2 **(a)** State the relation between force and momentum.

.....

.....

..... [1]

(b) A rigid bar of mass 450 g is held horizontally by two supports A and B, as shown in Fig. 2.1.

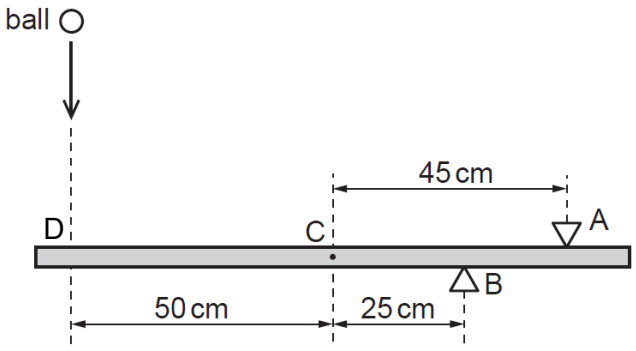

Fig. 2.1

Support A is 45 cm from the centre of mass C of the bar while support B is 25 cm from C.

A ball of mass 140 g falls vertically onto the bar such that it hits the bar at point D, a distance of 50 cm from C.

The variation with time *t* of the velocity *v* of the ball before, during and after hitting the bar is shown in Fig. 2.2.

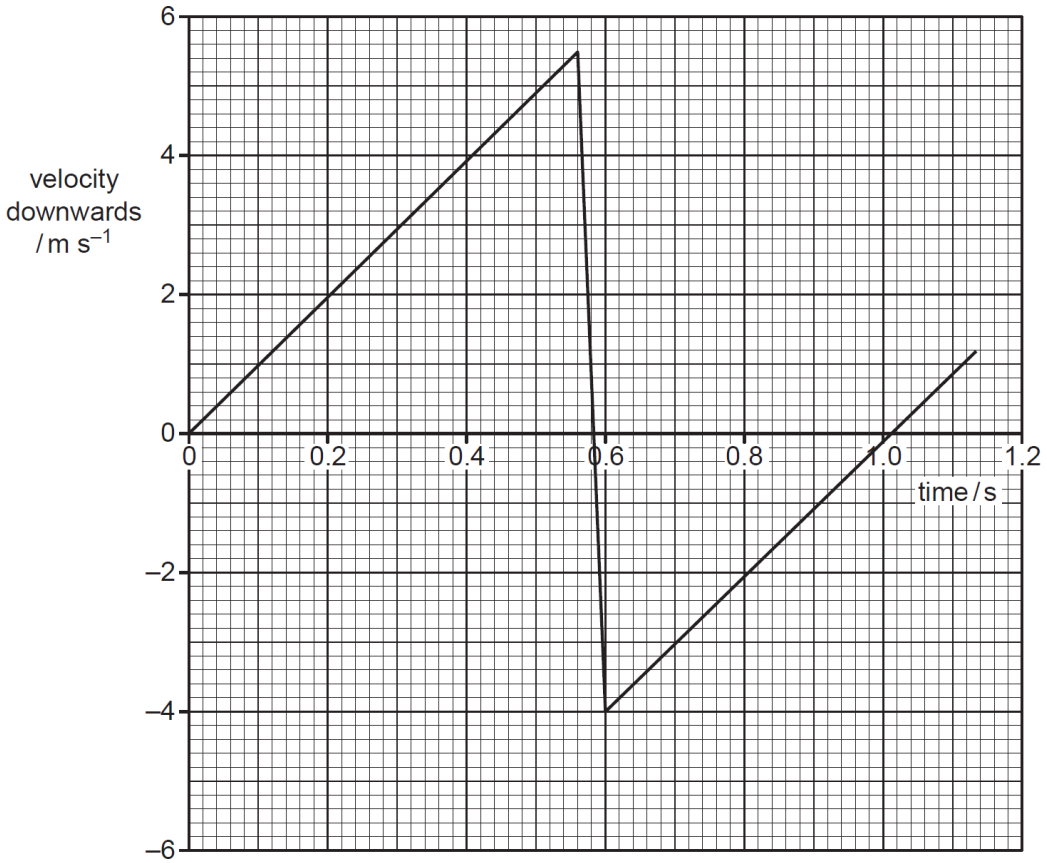

Fig. 2.2

For the time that the ball is in contact with the bar, use the data provided to

(i) determine the change in momentum of the ball,

change in momemtum = ... kg m s^{-1} [2]

(ii) show that the magnitude of the average force exerted by the ball on the bar is 35 N,

[2]

(iii) calculate the average force exerted on the bar by the support A.

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force = ... N [2]

(iv) determine the net energy lost by the ball due to the inelastic collision with the bar at D.

energy = ... J [1]

(c) The ball is now dropped under the same conditions, this time with a light cushion fitted at point D.

Explain the effect on your answer to **(b)(iii)** when the ball makes contact at point D.

.....

.....

..... [2]

[Total: 10]