5 Fig. 5.1 shows the variation with time t of the displacements x_A and x_B at a point P of two sound waves A and B.

For Examiner's Use

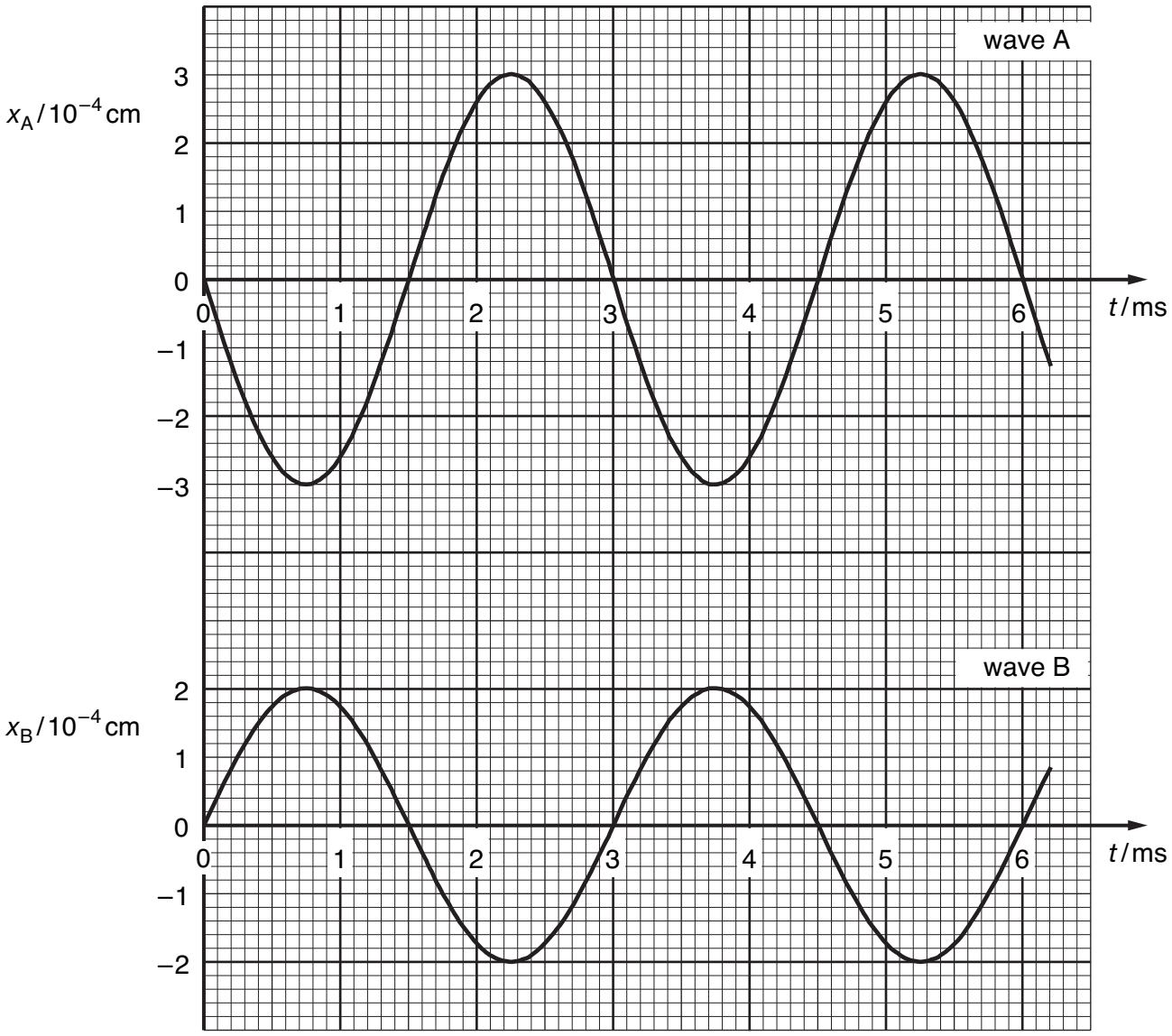

Fig. 5.1

(a) By reference to Fig. 5.1, state one similarity and one difference between these two waves.

similarity: .....

difference: ..... [2]

(b) State, with a reason, whether the two waves are coherent.

.....

..... [1]

(c) The intensity of wave A alone at point P is I.

For Examiner's Use

(i) Show that the intensity of wave B alone at point P is $\frac{4}{9}I$.

[2]

(ii) Calculate the resultant intensity, in terms of I, of the two waves at point P.

resultant intensity = ... I [2]

(d) Determine the resultant displacement for the two waves at point P

(i) at time $t = 3.0$ ms,

resultant displacement = ... cm [1]

(ii) at time $t = 4.0$ ms.

resultant displacement = ... cm [2]

5 **(a)** Explain what is meant by the *diffraction* of a wave.

For Examiner's Use

.....

.....

.....[2]

(b) Light of wavelength 590 nm is incident normally on a diffraction grating having 750 lines per millimetre.
The diffraction grating formula may be expressed in the form

$$d \sin\theta = n\lambda.$$

(i) Calculate the value of d, in metres, for this grating.

d = ... m [2]

(ii) Determine the maximum value of n for the light incident normally on the grating.

maximum value of n = ... [2]

(iii) Fig. 5.1 shows incident light that is not normal to the grating.

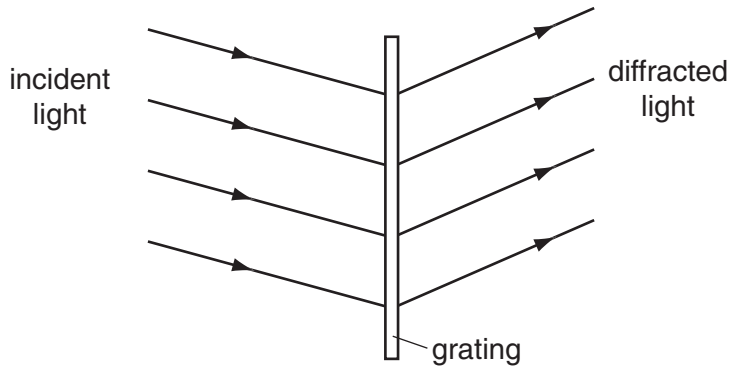

Fig. 5.1

Suggest why the diffraction grating formula, $d\sin\theta = n\lambda$, should **not** be used in this situation.

.....

.....[1]

(c) Light of wavelengths 590 nm and 595 nm is now incident normally on the grating.
Two lines are observed in the first order spectrum and two lines are observed in the second order spectrum, corresponding to the two wavelengths.
State two differences between the first order spectrum and the second order spectrum.

1. .....

.....

2. .....

.....[2]