

Mark schemes

1	(a) from K to L	1
	<i>correct order only</i>	1
	smaller than	1
	(c) 4 N	1
	(d) the limit of proportionality is reached when a weight of 7N is added to the spring <i>accept any number from 6.8 to 7.2 inclusive</i>	1
	(e) the extension is directly proportional to the weight.	1
	(f) C	1
		[7]
2	(a) Third Law	1
	(b) elastic potential	1
	(c) weight = mass × gravitational field strength <i>accept gravity for gravitational field strength</i>	1
	<i>accept $W = mg$</i>	
	<i>accept correct rearrangement ie mass = weight / gravitational field strength or $m = W / g$</i>	
	(d) $343 = m \times 9.8$	1
	$m = \frac{343}{9.8}$	1
	$m = 35$	1

allow 35 with no working shown for 3 marks

- (e) force = spring constant \times compression
 accept force = spring constant \times extension
 accept $F = k e$
 accept correct rearrangement ie constant = force / extension **or** $k = F / e$

1

- (f) compression = 0.07m

1

$$343 = k \times 0.07$$

1

$$k = 343 \div 0.07$$

1

$$k = 4900$$

1

allow 4900 with no working shown for 4 marks

allow 49 with no working shown for 3 marks

[11]

3

- (a) accept any value between 12 (mm) and 13 (mm) inclusive

1

- (b) to reduce the error in measuring the extension of the spring
 accept length for extension throughout

1

as the ruler at an angle would make the measured extensions shorter

1

- (c) 1 (N) to 6 (N)
 accept from 0 (N) to 6 (N)

1

- (d) gives a straight line through the origin

1

- (e) any practical technique that would improve the accuracy of length measurement eg
 use a set square

1

to line up the bottom of the spring with the ruler scale

or

attach a horizontal pointer to the bottom of the spring (1)

so that the pointer goes across the ruler scale (1)

1

(f) the spring has been inelastically deformed

1

because it went past its limit of proportionality

accept elastic limit for limit of proportionality

1

accept it does not go back to its original length when the weights are removed

[9]**4**

(a) (i) any **two** from:

- length of coils increased
- coils have tilted
- length of loop(s) increased
- increased gap between coils
- *spring has stretched / got longer*
- *spring has got thinner*

2

(ii) remove mass

accept remove force / weight

1

observe if the spring returns to its original length / shape (then it is behaving elastically)

1

(b) (i) 8.0 (cm)

1

extension is directly proportional to force (*up to 4 N*)

for every 1.0 N extension increases by 4.0 cm (up to 4 N)

evidence of processing figures eg 8.0 cm is half way between 4.0 cm and 12.0 cm

1

allow spring constant (k) goes from to $\frac{1}{4}$ to $\frac{5}{22}$

1

(ii) any value greater than 4.0 N and less than or equal to 5.0 N

1

*the increase in extension is greater than 4 cm per 1.0 N (of force) added
dependent on first mark*

1

(c) (i) elastic potential energy

1

(ii) misread stopwatch

1

timed too many complete oscillations

1

- (iii) 4.3 (s)
accept 4.33 (s) 1
- (iv) stopwatch reads to 0.01 s 1
- reaction time is about 0.2 s
or
reaction time is less precise than stopwatch 1
- (v) use more masses 1
- smaller masses eg 50 g
not exceeding limit of proportionality 1
- 5** (a) (i) **B C**
either order 1
- (ii) elastic potential (energy)
accept strain for elastic 1
- (b) (i) *mark both parts together* 1
- measured / recorded the length of the spring (and not extension)
*accept measured **A–C** (and not **B–C**)*
accept did not work out/measure the extension
- extension does not equal zero when force = 0
accept line should pass through the origin 1
- (ii) point marked at 5.5 (N)
accept any point between 5.0 and 5.6 inclusive 1
- up to that point force and extension are (directly) proportional
accept it's at the end of the straight part (of the graph line)
accept past that point force and extension are no longer (directly) proportional
accept the line starts to curve 1

[17]

(c) 1.8

allow **1** mark for correct substitution, ie 25×0.072 provided no subsequent step shown
 an answer 1800 gains **1** mark
 an incorrect conversion from mm to m with a subsequent correct calculation gains **1** mark

