Physicsaholics

DPP – 4

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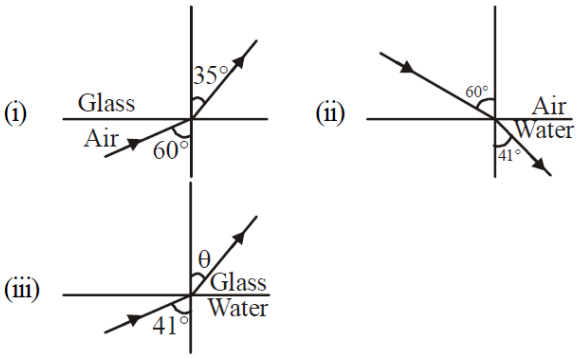
Q 1. A light ray is incident on water surface from air at an angle 45^0, then angle of refraction in water is: $\left(\mu_w = \frac{4}{3}\right)$

(a) $\sin^{-1}\frac{3}{4\sqrt{2}}$ (b) $\sin^{-1}\frac{3}{\sqrt{2}}$ (c) $\sin^{-1}\frac{1}{\sqrt{2}}$ (d) $\tan^{-1}\frac{3}{4\sqrt{2}}$

Q 2. A light ray goes from medium A (refractive index $\sqrt{2}$ & angle of incidence 45^0) to medium B (refractive index $\frac{2}{\sqrt{3}}$) then light ray is deviated by angle

(a) 25^0 (b)30^0 (c) 15^0 (d) 50^0

Q 3. Refraction of light from air to glass and from air to water are shown in figure (i) and figure (ii) below. The value of the angle θ in the case of refraction as shown in figure (iii) will be



(a) 30° (b) 35°
(c) 60° (d) 41°

Q 4. A ray of light refracts as it passes from glass into a vacuum. It's angle of incidence is 30^0, and its angle of refraction is 60^0, what is the index of refraction of the glass?

(a) $\sqrt{3}$ (b) $\frac{1}{3}\sqrt{3}$ (c) 1.33 (d) $\frac{2}{3}\sqrt{3}$

Q 5. The following figure shows refraction of light at the interface of three media Correct order of optical density (d) of the media is: $(i_1 > r_2)$

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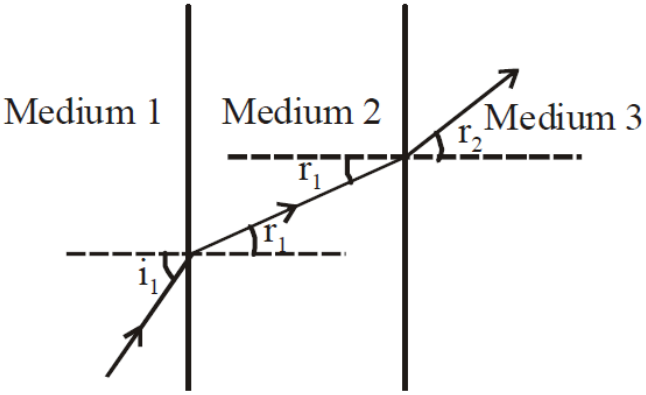

(a) $d_1 > d_2 > d_3$
(b) $d_2 > d_1 > d_3$
(c) $d_3 > d_1 > d_2$
(d) $d_2 > d_3 > d_1$

Q 6. The refractive index of glass and water with respect to air are 3/2 and 4/3 respectively. The refractive index of glass with respect to water is:
(a) 8/9 (b) 9/8 (c) 2 (d) 1/2

Q 7. A light ray goes from medium A (refractive index μ_1 & angle of incidence i) to medium B (refractive index μ_2 & angle of refraction r) then:
(a) $\mu_1 \sin i = \mu_2 \sin r$ (b) $\mu_1 \tan i = \mu_2 \tan r$
(c) $\mu_2 \sin i = \mu_1 \sin r$ (d) $\mu_1 \sin r = \mu_2 \sin i$

Q 8. Calculate the ratio of sine of incident angle to the sine of refracted angle when the refractive indices of medium 1 and 2 are given as 2.33 and 1.66 respectively.
(a) 0.71 (b) 1.4
(c) 2 (d) 3.99

Q 9. Find the ratio of the refractive index of medium 1 to that of medium 2, when the incident and reflected angles are given by 30^0 and 45^0 respectively.
(a) 0.5 (b) 1
(c) 2 (d) $\sqrt{2}$

