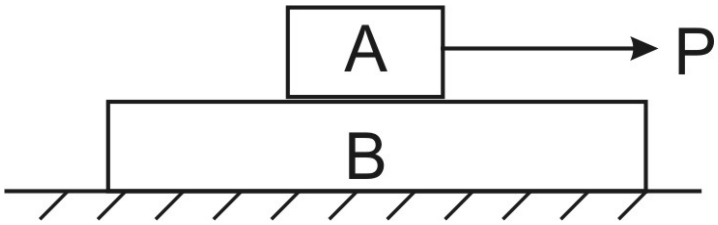
Dynamics 2 – Tutorial 3

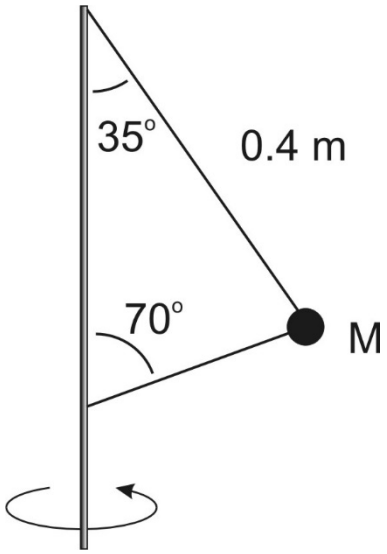
Dynamics of Particles and Newton's Laws

Attempt **all** and use **large** clear Free Body Diagrams.

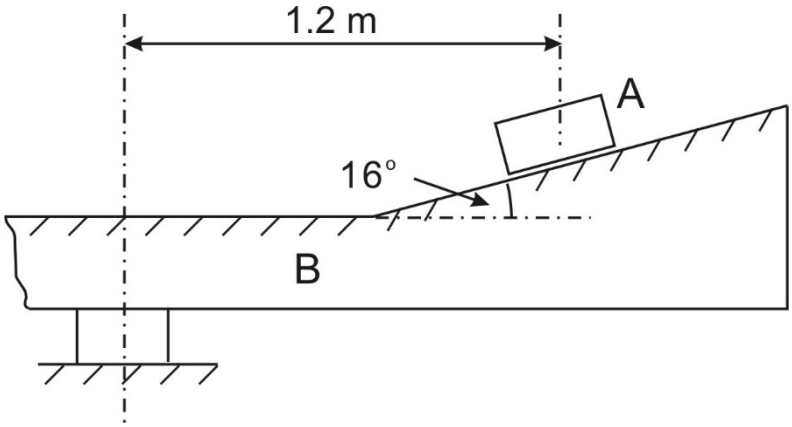
1. A is a mass of 18 kg resting on top of block B (mass of 32 kg) which rests on a table. The upper surface of B has a coefficient of friction of 0.45 whilst its lower surface has a coefficient of friction of 0.15. A horizontal force P of 150 Newtons is applied to A as shown. Draw free body diagrams with all forces and inertia forces shown clearly, and use these to calculate the accelerations of A and B.



2. The figure shows a vertical shaft which is turning steadily at 120RPM. A mass M (2.8 kg) is attached by two wires and is moving in a circular path due to the shaft motion. By drawing a clear free body diagram of the mass, calculate the tensions in the two wires.



3. Mass A is placed on a circular platform B with an angled surface, shown in cross section. $\mu = 0.35$ for the platform surface. If the platform rotation speed is slowly increased from rest, at what speed will mass A start to slip?



4. State clearly the difference between Newton's Second Law (N2) and Generalised Newton's Second Law (GN2). Use GN2 to answer the following:

    - I put my pet canary in an **airtight** Perspex box (for a short time!) and put the box on bathroom scales. If the bird is flying around, will the reading on the scales (a) remain steady or (b) fluctuate?
    - Because you are an engineering student, a friend from social science asks why you can't lift yourself off the ground by pulling on your shoe laces.