Work, Energy & Power

Mark Scheme 4

Level	International A Level
Subject	Physics
Exam Board	CIE
Topic	Work, Energy & Power
Sub Topic	
Paper Type	Theory
Booklet	Mark Scheme 4

Time Allowed: **48 minutes**

Score: **/40**

Percentage: **/100**

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1 (a) (i) (change in) potential energy= *mgh* C1
= 0.056 × 9.8 × 16
= 8.78 **J** *(allow 8.8)* A1 [2]

(ii) (initial) kinetic energy= *½mv2* C1
= ½ × 0.056 × 18^2
= 9.07 **J** *(allow 9.1)* C1
total kinetic energy= 8.78 + 9.07 = 17.9 **J** A1 [3]

(b) kinetic energy= *½mv2*
17.9 = ½ x 0.056 x *v2* and **v** = 25(.3) m s^{-1} B1 [1]

(c) horizontal velocity= 18 m s^{-1} B1 [1]

(d) (i) correct shape of diagram
(two sides of right-angled triangle with correct orientation) B1

(ii) angle = 41° – 48° (allow trig. solution based on diagram) A2 [3]
(for angle 38°-, 41° or 48°-, 51°, allow 1 mark)

2	**(a)**	**(i)**	product of force and distance <u>moved</u>	M1	
			(by force) in the direction of the force	A1	[2]
		(ii)	work (done) per unit time (*idea of ratio needed*)	B1	[1]
	(b)		*either* work/time *or* power = (force × distance)/time	M1	
			to give power = force × velocity	A1	[2]
	(c)	**(i)**	kinetic energy (= $\frac{1}{2}mv^2$) = $\frac{1}{2} \times 1900 \times 27^2$	C1	
			power = 692550 / 8.1 = 8.55×10^4 W	A1	[2]
		(ii)	*either* for equal increments of speed, increments of E_K are different	M1	
			so longer time (to increase speed) at high speeds	A1	[2]
			or air resistance increases with speed (M1)		
			so driving force (and acceleration) reduced (A1)		
			or P (= Fv) = mav (M1)		
			(P and m constant) so when v increases, a decreases (A1)		

3	**(a)**		product of force and distance	M1	
			moved in the direction of the force	A1	**[2]**
	(b)		falls from rest		
			decreasing acceleration	B1	
			reaches a constant speed	B1	**[3]**
		(ii)	straight line with negative gradient	B1	
			y-axis intercept above maximum E_K	B1	
			reasonable gradient (same magnitude as that for E_K initially)	B1	**[3]**

4 **(a) (** $\Delta E_p = mg\Delta h$ C1
$= 0.602 \times 9.8 \times 0.086$
$= 0.51$ J A1 **[2]**
(do not allow g = 10, m = 0.600 or answer 0.50 J)

(ii) $v^2 = (2gh =) 2 \times 9.8 \times 0.086$ or (2 x 0.51)/0.602 M1
$v = 1.3$ (m $s^{-1)}$ A0 **[1]**

(b) $2 \times V = 602 \times 1.3$ (allow 600) C1
$V = 390$ m s^{-1} A1 **[2]**

(c) (i $E_k = ½mv^2$ C1
$= ½ \times 0.002 \times 390^2$
= 152 J or 153 J or 150 J A1 **[2]**

(ii) E_k not the same/changes
or E_k before impact>E_k after/E_p after M1
so must be inelastic collision A1 **[2]**
(allow 1 mark for 'bullet embeds itself in block' etc.)

5 (a) force x distance moved M1
in the direction of the force ..... A1 [2]

(b) weight/ force = mg M1
$M_p = mg$ x Afz ..... A1 [2]
(no marks for quote of mgM)