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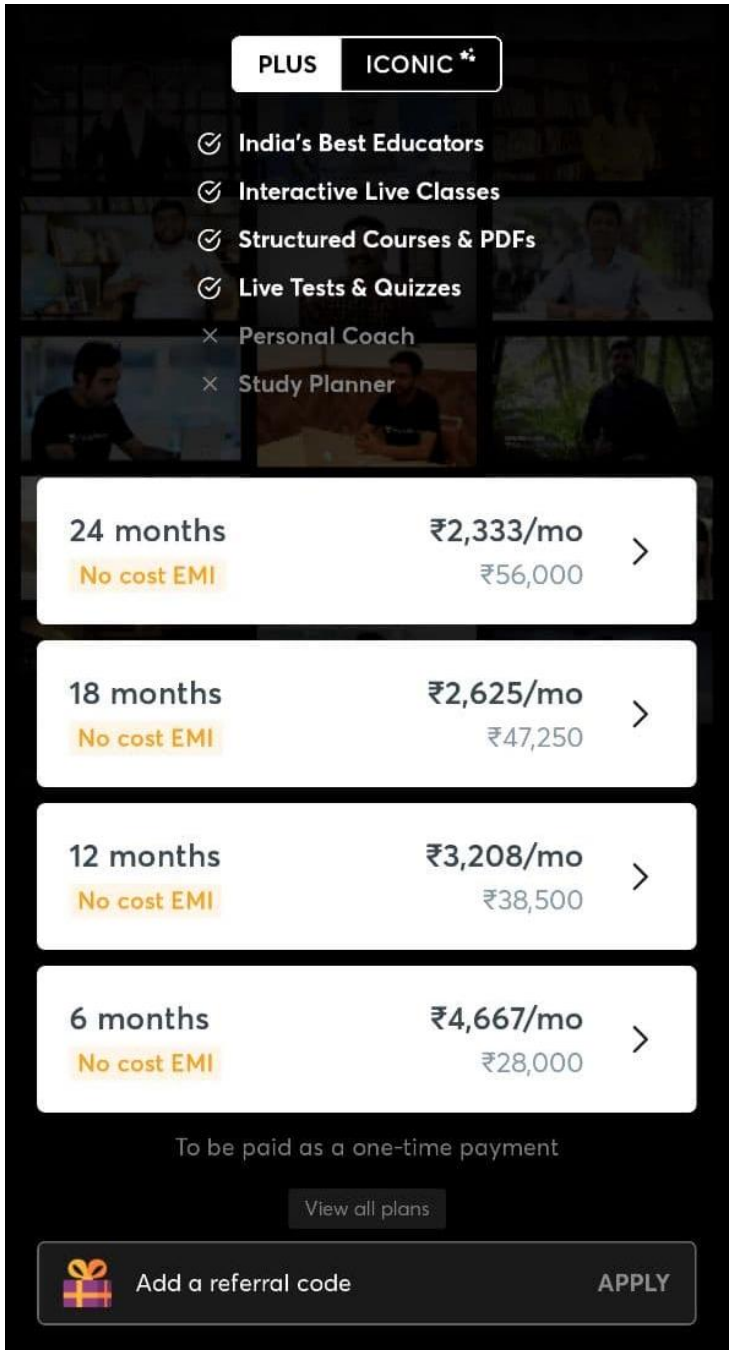
Answer Key

Q.1 a	**Q.2 c**	**Q.3 b**	**Q.4 a**	**Q.5 d**
Q.6 b	**Q.7 a**	**Q.8 a**	**Q.9 d**	



