NAME……

AS PHYSICS

MOMENTUM TUTORIAL

31 MARCH 2021

1

(a) Define *force*.

.....

..... [1]

(b) A ball falls vertically downwards towards a horizontal floor and then rebounds along its original path, as illustrated in Fig. 3.1.

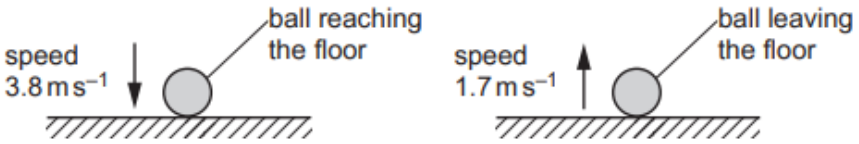

Fig. 3.1

The ball reaches the floor with speed $3.8\,m\,s^{-1}$. The ball is then in contact with the floor for a time of 0.081 s before leaving it with speed $1.7\,m\,s^{-1}$. The mass of the ball is 0.062 kg.

(i) Calculate the loss of kinetic energy of the ball during the collision.

loss of kinetic energy = ... J [2]

(ii) Determine the magnitude of the change in momentum of the ball during the collision.

change in momentum = ... Ns [2]

(iii) Show that the magnitude of the average resultant force acting on the ball during the collision is 4.2 N.

[1]

(iv) Use the information in **(iii)** to calculate the magnitude of:

1. the average force of the floor on the ball during the collision

average force = ... N

2. the average force of the ball on the floor during the collision.

average force = ... N
[2]

[Total: 8]

2

2 A wooden block moves along a horizontal frictionless surface, as shown in Fig. 2.1.

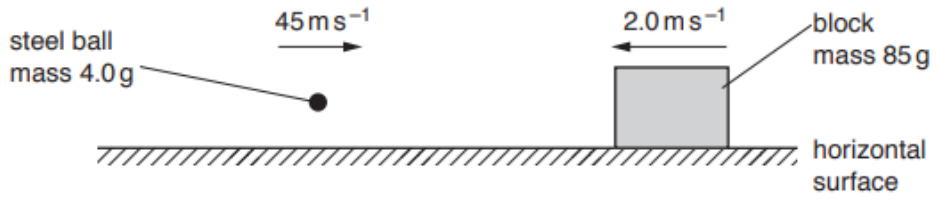

Fig. 2.1

The block has mass 85 g and moves to the left with a velocity of 2.0 m s^{-1}. A steel ball of mass 4.0 g is fired to the right. The steel ball, moving horizontally with a speed of 45 m s^{-1}, collides with the block and remains embedded in it. After the collision the block and steel ball both have speed *v*.

(a) Calculate *v*.

v = ... m s^{-1} [2]

(b) **(i)** For the block and ball, state

1. the relative speed of approach before collision,

relative speed of approach = ... m s^{-1}

2. the relative speed of separation after collision.

relative speed of separation = ... m s^{-1}
[1]

(ii) Use your answers in **(i)** to state and explain whether the collision is elastic or inelastic.

.....

..... [1]

(c) Use Newton's third law to explain the relationship between the rate of change of momentum of the ball and the rate of change of momentum of the block during the collision.

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.....

.....

..... [2]

[Total: 6]