

- 3** A string is attached to a block of mass 4 kg which rests in limiting equilibrium on a rough horizontal table. The string makes an angle of 24° above the horizontal and the tension in the string is 30 N.

(a) Draw a diagram showing all the forces acting on the block. [1]

(b) Find the coefficient of friction between the block and the table. [5]

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[5]

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[6]

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- 4 A particle P of mass 0.2 kg lies at rest on a rough horizontal plane. A horizontal force of 1.2 N is applied to P .

(a) Given that P is in limiting equilibrium, find the coefficient of friction between P and the plane. [3]

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(b) Given instead that the coefficient of friction between P and the plane is 0.3 , find the distance travelled by P in the third second of its motion. [4]

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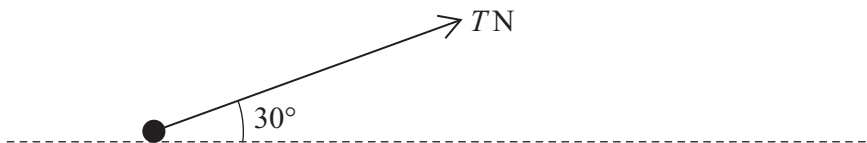
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A particle of mass 12 kg is going to be pulled across a rough horizontal plane by a light inextensible string. The string is at an angle of 30° above the plane and has tension $T\text{ N}$ (see diagram). The coefficient of friction between the particle and the plane is 0.5 .

- (a) Given that the particle is on the point of moving, find the value of T . [5]

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- (b) Given instead that the particle is accelerating at 0.2 m s^{-2} , find the value of T . [3]

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- 2 A particle P of mass 0.4 kg is on a rough horizontal floor. The coefficient of friction between P and the floor is μ . A force of magnitude 3 N is applied to P upwards at an angle α above the horizontal, where $\tan \alpha = \frac{3}{4}$. The particle is initially at rest and accelerates at 2 m s^{-2} .

(a) Find the time it takes for P to travel a distance of 1.44 m from its starting point. [2]

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(b) Find μ . [4]

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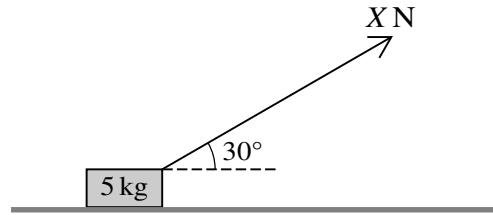
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A block of mass 5 kg is being pulled along a rough horizontal floor by a force of magnitude X N acting at 30° above the horizontal (see diagram). The block starts from rest and travels 2 m in the first 5 s of its motion.

- (a)** Find the acceleration of the block. [2]

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- (b) Given that the coefficient of friction between the block and the floor is 0.4, find X . [4]

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The block is now placed on a part of the floor where the coefficient of friction between the block and the floor has a different value. The value of X is changed to 25, and the block is now in limiting equilibrium.

- (c) Find the value of the coefficient of friction between the block and this part of the floor. [3]

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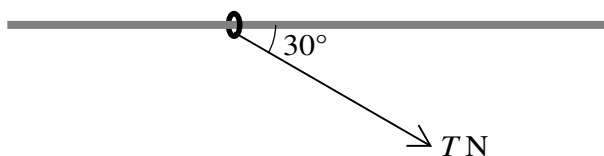
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The diagram shows a ring of mass 0.1 kg threaded on a fixed horizontal rod. The rod is rough and the coefficient of friction between the ring and the rod is 0.8 . A force of magnitude $T\text{ N}$ acts on the ring in a direction at 30° to the rod, downwards in the vertical plane containing the rod. Initially the ring is at rest.

- (a) Find the greatest value of T for which the ring remains at rest. [4]

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