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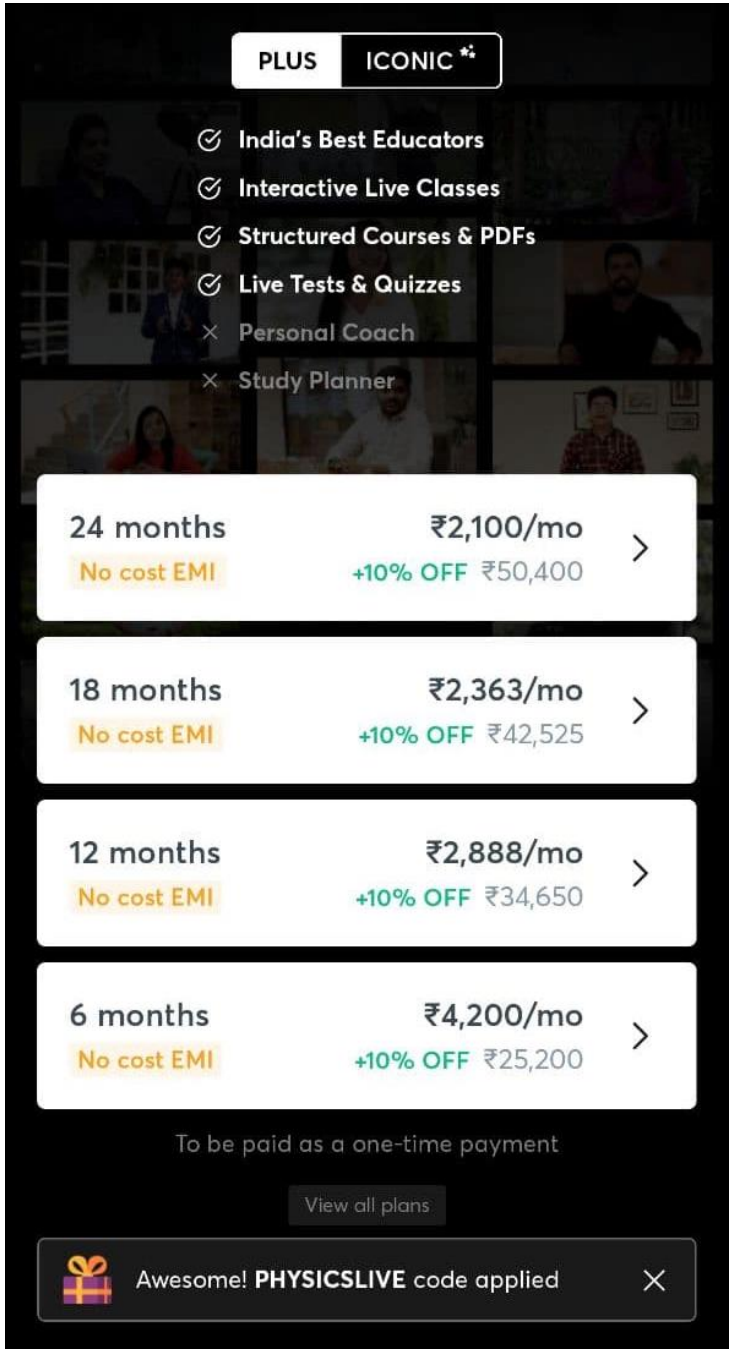

