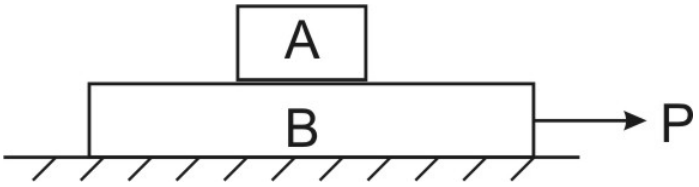
Dynamics 2 – Tutorial 2

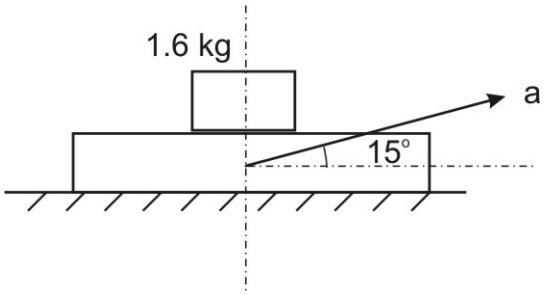
Dynamics of a Single Particle and D'Alembert's Method

You will be asked to show your attempts at Questions 2 and 4 at the tutorial.

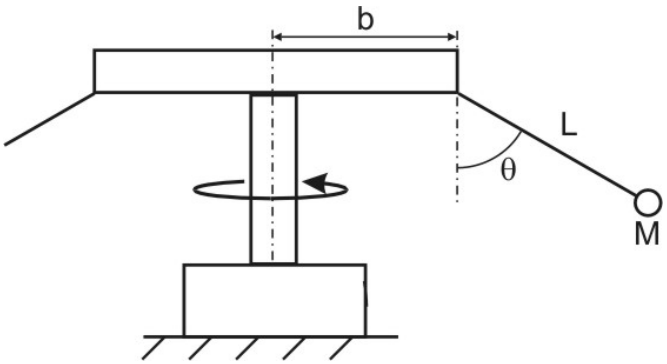
1. In the figure, A is a mass of 1.6 kg resting on top of bar B (mass 4.2 kg) which is resting on a table. The lower surface of B is frictionless but the upper surface has a coefficient of friction of 0.26. A horizontal force P of 45 N is applied to B as shown. Calculate the accelerations of A and B. Show large FBDs with all forces shown clearly.



2. A mass of 1.6 kg is placed at the mid-point of the top of a platform 2.4 m long ($\mu = 0.35$). The platform is accelerated at 7 m/s^2 in a direction at 15° to the horizontal, Calculate how long the mass will take to fall off the platform. [0.94 s]



3. The figure shows and outline for a fairground ride proposal. L represents one of a set of chains attached to a central rotating tower. M (75 kg) represent a paying customer on a seat attached to the chain. The Health and Safety Executive require that the chain angle should not exceed 60°. If b = 2.5 m and L = 4 m, what should the maximum rotational speed of the tower in RPM? The customers will experience a "weight increase" during the ride – by what percentage will their apparent weight be increased? [16.12 RPM, ?]



4. A tower crane with a horizontal jib is rotating about its vertical axis at 4 RPM in an anti-clockwise direction as viewed from above. A 400 kg trolley (treat as particle!) is being moved outwards on rails along the jib at 1.4 m/s by means of wires. When the trolley is 10 m along the jib, calculate and show clearly al its acceleration components. What is the magnitude of the Coriolis acceleration? Determine the radial force on the trolley applied by the rails assuming no friction – is it outwards or inwards? Determine the sideways horizontal force on the rails, showing its direction clearly, as viewed from above.