Chapter 16 Light. (Revision Questions page 469). Multiple Choice Answers

Q	Ans	Explanation
1	A	(Linear) polarisation refers to light in the form of a plane wave in space rather than composed of waves vibrating in all directions. That way you can make sense of the answer. You'll see that the top figure shows light vibrating in one plane and when it meets a polariser it allows the light through if the direction of the polariser is the same as the plane of the wave. In the lower diagram you'll se that the direction of the polariser is at 90° to the plane of the wave so doesn't allow any through. If the incident light was unpolarised, some light would get through as it has an infinite number of planes of vibration. In Unit 3, you'll see that light has two components – a vibrating magnetic field and a vibrating electric field at right angles to each other. For polarisation, we are concerned only with the electric field.
2	B	The light is refracting towards the normal so it must be passing from a less optically dense medium to a more optically dense medium. AS medium II has a RI of 1.33, the RI for Medium I must be less than that, but it can't be less than 1.0. Hence, it must be 1.0 (Option B).
3	B	$n_{a\to X} = \frac{\sin i}{\sin r} = \frac{\sin 40^\circ}{\sin 29^\circ} = 1.325$ $n_{a\to Y} = \frac{\sin i}{\sin r} = \frac{\sin 40^\circ}{\sin 34^\circ} = 1.149$ $n_{Y\to X} = \frac{n_X}{n_Y} = \frac{n_{a\to X}}{n_{a\to Y}} = \frac{1.325}{1.149} = 1.153$ $n_{Y\to X} = \frac{\sin i_Y}{\sin r_X}$ $= \frac{\sin 40^\circ}{\sin r_X}$ $\sin r_X = \frac{\sin 40^\circ}{n_{Y\to X}} = \frac{0.643}{1.153} = 0.557$ $r_X = \sin^{-1} 0.557$ $= 33.9^\circ$ This is closer to 5° than to 63° but I feel like I've made a mistake in the options provided.

4	A	Images in plane mirrors are always virtual (behind the mirror), upright, and same size (4 cm) as the object, and as far behind (15 cm) the mirror as the object is in front (15 cm).
5	C	The critical angle can be calculated from: $n_1 \sin\theta_1 = n_2 \sin\theta_2$ $n_1 \sin\theta_c = n_2 \sin 90^\circ$ $n_g \sin\theta_c = n_{air} \sin 90^\circ$ $n_g \sin 41^\circ = 1.0$ $n_g = \frac{1}{\sin 41^\circ} = 1.524$ $Case\ 2$ $n_1 \sin\theta_c = n_2 \sin 90^\circ$ $n_g \sin\theta_c = n_{liquid} \sin 90^\circ$ $1.524 \times \sin\theta_c = 1.3 \times \sin 90^\circ$ $\sin\theta_c = \frac{1.3}{1.524} = 0.853$ $\theta_c = \sin^{-1} 0.853$ $\theta_c = 58.5^\circ$ $\theta_c > 41^\circ$