Question number	Answer		Mark
13(a)	• Use of $E_{el} = \frac{1}{2}F\Delta x$ • $W = 0.12$ (J) Example of calculation $W = 0.5 \times 14 \text{ N} \times 0.017 \text{ m}$ $W = 0.119 \text{ J}$	(1) (1)	(2)
13 (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 Example of calculation 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 $= 6.10$ m s^{-1} max momentum of head $= 0.0064 \text{ kg} \times 6.1$ m s^{-1} $p_{head} = 0.039$ 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 $= 0.106$ J $\frac{1}{2} \times 0.0072 \text{ kg} \times v^2 = 0.106 \text{ J}$ For whole toy, initial $v = 5.42$ m s^{-1} For whole toy, initial momentum $= 0.0072 \text{ kg} \times 5.42$ m s^{-1} $= 0.039$ kg m s^{-1}	(1) (1) (1) (1) (1)	(5)
13 (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) Example of calculation Head ke $= \frac{1}{2} \times 0.0064 \text{ kg} \times (6.1$ m s$^{-1})^2 = 0.119 \text{ J}$ Whole toy ke $= \frac{1}{2} \times 0.0072 \text{ kg} \times (5.42$ m s$^{-1})^2 = 0.106 \text{ J}$	(1) (1)	(2)
	Total for question 13		9