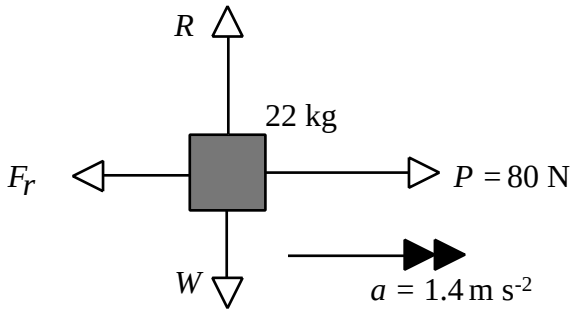
Lesson 7

A-Level Applied Mathematics
Mechanics : Dynamics II : Year 2

7.1 Revision

Question 1

A force of 80 N is dragging a 22 kg suitcase over a rough, level surface.
The suitcase is accelerating at 1.4 m s^{-2}



Find **(i)** The normal reaction, R

[2 marks]

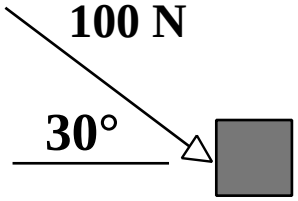
(ii) The friction force, F_r

[2 marks]

(iii) The coefficient of friction, μ

[2 marks]

Question 2
A-Level M1 Examination Question from May 2010, Q3



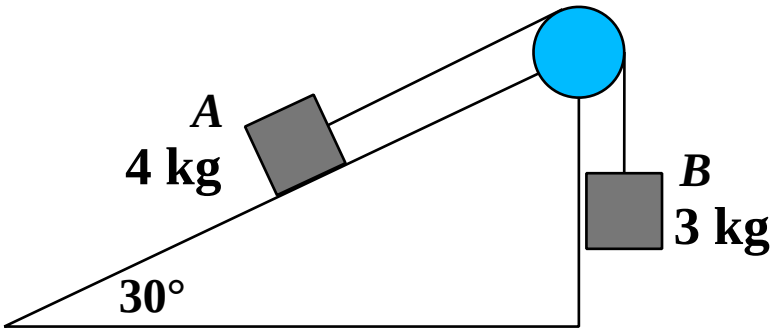
A small box is pushed along a floor.
The floor is modelled as a rough horizontal plane and the box is modelled as a particle.
The coefficient of friction between the box and the floor is 0.5
The box is pushed by a force of magnitude 100 N which acts at 30° with the floor.

Given that the box moves with constant speed, find the mass of the box.

[7 marks]

Question 3

A-Level M1 Examination Question from January 2004, Q5



A particle *A* of mass 4 kg moves on the inclined face of a smooth wedge. This face is inclined at 30° to the horizontal. The wedge is fixed on horizontal ground. Particle *A* is connected to a particle *B* of mass 3 kg by a light inextensible string. The string passes over a small light smooth pulley which is fixed at the top of the plane. The section of the string from *A* to the pulley lies in a line of greatest slope of the wedge. The particle *B* hangs freely below the pulley, as shown. The system is released from rest with the string taut. For the motion before *A* reaches the pulley and before *B* hits the ground, find

(a) the tension in the string

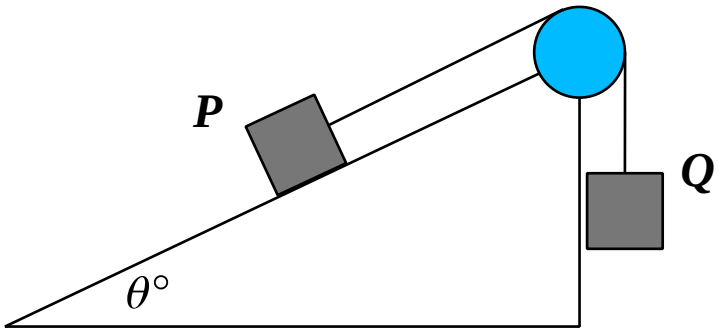
[6 marks]

(b) the magnitude of the resultant force exerted by the string on the pulley

[3 marks]

Question 4

A-level M1 Examination Question, June 2015, Q8



Two particles P and Q have mass 4 kg and 0.5 kg respectively. The particles are attached to the ends of a light inextensible string. Particle P is held at rest on a fixed rough plane, which is inclined to the horizontal at an angle θ where,

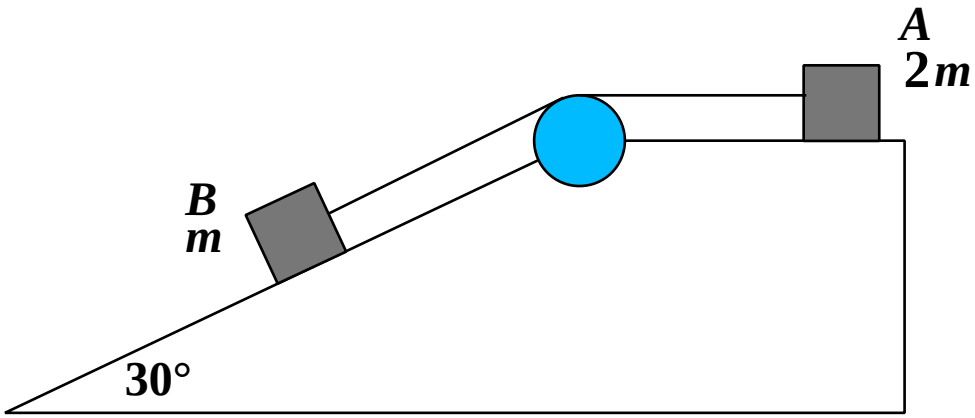
$$\tan\theta = \frac{4}{3}$$

The coefficient of friction between P and the plane is 0.5. The string lies along the plane and passes over a small smooth light pulley which is fixed at the top of the plane. Particle Q hangs freely at rest vertically below the pulley. The string lies in the vertical plane which contains the pulley and a line of greatest slope of the inclined plane. Particle P is released from rest with the string taut and slides down the plane.
Given that Q has not hit the pulley, find the tension in the string during the motion.

[11 marks]

Question 5

A-Level M1 Examination Question from June 2002, Q7



Particles A and B of mass $2m$ and m respectively, are attached to the ends of a light inextensible string. The string passes over a small smooth pulley fixed at the edge of a rough horizontal table. Particle A is held on the table, while B rests on a smooth plane inclined at 30° to the horizontal. The string is in the same vertical plane as a line of greatest slope of the inclined plane. The coefficient of friction between A and the table is μ. The particle A is released from rest and begins to move.

By writing down an equation of motion for each particle

(a) show that, while both particles move with the string taut, each particle has an acceleration of magnitude $\frac{1}{6}(1 - 4\mu)g$

[7 marks]

When each particle has moved a distance h, the string breaks.
The particle A comes to rest before reaching the pulley.
Given that $\mu = 0.2$,

(b) find, in terms of h, the total distance moved by A,

[6 marks]

For the model described above,

(c) state two physical factors, apart from air resistance, which could be taken into account to make the model more realistic

[2 marks]