

Exercise 2C

1 Work done = $\frac{\lambda x^2}{2l} = \frac{8 \times 0.4^2}{2 \times 0.6}$
 = 1.07 J (3 s.f.)

2 Work done = $\frac{\lambda x^2}{2l} = \frac{4 \times 0.2^2}{2 \times 0.8}$
 = 0.1 J

3 Work done = $\frac{10 \times 0.6^2}{2 \times 1.2} - \frac{10 \times 0.3^2}{2 \times 1.2}$
 = $\frac{10}{2.4} (0.6^2 - 0.3^2)$
 = $\frac{10}{2.4} \times 0.9 \times 0.3$
 = 1.125 J

4 a $\frac{20}{2 \times 0.7} (0.2^2 - 0^2) = 0.571 \text{ J (3 s.f.)}$

b $\frac{20}{2 \times 0.7} (0.3^2 - 0.1^2)$
 = $\frac{20}{1.4} \times 0.4 \times 0.2 = 1.14 \text{ J (3 s.f.)}$

c $\frac{20}{2 \times 0.7} (0.7^2 - 0.5^2)$
 = $\frac{20}{1.4} \times 1.2 \times 0.2 = 3.43 \text{ J (3 s.f.)}$

5 (↑) $T = 2g$

$\frac{10x}{1.2} = 2g$

$x = \frac{2.4g}{10} = 0.24g$

Energy stored = $\frac{10 \times (0.24g)^2}{2 \times 1.2}$
 = 23.04...

Energy stored in the spring is 23 J (2 s.f.)

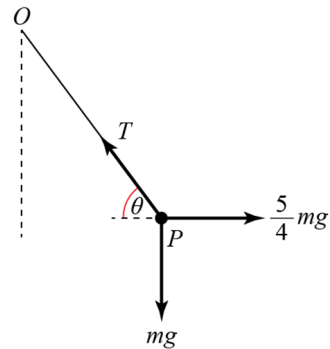


6 (↑) $T = 2mg$
 $\frac{\lambda \times 2a}{a} = 2mg$
 $\Rightarrow \lambda = mg$

Energy stored = $\frac{\lambda x^2}{2l}$
 = $\frac{mg(2a)^2}{2a}$
 = $2mga$



7 a

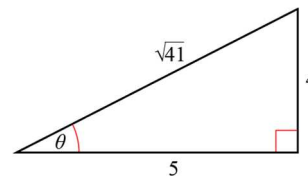


(→) $T \cos \theta = \frac{5mg}{4}$

(↑) $T \sin \theta = mg$

So, $\frac{T \sin \theta}{T \cos \theta} = \tan \theta = \frac{mg}{5mg/4} = \frac{4}{5}$

So, from the right-angled triangle:



$\sin \theta = \frac{4}{\sqrt{41}}$ and $\cos \theta = \frac{5}{\sqrt{41}}$

So, $T = \frac{mg}{\sin \theta} = \frac{mg}{4/\sqrt{41}} = \frac{\sqrt{41}mg}{4}$

The tension in the string is $\frac{\sqrt{41}mg}{4}$ N

7 b Using Hooke's law, $T = \frac{2mgx}{a}$

$$\text{So } \frac{\sqrt{41}mg}{4} = \frac{2mgx}{a}$$

$$\text{and } x = \frac{\sqrt{41}}{8}a$$

$$\begin{aligned} \text{Elastic energy stored} &= \frac{\lambda x^2}{2l} \\ &= \frac{2mg}{2a} \left(\frac{41a^2}{64} \right) \\ &= \frac{41mga}{64} \end{aligned}$$

The elastic energy stored is $\frac{41mga}{64}$ J