2 (a) State the principle of conservation of momentum.

....

....

.... [2]

(b) A ball X has mass 240 g and moves in a straight line on a horizontal frictionless surface with an initial speed of $16\,\text{m s}^{-1}$. The ball collides with a stationary ball Y that has mass 480 g. After the collision, ball X is stationary, as shown in Fig. 2.1.
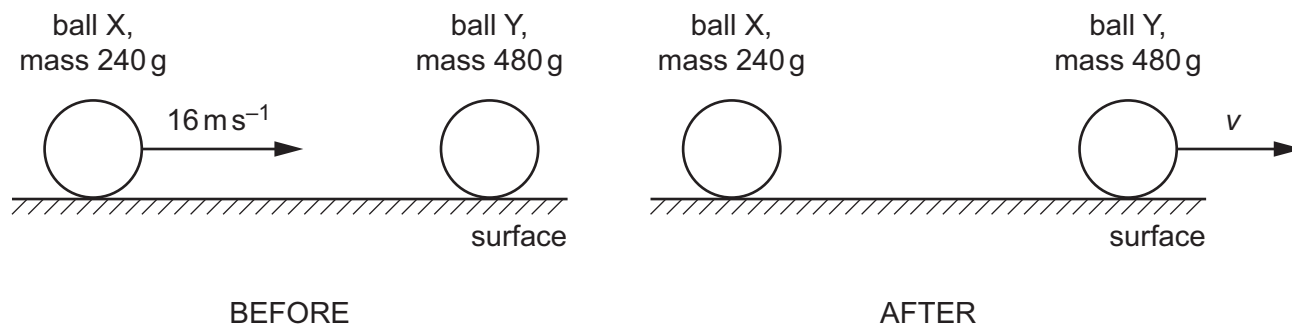

BEFORE   AFTER

Fig. 2.1

(i) Show that the speed v of ball Y after the collision is $8.0\,\text{m s}^{-1}$.

[1]

(ii) Calculate the change in the total kinetic energy ΔE_K of the balls due to the collision.

ΔE_K = ... J [3]

(c) The collision in **(b)** lasts for a time of 2.0 ms. Assume that the contact force between the balls is constant during this time.

(i) Determine the magnitude and direction of the force exerted on ball X by ball Y during the collision.

magnitude = ... N

direction ....

[3]

(ii) Compare the magnitude and direction of the force exerted on ball Y by ball X during the collision with the answers in **(c)(i)**. No further calculations are required.

....

....

.... [2]

[Total: 11]