Name of the Student:_____
Max. Marks : 26 Marks **Time : 26 Minutes**

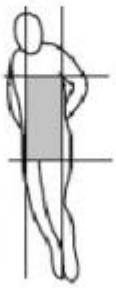
Mark Schemes

Q1.

Question Number	Answer		Mark
(a)(i)	Convex curve drawn from the box to the drop zone	(1)	1
(a)(ii)	Use of $s = ut + \frac{1}{2} at^2$ t = 3.6 (s) Example of calculation 63 m = 0 + (½ × 9.81 m s^{-2} × t^2) t = 3.6 s	(1) (1)	2
(a)(iii)	Use of speed = $\frac{\text{distance}}{\text{time}}$ Distance = 270 m (ecf) [300 m using the show that value] Example of calculation 75 m s^{-1} = $\frac{\text{distance}}{3.6\ s}$ Distance = 270 m	(1) (1)	2
(b)(i)	Use of GPE = mgh GPE = 6.2 (kJ) (A unit is required for an answer in J to score MP2) Example of calculation GPE = 10.0 kg × 9.81 N kg^{-1} × 63 m GPE = 6180 J	(1) (1)	2
(b)(ii)	Use of KE = ½ mv^2 KE = 28.1 (kJ) (A unit is required for an answer in J to score MP2) Example of calculation KE = ½ × 10.0 kg × (75 m s^{-1})^2 KE = 28 125 J	(1) (1)	2

(b)(iii)	KE at bottom = 34.3 kJ (ecf) Example of calculation KE at bottom = 6180 J + 28 125 J = 34 305 J	(1)	1
(b)(iv)	Work is done against air resistance **Or** energy transferred due to air resistance	(1)	1
(c)	Reduces the acceleration of the package **Or** reduces the speed on impact of the package **Or** has a lower terminal velocity **Or** less (resultant) force on the package	(1)	1
	Total for question		12

Q2.

Question Number	Answer		Mark
(a)	Correctly marks position of centre of gravity within grey box below  Point where all of the weight (can be assumed to) act **Or** the point at which all the weight is centred upon **Or** the point that can be used to represent the whole weight	(1) (1)	2
(b)	Vertically: the jumper is accelerating **Or** the velocity is increasing **Or** Gravity/weight acts vertically (downwards) Horizontally: the velocity remains constant **Or** there is no horizontal acceleration **Or** no (resultant) force acts on the man horizontally (ignore all references to air resistance)	(1) (1)	2
(c)	Use of equations of motion suitable to find time Time = 2.5 (s) Picture rate = 3.2 (s^{-1}) Candidates may adopt a circuitous route with multiple equations, so check back over apparently incorrect answers, but only credit if they lead to time Example of calculation $s = ½ gt^2$ $t^2 = 2 \times 30 \text{ m} / 9.81 \text{ ms}^{-2}$ $t = 2.47$ s Picture rate = 8 pictures / 2.47 s = 3.2 (s^{-1})	(1) (1) (1)	3

(d)	Vertical distance range 10.0 cm to 10.4cm. Horizontal distance range 4.3 cm to 4.7 cm Scale calculation Horizontal distance 12.4 (m) to 14.1 (m) (Note: numerical values in the mark scheme are based on a full sized examination paper. Enlarged papers or papers printed from pdf etc will give different scale values but the same final answer.) <u>Example of calculation</u> Vertical distance 10.2 cm to horizontal distance 4.5 cm Scale calculation: 4.5 cm x 30 m / 10.2 cm Horizontal distance = 13.2 (m)	(1) (1) (1)	3
(e)	Use of (horizontal) velocity = horizontal distance / time (Horizontal) velocity = 5.3 m s^{-1} (ecf of time from part (c)) (Candidates may use their own value for horizontal distance or any value in the range 12 m to 15 m.) Use suitable equation of motion for vertical velocity Vertical velocity = 24.5 m s^{-1} (ecf of time from part (c)) <u>Example of calculation</u> Horizontal v = 13.2 m / 2.5 s = 5.28 m s^{-1} Vertical v = 0 m s^{-1} +(9.81 m s^{-2} x 2.5 s) = 24.5 m s^{-1}	(1) (1) (1) (1)	4