proprep™

Workbook

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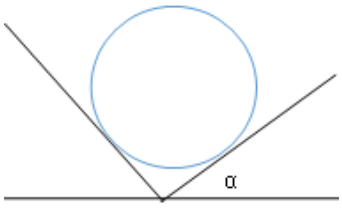
Dynamics

Frictionless Statics

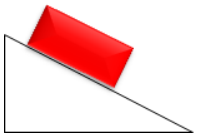
Questions

1) Normal Force – a Ball in a Box.
A ball of mass m is placed in a box.
The box is resting at an angle α.
The sides of the box are perpendicular to one another.
What is the force exerted by each face of the box onto the ball?

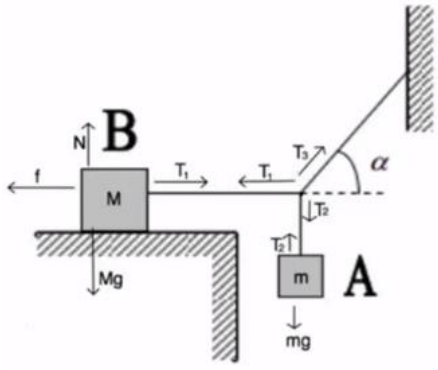


Statics with Friction

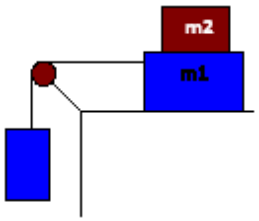
2) Minimum Value for Coefficient of Friction.
The mass and angle of the slope are given.
What is the smallest value that the coefficient of friction may be, such that the system remains at rest?



3) What is the minimum coefficient of friction between the plane and the mass,
that will keep the system held in place?



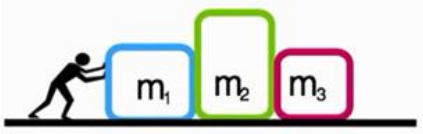
4) Mass Tied to another Mass.
Three masses are given. The plane is smooth.
We are given the coefficient of friction between the two masses.
What is the maximum mass we could hang, such that the system remains static?



Frictionless Motion

5) Three Masses.

Three masses are resting on a smooth surface.
They are being pushed with an acceleration of a.

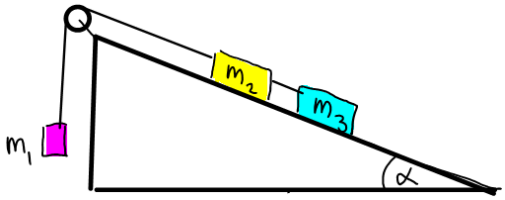


a. What is this force?

b. Which forces are acting between each of the masses?

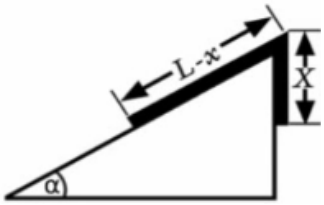
6) Three Masses on a Slope.

Find the acceleration of the masses.



7) Chain Resting on a Slope

A chain holds two masses, as shown in the diagram.
The chain is of length L and of mass m. The slope is smooth.
What is the length of the part of the chain labeled X
(the section of the chain hanging in the air)?



Answer Key

1) $N_1 = mg\sin\alpha, \quad N_2 = mg\cos\alpha$

2) $\tan\alpha \le \mu$

3) $f = \tilde{\mu}N$

4) $m_3 = \mu m_2$

5) a. $\tilde{F} = (m_1 + m_2 + m_3)\cdot a$ b. $N_1 = m_2 \cdot a + m_3 \cdot a$

6) $m_1 a = m_1 g - T_2, \quad m_2 a = T_2 - T_1 - m_2 g\sin\alpha, \quad m_3 a = T_1 - m_3 g\sin\alpha$