



Higher Refraction of Light Answers

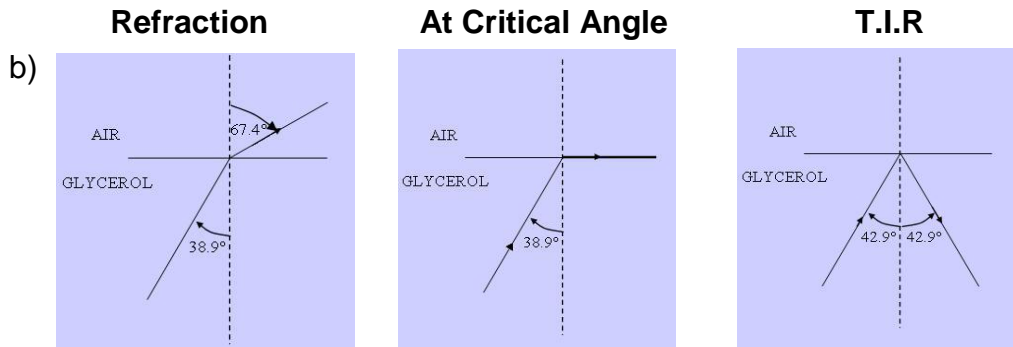
1. a) Water, $n = 1.33$.
b) Diamond, $n = 2.42$.

2. a) $n = 1.31$.
b) $\lambda_R = 496 \text{ nm}$.
c) $v_R = 2.29 \times 10^8 \text{ ms}^{-1}$.
d) $f_R = 4.62 \times 10^{14} \text{ Hz}$.
e) The same.

3. a) $n = \sin A^\circ / \sin Q^\circ$.
b) $n = 1.53 \pm 0.01$.

4. a) Water = 48.8° .
b) Crown Glass = 41.8° .
c) Diamond = 24.4° .

5. a) Glycerol = 42.9° .



6. a) $A = 22.4^\circ$.

b) $B = 37.6^\circ$.

c) $C = 70.0^\circ$.

7. a) $v_R = 1.97 \times 10^8 \text{ ms}^{-1}$.

b) $v_V = 1.95 \times 10^8 \text{ ms}^{-1}$.

c) $X = 0.4^\circ$.

8. $\theta_w = 58.7^\circ$.

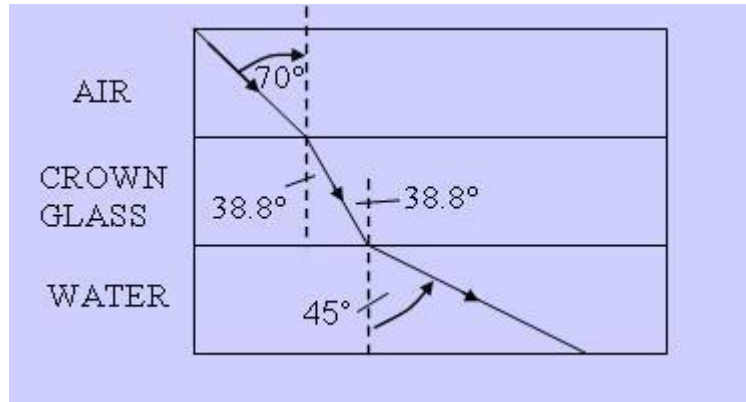
9. a) i) $X = 31.9^\circ$.

ii) $Y = 58.1^\circ$.

iii) Critical Angle = 41.5° .

b) The beam of light will **totally internally reflect at normal 2**. This is due to angle Y being greater than the critical angle for Perspex. ($58.1^\circ > 41.5^\circ$)

10. a)



b) i) $v_w = 2.26 \times 10^8 \text{ ms}^{-1}$.

ii) $v_{CG} = 2 \times 10^8 \text{ ms}^{-1}$.

c)

i) $\lambda_w = 323 \text{ nm}$.

ii) $\lambda_{CG} = 287 \text{ nm}$.

11.

a) $n_p = 1.43$

b) $f = 4.85 \times 10^{14} \text{ Hz}$.

12. i) $\lambda_{\text{Quartz}} = 329 \text{ nm}$.

ii) As the wavelength of visible light increases the refractive index of the quartz (n_{quartz}) decreases. This means that $(1/n_{\text{quartz}})$ increases and therefore $\theta_{\text{critical}}[\sin^{-1}(1/n_{\text{quartz}})]$ also increases.

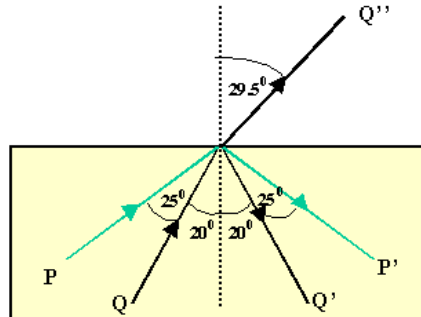
iii) Flint glass has a higher refractive index than crown glass for all wavelengths of light. It will produce a larger spread of the visible spectrum and will be lower down the screen.

13. a) $n_{\text{plastic}} = 1.49$

b) i) $\theta_c = 44^\circ$.

ii) Ray Q will be refracted and partially reflected.

Ray P will be totally internally reflected because the incident angle of 45° is greater than the critical angle.



14. a) $\theta_c = 48.8^\circ$. As the incident light angle is greater than the critical angle then T.I.R occurs.

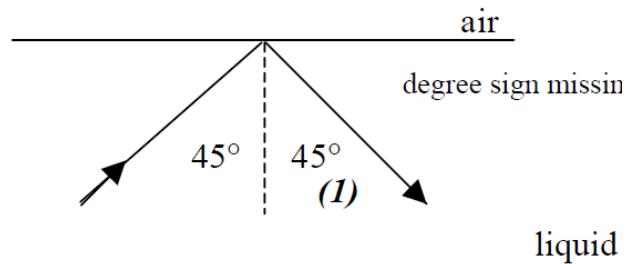
b) $n = 1.43$.

c) $\lambda = 456\text{nm}$.

15. a) i) $n = 1.40$.

ii) A larger refractive index gives a greater change in direction and so $\theta_{\text{air}} > 82^\circ$

b)



$\theta_c = 44^\circ$. (By calculation!!!)

$45^\circ > 44^\circ$. So Total Internal Reflection occurs.