearly it's $\mu_S = 1.31$.

Option d → Substance S.

(25) Refractive Index of water = 1.33

(26) $a_{ir}n_{water} = \frac{4}{3}$

$water\,n\,air = \frac{3}{4} = 0.75$

Option C - 0.75

(27) μ Water - 1.33
μ Sulphuric Acid - 1.43
μ Glass - 1.53
μ Carbon disulphide - 1.63

Max. R.T ⟶ Slowest the speed of Light of the medium.

Clearly it's Carbon disulphide.

Option d - Carbon disulphide.

(25) air n glass → $\frac{3}{2}$

air n water → $\frac{4}{3}$

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

$= 2 \times 10^8$ m/s

Speed of light in water = $\frac{3 \times 10^8}{\frac{4}{3}}$ m/s

$= \frac{9}{4} \times 10^8$ m/s

$= 2.25 \times 10^8$ m/s

water n glass = $\frac{2.25 \times 10^8}{2 \times 10^8}$

$= 1.125$

Option d - 1.125

MCQ.

19) d) S

20) c) material C

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

22) ~~c) medium~~ C d) Medium D

23) a) 2.4

24) c) Substance R

25) a) 1.33

26) c) 0.75

27) d) Carbon disulphide

28) d) 1.125