Name of the Student:_____

Max. Marks : 26 Marks **Time : 26 Minutes**

Mark Schemes

Q1.

Question Number	Answer		Mark
(a)	Sum of momenta before (collision) = sum of momenta after (collision) **Or** the total momentum before (a collision) = the total momentum after (a collision) **Or** total momentum remains constant **Or** the momentum of a system remains constant	**(1)**	
	Providing no external/unbalanced/resultant force acts **Or** in a closed system	**(1)**	**2**
(b)(i)	Use of equation(s) of motion sufficient to get answer Initial speed = 1.1 (m s^{-1}) Example of calculation $s = (u + v)t/2$ 0.69 m = $(u + 0) \times 1.3$ s /2 u = 1.06 m s^{-1}	**(1)** **(1)**	**2**
(b)(ii)	Constant acceleration/deceleration (accept constant force)	**(1)**	**1**
(b)(iii)	Use of momentum = mv ecf v from (b)(i) Calculates momentum after collision using correct mass Speed of pellet = 117 or 124 or 129 (m s^{-1}) Example of calculation Momentum after = (97.31 + 0.84) g × 1.06 m s^{-1} = 104 g m s^{-1} Momentum before = momentum after Speed of pellet = 104 g m s^{-1} / 0.84 g = 124 m s^{-1}	**(1)** **(1)** **(1)**	**3**

*(c)(i)	(QWC – Work must be clear and organised in a logical manner using technical wording where appropriate) Mention of momentum Pellet (bounces back so) has negative momentum /velocity **Or** momentum after = momentum of car - momentum of pellet Pellet undergoes a bigger momentum/velocity change **Or** mass of car is less	**(1)** **(1)** **(1)**	**3**
(c)(ii)	reference to greater horizontal momentum/force	**(1)**	**1**
(d)	[The question says that the calculations are correct, the question is about the assumptions made. Do not credit a statement that the GPE is correct. MP1 is for the assumption that the KE after firing is the same as the max GPE. Do not credit energy loss due to air resistance or sound] $E_k \rightarrow E_{grav}$ of pendulum correct **Or** KE after collision is correct E_k in collision not conserved **Or** not an elastic collision **Or** inelastic collision (do not credit just 'KE is lost') Some energy becomes heat E_k (of pellet before collision)is greater than 0.16J	**(1)** **(1)** **(1)** **(1)**	**4**
	Total for question		**16**

Q2.

Question Number	Acceptable Answer	Additional guidance	Mark
(a)	• use of $T = \frac{2\pi}{w}$ (1) • 1.7×10^{-3} rad s^{-1} or $\frac{\pi}{1800}$ rad s^{-1} (1)	Example of calculation: $w = \frac{2\pi}{(60 \times 60)\ s}$	**(2)**

Question Number	Acceptable Answer	Additional guidance	Mark
(b)	• recognises weight acts halfway along hand (1) • uses correct angle between the two positions (1) • determines change in vertical height (= 0.008 m) (1) • use of $\Delta E = mg\Delta h$ (1) • work done = 1.1 (mJ) (1)	Example of calculation: $W = 0.014\ \text{kg} \times 9.81\ \text{N kg}^{-1} \times (2 \times 0.04 \sin 6^\circ\ \text{m})$ $W = 1.1 \times 10^{-3}\ \text{J}$	**(5)**

Question Number	Acceptable Answer	Additional guidance	Mark
(c)	• use of $P = VI$ (1) • use of $P = \frac{W}{t}$ AND 65% (1) • t = 141 s (1)	Example of calculation: $P = 1.5\ \text{V} \times 8.0 \times 10^{-6}\ \text{A} = 1.2 \times 10^{-5}\ \text{W}$ $t = \frac{1.1 \times 10^{-3}\ \text{J}}{0.65 \times 1.2 \times 10^{-5}\ \text{W}} = 141\ s$	**(3)**