**Mark schemes**

Q1.

(a) from K to L

1

(b) the same as

1

smaller than

1

correct order only

(c) 4 N

1

(d) the limit of proportionality is reached when a weight of 7N is added to the spring

accept any number from 6.8 to 7.2 inclusive

1

(e) the extension is directly proportional to the weight.

1

(f) C

1

[7]

Q2.

(a) Third Law

1

(b) elastic potential

1

(c) weight = mass × gravitational field strength

accept gravity for gravitational field strength

1

accept W = mg

accept correct rearrangement ie mass = weight / gravitational field strength or m = W / g

(d) 343 = m × 9.8

1

m = 343

9.8

1

m = 35

1

allow 35 with no working shown for 3 marks

(e) force = spring constant × compression

accept force = spring constant × extension

accept F = k e

accept correct rearrangement ie constant = force / extension or k = F / e

1

(f) compression = 0.07m

1

343 = k × 0.07

1

k = 343 ÷ 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]

Q3.

(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]

Q4.

(a) elastic potential

1

(b) (i) line is straight

accept line does not curve

1

(ii) 400

allow 1 mark for correct substitution of any pair of numbers correctly taken from the graph e.g.160 = k × 0.40

2

newtons per metre or N/m

if symbols are used they must be correct

1

(iii) 300

allow 1 mark for correctly obtaining force on 1 spring = 100N

2

(c) 52

allow 2 marks for calculating change in gpe for 1 chin-up as 260 (J) or for 12 chin-ups as 3120 (J)

an answer 4.3 gains 2 marks

allow 1 mark for correct substitution into gpe equation ie gpe = 65 × 10 × 0.4 (× 12)

or

correct use of power equation with an incorrect value for energy transferred

3

[10]

Q5.

(a) 3 (.0)

allow 1 mark for correct substitution i.e. 25 × 0.12 provided no subsequent step

2

(b) (i) elastic potential

correct order only

1

kinetic

1

(ii) increases

1

to 80 (mm) (or more)

accept any number greater than 75

an answer ‘it (more than) doubles’ gains both marks

1

(c) (i) weight

1

(ii) downward speed increases

1

[8]

Q6.

(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

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

[17]

Q7.

(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

(c) 1.8

allow 1 mark for correct substitution, ie 25 x 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]

Q8.

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

symbols must be correct

ignore a voltmeter drawn in series

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,

ie resistance =

2

(ii) increases

1

(iii) elastic / strain potential

do not accept potential

1

[7]

Q9.

(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

accept1 – 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]

Q10.

(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) 0.2cm

allow 1 mark for clearly showing correct use of graph using an incorrect value for (b)(ii)

2

[10]

Q11.

(a) (i) plasticine stretches/snaps

stays stretched/snapped

for 1 mark each

2

(ii) spring compresses OWTTE

returns to original length/shape or gets longer

for 1 mark each

2

(iii) ruler bends/breaks

returns to original shape or stays broken

for 1 mark each

2

(b) (i) 1.5N

for 1 mark

1

(ii) 4 cm

for 1 mark

1

(iii) 19 cm

for 1 mark

1

[9]

Q12.

(a) plasticine stretches/snaps

stays stretched/snapped/same

for 1 mark each

2

(b) spring compresses OWTTE

returns to original length/gets longer

for 1 mark each

2

[4]

Q13.

(a) weight or gravity or gravitational

for 1 mark

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 ± 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]

Q14.

(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]