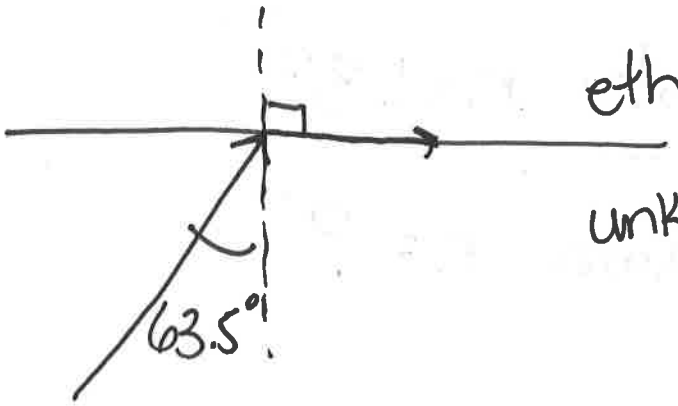
1



$$n_1 \sin\theta_1 = n_2 \sin\theta_2$$

$$n_1(\sin 63.5^\circ) = 1.36(\sin 90^\circ)$$

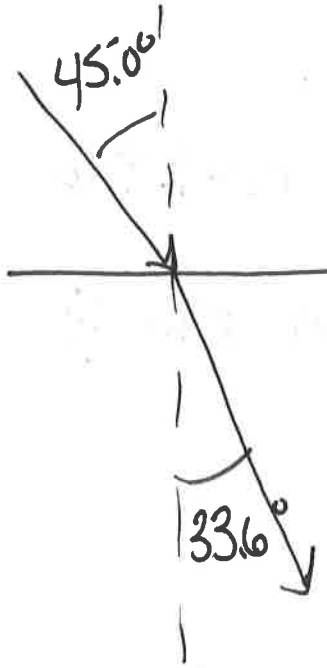
$$n = \frac{1.36}{\sin 63.5^\circ} = \boxed{1.52}$$

$$n_1 \sin\theta_1 = n_2 \sin\theta_2$$

$$1.36 \sin 63.5 = 1.52 \sin\theta_2$$

$$\boxed{53.2^\circ = \theta_2}$$

(2)



Water $n = 1.33$

glass $n = ?$

$$n_1 \sin\theta_1 = n_2 \sin\theta_2$$

$$1.33 \sin 45^\circ = n \sin 33.6^\circ$$

$$1.70 = n$$

$$n = \frac{c}{v} \rightarrow v = \frac{c}{n} = \frac{3.00 \times 10^8}{1.33} = 2.26 \times 10^8 \text{ m/s}$$

$$n = \frac{c}{v} \rightarrow v = \frac{c}{n} = \frac{3.00 \times 10^8}{1.70} = 1.76 \times 10^8 \text{ m/s}$$

③ $n \sin\theta_c = n(\sin 90°)$

a) $1.52 \sin\theta_c = 1.000293(\sin 90°)$

$\sin\theta_c = 0.6581$

$\theta_c = 41.2°$

b) $2.419 \sin\theta_c = 1.58(1)$

$\sin\theta_c = 0.6532$

$\theta_c = 40.8°$

c) $1.51 \sin\theta_c = 1.33(1)$

$\sin\theta_c = 0.8808$

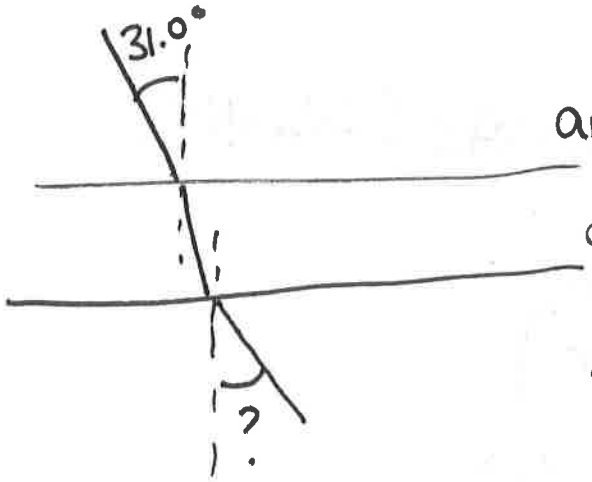
$\theta_c = 61.7°$

d) $2.419 \sin\theta_c = 1.000293(1)$

$\sin\theta_c = 0.4135$

$\theta_c = 24.43°$

(4)



