

Mark Scheme Energy Past Paper Questions

Jan 2002 to Jan 2009

5(a) decreases for the first four seconds ✓
zero for the remaining six seconds ✓ **Q5 Jan 2002** (2)

(b) $E_k = \frac{1}{2} \times 1.4 \times 10^3 \times 16^2$ ✓
 $= 1.8 \times 10^5 \text{ J}$ ✓
(accept $v = 15 \text{ m s}^{-1}$ from misleading graph and $E_k = 1.6 \times 10^5 \text{ J}$) (2)

(c) (use of $P = Fv$ gives) $20 \times 10^3 = F \times 30$ ✓
 $F = 670 \text{ N}$ ✓ (2)
(6)

6(a) loss of potential energy = $m \times 9.81 \times 6.0$ ✓
gain in kinetic energy = loss of potential energy ✓
 $\frac{1}{2}mv^2 = 58.9 m$ gives $v = 10.8 \text{ (m s}^{-1}\text{)}$ ($\approx 11 \text{ m s}^{-1}$) ✓ (3)

Q6 Jan 2002

(b) loses potential energy (as it moves to B) ✓
gains kinetic energy (as it moves to B) ✓
regains some potential energy at the expense of kinetic energy
as it moves from B to C ✓
some energy lost as heat (due to friction) ✓ (4)
(7)

7(a)(i) $E_p = mg\Delta h$ ✓
 $= 5.8 \times 10^{-2} \times 9.8(1) \times 1.5 = 0.85 \text{ J}$ ✓

Q7 Jun 2002

(ii) 0.85 J ✓

(allow C.E. for value of E_p from (i))

(iii) (use of $E_k = \frac{1}{2}mv^2$ gives) $0.85 = 0.5 \times 5.8 \times 10^{-2} \times v^2$ ✓
 (allow C.E. for answer from (ii))

($v^2 = 29.3$) $v = 5.4 \text{ m s}^{-1}$ ✓

(iv) (use of $p = mv$ gives) $p = 5.8 \times 10^{-2} \times 5.4$ ✓

(allow C.E. for value of v from (iii))
 $= 0.31 \text{ N s}$ ✓

(7)

(b) $\left(\text{use of } F = \frac{\Delta(mv)}{\Delta t} \text{ gives} \right) F = \frac{0.31}{0.010}$ ✓

(allow C.E. for value of p from (iv))
 $= 31 \text{ N}$ ✓

[or $a = \frac{5.4}{0.010} = 540 \text{ (m s}^{-2}\text{)}$ ✓

$F = 5.8 \times 10^{-2} \times 540 = 31 \text{ N}$ ✓]

(2)

(c) egg effectively stopped in a longer distance ✓
 hence greater time and therefore less force on egg ✓
 [or takes longer to stop

hence force is smaller as $F = \frac{\Delta(mv)}{t}$]

[or acceleration reduced as it takes longer to stop
 thus force will be smaller]

[or some energy is absorbed by container
 less absorbed by egg]

(2)

(11)

(a)(i) (use of $E_p = mgh$ gives) $E_p = 70 \times 9.81 \times 150 \checkmark$
 $= 1.0(3) \times 10^5 \text{ J} \checkmark$

Q4 Jun 2004

(ii) (use of $E_k = \frac{1}{2}mv^2$ gives) $E_k = \frac{1}{2} \times 70 \times 45^2 \checkmark$
 $= 7.1 \times 10^4 \text{ J} \checkmark$ (7.09 $\times 10^4$ J) (4)

(b)(i) work done ($= 1.03 \times 10^5 - 7.09 \times 10^4$) $= 3.2(1) \times 10^4 \text{ J} \checkmark$
 (allow C.E. for values of E_p and E_k from (a))

(ii) (use of *work done* $= Fs$ gives) $3.21 \times 10^4 = F \times 150 \checkmark$
 (allow C.E. for value of *work done* from (i))
 $F = 210 \text{ N} \checkmark$ (213 N) (3)

(7)

Question 2		
(a)	(i) (gravitational) potential energy \checkmark to kinetic energy \checkmark	Q2 Jan 2006
	(ii) both trolley and mass have kinetic energy \checkmark mention of thermal energy (due to friction) \checkmark	
(b)	masses of trolley and falling mass \checkmark distance mass falls (or trolley moves) and time taken to fall (or speed) \checkmark	2
(c)	calculate loss of gravitational pot. energy of falling mass (mgh) \checkmark calculate speed of trolley (as mass hits floor), with details of speed calculation \checkmark calculate kinetic energy of trolley \checkmark and mass \checkmark compare (loss of) potential energy with (gain of) kinetic energy \checkmark	Max 4
Total		10

Question 2		
(a)	potential energy to kinetic energy \checkmark mention of thermal energy and friction \checkmark	2
(b)	(use of $\frac{1}{2}mv^2 = mgh$ gives) $\frac{1}{2}v_h^2 = 9.81 \times 1.5 \checkmark$ $v_h = 5.4(2) \text{ ms}^{-1} \checkmark$ (assumption) energy converted to thermal energy is negligible \checkmark	3
(c)	component of weight down the slope causes acceleration \checkmark this component decreases as skateboard moves further down the slope \checkmark air resistance/friction increases (with speed) \checkmark	max 2
(d)	(i) distance ($= 0.42 \times 5.4$) $= 2.3 \text{ m} \checkmark$ (2.27 m) (allow C.E. for value of v_h from (b))	Q2 Jun 2006
	(ii) $v_v = 9.8 \times 0.42 \checkmark$ $= 4.1(1) \text{ ms}^{-1} \checkmark$	
	(iii) $v^2 = 4.1^2 + 5.4^2 \checkmark$ $v = 6.8 \text{ ms}^{-1} \checkmark$ (6.78 ms^{-1}) (allow C.E. for value of v_h from (b))	
Total		12