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

Medium	Speed of light.
Vacuum	3.00×10^8 m/s
Flint glass	1.86×10^8 m/s
Crown glass	1.97×10^8 m/s

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

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

(a) $n_{Flint} = \frac{\text{Speed of light in vacuum}}{\text{Speed of light in flint glass}} = \frac{3 \times 10^8}{1.86 \times 10^8} = 1.61$

$n_{crown} = \frac{\text{Speed of light in vacuum}}{\text{Speed of light in crown glass}} = \frac{3 \times 10^8}{1.97 \times 10^8} = 1.52$

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

$= 1.059$

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) air n_x (b) air n_y (c) $x n_y$.

Ans Given:-
Speed of light in air $= 3.0 \times 10^8$ m/s
Speed of light in medium $x = 2.0 \times 10^8$ m/s.
Speed of light in medium $Y = 2.50 \times 10^8$ m/s

(a) air n_x = $\frac{\text{Speed of light in air}}{\text{Speed of light in medium } x}$

air n_x = $\frac{3.0 \times 10^8 \text{ m/s}}{2.0 \times 10^8 \text{ m/s}}$ = 1.5.

(b) air n_y = ?

air n_y = $\frac{\text{Speed of light in air}}{\text{Speed of light in medium } Y}$.

air n_y = $\frac{3.0 \times 10^8 \text{ m/s}}{2.50 \times 10^8 \text{ m/s}}$ = 1.2.

(c) $x n_y$ = $\frac{\text{Speed of light in medium } x}{\text{Speed of light in medium } Y}$.

$x n_y$ = $\frac{2.0 \times 10^8 \text{ m/s}}{2.50 \times 10^8 \text{ m/s}}$ = 0.8.

14: What is the speed of light in a medium of refractive index $\frac{6}{5}$ if its speed in air is 3,00,000 km/s

Ans Refractive index of medium = 6/5 = 1.2

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

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

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

15: Refractive index of glass = 1.5

Speed of light in air = 3.0×10^8 m/s

We know that,

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

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

$\therefore$ Speed of light in glass = 2×10^8 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 = $\frac{3 \times 10^8}{2.25 \times 10^8}$ = 1.3

17. Refractive index of diamond = 2.42
Speed of light in air = 3.0×10^8 m/s

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

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

18. Option (d)

∵ The lesser the refractive index of a medium, the more is the speed in it and vice-versa

∴ The speed of light in medium 3 is the maximum because it has comparatively lesser refractive index.

20: (c)

∵ The larger the refractive index of the substance the more is the refraction and vice-versa.

∴ The light rays get refracted maximum in material C.

21: option (c) 416

Let the speed of light be n.

$$\mu_{air\ glass} = \frac{3\times10^8 m/s}{n} = \frac{3}{2}$$

$$= \frac{3\times10^8 m/s \times 2}{3} = n$$

$$\Rightarrow 2\times10^8 m/s = n.$$

$$\therefore \mu_{glass\ air} = \frac{2\times10^8 m/s}{3\times10^8 m/s}$$

$$= 0.67 = 416.$$

22: ∵ The smaller the refractive index of a medium, the lesser is the refraction & the angle of refraction.

∴ As the refractive index of medium D is comparitively smaller than others.

Ans = (d)

23: $_{med.}{}^{air}n = \frac{\text{Speed of light in air}}{\text{Speed of light in medium}}$

$= \frac{3\times10^8 m/s}{1.25\times10^8 m/s}$

$= 2.4.$

(a) 2.4.

24: ∵ We know that, the larger the refractive index of a substance the more it is of refraction,

∴ As the refractive index of substance R is largest among others.

∴ The angle of refraction will the maximum in substance R [C]

25: $_{water}{}^{air}n = \frac{3\times10^8 m/s}{2.25\times10^8 m/s} = 1.33$

(a) = 1.33.

26: $_{air}{}^{water}n = \frac{2.25\times10^8 m/s}{3\times10^8 m/s}$

$= 0.75$

(c = 0.75.

27: ∵ We know that the smaller the refractive index, more is the speed of light in the substance and vice-versa.

∴ As the refractive index is CO_2 comparatively larger.

So, the speed of light is the least in it.

(d) = CO_2.

28: Let Speed of light in glass be n.

air ~ glass = $\frac{3}{2}$

$\Rightarrow \frac{3\times10^8 \text{ m/s}}{n} = \frac{3}{2}$

$\Rightarrow \frac{2\times3\times10^8 \text{ m/s}}{3} = n$

$\Rightarrow 2\times10^8 \text{ m/s} = n$

Let the speed of light in water be y.

air ~ water = $\frac{4}{3}$

$\Rightarrow \frac{3\times10^8 \text{ m/s}}{y} = 4/3$

$\Rightarrow \frac{3\times3\times10^8 \text{ m/s}}{4} = y$

$\Rightarrow 2.25\times10^8 \text{ m/s} = y$

∴ water ~ glass = $\frac{y}{n} = \frac{2.25\times10^8 \text{ m/s}}{2\times10^8 \text{ m/s}}$

∴ (d) = 1.125 = 1.125