

Booklet # 37

Name		Period		Date	Nov 18, 2015 (Wednesday)
Unit # 2		Topic: inclined plane			
Items		Points		Your score	
Do-now		25%			
Note taking		25%			
Assessment		25%			
Homework		25%			
You have earned					

Sir Isaac Newton (1642-1726)

**“Nature and nature's laws lay hid in night;
God said "Let Newton be" and all was light...”.**

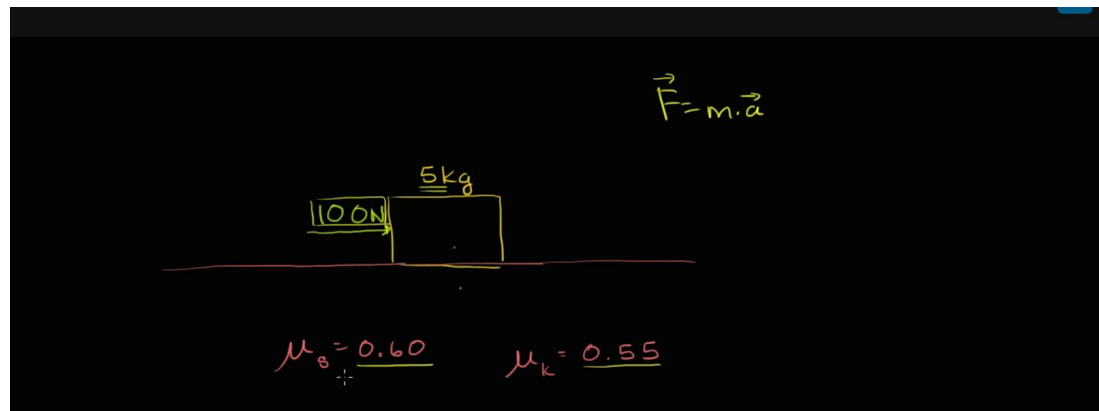
Does the moon also fall?

If Apple fall...

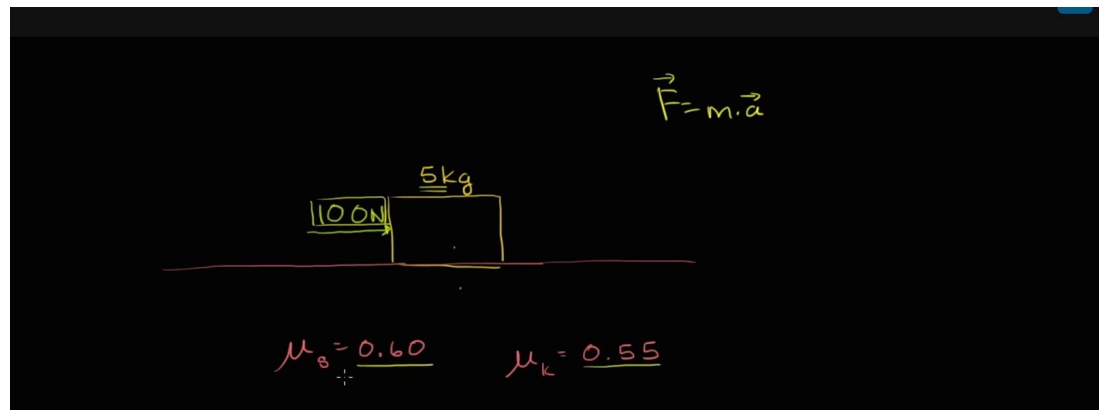
Newton invented calculus in 1765 , to solve the falling moon problem, which eventually helped him formulate the laws of motions, and gravitation, which dominated scientists' view of the universe ever since.

