Examiner only

8. Answer the following questions in your own words. Direct quotes from the original article will not be awarded marks.

(a) Explain why the water in Figure 1 flows in a downward curve (paragraph 1). [2]

(b) Show that the minimum angle (ϕ) for total internal reflection in the optical fibre of Figure 2 is less than 80° (paragraph 3). [2]

(c) Explain why the light emerging from the optical fibre is in the shape of a cone of light (paragraphs 3 & 4 and Figures 2 & 3). [2]

(d) Calculate the angle (α) of the cone of light emerging from the optical fibre in Figure 3 (see paragraphs 3 & 4 and Figures 2 & 3). [4]

Examiner only

(e) Rhys makes the following claim:

"A multimode optical fibre that can transfer data at a maximum bit rate of 500 Mb s^{-1} over a distance of 1 km would be able to transfer data at a maximum rate of 50 Mb s^{-1} over a distance of 10 km."

Discuss whether or not Rhys's claim is valid (paragraph 5 & 6). [3]

(f) A certain type of optical fibre has an attenuation of 0.8 dB/km. When the signal decreases to 6% of its original intensity it must be amplified or the signal will be lost. An engineer intends to install these optical fibres in lengths of 20 km before each amplifier. Determine whether or not this is an appropriate length of optical fibre to use (see paragraph 7 and Table 1). [3]

(g) Aled claims that a core diameter of around 13 μm is thin enough for a monomode optical fibre because a wavelength in air of 1.3 μm is usually used in communications. Rhian claims that this is nonsense because the wavelength in the optical fibre is changed due to its refractive index. Justify by including a calculation who is correct (paragraph 6). [4]

END OF PAPER