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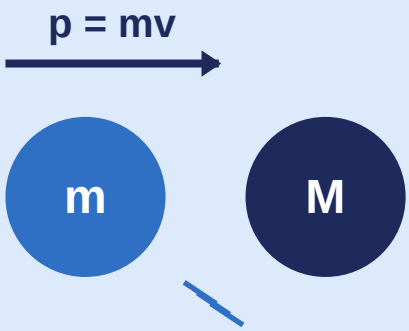
Year 10/11 • GCSE & IGCSE Physics

Momentum

Homework Worksheet

Practise p = mv, negative momentum, conservation of momentum, impulse and car safety features.



p = mv | Vectors | Collisions | Explosions | Impulse | Safety

KEY IDEAS IN THIS WORKSHEET **YEAR 10/11**

Name: _____ Class: _____

Date set: _____ Date due: _____

What's inside

Section A	Momentum and p = mv	**12 marks**
Section B	Conservation of momentum	**15 marks**
Section C	Force, impulse and safety	**12 marks**
Section D	Challenge: ice skaters	**6 marks**

Instructions

- Answer all questions in the spaces provided.
- Use a pencil and ruler for diagrams.
- Marks for each question are shown in [ ].
- GCSE Higher tier / IGCSE Extended content.

Total score

/ 45

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Momentum Worksheet

Year 10/11 • GCSE Physics (Higher) and Cambridge IGCSE Physics 0625 (Extended) • Momentum, conservation and impulse.
Show your working.

Section A — Momentum and p = mv [12 marks]

1 Momentum.

(a) Write down the equation that links momentum, mass and velocity. **[1]**

.....

(b) Give the unit of momentum. **[1]**

.....

(c) Momentum is a vector quantity. Explain what this means. **[1]**

.....

(d) An elephant is standing still. State its momentum and explain your answer. **[1]**

.....

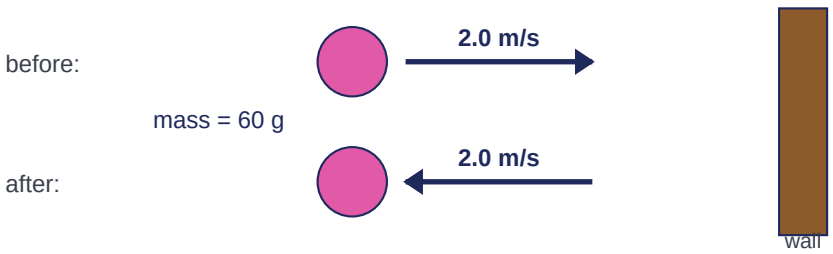
2 A lorry has a mass of 7500 kg. It travels south at a speed of 25 m/s. Calculate the momentum of the lorry. Give the unit and the direction. **[3]**

.....

.....

.....

3 A tennis ball of mass 60 g travels towards a wall at 2.0 m/s and bounces back at 2.0 m/s. Take the direction towards the wall as positive.



(a) Convert 60 g into kilograms. **[1]**

.....

(b) Calculate the momentum of the ball before it hits the wall. **[1]**

.....

(c) Calculate the momentum of the ball after it bounces back. Include the sign. **[1]**

.....

(d) Calculate the change in momentum of the ball. **[2]**

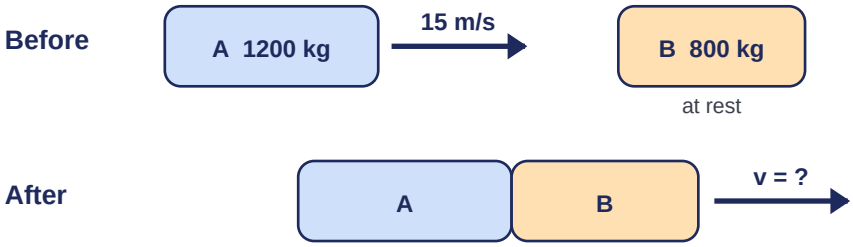
Section B — Conservation of momentum [15 marks]

4 Conservation of momentum.

(a) State the principle of conservation of momentum. **[2]**

(b) What is meant by a **closed system**? **[1]**

5 Car A (1200 kg) travels at 15 m/s and hits car B (800 kg), which is at rest. The cars stick together. Calculate the velocity of the two cars just after the collision. **[4]**



6 Trolley P (2.0 kg) moves at 3.0 m/s and hits trolley Q (1.0 kg), which is at rest. After the collision, P moves at 1.0 m/s in the same direction. Calculate the velocity of Q after the collision. **[3]**

7 A rifle of mass 4.0 kg fires a bullet of mass 0.010 kg at 400 m/s. The rifle is at rest before it is fired.



(a) What is the total momentum of the rifle and bullet before firing? **[1]**

(b) Calculate the recoil velocity of the rifle. State its direction. **[3]**

(c) Explain why the rifle moves in the opposite direction to the bullet. **[1]**

Section C — Force, impulse and safety [12 marks]

8 A footballer kicks a ball of mass 0.45 kg from rest to 20 m/s. The foot is in contact with the ball for 0.050 s.

(a) Write down the equation that links force, change in momentum and time. **[1]**

(b) Calculate the change in momentum of the ball. **[1]**

(c) Calculate the average force on the ball. **[2]**

9 Explain how an airbag reduces the force on a driver in a crash. **[3]**

10 Use your answer to 3(d). The tennis ball is in contact with the wall for 0.020 s. Calculate the average force the wall exerts on the ball. **[2]**

11 A car of mass 1200 kg moves at 0.75 m/s. A resultant force of 30 N acts on it for 10 s in the direction of motion.

(a) Calculate the impulse of the force. **[1]**

(b) Calculate the new velocity of the car. **[2]**

Section D — Challenge: ice skaters [6 marks]

12 Two ice skaters stand still on the ice and push each other apart. Skater X (60 kg) moves to the left at 2.0 m/s.

(a) Skater Y has a mass of 40 kg. Calculate the velocity of skater Y. **[2]**

(b) Calculate the total kinetic energy of the skaters after the push. Suggest where this energy came from. **[3]**

(c) The total momentum stays the same, but the kinetic energy increases. Explain how this is possible. **[1]**

END OF WORKSHEET **Total: _____ / 45**