1

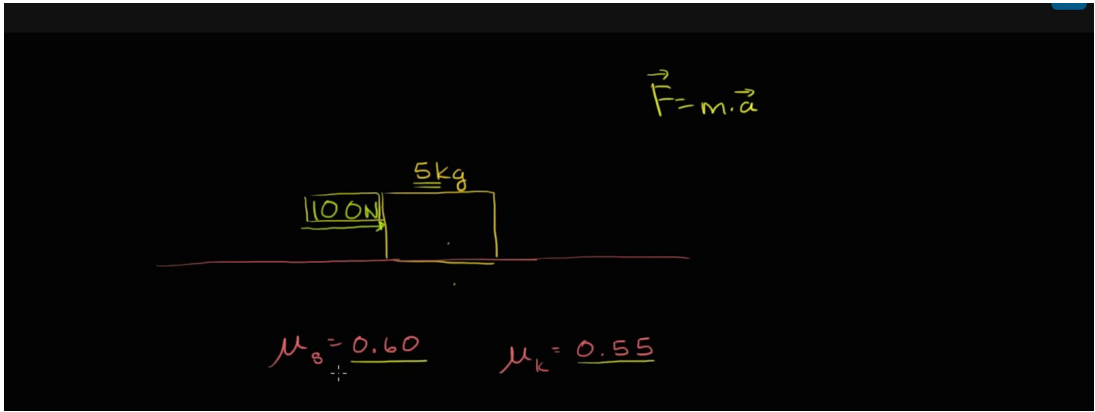
Find the acceleration of the object below.



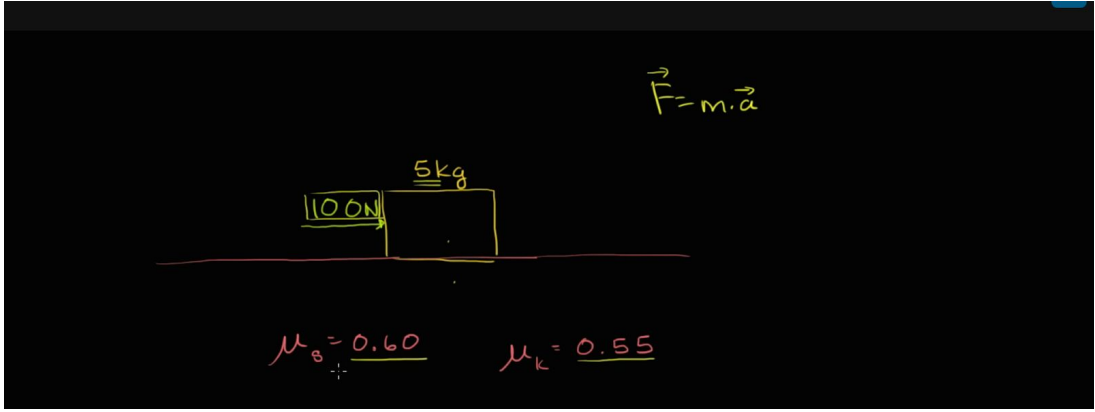
How much force you have to apply to make the box (which is at rest) moving?



