7 **(a)** White light is passed normally through a diffraction grating with 400 lines per mm, and then incident on a screen that is parallel to the diffraction grating.

(i) Describe and explain the appearance of the diffraction pattern on the screen, for the central and first order maxima.

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……………………………………………………………….................. [3]

(ii) Calculate the highest order maxima where a full spectrum can be seen.

highest order maxima = …………………… [3]

(b) Explain the term *interference*.

…………………………………….……………………………………...........

…………………………………………………………….……………………...

……………………………………………………………............................. [1]

(c) The ripple tank, as shown in Fig. 7.1, is a common set-up used to illustrate the effects of wave interference. Two rounded dippers, D_1 and D_2, are made to oscillate vertically in phase.
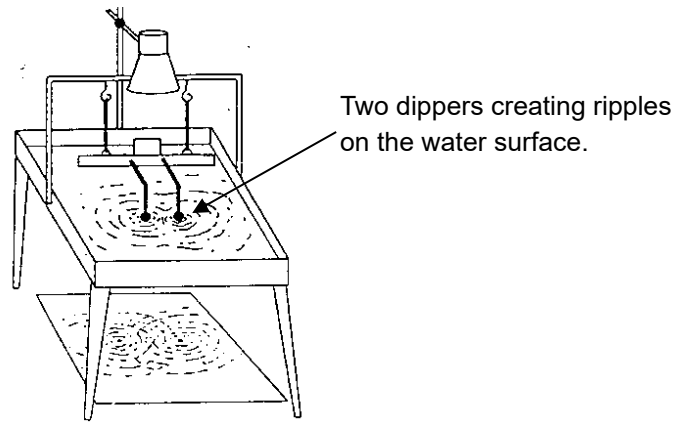
Fig. 7.1

As the bottom of the dippers just 'hits' the surface of the water, circular waves are formed. The top view is shown in Fig. 7.2.
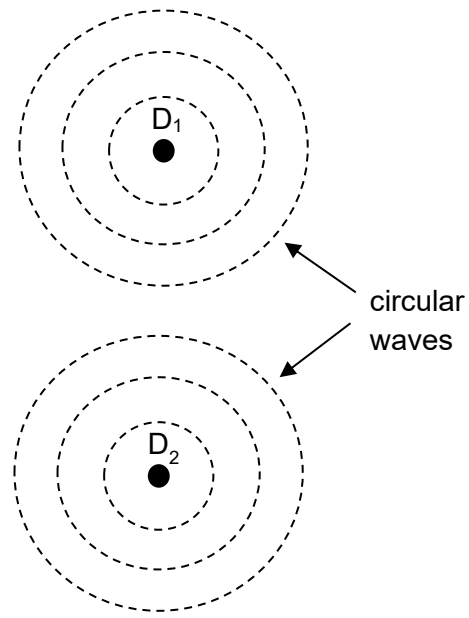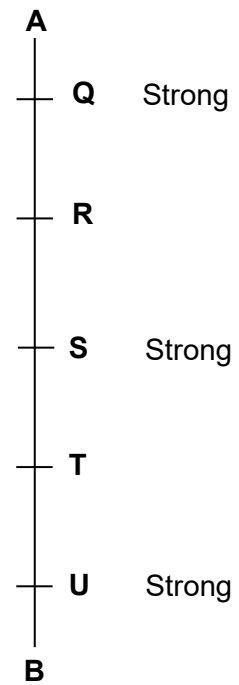

circular waves

Fig. 7.2

A

Q   Strong

R

S   Strong

T

U   Strong

B

(i)   In Fig.7.2, the wave pattern formed along the line **AB** is observed to have strong amplitudes at **Q**, **S, U** and weak amplitudes at **R**, **T**.

State and explain how the wave pattern along **AB** is affected with reference to points **Q, R, S, T, U** when the following changes are done independently.

1.   The frequency of the vibrator is decreased at constant amplitude.

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………………………………………………………………………......   [3]

2.   The amplitude of the vibrator is increased at constant frequency.

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………………………………………………………………………......   [2]

3. D_1 and D_2 are now vibrating with different frequencies.

………………………………………………………………………………………

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………………………………………………………………………......   [2]

(ii) In one experiment, shown in Fig. 7.3, the distance between D_1 and D_2 is 56 mm and the distance from D_1 to line **AB** is 1120 mm.
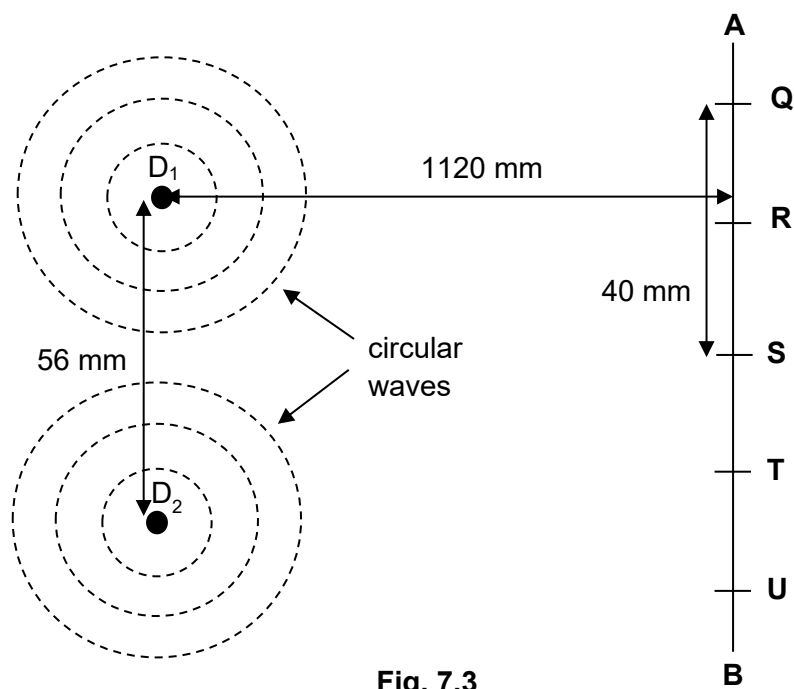

Fig. 7.3

When the frequency of vibration of the dippers is 25 Hz, the distance from **Q** to **S** is 40 mm.

1. Calculate the speed of the wave.

speed = ... m s^{-1} [3]

2. Consider the wave produced by one of the dipper. Determine the phase difference between two points that are 1.5 mm apart along the direction of wave propagation.

Include the relevant unit.

phase difference = …………………… unit: …………..   [3]