

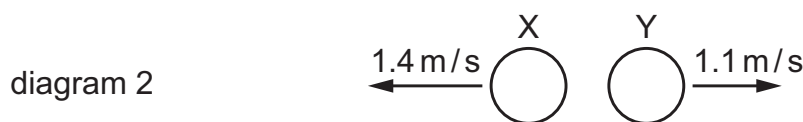
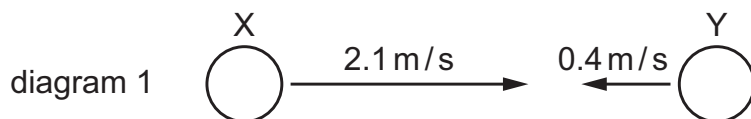
- 7 The momentum of a car changes from $10\,000\text{ kg m/s}$ to $15\,000\text{ kg m/s}$ in a time of 8.0 s .

What is the resultant force acting on the car?

- A** 630 N **B** 3100 N **C** 40 000 N **D** 200 000 N

- 6 Diagram 1 shows a ball X of mass 0.15 kg travelling horizontally with a velocity of 2.1 m/s towards ball Y travelling at 0.4 m/s in the opposite direction.

Diagram 2 shows the velocities of the balls immediately after they collide.



What is the mass of ball Y?

- A** 0.15 kg **B** 0.19 kg **C** 0.35 kg **D** 0.79 kg

- 8 A ball is at rest on the ground. A boy kicks the ball. The boy's boot is in contact with the ball for a time of 0.040 s .

The average force on the ball is 200 N . The ball leaves the boy's boot with a speed of 20 m/s .

Which row gives the impulse of the boot on the ball and the average acceleration of the ball during the time of 0.040 s ?

	<u>impulse on ball</u> Ns	<u>average acceleration of ball</u> m/s^2
A	8	0.8
B	8	500
C	5000	0.8
D	5000	500

- 2** A cricket ball is travelling at a speed of 25 m/s horizontally through the air. The mass of the ball is 0.14 kg.

A player catches the ball and the ball comes to rest.

- (a)** Calculate the change in momentum of the ball during the catch.

change in momentum = [2]

- (b)** The player's hands are in contact with the moving ball for 9.7 ms.

Calculate the horizontal force exerted by her hands to bring the ball to rest.

force = [3]

[Total: 5]

- 6** A ball of mass m falls vertically and hits a hard surface.

Its speed on hitting the surface is v_1 .

It rebounds vertically upwards with speed v_2 .

What is the change in momentum of the ball?

- A** mv_1 **B** mv_2 **C** $m(v_1 + v_2)$ **D** $m(v_2 - v_1)$

2 Fig. 2.1 shows two identical trolleys, P and Q, held at rest on a frictionless horizontal surface. A load is fixed to trolley P.

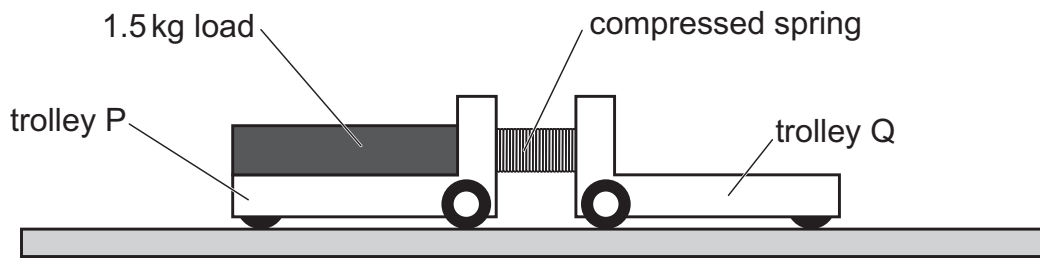


Fig. 2.1

There is a compressed spring between trolley P and trolley Q.

The trolleys are released. As the spring expands, it pushes the trolleys apart.

Trolley Q moves to the right at a constant speed of 0.36 m/s.

The mass of each trolley is 1.2 kg. The mass of the load on trolley P is 1.5 kg.

The spring has negligible mass.

(a) Calculate:

(i) the speed at which trolley P moves to the left

speed of P = [3]

(ii) the kinetic energy of trolley Q when it moves at 0.36 m/s.

kinetic energy of Q = [3]

(b) State the energy transfer that takes place as the spring expands.

.....

.....

..... [2]

7 A sphere X collides head on with a second identical sphere Y which is stationary.

The mass of each sphere is 0.15 kg.

Sphere X is travelling at a velocity of 2.0 m/s before the collision and produces an impulse of 0.21 N s on sphere Y.

What is the velocity of sphere X after collision?

- A** 0.60 m/s in the opposite direction to Y
- B** 0.60 m/s in the same direction as Y
- C** 1.4 m/s in the opposite direction to Y
- D** 1.4 m/s in the same direction as Y

- 1 A girl holds a rubber ball out of a window of a tall building. The mass of the ball is 0.20 kg. The ball is at rest 10 m above a concrete path.

- (a) Calculate the gravitational potential energy of the ball relative to the concrete path.

gravitational potential energy = [2]

- (b) The girl releases the ball and it falls towards the path. The ball strikes the path and bounces vertically upwards.

Fig. 1.1 shows the ball falling towards the path.

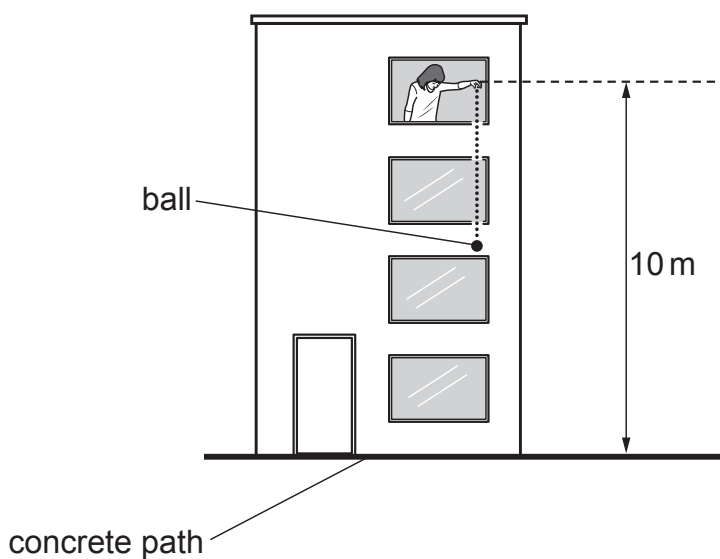


Fig. 1.1

The speed of the ball immediately **before** it strikes the path is 14 m/s.

The speed of the ball immediately **after** it strikes the path is 12 m/s.

- (i) Calculate the kinetic energy of the ball immediately **after** it strikes the concrete path.

kinetic energy = [2]

- (ii) Show that the change in momentum of the ball when it bounces off the path is 5.2 kg m/s.

(iii) The ball is in contact with the path for 0.25 s.

Calculate the average resultant force on the ball when it is in contact with the path.

force = [2]

[Total: 9]