4 **(a)** State Newton's first law of motion.

.....

.....[1]

(b) An object A of mass 100 g is moving in a straight line with a velocity of 0.60 m s^{-1} to the right. An object B of mass 200 g is moving in the same straight line as object A with a velocity of 0.80 m s^{-1} to the left, as shown in Fig. 4.1.

Fig. 4.1

Objects A and B collide. Object A then moves with a velocity of 0.40 m s^{-1} to the left.

(i) Calculate the magnitude of the velocity of B after the collision.

magnitude of velocity = ...m s^{-1} [2]

(ii) The collision between A and B is inelastic.

Explain how the collision is inelastic and still obeys the law of conservation of energy.

.....

.....

.....[1]

[Total: 4]

5 **(a)** Define the *frequency* of a sound wave.

.....

.....[1]

(b) A sound wave travels through air. Describe the motion of the air particles relative to the direction of travel of the sound wave.

.....

.....[1]

(c) The sound wave emitted from the horn of a stationary car is detected with a microphone and displayed on a cathode-ray oscilloscope (c.r.o.), as shown in Fig. 5.1.

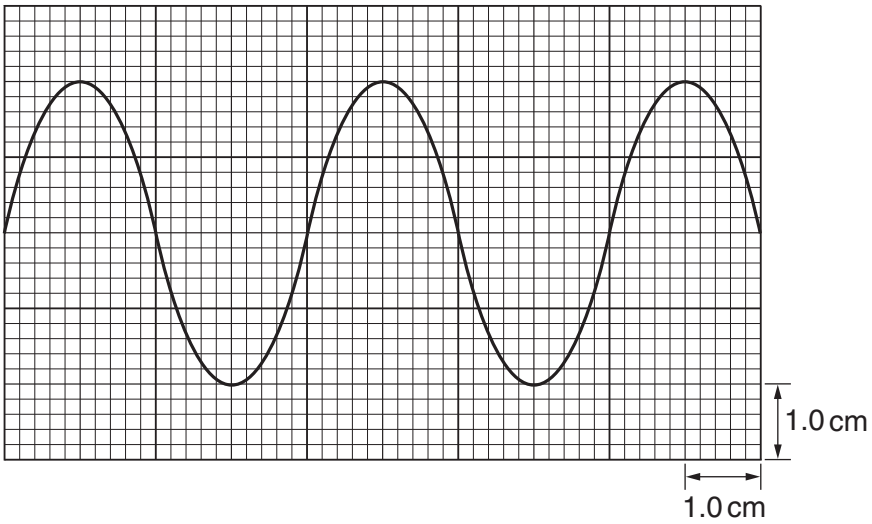

Fig. 5.1

The *y*-axis setting is 5.0 mV cm^{-1}.
The time-base setting is 0.50 ms cm^{-1}.

(i) Use Fig. 5.1 to determine the frequency of the sound wave.

frequency = ... Hz [2]

(ii) The horn of the car sounds continuously. Describe the changes to the trace seen on the c.r.o. as the car travels at constant speed

1. directly towards the stationary microphone,

.....

.....

2. directly away from the stationary microphone.

.....

.....

[3]

[Total: 7]