Written Solution

DPP- 4 Snell's Law

By Physicsaholics Team

Solution: 1

$$\mu_{aw} = \frac{4}{3}$$

$$\mu_a \sin i = \mu_w \sin\gamma$$

$$1 \times \sin 30^\circ = \frac{4}{3}(\sin\gamma)$$

$$\sin\gamma = \frac{3}{4\sqrt{2}}$$

$$\gamma = \sin^{-1}\left(\frac{3}{4\sqrt{2}}\right)$$

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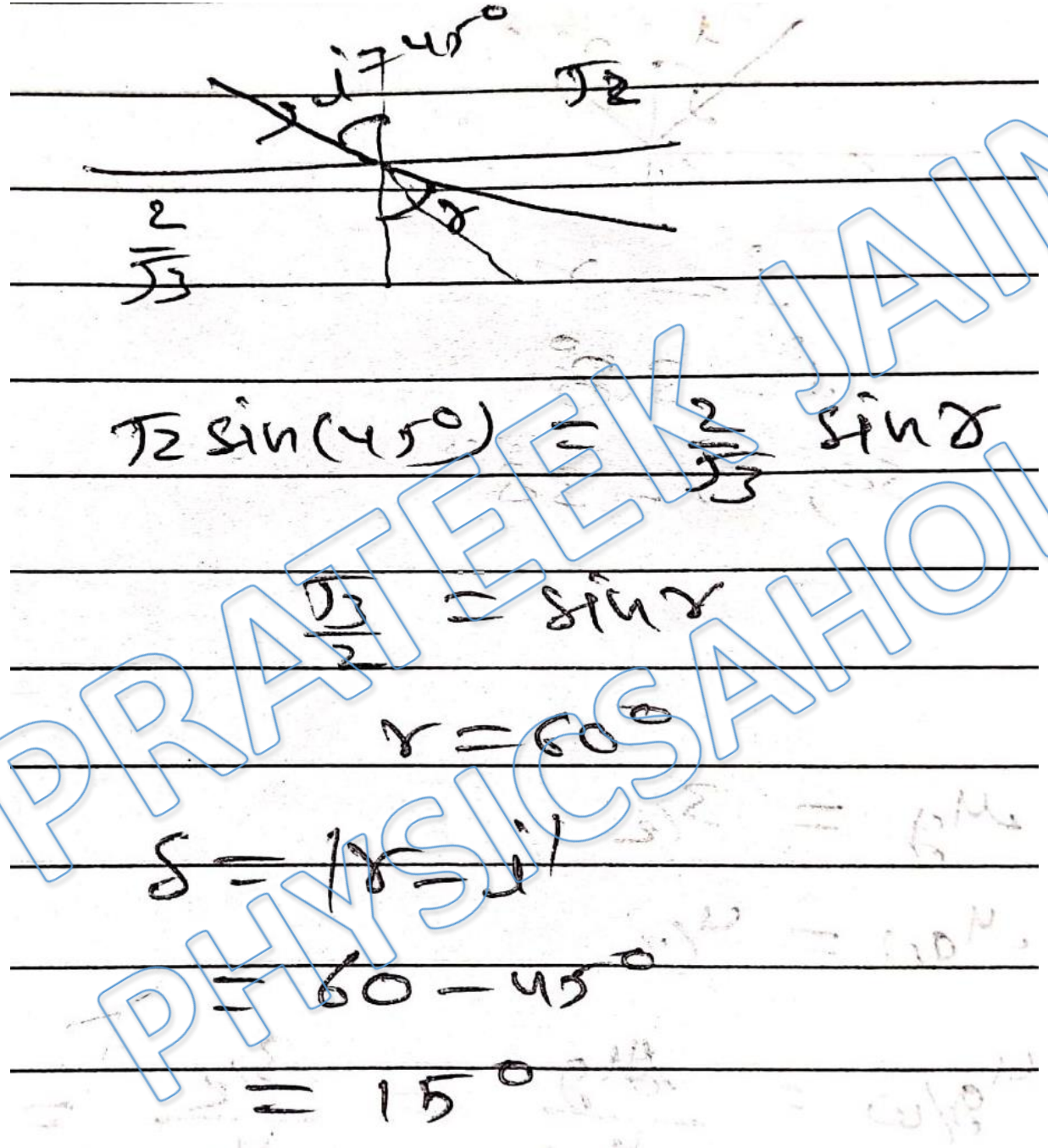
Ans. a

Solution: 2



$$r_2 \sin(45^\circ) = \frac{2}{\sqrt{3}} \sin\gamma$$

$$\frac{\sqrt{3}}{2} = \sin\gamma$$

$$\gamma = 60^\circ$$

$$\delta = \gamma - i$$

$$= 60 - 45^\circ$$

$$= 15^\circ$$

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Ans. c

Solution: 3

from (i) $\mu_a \sin 60^\circ = \mu_g \sin 35^\circ$ — (1)

from (ii) $\mu_a \sin 60^\circ = \mu_w \sin \theta$ — (2)

from (iii) $\mu_w \sin \theta = \mu_g \sin \theta$ — (3)

from eq^n (1) & (2)

$\mu_a \sin 60^\circ = \cos \theta \mu_w$

so, $\mu_g \sin 35^\circ = \mu_w \sin \theta$ — (4)

comparing eq^n (3) & (4)