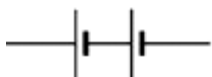
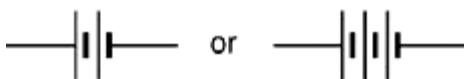
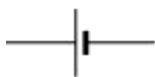
2

[8]

6

(a) (i) ammeter and battery **in series** with the **gauge**

symbols must be correct
ignore a voltmeter drawn in series
accept



not



or cells reversed to cancel out

1

voltmeter in parallel with the gauge
symbol must be correct
accept a freestanding circuit
diagram provided strain gauge is labelled or a resistor symbol used for the strain gauge

1

(ii) d.c. flows only in one direction
a.c. changes direction is insufficient

1

(b) (i) 75

*this answer only**allow 1 mark for correct substitution **and** transformation,*

$$\text{ie resistance} = \frac{3.0}{0.040}$$

2

(ii) increases

1

(iii) elastic / strain potential*do **not** accept potential*

1

[7]**7**(a) **B** or bungee cords

1

C or springs or playground ride*each additional answer loses 1 mark minimum mark zero*

1

will go back to original shape/size

1

(b) (i) newton

1

(ii) 0 – 5 (N) or 5

*accept 1 – 5 (N)**do **not** accept 4*

1

(iii) 16 (cm)

1

(iv) 2.5 (N)

accept answer between 2.4 and 2.6 inclusive

1

[7]

8

(a) Z

1

weight **or** mass acts through pivot*accept rod **or** base for pivot**accept centre of gravity in line with pivot*

1

no (resultant) (turning) moment*accept clockwise moment equals anticlockwise moment**do **not** accept same weight on each side of rod*

1

(b) (i) 30

*allow **1** mark for 2×15* ***or** 2×0.15*

2

N cm

or*for full credit the unit must be consistent with the numerical answer*

0.3

Nm

*do **not** accept joules*

1

(ii) 1.5 (N)

*allow **1** mark for correct transformation**allow **2** marks ecf their part (b)(i)/20 (ecf only if correct physics)*

2

(c) 5 (cm)

*allow **1** mark for 6.0 (cm)**allow **1** mark for a subtraction of 1 from a value clearly obtained from the graph**allow **2** marks for correct ecf using an incorrect value for (b)(i) $\pm 0.2\text{cm}$* *allow **1** mark for clearly showing correct use of graph using an incorrect value for (b)(ii)*

2

[10]

9	(a)	(i)	plasticine stretches/snaps stays stretched/snapped <i>for 1 mark each</i>	2	
		(ii)	spring compresses OWTTE returns to original length/shape or gets longer <i>for 1 mark each</i>	2	
		(iii)	ruler bends/breaks returns to original shape or stays broken <i>for 1 mark each</i>	2	
	(b)	(i)	1.5N <i>for 1 mark</i>	1	
		(ii)	4 cm <i>for 1 mark</i>	1	
		(iii)	19 cm <i>for 1 mark</i>	1	[9]
	10	(a)	plasticine stretches/snaps stays stretched/snapped/same <i>for 1 mark each</i>	2	
			(b)	spring compresses OWTTE returns to original length/gets longer <i>for 1 mark each</i>	2
	11	(a)	weight or gravity or gravitational <i>for 1 mark</i>	1	

- (b) (i) only force A acts / force A > air resistance / gravity / weight
for 1 mark 1
- (ii) force A > force B
for 1 mark 1
- (iii) force C > force A
for 1 mark
(Forces A, B and C need not be used, description of forces are OK) 1
- (c) (i) graph points all correct \pm little square
gains 2 marks
- one point wrong
gains 1 mark
- 2+ points wrong
gains 0 mark
- appropriate line – good freehand OK
gains 1 mark
Bar chart gets 0, but if points clear can get 2 3
- (ii) 16 or candidates own intercept should be 16 m in range 1-19
if no kinks on graph line
for 1 mark 1

[8]

12

(a) **F** 50 cm on first part of graph
tolerance + or – 3cm

1

(b) **S** at the far right
credit anywhere to right of last trough

1

(c) **M** on any two tops of peaks **or** bottoms of troughs
*both are required for the mark M needs to be central to the trough
or peak, except if F is in the way in one case*

1

[3]