Solutionbank M1

Heinemann Modular Maths for Edexcel AS and A-level

5 Newton's laws of motion

Exercise B, Question 20

Question:

A tree trunk, of mass 250 kg, is pulled up a slope by a chain attached to a tractor. The chain is at an angle of 10° to the slope. The slope itself is at 8° to the horizontal. The tree trunk initially accelerates at 0.2 m s^{-2}. A friction force, of magnitude 2000 N, acts on the tree trunk.

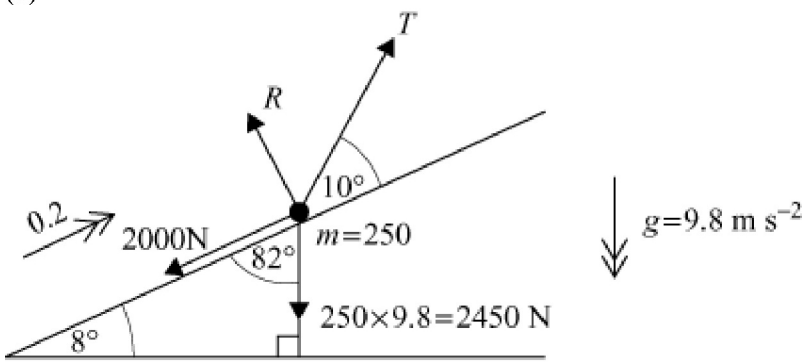
(a) Model the tree trunk as a particle. Draw and label a diagram to show the forces acting on it.

(b) Find the initial tension in the chain.

(c) Explain why the tension in the chain will probably decrease. [A]

Solution:

(a)



(b) Newton's 2nd Law up slope

$$T\cos 10° - 2000 - 2450 \times \cos 82° = 250 \times 0.2$$

$$\therefore T = \frac{(250 \times 0.2 + 2000 + 2450\cos 82°)}{\cos 10°}$$

$$T = 2427.85...$$

$$T = 2430 \text{ N (3 s.f.)}$$

(c) As the speed increases, the resistive force will increase and the trunk will reach its maximum speed and stop accelerating.