$\theta = 35^\circ$

Ans. b

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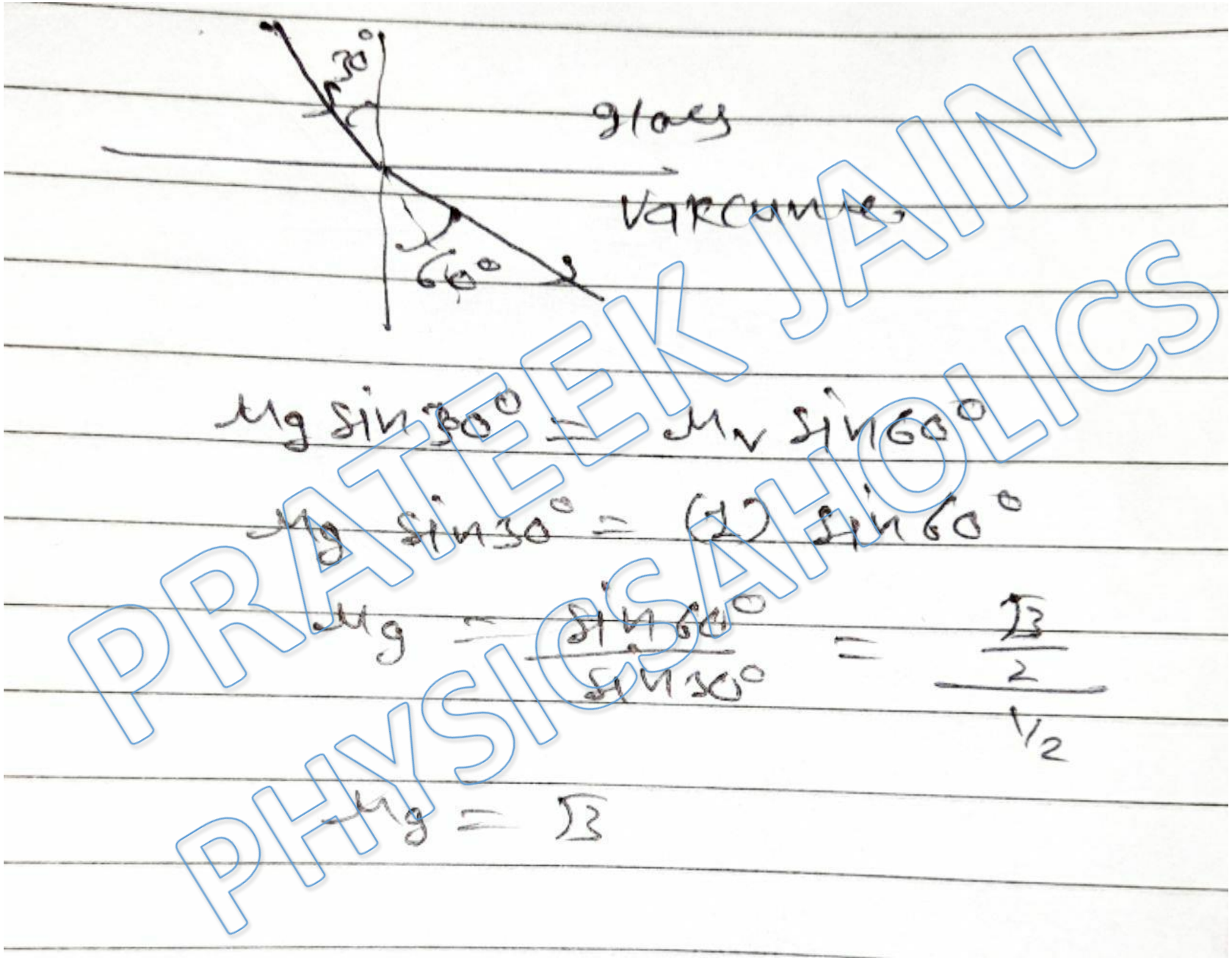
Solution: 4



$$\mu_g \sin 30^\circ = \mu_v \sin 60^\circ$$

$$\mu_g \sin 30^\circ = (1) \sin 60^\circ$$

$$\mu_g = \frac{\sin 60^\circ}{\sin 30^\circ} = \frac{\frac{\sqrt{3}}{2}}{\frac{1}{2}}$$

