Pegs and String

A Level

A light string is tied to two pegs P and R, with R above and to the right of P. A mass m is attached to a point Q on the string such that the section PQ is horizontal and the section QR makes an angle of $\theta = 30\,^\circ$ to the horizontal.

If the system is in equilibrium, what is the tension in the section of string PQ?

The following symbols may be useful: `g, m`

Advanced Systems 3ii

A Level

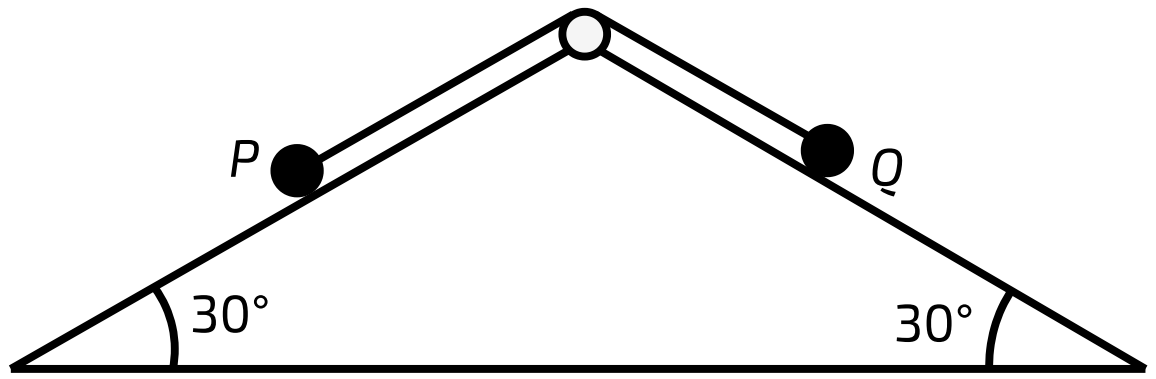

Figure 1: Particles P and Q connected by a light inextensible spring passing over a pulley.

Two identical smooth inclined planes are fixed so that their upper edges coincide and each of the planes is at an angle of 30° to the horizontal. Particles of masses $0.40\,\mathrm{kg}$ and $0.09\,\mathrm{kg}$ are connected to the ends of a light inextensible string which passes over a smooth pulley fixed at the top of the inclined planes. The system is held at rest with the string taut and the particles in contact with the planes. The system is then released.

Part A Acceleration of particles

Find the acceleration of the particles to 2 significant figures.

Part B Tension in string

Find the tension in the string. Give your answer to 2 significant figures.

Part C Force exerted on pulley

Find the magnitude of the force exerted by the string on the pulley. Give your answer to 2 significant figures.

Used with permission from UCLES, A Level, November 2004, OCR M1, Question 3

Advanced Systems 2i

A Level

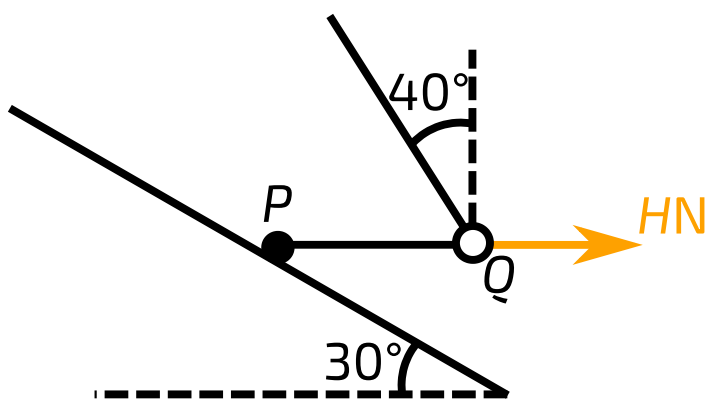

Figure 1: A particle P on an inclined plane attached to a string passing through a ring.

