Momentum and Force Practice

1 Fill in the blanks in these sentences.
Use the words or phrases **change of velocity**, **unbalanced**, **momentum**.
_____ forces change an object's _____. You can calculate the change in momentum by multiplying the mass by the _____.

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2 A 4 kg cat speeds up from 2 m/s to 5 m/s.

(a) Calculate the change in velocity and state its direction.

(b) Calculate the cat's momentum before it speeds up using the equation.

$$\text{momentum}\ (\text{kg m/s}) = \text{mass}\ (\text{kg}) \times \text{velocity}\ (\text{m/s})$$
$$\square = 4 \times \square$$

(c) Calculate the change of momentum using the equation.

$$\text{momentum change}\ (\text{kg m/s}) = \text{mass}\ (\text{kg}) \times \text{velocity change}\ (\text{m/s})$$
$$\square = 4 \times \square$$

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3 A 4 kg cat **slows down** from 5 m/s to 3 m/s.

(a) Calculate the change in velocity and state its direction.

(b) Calculate the change of momentum using the equation.

$$\text{momentum change}\ (\text{kg m/s}) = \text{mass}\ (\text{kg}) \times \text{velocity change}\ (\text{m/s})$$
$$\square = 4 \times \square$$

(c) Calculate the change of momentum if the cat slows down from 3 m/s to rest.

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4 Calculate the change in momentum for:

(a) A 750 kg car which speeds up from 12 m/s to 24 m/s.

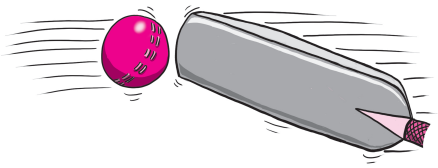
(b) A 200 kg lion who speeds up from 8.0 m/s to 18.0 m/s.

(c) A 9000 kg tram which slows down from 12 m/s to 5 m/s.

(d) A 2.0 kg bag of flour which hits the floor at 1.5 m/s then stops.

5 A 0.16 kg cricket ball is bowled at 35 m/s and is hit in the other direction at 45 m/s.

(a) Calculate the momentum of the ball before it hits the bat.



(b) Calculate the momentum of the ball after it has been hit. State the direction.

(c) Calculate the change in momentum.

(d) How much force would be needed to stop the ball in 1 s straight off the bat?

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6 Calculate the change in momentum when a 0.80 kg basketball travelling at 12 m/s bounces and then goes the other way at 8 m/s.

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7 Fill in the blanks in these sentences.
Use the words **momentum**, **second**, 4 **N**, 4 **kg m/s**, **resultant**, **change**.
A _____ force of _____ will _____ an object's _____ by _____ each _____.

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8 A 2 kg trolley is moving at 1.0 m/s. It is then pushed forwards by a 4.0 N force for 0.5 s.

(a) Calculate the momentum before it is pushed.

(b) Calculate the change in momentum using the equation

momentum change (kg m/s) = force (N) × time (s)

	=	_	×	

(c) Calculate the momentum after it has been pushed.

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9 A badger runs into a fence and stops. Its momentum reduces from 10 kg m/s to zero in 0.2 s. Calculate the force on the badger using the equation

momentum change (kg m/s) = force (N) × time (s)

_	=		×	0.2

10 A $300\,000$ kg train is moving at 25 m/s. Its motors then provide an extra force forwards of $3\,000$ N for sixty seconds.

(a) Calculate the momentum of the train before the extra force.

(b) Calculate the change in momentum caused by the extra force.

(c) Calculate the momentum of the train after the sixty seconds.

(d) Calculate the new speed of the train.

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11 How much force is needed to bowl a 0.16 kg cricket ball at 36 m/s if it takes 0.09 s to throw it?

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12 Write a word equation containing **momentum change**, **resultant force** and **time**. Make **resultant force** the subject of the equation.

resultant force $=$

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13 An 80 kg coach passenger slows down from 30 m/s to 8 m/s in 18 s.

(a) Calculate the change in momentum.

(b) Calculate the force needed to slow the passenger down.

(c) Calculate the force if the passenger slowed down in 2.5 s instead.

14 Calculate the force needed to slow a $24\,000$ kg coach down from 30 m/s to 8 m/s in 10 s.