$n_1 = 1.000293$

$n_2 = 1.58$

$n_3 = 1.33$

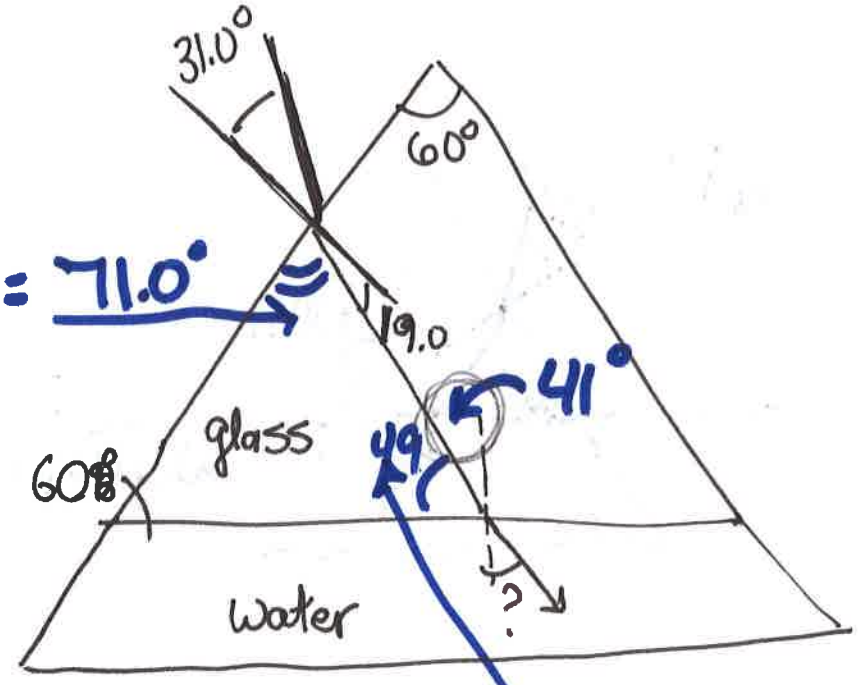
$$n_1 \sin\theta_1 = n_2 \sin\theta_2$$

$$n_2 \sin\theta_2 = n_3 \sin\theta_3$$

$$(1.000293)(\sin 31°) = (1.33)\sin\theta_3$$

$$0.3874 = \sin\theta_3$$

$$22.8° = \theta_3$$



$90 - 19.0 = 71.0°$

$180 - 71.0 - 60 = 49$

$$n_a \sin\theta_a = n_g \sin\theta_g$$

$$(1.00)\sin 31^\circ = 1.58 \sin\theta_g$$

$$19.0^\circ = \theta_g$$

$$n_g \sin\theta_{g_2} = n_w \sin\theta_w$$

$$1.58 \sin(41^\circ) = 1.33 \sin\theta_w$$

$$0.7794 = \sin\theta_w$$

$$\boxed{51.2^\circ = \theta_w}$$

(5) $I = I_0 \cos^2\theta$

I_0 = Intensity incident upon Analyzer (2nd filter) = 50% of original light.

$I = 50 \cdot \cos^2(70)^\circ$

$I = 5.85\%$

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(6) $\tan\theta_p = \frac{1.52}{1.00} = \frac{n_2}{n_1}$

$\theta_p = 56.7^\circ$