Mark Scheme Energy Past Paper Questions

Jan 2002 to Jan 2009

Q5 Jan 2002

5(a) decreases for the first four seconds ✓
zero for the remaining six seconds ✓ (2)

(b) $E_k = ½ \times 1.4 \times 10^3 \times 16^2$ ✓
$= 1.8 \times 10^5$ J ✓
(accept $v = 15$ m s^{-1} from misleading graph and $E_k = 1.6 \times 10^5$ J) (2)

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

Q6 Jan 2002

6(a) loss of potential energy = $m \times 9.81 \times 6.0$ ✓
gain in kinetic energy = loss of potential energy ✓
$½mv^2 = 58.9\,m$ gives $v = 10.8$ (m s^{-1}) ($\approx$11 m s^{-1}) ✓ (3)

(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)

Q7 Jun 2002

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

(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))
($v^2 = 29.3$) $v = 5.4$ 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))
$= 0.31$ 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))
$= 31$ N ✓

[or $a = \frac{5.4}{0.010} = 540$ (m s^{-2}) ✓
$F = 5.8 \times 10^{-2} \times 540 = 31$ 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*)

4

Q4 Jun 2004

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

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

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

(ii) (use of *work done* = *Fs* gives) $3.21 \times 10^4 = F \times 150$ ✓
(allow C.E. for value of *work done* from (i))
$F = 210$ N ✓ (213 N) (*3*)
(*7*)

Q2 Jan 2006

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

Q2 Jun 2006

Question 2			
(a)		potential energy to kinetic energy ✓ mention of thermal energy and friction ✓	**2**
(b)		(use of $\frac{1}{2}mv^2 = mgh$ gives) $\frac{1}{2}v_h^2 = 9.81 \times 1.5$ ✓ $v_h = 5.4(2)\,m\,s^{-1}$ ✓ (assumption) energy converted to thermal energy is negligible ✓	**3**
(c)		component of weight down the slope causes acceleration ✓ this component decreases as skateboard moves further down the slope ✓ air resistance/friction increases (with speed) ✓	**max 2**
(d)	(i)	distance $(= 0.42 \times 5.4) = 2.3$ m ✓ (2.27 m) (allow C.E. for value of v_h from (b))	**5**
	(ii)	$v_v = 9.8 \times 0.42$ ✓ $= 4.1(1)\,m\,s^{-1}$ ✓	
	(iii)	$v^2 = 4.1^2 + 5.4^2$ ✓ $v = 6.8\,m\,s^{-1}$ ✓ $(6.78\,m\,s^{-1})$ (allow C.E. for value of v_h from (b))	
		Total	**12**