For Examiner's Use

4 **(a)** **(i)** Explain what is meant by a *polarised wave*.

……

……..…… [1]

(ii) A vertically polarised light of intensity I is incident on a polariser with its transmission axis at an angle of 40° from the vertical as shown in Fig. 4.1. The wave then passes through another polariser with its transmission axis at an angle of 40° from the vertical in the other direction.

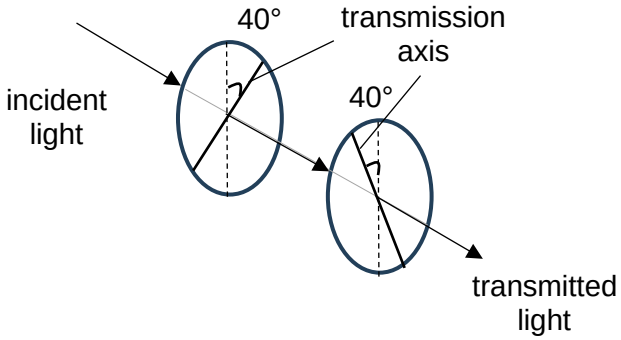

Fig. 4.1

Determine the intensity of the transmitted light in terms of I.

intensity = …… I [2]

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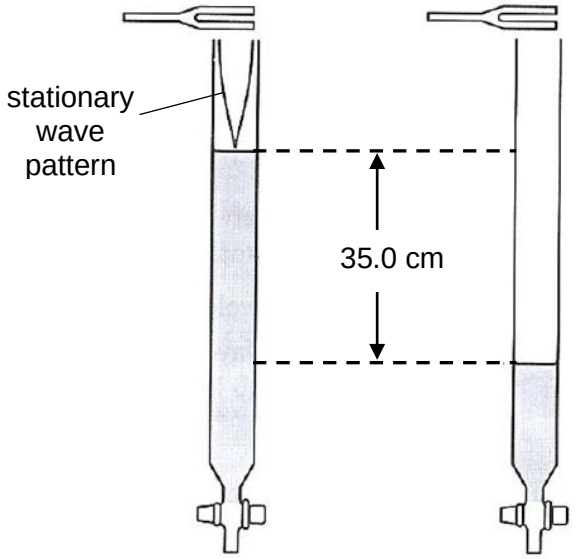
(b) Fig. 4.2 shows a long tube, fitted with a tap at the bottom, filled with water. A tuning fork is sounded above the top of the tube as the water is allowed to run out of the tube.

Fig. 4.2 and Fig. 4.3 show the water levels when a loud sound is first heard and when it is next heard respectively.



First loud sound

Fig. 4.2

Next loud sound

Fig. 4.3

(i) Fig. 4.2 shows the stationary wave pattern produced in the tube.

1. Describe how the pattern illustrates a longitudinal wave.

……

……

……

..…… [2]

2. On Fig. 4.3, sketch the stationary wave pattern set up in the tube. [1]

3. Indicate, with the letter N, the positions of any displacement nodes on the stationary wave in Fig. 4.3. [1]

[Turn over

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(ii) The speed of sound in the tube is 340 m s^{-1}. The water levels for the two positions differs by 35.0 cm.

Determine the frequency of the tuning fork.

frequency = …… Hz [2]

(c) A diffraction grating, with 5.00×10^5 lines per metre, has a narrow beam of coherent light of wavelength 540 nm incident normally on it.

(i) Determine the number of maxima that are visible on a screen placed in front of the diffraction grating.

number = …… [3]

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(ii) The incident beam is suspected to consist of two wavelengths of light, one at 542 nm and the other at 539 nm.

Given that the minimum angular separation of the maxima for which two wavelengths may be distinguished is 0.30°, determine whether the second order maxima of the two wavelengths of light could be observed as separate images.

…… [2]

[Total: 14]

[Turn over