A particle P lies on a slope inclined at $30\,^\circ$ to the horizontal. P is attached to one end of a taut light inextensible string which passes through a small smooth ring Q of mass $m\,\mathrm{kg}$. The portion PQ of the string is horizontal and the other portion of the string is inclined at $40\,^\circ$ to the vertical. A horizontal force of magnitude $H\,\mathrm{N}$, acting away from P, is applied to Q. The tension in the string is $6.4\,\mathrm{N}$, and the string is in the vertical plane containing the line of greatest slope on which P lies. Both P and Q are in equilibrium.

Part A Calculating m

Calculate m.

Part B Calculating H

Calculate H to 3 significant figures.

Part C Coefficient of friction

Given that the weight of P is $32\,\mathrm{N}$, and that P is in limiting equilibrium, find the coefficient of friction between P and the slope correct to 3 significant figures.

Part D Equilibrium

Q and the string are now removed.

Find the maximum frictional force on P to 3 significant figures.

Find the component of weight down the slope to 2 significant figures.

Does P remain in equilibrium?

- No, P no longer remains in equilibrium.
- Yes, P remains in equilibrium.
- It's impossible to tell.

Advanced Systems 4i

A Level

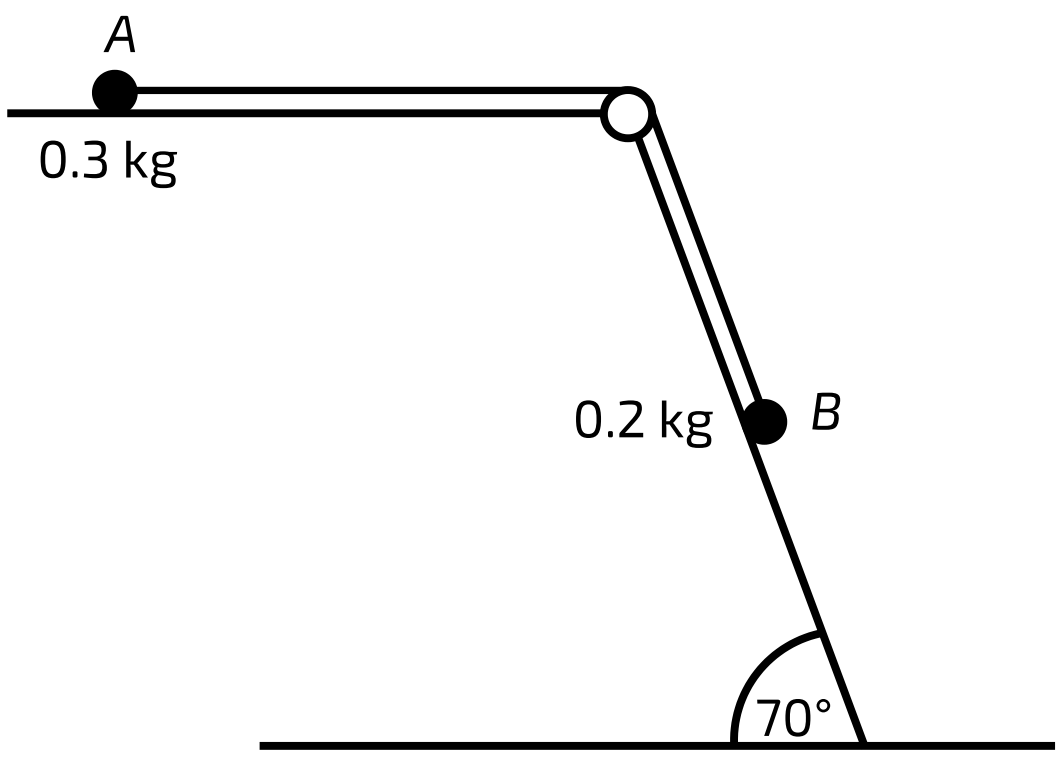

Figure 1: Two particles A and B connected by a light inextensible string passing over a pulley.

The upper edge of a smooth plane inclined at 70° to the horizontal is joined to an edge of a rough horizontal table. Particles A and B, of masses $0.3\,\text{kg}$ and $0.2\,\text{kg}$ respectively, are attached to the ends of a light inextensible string. The string passes over a smooth pulley which is fixed at the top of the smooth inclined plane. Particle A is held in contact with the rough horizontal table and particle B is in contact with the smooth inclined plane with the string taut. The coefficient of friction between A and the horizontal table is 0.4. Particle A is released from rest and the system starts to move.

