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D8 Refraction and Total Internal Reflection

Data: Refractive index of crown glass $= 1.51$
Refractive index of flint glass $= 1.61$
Refractive index of water $= 1.34$
Refractive index of cubic zirconia $= 2.16$
Refractive index of diamond $= 2.42$
Take the refractive index of air to be 1.00

Complete the table to show the missing angles. In some cases, refraction is impossible. In these cases give your answer as 'Total Internal Reflection'.

	Light passing from...		...to	
	Material	Angle of incidence /°	Material	Angle of refraction /°
D8.1	Air	30	Crown glass	(a)
	Air	30	Flint glass	(b)
	Air	13	Flint glass	(c)
	Air	(d)	Crown glass	30
D8.2	Crown glass	50	Air	(a)
	Crown glass	40	Water	(b)
	Crown glass	50	Flint glass	(c)
D8.3	Water	(a)	Air	60
	Flint glass	(b)	Air	90

Complete the table to show the missing critical angles.

	Boundary between		Critical angle
D8.4	Water	Air	(a)
	Crown glass	Air	(b)
	Flint glass	Air	(c)
	Cubic zirconia	Air	(d)
	Diamond	Air	(e)
D8.5	Flint glass	Water	(a)
	Crown glass	Water	(b)

D8.6 Calculate the speed of light in:

a) Flint glass.

b) Diamond.

D8.7 Calculate the speed of light in:

a) Cubic zirconia as a fraction of the speed of light in air.

b) Diamond as a fraction of the speed in cubic zirconia.

D8.8 The critical angle for light passing from flint glass into ethanol is $57.6°$. Calculate the refractive index of ethanol.

D8.9 When light passes from water into ice at an incident angle of $38.0°$, the angle of refraction is $39.0°$. Calculate the refractive index of ice.