

4 (a) For a progressive water wave, state what is meant by:

(i) *displacement*

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

(ii) *amplitude*.

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

(b) Two coherent waves X and Y meet at a point and superpose. The phase difference between the waves at the point is  $180^\circ$ . Wave X has an amplitude of 1.2 cm and intensity  $I$ . Wave Y has an amplitude of 3.6 cm.

Calculate, in terms of  $I$ , the resultant intensity at the meeting point.

intensity = ..... [2]

(c) (i) Monochromatic light is incident on a diffraction grating. Describe the diffraction of the light waves as they pass through the grating.

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

- (ii) A parallel beam of light consists of two wavelengths 540 nm and 630 nm. The light is incident normally on a diffraction grating. Third-order diffraction maxima are produced for each of the two wavelengths. No higher orders are produced for either wavelength.

Determine the smallest possible line spacing  $d$  of the diffraction grating.

$$d = \dots\dots\dots \text{ m [3]}$$

- (iii) The beam of light in (c)(ii) is replaced by a beam of blue light incident on the same diffraction grating.

State and explain whether a third-order diffraction maximum is produced for this blue light.

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

[Total: 11]