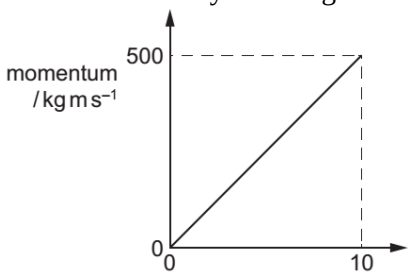
Momentum Work sheet

MCQ

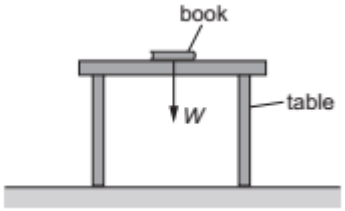
1.2. The graph shows how the momentum of a motorcycle changes with time. 9702/11/M/J/14



What is the resultant force on the motorcycle?

A 50 N B 500 N C 2500N D 5000N

3.17. A book of weight W is at rest on a table. A student attempts to state Newton's third law of motion by saying that 'action equals reaction'. **9702_s17_qp_12**

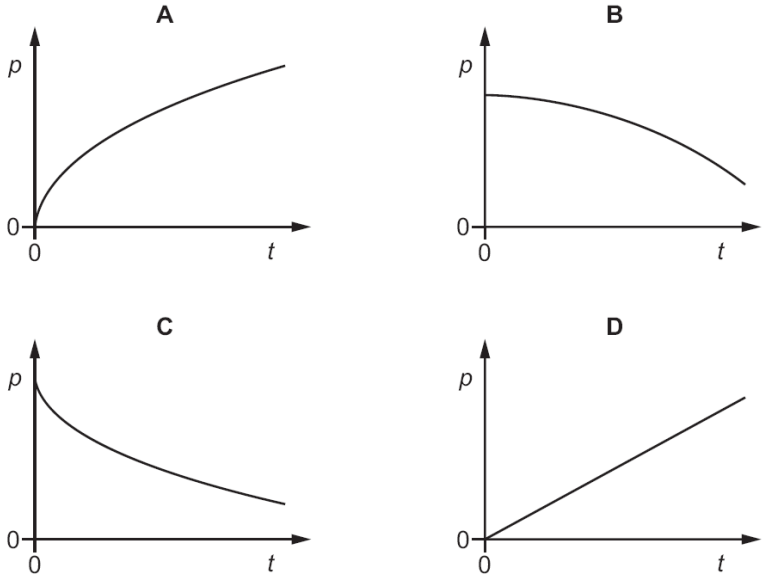


If the weight of the book is the 'action' force, what is the 'reaction' force?

A the force W acting downwards on the Earth from the table
B the force W acting upwards on the book from the table
C the force W acting upwards on the Earth from the book
D the force W acting upwards on the table from the floor

7.34. The resultant force acting on an object is slowly increased. 9702_s20_qp_12

Which graph could show the variation with time *t* of the momentum *p* of the object?



8.36. A ball of mass m travels vertically downwards and then hits a horizontal floor at speed u.

It rebounds vertically upwards with speed v. 9702/13/M/J/20

The collision lasts a time Δt.

What is the average resultant force exerted on the ball during the collision?

A $\frac{mv - mu}{\Delta t}$ downwards

B $\frac{mv - mu}{\Delta t}$ upwards

C $\frac{mv + mu}{\Delta t}$ downwards

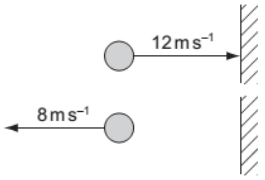
D $\frac{mv + mu}{\Delta t}$ upwards

24.9. A ball of mass 2.0 kg travels horizontally with a speed of 4.0 m s^{-1}. The ball collides with a wall and rebounds in the opposite direction with a speed of 2.8 m s^{-1}. The time of the collision is 150 ms.

What is the average force exerted on the wall? 9702/12/O/N/24

A 16 N B 37 N C 53 N D 91 N

2.10. A ball of mass 0.5 kg is thrown against a wall at a speed of 12 m s^{-1}. It bounces back with a speed of 8ms^{-1}. The collision lasts for 0.10s. 9702/12/O/N/12



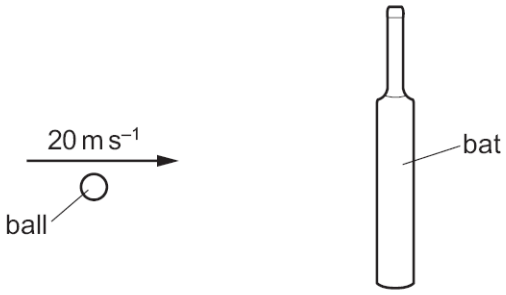
What is the average force on the ball due to the collision?
A 0.2N B 1N C 20N D 100N

28.8 A snooker ball has a mass of 200 g. It hits the cushion of a snooker table and rebounds along its original path. 9702/13/O/N/23

The ball arrives at the cushion with a speed of 14.0 ms^{-1} and then leaves it with a speed of 7.0 ms^{-1}. The ball and the cushion are in contact for a time of 0.60 s.