$$\mu_g = \sqrt{3}$$

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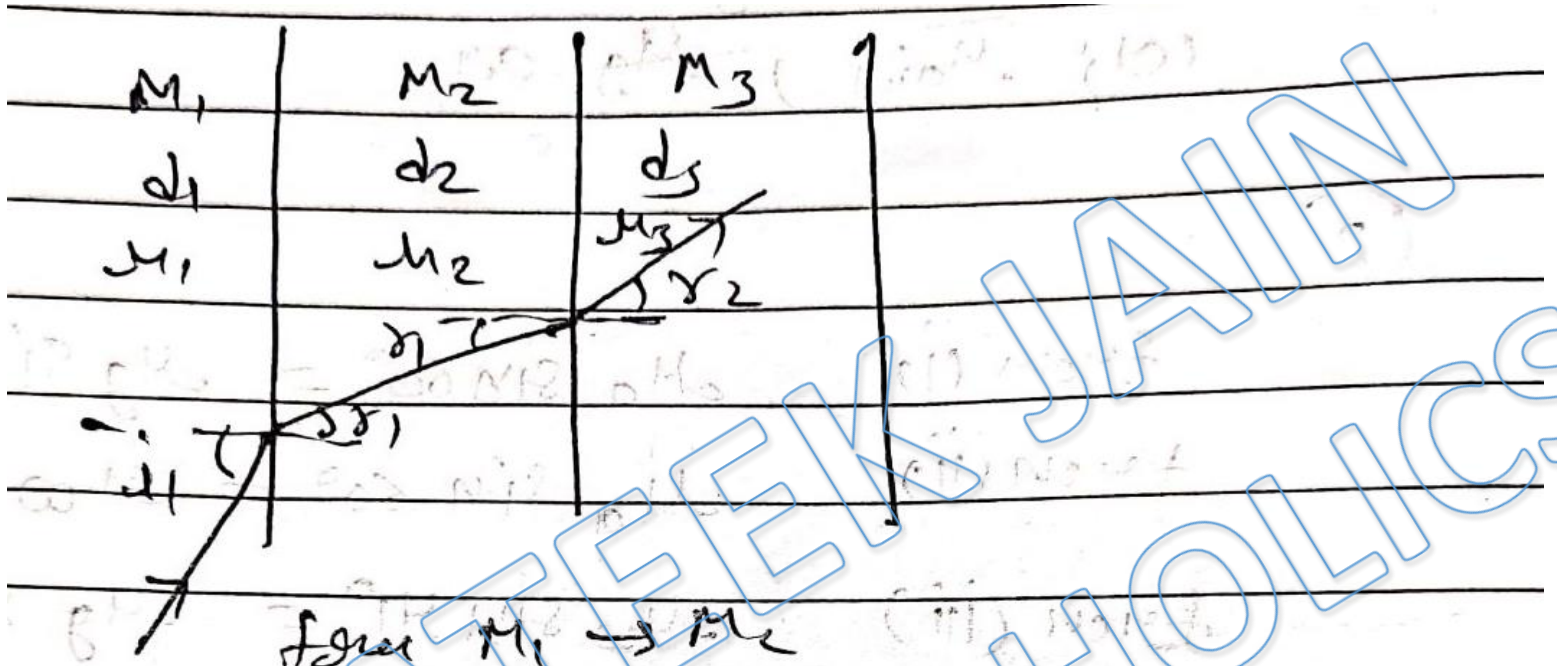
Ans. a

