Q1.(2018)

a)

set up a clamp stand with a clamp

hang the spring from the clamp

use a second clamp and boss to fix a (half) metre ruler alongside the spring

record the metre ruler reading that is level with the bottom of the spring

hang a 2 N weight from the bottom of the spring

record the new position of the bottom of the spring

calculate the extension of the spring

measure the extension of the spring

add further weights to the spring so the force increases 2 N at a time up to 10 N

for each new force record the position of the bottom of the spring and calculate / measure the extension

possible source of inaccuracy

not fixing the ruler in position but simply holding the ruler next to the spring

not clamping the ruler vertical

misjudging the position of the bottom of the spring

parallax error

allow any other sensible suggestion that could reasonably lead to inaccuracy in the data

allow a description that would increase accuracy

repeating the measurements is insufficient

b)

to identify any anomalous results
or
to reduce the effect of random error

c)

both points plotted correctly

correct line of best fit drawn

d)

force = spring constant × extension

e)

extension = 0.2

$10 = k \times 0.2$

$$k = \frac{10}{0.2}$$

$k = 50$

f)

the line is straight

and passes through the origin

Q2.(2019)

(soft foam) increases the time taken to stop
or
increases the time taken to decrease momentum

decreases the rate of change in momentum

reducing the force (on the egg)

Q3.(2021)

a)

will return to its original shape/length

when the force is removed

b)

- set up a clamp stand with a clamp
- hang the spring from the clamp
- use a second clamp and boss to fix a (half) metre rule alongside the spring
- record the ruler reading that is level with the bottom of the spring
- hang a 1 N / a known weight from the bottom of the spring
- record the new position of the bottom of the spring
- calculate the extension of the spring
- measure the extension of the spring
- add further weights to the spring so the force increases 1 N at a time up to 5 N
- for each new force record the position of the bottom of the spring and calculate / measure the extension

Risk Assessment

Hazard:	Clamp (stand, boss and masses) might fall off desk
Risk:	injury to feet
Precaution:	Use clamp to fix apparatus to the bench **or** Ensure that the slotted masses hang over the base/foot of the stand **or** Ensure that the boss is screwed tightly into the stand and clamp **or** Put (heavy) masses on the base/foot of the stand **or** Stand up so that you can move out of the way
Hazard:	Spring could break / come loose
Risk:	damage eye
Precaution:	Wear safety goggles

If a risk assessment / hazard is not given, the answer can still reach level 3, but not full marks.

Full marks may be awarded for alternative feasible methods.

c)

force = spring constant × extension

d)

5.00 0.125

$$k = \frac{5.00}{0.125}$$

k = 40 (N/m)

e)

the line is straight

and passes through the origin

f)

$e = 0.20$ m

$E_e = 0.5 \times 13 \times 0.20^2$

$E_e = 0.26$ (J)