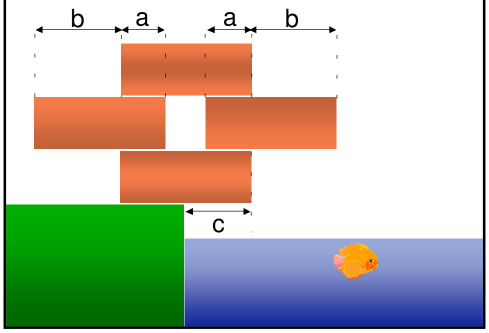
Problems class 8

Work out how far you can make four bricks of length L extend over the bank of a stream if arranged as shown below. Can you think of an arrangement that allows a larger overhang over the stream using the same bricks?



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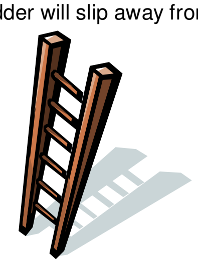
A ladder of length 24 m and mass 20 kg is leaning against a vertical wall at an angle of 30°. If a window cleaner of mass 80 kg is standing half way up the ladder, calculate the magnitude of the horizontal force the wall exerts on the ladder. The coefficient of static friction between the wall and the ladder is negligible, and that between the ladder and the ground is 0.1 (the ground is icy!), calculate the vertical force exerted on the ladder by the ground on which it is standing. Determine whether the base of the ladder will slip away from the wall.



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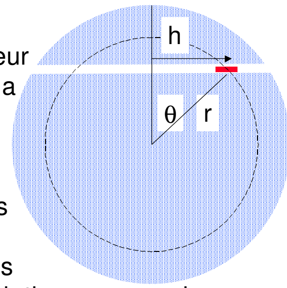

An entrepreneur plans to build a network of tunnels connecting various places on the earth's surface. Trains will run through these powered primarily by gravity. Assuming the earth to be a non-rotating uniform sphere, show that a train released at the earth's surface executes simple harmonic motion, if damping effects are negligible. Calculate the time for a journey through one of the tunnels if the earth's density is $5 \cdot 5 \times 10^{3}\ \mathrm{kg\,m^{-3}}$ and $G = 6 \cdot 67 \times 10^{-11}\ \mathrm{m^{3}kg^{-1}s^{-2}}$