Question		Expected response	Max mark	Additional guidance
3.	(a)	$v^{2} = u^{2} + 2as$ $v^{2} = 0^{2} + 2 \times (-)9 \cdot 8 \times (-)1 \cdot 27$ $v = 5 \cdot 0 \text{ m s}^{-1}$ (1)	3	Accept: 5, 4·99, 4·989 a and s must have the same sign, otherwise max 1 mark. For alternative methods: 1 mark for all relationships 1 mark for all substitutions 1 mark for final answer eg $E_p = mgh$ $E_p = 1·59 \times 10^{-2} \times 9·8 \times 1·27$ $E_k = \frac{1}{2}mv^2$ $(1·59 \times 10^{-2} \times 9·8 \times 1·27) = \frac{1}{2} \times 1·59 \times 10^{-2} \times v^2$ $v = 5·0 \text{ ms}^{-1}$
	(b)	$Ft = mv - mu$ $0.14 = (1.59 \times 10^{-2} \times v) - (1.59 \times 10^{-2} \times -5.0)$ $v = 3.8 \text{ m s}^{-1}$ (1)	3	Or consistent with (a) Accept: 4, 3.81 , 3.805 Ft and u must have opposite signs otherwise max 1 mark. Accept:
	(c)	Kinetic energy is greater before (the collision) than after. OR Kinetic energy is lost (during the collision)	1	Do not accept E_k before not equal to E_k after. Do not accept E_k is not conserved.
	(d)	(Softer material would) increase the time of contact (1) and decrease the (maximum/ average) force (1)	2	Independent marks

Q3(a) Maximum mark: 3

Response A

$$V^2 = 4^2 + 2as$$

 $V^2 = 0^2 + 2x - 9 - 8 \times 1.27$
 $V = 5my^{-2}$

Marks

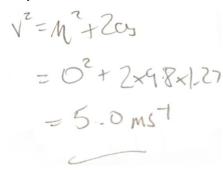
Response B

$$v^2 = u^2 + 2cas$$

 $v^2 = 0 + 2x9.81 \times 1.27$
 $V = 5 \text{ m/s}^2$



Response C





Q3(b) Maximum mark: 3 Response A

Ft = NV - MU $O.14 = (1.59 \times 10^{7})V - (1.59 \times 10^{7}) \times 5$ $1.59 \times 10^{7}V - 0.079 = 0.14$ $1.59 \times 10^{7}V = 0.219$ V = 13.8 ms

Maximum mark: 1					
Response A					
Energy is lost in collision					
Response B					
Ex gow down and Ep gos					
wp					
Response C					
In collision Excepts lest.					
	Response B Ex gows down and Ep gres When Response C				

Q3(d)	Maximum mark: 2 Response A				
	t1:. FV				
	Response B				
	L'increases so F de cheases				

3(a)	А	3	1	The candidate has selected an appropriate relationship but has incorrectly substituted values (a and s must have the same sign).
	В	3	2	The candidate has selected an appropriate relationship, correctly substituted values (a and s have the same sign) but has not given an acceptable final answer (the unit should be m s ⁻¹ rather than m s ⁻²).
	С	3	3	The candidate has selected an appropriate relationship, correctly substituted values (<i>a</i> and <i>s</i> have the same sign) and has given the correct final answer.
3(b)	Α	3	1	The candidate has selected an appropriate relationship but has incorrectly substituted

Question	Candidate response	Max mark	Mark awarded	Commentary
				values (Ft and u must have opposite signs).
3(c)	A	1	0	The candidate's explanation is not sufficiently precise. <i>Kinetic</i> energy should be specified.
	В	1	0	The candidate's explanation is not sufficiently precise. 'Goes down' and 'goes up' are not acceptable alternatives to 'decreases' and 'increases'.
	С	1	1	The candidate's explanation is acceptable.
3(d)	А	2	0	'↑' and '↓' are not acceptable alternatives to 'increases' and 'decreases'.
	В	2	1	The candidate has not specified an increase in time of contact but has specified a decrease in force.