

Friction

Question Paper

Level	Pre U
Subject	Maths
Exam Board	Cambridge International Examinations
Topic	Mechanics- Friction
Booklet	Question Paper

Time Allowed: 25 minutes

Score: /21

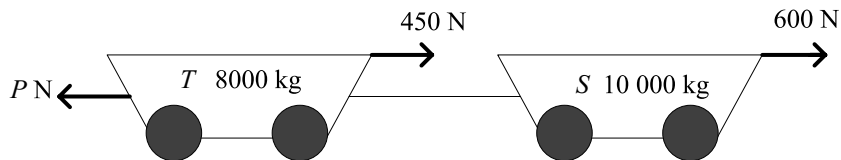
Percentage: /100

Grade Boundaries:

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- 1 Two trucks, S and T , of masses 8000 kg and $10\,000\text{ kg}$ respectively, are pulled along a straight, horizontal track by a constant, horizontal force of $P\text{ N}$. A resistive force of 600 N acts on S and a resistive force of 450 N acts on T . The coupling between the trucks is light and horizontal (see diagram).



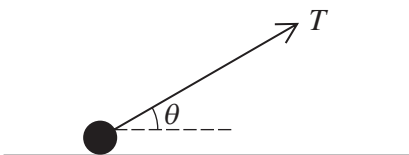
The acceleration of the system is 0.3 ms^{-2} in the direction of the pulling force of magnitude P .

- (i) Calculate the value of P . [2]

Truck S is now subjected to an extra resistive force of 1800 N . The pulling force, P , does not change.

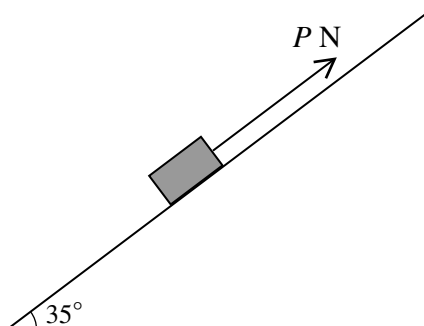
- (ii) Calculate the new acceleration of the trucks. [2]
 (iii) Calculate the force in the coupling between the trucks. [2]

- 2 A particle of mass $m\text{ kg}$ rests in equilibrium on a rough horizontal table. There is a string attached to the particle. The tension in the string is $T\text{ N}$ at an angle of θ to the horizontal, as shown in the diagram.



- (i) Copy and complete the diagram to show all the forces acting on the particle. [1]
 (ii) The coefficient of friction between the particle and the table is μ and the particle is on the point of slipping. Show that $T = \frac{\mu mg}{\cos \theta + \mu \sin \theta}$. [4]
 (iii) Given that $\mu = 0.75$, find the value of θ for which T is a minimum. [4]

3



The diagram shows a block of wood, weighing 100 N , at rest on a rough plane inclined at 35° to the horizontal. The coefficient of friction between the block and the plane is 0.2 . A force of $P\text{ N}$ acts on the block up the slope.

- (i) Find the maximum possible value of the friction acting on the block. [2]
- (ii) Given that the block is on the point of moving *up* the slope, find P . [2]
- (iii) Given that the block is on the point of moving *down* the slope, find P . [2]