Q1. (2018)

a)

05.1	increases		1	AO1 6.5.3

b)

05.2	the band returns to its original shape because there is an elastic force	allow band gets shorter allow because the stretching force has been removed if no other mark has been scored, allow for **1** mark the elastic potential energy decreases	1 1	AO1 6.5.3

c)

05.3	any **two** from: • initially the band does not stretch when a force is applied • (when extending) as force increases the extension increases • the relationship is non-linear	allow a certain force is needed before the band extends allow the increase is not proportional do **not** accept directly proportional	2	AO3 6.5.3

Q2. (2018)

05.4	straight diagonal line from bottom left to top right straight line through the origin	allow the line to curve upwards beyond the elastic limit	1 1	AO1 6.5.3

Q3. (2018)

05.5	force = spring constant × extension	allow F = *k e*	1	AO1 6.5.3

Q4. (2020)

a)

02.1	springs push the keys back to their original position		1	AO1 6.5.3

b)

02.2	so that the same force is needed to press each key		1	AO3 6.5.3

c)

02.3	(the length) decreases	allow the spring compresses	1	AO1 6.5.3

d)

02.6	F = 200 × 0.0040 F = 0.80 (N)	 allow 0.8 (N)	1 1	AO2 6.5.3

e)

02.7	shorter spring spring with a lower spring constant	 allow spring that requires less force to compress allow weaker spring allow spring that is easier to compress	1 1	AO3 6.5.3

Q5. (2021)

a)

06.1	the spring will return to its original length when the force is removed		1	6.5.3 AO1

b)

06.2	measure the original length of the spring **and** the extended length of the spring (with the metre rule) extension = extended length – original length		1 1	6.5.3 AO1

c)

06.3	e = 0.080 m $E_e = 0.5 \times 40 \times (0.080)^2$ $E_e = 0.128$ (J)	 allow a correct substitution using an incorrectly / not converted value of e allow a correct calculation using an incorrectly / not converted value of e	1 1 1	6.5.3 AO2

d)

06.4	force = spring constant × extension **or** F = k e		1	6.5.3 AO1

e)

06.5	300 = k × 0.40 $k = \frac{300}{0.40}$ k = 750 (N/m)		1 1 1	6.5.3 AO2

Q6. (2023)

a)

01.1	weight acts downwards		1	AO2 6.5.3

b)

01.3	$W = 12\ 000 \times 0.070$ $W = 840$ (N)		1 1	AO2 6.5.3

c)

01.4	$E_e = 0.5 \times 12\ 000 \times (0.070)^2$ $E_e = 29.4$ (J)	 allow 29 (J)	1 1	AO2 6.5.3

d)

01.5	the spring will not go back to its original length when the force is removed		1	AO1 6.5.3

e)

01.6	B		1	AO3 6.5.3 RPA18

f)

01.7	B		1	AO1 6.5.3 RPA18

g)

01.8	any **two** from: • use a greater range of forces • use forces that are similar to the weight of a person • test more (identical) springs • find the limit of proportionality • repeat (discard anomalous results) and calculate a mean	 allow test more forces allow elastic limit	2	AO3 6.5.3 RPA18

Q7. (2024)

07.2	$e = 0.012$ m		1	AO2
	$E_e = 0.5 \times 8500 \times 0.012^2$	allow a correct substitution using an incorrectly / not converted value of e	1	AO2
	$E_e = 0.612$	allow 0.61 allow a correct calculation using an incorrectly / not converted value of e	1	AO2
	J **or** joule		1	AO1 6.5.3

Q8. (2024)

a)

07.3	measure the original length of the spring **and** the compressed length of the spring (using a metre rule) compression = original length − compressed length **OR** calculate / measure the weight of the mass on the spring (1) use the equation $e = \frac{F}{k}$ (1)		1 1	AO3 6.5.3 RPA18

b)

07.4	masses could fall (off the spring) (so) less likely to cause injury / damage (if done on the floor)	 allow less hazardous allow lower risk (of injury) allow specific cause of injury eg landing on foot	1 1	AO1 6.5.3 RPA18

c)

07.5	Δy = (330 – 80 =) 250 (N)		1	AO3 6.5.3 RPA18

d)

07.6	Δx = (0.052 – 0.010 =) 0.042 (m)		1	AO3 6.5.3 RPA18

e)

07.7	 $k = \frac{250}{0.042}$ 5950 (N/m)	allow ecf from question **07.5** **and** question **07.6** allow k = 5952.38 allow their calculated gradient to 3 significant figures	 1 1	AO3 6.5.3 RPA18