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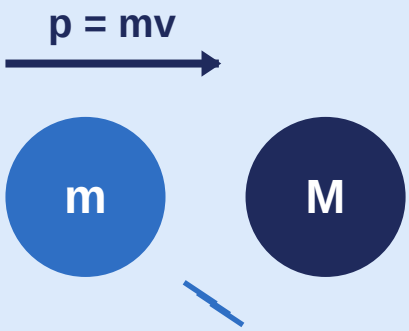
Year 10/11 • GCSE & IGCSE Physics

Momentum

Mark Scheme – Teacher Copy

Answers, marking points and guidance for the Momentum worksheet.



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**

Marking notes

- (1) = one mark for each marking point.
- / separates alternative answers.
- Allow error carried forward in calculations.
- Accept any correct, clearly expressed alternative.

Total marks

45

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Momentum Worksheet – Mark Scheme

Total: 45 marks. (1) = one mark. Accept any scientifically correct alternative wording.

Section A – Momentum and p = mv

Q	Answer	Mark	Guidance
1(a)	momentum = mass × velocity (p = mv)	1	
1(b)	kg m/s	1	allow N s
1(c)	it has both magnitude (size) and direction	1	
1(d)	zero (1) because its velocity is zero	1	both needed
2	p = 7500 × 25 (1) = 187 500 kg m/s (1) south (1)	3	1 mark for direction
3(a)	0.060 kg (6.0×10^{-2} kg)	1	do not allow 6.0×10^{-3} kg
3(b)	0.060 × 2.0 = 0.12 kg m/s	1	
3(c)	0.060 × (–2.0) = –0.12 kg m/s	1	sign needed
3(d)	–0.12 – 0.12 (1) = –0.24 kg m/s (1)	2	allow 0.24 kg m/s away from the wall
	Section A total	**12**	

Section B – Conservation of momentum

Q	Answer	Mark	Guidance
4(a)	in a closed system (1); total momentum before an event = total momentum after the event (1)	2	
4(b)	a system with no external forces acting on it	1	
5	momentum before = 1200 × 15 = 18 000 kg m/s (1); total mass = 2000 kg (1); v = 18 000 ÷ 2000 (1) = 9.0 m/s (1)	4	allow ecf
6	2.0 × 3.0 = 6.0 kg m/s (1); 6.0 = 2.0 × 1.0 + 1.0 × v (1); v = 4.0 m/s (1)	3	
7(a)	zero	1	
7(b)	bullet: 0.010 × 400 = 4.0 kg m/s (1); v = 4.0 ÷ 4.0 = 1.0 m/s (1); backwards / opposite to the bullet (1)	3	allow –1.0 m/s
7(c)	total momentum must stay zero, so the rifle has equal momentum in the opposite direction	1	
	Section B total	**15**	

Section C – Force, impulse and safety

Q	Answer	Mark	Guidance
8(a)	F = Δp ÷ Δt	1	allow FΔt = Δ(mv) or F = mΔv ÷ Δt
8(b)	0.45 × 20 = 9.0 kg m/s	1	
8(c)	F = 9.0 ÷ 0.050 (1) = 180 N (1)	2	
9	increases the time taken to stop (1); change in momentum is the same (1); so the rate of change of momentum / force is smaller (1)	3	
10	F = 0.24 ÷ 0.020 (1) = 12 N (1)	2	allow ecf from 3(d)
11(a)	impulse = 30 × 10 = 300 N s	1	
11(b)	new momentum = 1200 × 0.75 + 300 = 1200 kg m/s (1); v = 1.0 m/s (1)	2	
	Section C total	**12**	

Section D – Challenge: ice skaters

Q	Answer	Mark	Guidance
12(a)	60 × 2.0 = 40 × v (1); v = 3.0 m/s to the right (1)	2	1 mark for direction
12(b)	½ × 60 × 2.0^2 + ½ × 40 × 3.0^2 = 120 + 180 (1) = 300 J (1); from the chemical store of the skaters' muscles (1)	3	
12(c)	momentum is a vector: equal and opposite momenta add to zero; kinetic energy is a scalar and is never negative	1	
	Section D total	**6**	