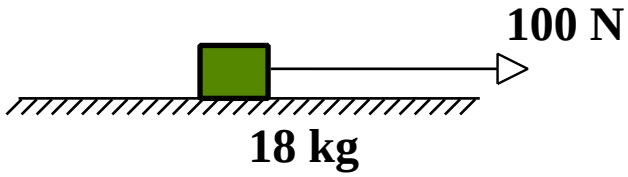
**Lesson 7**

**A-Level Applied Mathematics**
**Mechanics : Statics : Year 2**

## 7.1 Revision

*Any solution based entirely on graphical*
*or numerical methods is not acceptable*
Marks Available : 50

**Question 1**




$\mu = 0.6$

A man applies a horizontal force of 100 Newtons to a box of apples of mass 18 kg which is at rest on a rough horizontal floor. The coefficient of friction between the box and the floor is 0.6

**( i )** Calculate, in Newtons, the Normal Reaction of the floor on the box.

**[ 2 mark ]**

**( ii )** What is the maximum force due to friction that could be available to prevent the box from starting to move

**[ 2 mark ]**

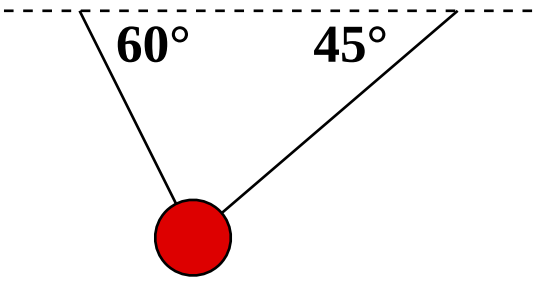
**( iii )** Giving a reason, explain why the box will not move.

**[ 2 marks]**

**( iv )** Apples, each with a mass of 0.085 kg are thrown out of the box. How many apples would need to be thrown out before the box started to move ?

**[ 4 marks ]**

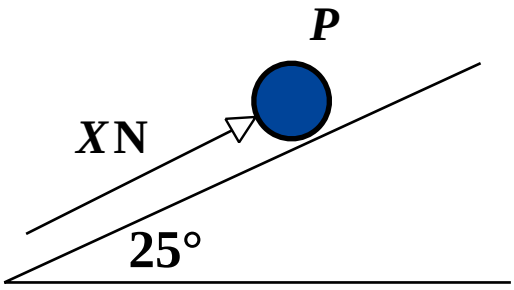
**Question 2**




A particle of mass 6 kg hangs in equilibrium, suspended by two light inextensible strings, inclined at 60° and 45° to the horizontal, as shown.
The particle is attached separately to each string so the tensions in the two strings can be different.
Find the tension in each of the strings.

**[ 6 marks ]**

**Question 3**




A particle, *P*, of mass 12 kg is on the verge of sliding up a rough slope inclined at 25° to the horizontal. A force of *X* Newtons, parallel to the plane, is acting on *P* as shown. The coefficient of friction between *P* and slope is 0.35.

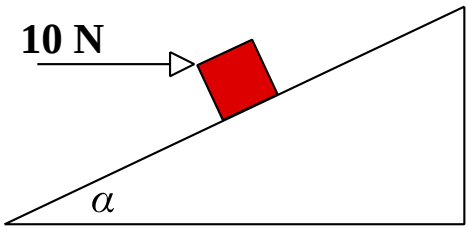
( i ) Draw a good sized diagram showing the forces acting on the particle and in which any force not parallel nor perpendicular to the plane is resolved into component parts which are.

**[ 3 marks ]**

**( ii )** Determine the magnitude of the force, *X*

**[ 5 marks ]**

**Question 4**




Tony, an ant, is trying to push a rock of mass 3 kg up a rough inclined plane with a horizontal force of magnitude 10 Newtons.

The plane is inclined to the horizontal at an angle $\alpha$, where $\tan \alpha = \frac{5}{12}$.
The line of action of the force lies in the vertical plane containing the sledge and a line of greatest slope of the plane.
The coefficient of friction between the sledge and the inclined plane is $\mu$.

**( i )** Show that if $\mu$ has its lowest possible value, Tony would not be able to stop the rock from sliding down the slope.

**[ 4 marks ]**

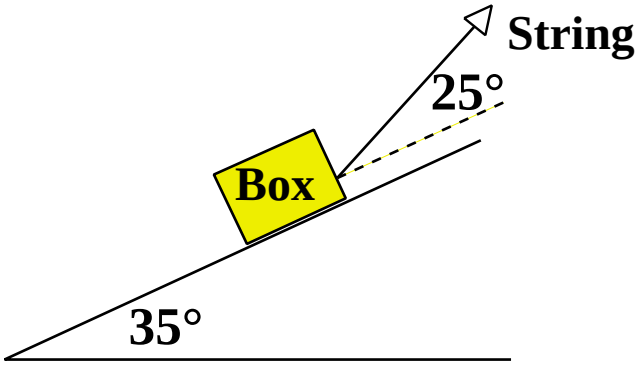
**( ii )** Given that Tony is able to hold the rock is in equilibrium, find the minimum possible value that $\mu$ must be.

**[ 6 marks ]**

**( iii )** Given that $\mu$ is 0.4, how many ants, including Tony, each pushing with a horizontal force of 10 Newtons, will be needed to push the rock up the slope ?

**[ 6 marks ]**

**Question 5**




A box of mass 10 kg rests on a plane inclined at an angle of 35° to the horizontal. The box is on the verge of sliding down the plane but is prevented from doing so by a string attached to the box that makes an angle of 25° with the inclined plane. The coefficient of friction between the box and the plane is 0.3

**( i )** Find the magnitude of the tension, *T*, in the string.

**[ 7 marks ]**

**( ii )** Find the magnitude of the force of friction acting on the particle

**[ 3 marks ]**