0 7 Kangaroos are large animals that travel by jumping.

Figure 8 shows a kangaroo.

Figure 8

Each leg of a kangaroo has a tendon connected to a muscle. Each tendon can be modelled as a spring.

When a jumping kangaroo lands on the ground, the tendons stretch.

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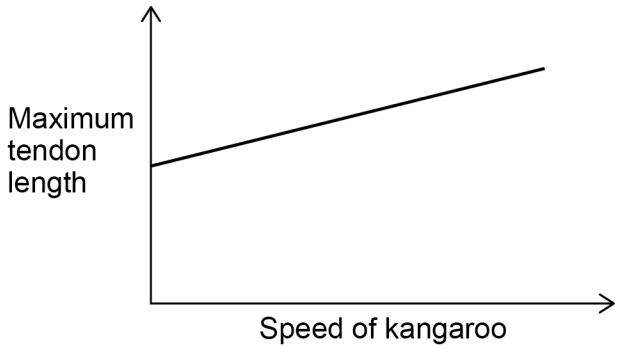
0 7 . 1 **Figure 9** shows a sketch graph of how the maximum tendon length during a jump changes with the speed of the kangaroo.

Figure 9



Explain why a kangaroo can jump higher as its speed increases.

[3 marks]

Question 7 continues on the next page

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0 7 . 2 A kangaroo has a maximum gravitational potential energy during one jump of 770 J

When the kangaroo lands on the ground 14% of the maximum gravitational potential energy is transferred to elastic potential energy in one tendon.

The tendon has an unstretched length of 35.0 cm

When the kangaroo lands on the ground the tendon stretches to a length of 42.0 cm

Calculate the spring constant of the tendon.

[5 marks]

Spring constant = _____ N/m

8

END OF QUESTIONS

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	the (maximum tendon) extension increases (as speed increases)	allow the tendons stretch more (as speed increases)	1	AO3 6.1.2.2
	so the elastic potential energy increases	allow so the (elastic) force increases	1	
	which is transferred to gravitational potential energy		1	
07.2	E = 770 × 0.14	allow E = 107.8 (J)	1	AO2 6.1.1.2
	extension = 0.070m		1	
	$107.8 = 0.5 \times k \times 0.070^2$	this mark may be awarded if extension is incorrectly/not converted and/or if the efficiency equation has not been applied	1	
	$k = 2 \times \frac{107.8}{0.070^2}$	this mark may be awarded if extension is incorrectly/not converted and/or if the efficiency equation has not been applied	1	
	k = 44 000 (N/m)	this mark may be awarded if extension is incorrectly/not converted this mark may not be awarded if the efficiency equation has not been applied	1	
Total			**8**	