Mark Scheme

Q1.

Question Number	Answer	Additional guidance	Mark
(i)	substitution (1) 4.0=k x 0.06 rearrangement (1) $\frac{4.0}{0.06}$ (=k) evaluation (1) 67 (N/m)	allow substitution and rearrangement in either order (k=) $\frac{F}{x}$ allow values that round to 67 (N/m) award full marks for the correct answer without working POT error 2 marks maximum	**(3)**

Question Number:	Answer	Additional guidance	Mark
(ii)	(measurement of) original length (1) (measurement of) final length (1)	Accept measure length of spring for 1 mark	**(2)**

Q2.

Question Number	Answer	Additional guidance	Mark
	substitution (1) (E=) ½ x 250 x 0.30(^{2}) evaluation 11 (1) unit (1) joule(s)/J	 accept 37.5, 37, 38 only accept 11.25, 11.2, 11.3 award full marks for the correct answer without working no POT error in evaluation independent mark j , Nm	**(3)**

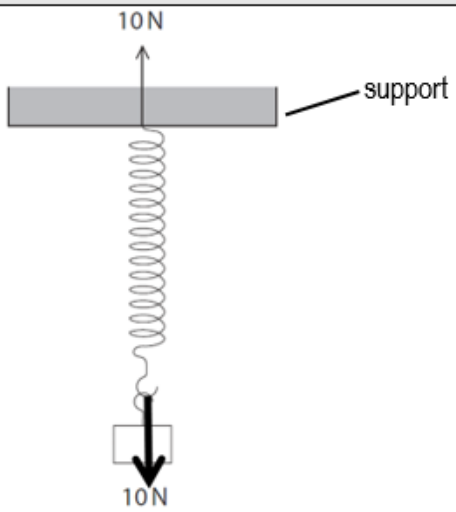
Q3.

Question number	Answer	Additional guidance	Mark
i	substitution (1) (E =) ½ X 20 x 0.09$^{(2)}$ evaluation (1) 0.08(1) (J)	 allow 1 mark for ½ x 20 x 9^2 or answer of 810 (J) or answer of 90 (J) award full marks for the correct answer without working	**(2)**

Question number	Answer	Additional guidance	Mark
ii	a description including mention of one relevant energy store (1) correct transfer in context (1)	 potential/ PE/ kinetic/ KE/ thermal/ heat/ elastic potential energy stored in the spring transferred to kinetic energy of the ball/rod scores 2 marks kinetic energy of rod is transferred to kinetic energy of ball scores 2 marks idea of energy transferred to the surroundings/ thermal scores 2 marks	**(2)**

Question number	Answer	Additional guidance	Mark
iii	an explanation linking two from (controls the maximum) extension (1) idea of keeping below the elastic limit (1) (which would result in) spring being permanently stretched (1)	ignore <u>damaging</u> the spring (given in stem) stretch prevents spring being over-stretched / extended too far scores 2 marks allow distorted/ break	**(2)**

Q4.

Question Number	Answer	Additional guidance	Mark
	 downwards arrow (1) Plus any one from: the same length as top arrow (1) from the bottom of the spring or from the weight (1)	 Anywhere below the support Judge by eye Judge by eye	(2)

Q5.

Question number	Answer	Additional guidance	Mark
	An answer that combines points of interpretation/evaluation to provide a logical description: • above 37.5 N/4 mm there are large increases of extension for small increases in load (1) • the maximum extension of the wire is about 16.5 mm before it breaks (1) • above 12 mm the wire keeps on extending when the load is reduced below 46 N (1)	accept extension is (much) greater for each 1 N increase in load above 37.5 N	(3)

Q6.

Question number	Answer	Additional guidance	Mark
	two similarities such as: (2) • both use the same loads • both start/end with same extension • both return to original length **two differences such as:** (2) • extensions for spring and rubber band differ • spring - loading and unloading are the same – rubber band different • extension- spring linear, rubber band non-linear	go up evenly/even steps steps uneven	**(4)**

Q7.

Question number	Answer	Additional guidance	Mark
i	 D A and B are incorrect because they only show one force C is incorrect because the forces are in the wrong direction		**(1)**

Question number	Answer	Additional guidance	Mark
ii	substitution (1) (F =) 20 x (0.0)7 evaluation (1) 1.4 (N)	award full marks for the correct answer without working allow 1 mark max for POT error	(2)

Q8.

Question number	Answer	Additional guidance	Mark
(a)	evidence that anomalous reading excluded (1) answer (1) average length = 20.31 (mm)	accept 101.57 (÷5) for first mark accept 20.314 (mm)	(2)

Question number	Answer	Additional guidance	Mark
(b)(i)	• Axes with linear scales that use more than half of each edge of the grid and labelled with units from table (1) • All points correctly plotted to ± half a square (1) • Single straight line passing through all points and the origin (1)	allow 1 mark if only one plotting error and correct line drawn for points plotted	(3)

Question number	Answer	Additional guidance	Mark
(b)(ii)	A comment that makes reference to the following points: (using table) • idea that equal increments of force/weight/mass cause equal increments of extension (1) • correct reference to figures in the table (1) OR (using graph) • the graph line is straight (1) • the graph line passes through the origin (1) AND therefore the student's conclusion is correct (1)	last marking point can only be achieved if at least one of the other two marks is awarded	(3)

Q9.

Question number	Answer	Additional guidance	Mark
(i)	An answer that combines the following to provide a logical description of the method • measure unstretched length of spring (1) • measure stretched length of spring (1) • subtract (1)	set unstretched position at 0 read stretched position use a ruler	(3)

Question number	Answer	Additional guidance	Mark
(ii)	substitution (1) $\frac{1.5}{30}$ evaluation (1) 0.05 (N/mm)	award full marks for correct answer without working 50 N/m allow power of 10 (POT) error for 1 mark	(2)