

0 4

Figure 8 shows a girl bowling a ball along a ten-pin bowling lane.

Figure 8



The girl is trying to knock down the ten pins at the end of the bowling lane.

0 4 . 1

Velocity is a vector quantity, speed is a scalar quantity.

Describe what is meant by a vector quantity and a scalar quantity.

[2 marks]

Vector quantity _____

Scalar quantity _____

0 4 . 2

The bowling lane is horizontal.

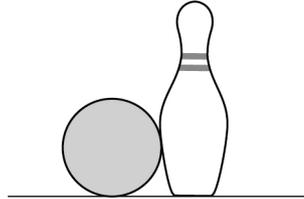
Explain why the bowling ball decelerates as it travels along the lane.

[2 marks]



Figure 9 shows the bowling ball hitting one of the pins.

Figure 9



0 4 . 3 Write down the equation that links mass (m), momentum (p) and velocity (v).

[1 mark]

0 4 . 4 The bowling ball has a velocity of 5.0 m/s when it hits the pin.

The momentum of the bowling ball is 26 kg m/s

Calculate the mass of the bowling ball.

[3 marks]

Mass = _____ kg

Question 4 continues on the next page

Turn over ►



0 4 . 5 Explain why the bowling ball slows down when it hits the pin.

You should use ideas about momentum in your answer.

[3 marks]

11



Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	(vector quantity) has magnitude and a direction		1	AO1 6.5.4.1.3
	(scalar quantity) has magnitude only		1	
04.2	resistive force acts on the ball	allow friction or air resistance	1	AO2 6.5.4.2.1
	so (resultant) force in opposite direction to velocity		1	
04.3	or			AO2 6.5.5.1
	so work is done on the ball			
04.4	momentum = mass × velocity		1	AO2 6.5.5.1
	or			
	$p = mv$		1	
04.4	$26 = m \times 5.0$		1	AO2 6.5.5.1
	$m = \frac{26}{5.0}$		1	
	5.2 (kg)		1	
04.5	momentum is conserved in the collision (assuming no external forces)		1	AO1 6.5.5.2
	momentum of the pin increases		1	
	therefore the momentum of the ball must decrease.	if no other mark is awarded, allow 1 mark for when the ball exerts a force on the pin, the pin	1	

		exerts an equal and opposite force on the ball		
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Total			11	
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Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	X-rays are absorbed by bone		1	AO1 6.6.2.4
	but can pass through flesh	ignore skin	1	
05.2	taking lots of X-rays would give a large dose		1	AO3 6.6.2.3
	which would increase the radiographer's risk		1	
	the screen absorbs some of the X-rays	allow screen reduces the risk/dose received by the radiographer	1	
05.3	electrical current / oscillations in the transmitter producing radio waves		1	AO1 6.6.2.3
	radio waves are absorbed by the receiver inducing electrical current / oscillations in the receiver		1	
	at the same frequency	if no other mark is awarded, allow 1 mark for radio waves transfer information/energy through the air	1	
Total			8	