Part A Acceleration of A

Find the acceleration of A correct to 3 significant figures.

Part B Tension in string

Find the tension in the string correct to 3 significant figures.

Part C Distance travelled by A

The string breaks when the speed of the particles is $1.5\,\mathrm{m\,s^{-1}}$.

Assuming A does not reach the pulley, find the distance travelled by A after the string breaks.

Part D Distance travelled by B

Assuming B does not reach the ground before A stops, find the distance travelled by B from the time the string breaks to the time that A stops. Give your answer to 3 significant figures.

Physics. You work it out.

Prism

A Level

This problem involves friction, which is not covered in some Physics A Levels. For more information please check with your teacher.

A prism has a cross section that is an isosceles triangle. It has a unique angle of (30.0°) as shown in Figure 1 and a mass of $m = 100\,\mathrm{g}$. You wish to lift it by touching the upper two faces only.

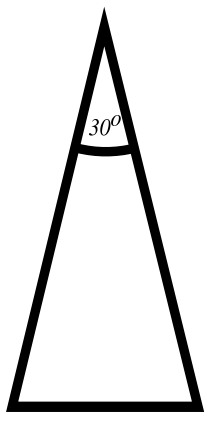

Figure 1: Isosceles prism.

If the coefficient of friction between the prism's surface and your skin is $\mu = 0.400$, what is the minimum normal force you need to apply to each face in order to support the prism?

- $0.51\,\mathrm{N}$
- $3.85\,\mathrm{N}$
- $1.27\,\mathrm{N}$
- $4.74\,\mathrm{N}$
- $0.85\,\mathrm{N}$

Used with permission from Cambridge University Tripos, Physics Paper 1A, Question A4.

Advanced Systems 1i

A Level

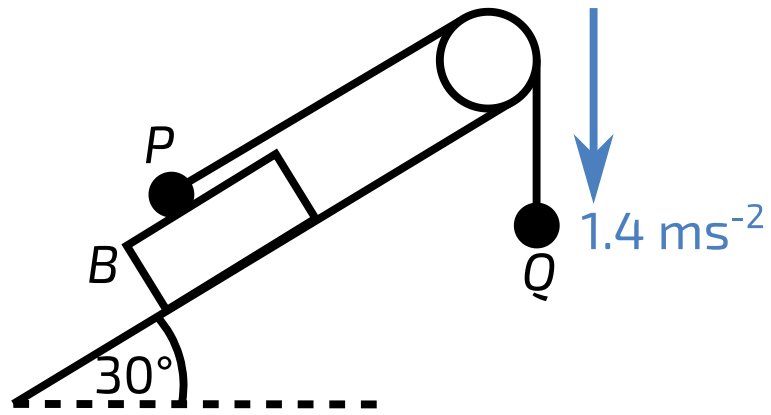

Figure 1: A block B is placed on an inclined plane.

A block B is placed on a plane inclined at $30\,^\circ$ to the horizontal. A particle P of mass $0.6\,\mathrm{kg}$ is placed on the upper surface of B. The particle P is attached to one end of a light inextensible string which passes over a smooth pulley fixed to the top of the plane. A particle Q of mass $0.5\,\mathrm{kg}$ is attached to the other end of the string. The portion of the string attached to P is parallel to a line of greatest slope of the plane, the portion of the string attached to Q is vertical and the string is taut. The particles are released from rest and start to move with acceleration $1.4\,\mathrm{m\,s^{-2}}$ It is given that B is in equilibrium while P moves on its upper surface.

Part A Tension in string

Find the tension in the string while P and B are in contact correct to 2 significant figures.

Part B μ for P and B

Calculate the coefficient of friction between P and B.

Part C μ for B and the plane

Given that the weight of B is $7\,\mathrm{N}$, calculate the lowest possible value for the coefficient of friction between B and the plane. Give your answer to 3 significant figures.

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