Solution: 5



for $M_1 \to M_2$

Light ~~note~~ rotates toward Normal

$\Rightarrow \mu_2 > \mu_1 \Rightarrow d_2 > d_1$

& $M_2 \to M_3$ (Light goes away from Norm

$\Rightarrow \mu_3 < \mu_2 \Rightarrow d_3 < d_2$

$i_1 > r_2 \Rightarrow \mu_3 > \mu_1 \Rightarrow d_3 > d_1$

$\Rightarrow d_2 > d_3 > d_1$

Ans. d

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Solution: 6

$$\mu_g = 3/2$$

$$\mu_w = 4/3$$

$$\mu_{g/w} = \frac{\mu_g}{\mu_w} = \frac{3/2}{4/3} = \frac{9}{8}$$

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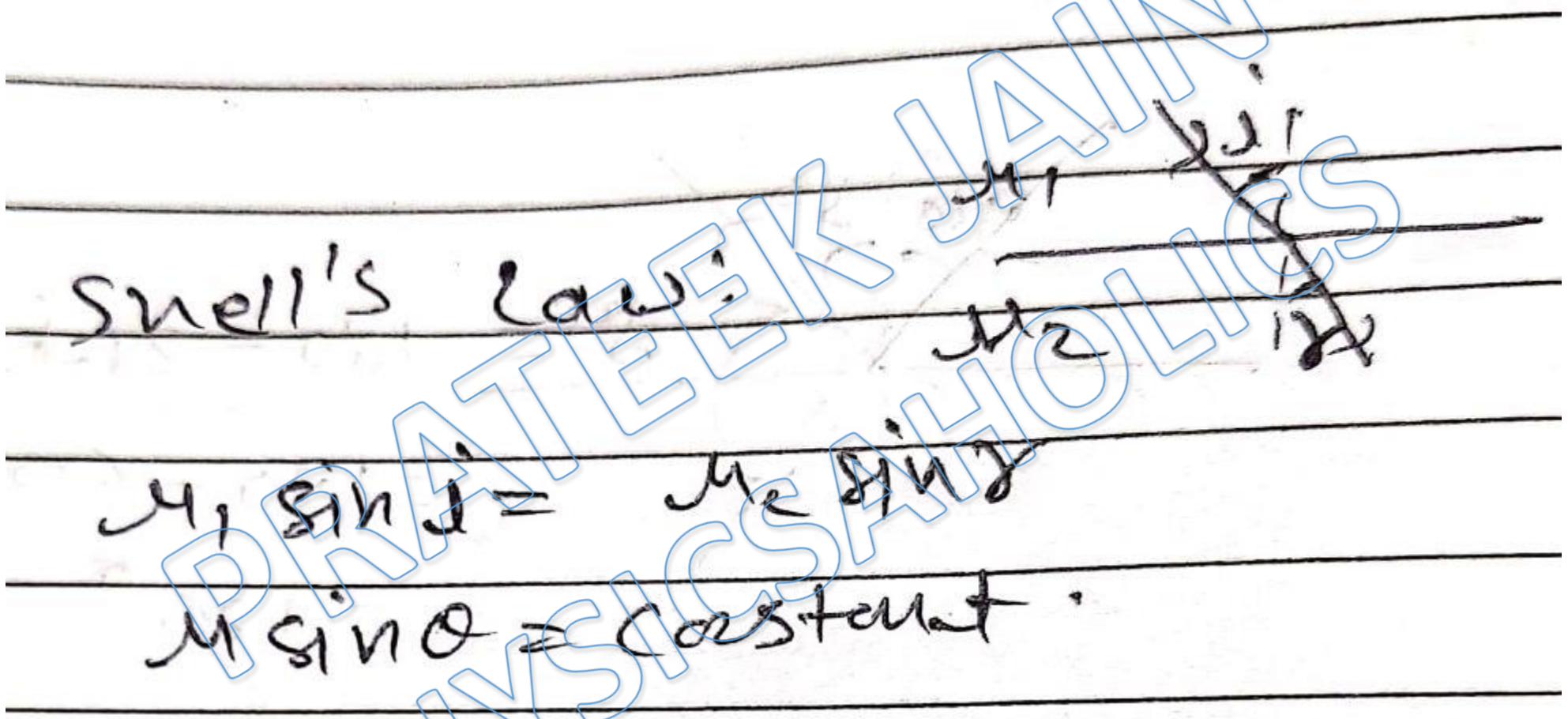
Ans. b

Solution: 7

Snell's Law:



$$\mu_1 \sin i = \mu_2 \sin r$$

$$\mu \sin\theta = \text{constant}.$$

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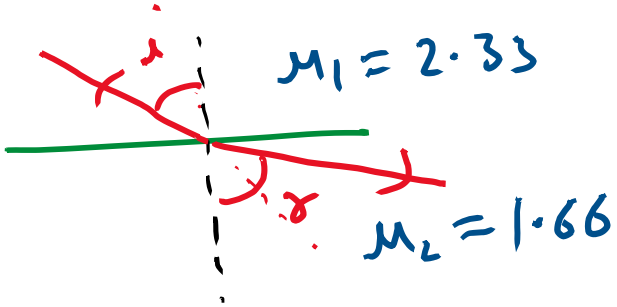
Ans. a

Solution: 8



$\mu_1 \sin i = \mu_2 \sin r$

$\frac{\sin i}{\sin r} = \frac{\mu_2}{\mu_1} = \frac{1.66}{2.33}$

$\boxed{\frac{\sin i}{\sin r} = 0.71}$ Ans

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Ans. a

Solution: 9

$$\mu_1 \sin i = \mu_2 \sin r$$

$$\frac{\mu_1}{\mu_2} = \frac{\sin r}{\sin i} = \frac{\sin(45^\circ)}{\sin(30^\circ)}$$

$$\frac{\mu_1}{\mu_2} = \frac{1/\sqrt{2}}{1/2} = \frac{2}{\sqrt{2}}$$

$$\boxed{\frac{\mu_1}{\mu_2} = \sqrt{2}} \quad \text{Ans}$$

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Ans. d

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