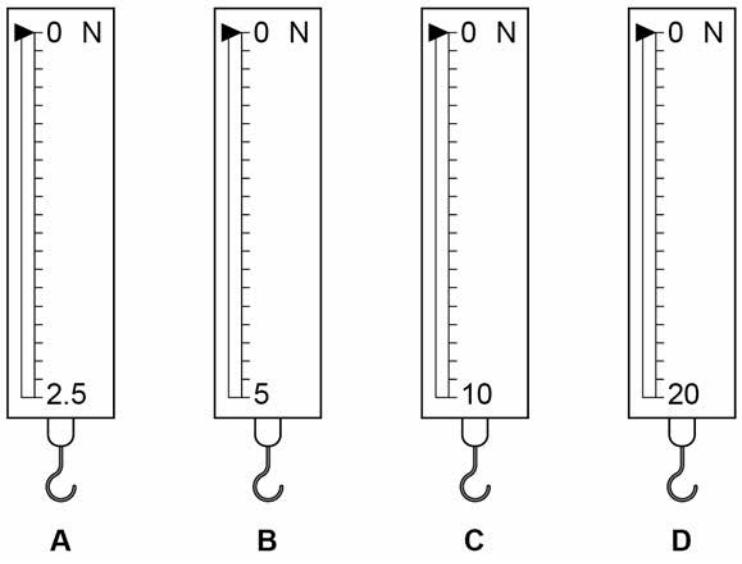
Do not write outside the box

0 4 . 1 **Figure 6** shows four newtonmeters.

Each newtonmeter contains a spring.

Figure 6



Which newtonmeter has the spring with the greatest spring constant?

Give a reason for your answer.

[2 marks]

Newtonmeter _____

Reason _____

_____

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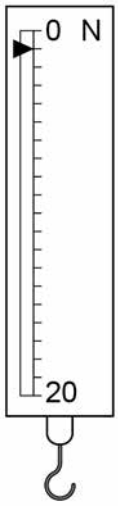
0 4 . 2 The newtonmeter in **Figure 7** will give an error when used to make a measurement.

Figure 7



Name the type of error.

Describe how this error can be corrected.

[2 marks]

Type of error _____

Correction _____

_____

Question 4 continues on the next page

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0 4 . 3 A student hangs a weight on a newtonmeter.

The energy now stored in the spring in the newtonmeter is 4.5×10^{-2} J

The student then increases the weight on the newtonmeter by 2.0 N

Calculate the total extension of the spring.

Spring constant = 400 N/m

[6 marks]

Total extension = _____ m

10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	D needs the greatest force to extend the spring the same amount	allow 20 (N) allow fourth (newtonmeter) reason only scores if correct newtonmeter selected	1 1	AO1 6.5.3
04.2	zero (error) any **one** from: • record the value and subtract from readings taken • adjust the newtonmeter to zero	allow systematic (error) allow subtract 1 from all readings	1 1	AO3 6.5.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3		an answer of 0.02 (m) gains **6** marks		AO2 6.5.3
	$4.5 \times 10^{-2} = 0.5 \times 400 \times e^2$	this mark may be awarded if the standard form value is incorrectly converted	1	
	$e = \sqrt{\frac{4.5 \times 10^{-2}}{0.5 \times 400}}$	this mark may be awarded if the standard form value is incorrectly converted allow $e^2 = \frac{4.5 \times 10^{-2}}{0.5 \times 400}$	1	
	e = 0.015 (m)	this answer only	1	
	2.0 = 400 × e		1	
	e = 0.005 (m)	this answer only	1	
	0.015 + 0.005 = 0.02 (m)	allow their initial extension + their additional extension correctly calculated	1	
	or			
	$4.5 \times 10^{-2} = 0.5 \times 400 \times e^2$ (1)	this mark may be awarded if the standard form value is incorrectly converted		
	$e = \sqrt{\frac{4.5 \times 10^{-2}}{0.5 \times 400}}$ (1)	this mark may be awarded if the standard form value is incorrectly converted allow $e^2 = \frac{4.5 \times 10^{-2}}{0.5 \times 400}$		
	e = 0.015 (m) (1)	this answer only		
	F = 400 × 0.015 F = 6 (N) (1)	allow an answer of 400 × their calculated value of e		
	total force = 6 + 2 8 = 400 × e (1)	allow an answer that is consistent with their calculated value of e		
	e = 0.02 (m) (1)			
Total			**10**	