What is the average force exerted on the ball by the cushion?
A 1.4 N **B** 2.3 N **C** 4.2 N **D** 7.0 N

31.13. A ball of mass 0.10 kg is thrown towards a stationary vertical bat. The ball hits the bat with a horizontal velocity of 20 m s^{-1}. 9702/11/M/J/24



The ball rebounds and leaves the bat with a horizontal velocity of 15 m s^{-1}.

What is the change in momentum of the ball?

A 0.20 N s B 0.50 N s C 1.5 N s D 3.5 N s

34.9. A ball collides with a wall. Before the collision, the ball moves with velocity 8 m s^{-1} to the right. After the collision, it moves with velocity 3 m s^{-1} to the left. 9702/12/M/J/24

What is the change in velocity of the ball during the collision?

A 5 m s^{-1} to the left

B 5 m s^{-1} to the right

C 11 m s^{-1} to the left

D 11 m s^{-1} to the right

Theory

Q20.2 In a safety test, a car of mass 1100 kg travels at a speed of 10 m / s and collides with a stationary van of mass 3000 kg.
After the collision the car and the van move together with a velocity v. 5054/21/M/J/23
Fig. 2.1 shows the car and van before and after the collision.

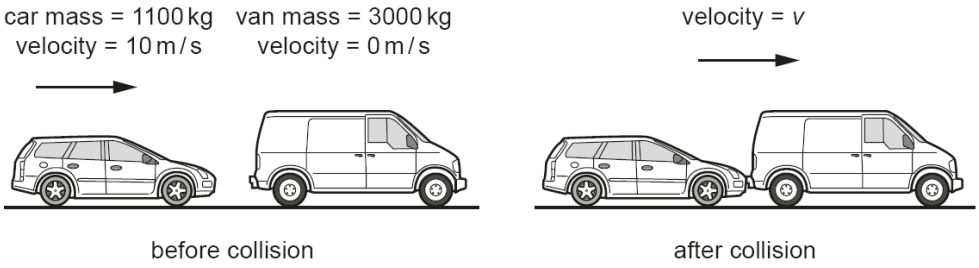


Fig. 2.1

The total momentum of the car and van is conserved during the collision.
(a) (i) Define 'momentum'.

.....

..... [1]

(ii) State the unit of momentum.

..... [1]

(b) Calculate the velocity *v* of the car and van after the collision.

v = ... m / s [2]

(c) (i) Calculate the total kinetic energy of the car and van after the collision.

kinetic energy = ... J [2]

(ii) State the transfer of energy that occurs in the collision.

.....

..... [1]

[Total: 7]

Q21.2 A spacecraft of mass 300 kg is moving in a straight line in space, at a speed of 8000 m / s.

(a) Calculate the momentum of the spacecraft. 5054/22/O/N/23

momentum = ... kg m / s [2]

(b) The fuel on the spacecraft explodes and the spacecraft splits into two parts. The direction in which the parts move does not change.

(i) After the explosion, the speed of the front part increases to 9000 m / s. It has a mass of 150 kg. Calculate the speed of the rear part after the explosion.

speed = ... m / s [3]

(ii) The total kinetic energy of the two parts after the explosion is greater than the original kinetic energy of the spacecraft.

State the energy transfer that occurs in the explosion.

.....

..... [1]

(iii) The explosion lasts for 0.20 s.

Calculate the average force on the front part during this time.

force = ... N [3]

[Total: 9]

Q22.1 A jet ski is a type of boat that carries one or two people and travels at high speed on water.
Fig. 1.1 shows a student riding on a jet ski. 5054/22/O/N/24

Fig. 1.1

A high-speed jet of water is forced backwards out of the back of the jet ski by a pump inside the jet ski.

(a) The pump increases the momentum of the water that is forced backwards out of the back of the jet ski.

(i) Complete the word equation to show the relationship between the resultant force on an object and the change in momentum of the object.

resultant force = [1]

(ii) In 2.0s, the pump increases the backwards speed of 180kg of water by 30m/s.
Calculate the backwards force exerted on the water.

force = ... N [2]

(b) (i) Using Newton's third law of motion, explain why there is a forwards force on the jet ski.

.....

.....

.....

..... [2]

(ii) The student has a mass of 70kg and the jet ski has a mass of 280kg.
Use your answer from (a)(ii) to determine the acceleration of the student and jet ski when no resistive forces are acting.

acceleration = ... m/s^2 [2]

(c) The jet ski reaches a speed of 20m/s.
Calculate the total kinetic energy of the student and jet ski at this speed.

kinetic energy = ... J [3]

[Total: 10]