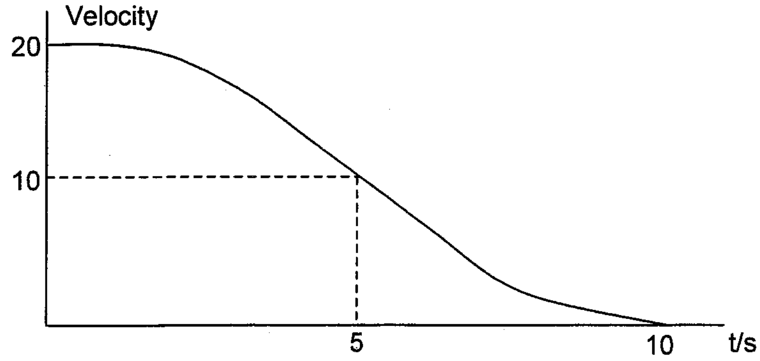
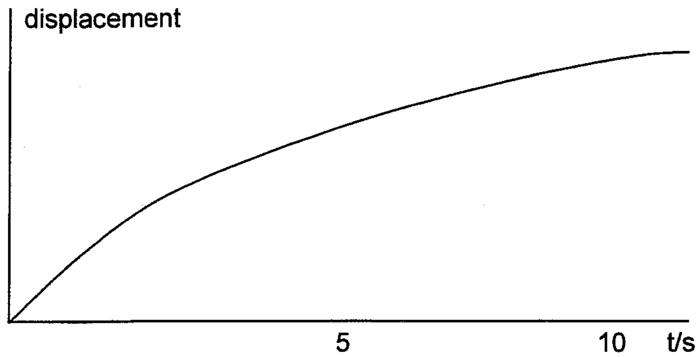
Abbreviations, annotations and conventions used in the Mark Scheme	m = method mark s = substitution mark e = evaluation mark / = alternative and acceptable answers for the same marking point ; = separates marking points NOT = answers which are not worthy of credit ( ) = words which are not essential to gain credit ___ = (underlining) key words which **must** be used to gain credit ecf = error carried forward AW = alternative wording ora = or reverse argument

Qn	Expected Answers	Park Mark	Mark	
1(a)	e.g. (kitchen) scales reading to 2g	1		
	in 250 g giving 0.8%	1	2	
(b)	e.g. tape measure reading to 1cm	1		
	400 cm giving 0.25%	1	2	
(c)	e.g. watch reading to 10s	1		
	in 25 000 s giving 0.04%	1	2	
(d)	e.g. compass reading to 2°	1		
	in 45° giving 4%	1	2	
(e)	e.g. (jam) thermometerreading to 2°C	1		
	in 50° giving 4%	1	2	10
2(a) (1)	load on a spring/ extension of spring	1		
	= spring constant	1		
(2)	force/ acceleration	1		
	= mass	1		
(3)	electromotive force/ electric current	1		
	= resistance	1		
(4)	stress/ strain	1		
	= Young Modulus	1		
(5)	charge/ potential difference	1		
	= capacitance	1	10	
(b)	possible marking points 1 each x 3	3	3	
	enables prediction to be carried out			
	often constant (so can be quoted in reference books)			
	helpful in solving problems			
	known facts can be extrapolated to deal with unknown situations			
	other ideas MAX	1		13

3(a)	the velocity is decreasing	1	1	
(b)				
	slow deceleration at start	1		
	slow deceleration at finish	1		
	maximum deceleration at 5 s	1	3	
(c)	(i) area under graph	1	1	
	(ii) 			
	smooth curve from origin	1		
	well over half way by 5 s	1	2	
(d)	average height of graph around 10 m s^{-1}	1		
	10 m s^{-1} x 10 s = 100 m	1	2	
(e)	possible marking points 1 each x 5			
	sudden application of a force is required for constant deceleration			
	jerk at the start of deceleration			
	sudden removal of the force must happen at the end of the deceleration			
	jerk at final stopping i.e. at 10 s			
	smooth change of force able to be accommodated by passenger			
	other valid point e.g. jerk as a sudden change of the force	5	5	14

4(a)

$F = ma$ $v = 0$ $F = (-)\, m\, u\, /\, t$ Hence $Ft = mv$	 1 1 0	$v^2 = u^2 + 2ad$ $a = (-)\, u^2/2d$ $F = m\, u^2/2d$ Hence $Fd = ½\, mv^2$	 1 1 	4	
mv = 2000 kg x 6 m s^{-1} = 12 000 N s	 1	$½\, mv^2$ = ½ x 2000 x 6^2 = 36 000 N m OR J	 1	2	
12 000 Ns / 300 N = 40 s	 1	36 000 N m / 300 N = 120 m	 1	2	8

(b) (i) it results from a vector multiplied by a scalar 1 1

(ii) momentum is a force time phenomenon 1

kinetic energy is a force distance phenomenon 1 2

(iii) in any collision between bodies the time the force acts between must be the same for both bodies 1

the distance which each body travels (while they interact) is not necessarily the same for each body 1

use of Newton's third law indicating forces on each is equal and opposite 1

since force and time is the same momentum must be conserved in all collisions 1

but this argument cannot be used for energy; some energy may be converted to other forms MAXIMUM 4 1 4

15

5	(a)	e.g. microphone	**sound**	**electrical**	1		
		lift	**electrical**	gravitational potential	1		
		electric motor	electrical	**kinetic**	1		
		(gas) cooker	**chemical**	heat	1	4	

(b) e.g.

sound to electrical in a microphone is very inefficient

electrical to gravitational potential in a lift is better (but there will be friction losses)

electrical to kinetic in a motor will result in high efficiency, (with some heat losses)

chemical to heat in a cooker will be highly efficient (up to 90%)

(1) for general ideas (1) for sensible suggestions 2

more efficient to start with (organised) energy such as electrical and to finish with disorganised energy such as heat 1

e.g. all the electrical energy to a resistor becomes heat 1 4 8