5 **(a)** A sound wave is detected by a microphone that is connected to a cathode-ray oscilloscope (CRO). The trace on the screen of the CRO is shown in Fig. 5.1.

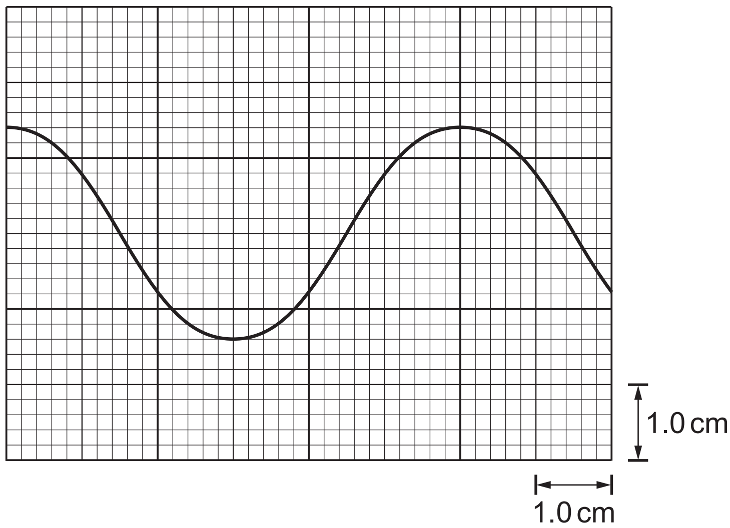

Fig. 5.1

The time-base setting of the CRO is $2.0 \times 10^{-5}\,\mathrm{s\,cm^{-1}}$.

(i) Determine the frequency of the sound wave.

frequency = ... Hz [2]

(ii) The intensity of the sound wave is now doubled. The frequency is unchanged. Assume that the amplitude of the trace is proportional to the amplitude of the sound wave.

On Fig. 5.1, sketch the new trace shown on the screen. [2]

(iii) The time-base is now switched off.

Describe the trace seen on the screen.

....

.... [1]

(b) A beam of light of a single wavelength is incident normally on a diffraction grating, as illustrated in Fig. 5.2.

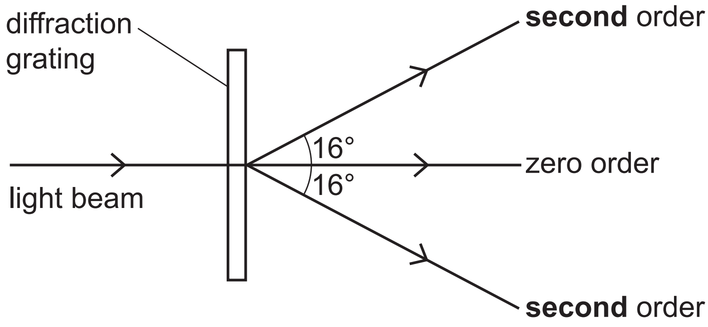

Fig. 5.2 (not to scale)

Fig. 5.2 does not show all of the emerging beams from the grating. The angle between the **second**-order emerging beam and the central zero-order beam is 16°. The grating has a line spacing of 3.4×10^{-6} m.

(i) Calculate the wavelength of the light.

wavelength = ... m [2]

(ii) Determine the highest order of emerging beam from the grating.

highest order = ... [2]

[Total: 9]