Impulse and Momentum - Mark Scheme

Q1.

Question number	Answer		Mark
(a)	• Use of $E_{el} = \frac{1}{2}F\Delta x$ • $W = 0.12$ (J) <u>Example of calculation</u> $W = 0.5 \times 14\ \text{N} \times 0.017\ \text{m}$ $W = 0.119\ \text{J}$	(1) (1)	(2)
(b)	• Use of $E_{grav} = mgh$ • Use of elastic potential energy $= \frac{1}{2}mv^2$ **Or** Use of grav potential energy $= \frac{1}{2}mv^2$ • $v_{head} = 6.1$ (m s^{-1}) **Or** $v_{toy} = 5.4$ (m s^{-1}) (ecf from (a)) • Use of $p = mv$ • $P_{head} = 0.039$ (kg m s^{-1}) and $p_{toy} = 0.039$ (kg m s^{-1}) and conclusion that momentum is conserved **Or** $P_{head} = 0.039$ (kg m s^{-1}) and $p_{toy} = (0.039$ kg m s$^{-1})$ and conclusion that momentum before = momentum after <u>Example of calculation</u> For head, max ke $= E_{el}$ of spring $\frac{1}{2} \times 0.0064\ \text{kg} \times v^2 = 0.119\ \text{J}$ max speed of head $= 6.10\ \text{m s}^{-1}$ max momentum of head $= 0.0064\ \text{kg} \times 6.1\ \text{m s}^{-1}$ $p_{head} = 0.039\ \text{kg m s}^{-1}$ $E_{grav} = 0.0072\ \text{kg} \times 9.81\ \text{N kg}^{-1} \times 1.5\ \text{m} = 0.106\ \text{J}$ For whole toy, initial ke $= 0.106\ \text{J}$ $\frac{1}{2} \times 0.0072\ \text{kg} \times v^2 = 0.106\ \text{J}$ For whole toy, initial $v = 5.42\ \text{m s}^{-1}$ For whole toy, initial momentum $= 0.0072\ \text{kg} \times 5.42\ \text{m s}^{-1}$ $= 0.039\ \text{kg m s}^{-1}$	(1) (1) (1) (1) (1)	(5)
(c)	• Calculate E_K values or identify from part (a) and (b) (0.12 J before and 0.11 J after) (ecf) • Conclude (kinetic energy is) not conserved because energy before is greater than energy after (accept a conclusion consistent with their answers) <u>Example of calculation</u> Head ke $= \frac{1}{2} \times 0.0064\ \text{kg} \times (6.1\ \text{m s}^{-1})^2 = 0.119\ \text{J}$ Whole toy ke $= \frac{1}{2} \times 0.0072\ \text{kg} \times (5.42\ \text{m s}^{-1})^2 = 0.106\ \text{J}$	(1) (1)	(2)

Q2.

Question number	Answer	Mark
	B	(1)