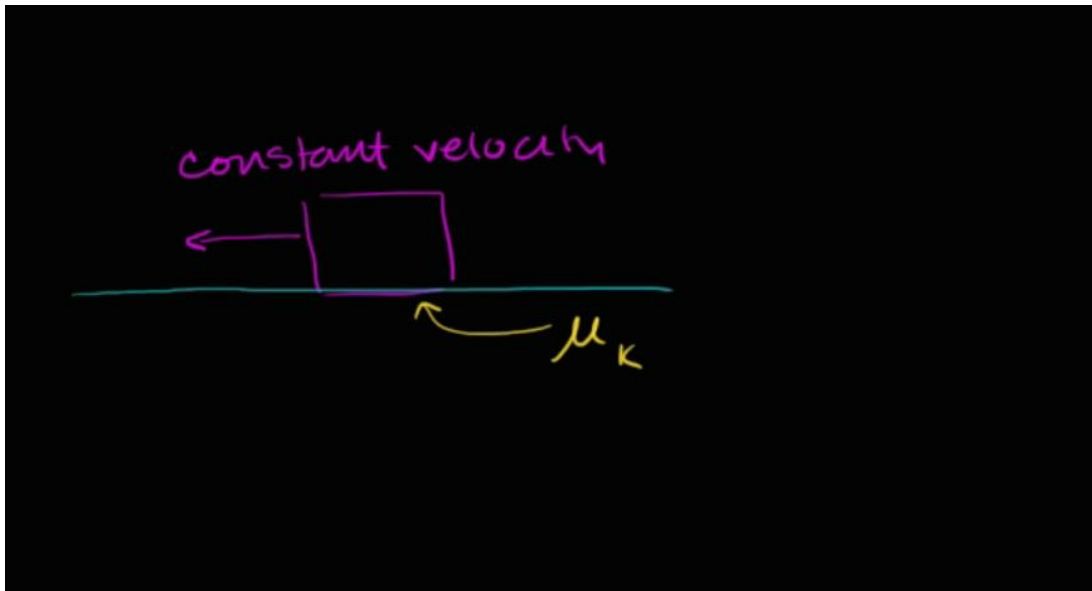
How much force you have to apply to make the box (which is in motion) to keep moving?



FIND Net force you need to apply to make it moving from the REST? Find the acceleration using Newton's second law



FIND Net force you need to apply to keep it moving while it's already MOVING?
 Find the acceleration using Newton's second law



"moment" $\vec{a} = 14.1 \text{ m/s}^2$ $\vec{F} = m \cdot \vec{a}$

70.6 N (force to the right)
 100 N (weight)
 5 kg (mass)
 49 N (normal force)
 26.95 (friction force to the left)
 29.4 N (friction force to the left)
 49 N (weight)
 73.05 N (net force to the right)
 \vec{F}_{net}
 \vec{a}

$\frac{\|\vec{F}_B\|}{\|\vec{F}_N\|} = \mu_s = 0.60$
 $\mu_k = 0.55 = \frac{\|\vec{F}_f\|}{\|\vec{F}_N\|} 49 \text{ N}$

$\|\vec{F}_B\| = 49 \text{ N} \cdot 0.60 = 29.4 \text{ N}$
 $\|\vec{F}_f\| = 49 \text{ N} \cdot 0.55 = 26.95 \text{ N}$

Write the equations for inclined plane

The image shows handwritten physics notes on a blackboard. At the top left, there is a small diagram of a vertical line and an inclined line with a right-angle symbol. To the right, the text "Soh can be" is written. Below this, the mass is given as m . A geometric derivation shows $x + 90 - \theta + 90 = 180$, leading to $x - \theta = 0$ and $x = \theta$. The main diagram shows an inclined plane at angle θ . A force vector $\vec{F}_g = m\vec{g}$ is shown acting vertically downwards. This force is decomposed into two components: $\vec{F}_{g\parallel}$ acting parallel to the incline and $\vec{F}_{g\perp}$ acting perpendicular to it. The angle between \vec{F}_g and $\vec{F}_{g\perp}$ is θ , and the angle between \vec{F}_g and $\vec{F}_{g\parallel}$ is $90 - \theta$. The following equations are written:

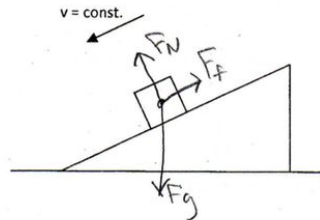
$$\frac{\|\vec{F}_{g\parallel}\|}{\|m\vec{g}\|} = \sin \theta$$
$$\|\vec{F}_{g\parallel}\| = \|m\vec{g}\| \sin \theta$$
$$\frac{\|\vec{F}_{g\perp}\|}{\|m\vec{g}\|} = \cos \theta$$
$$\|\vec{F}_{g\perp}\| = \|m\vec{g}\| \cos \theta$$

Additional notes include "90-θ" and "90°" with arrows pointing to the respective angles in the diagram.

Dynamics in action

Inclined Force

1. A 3.0 kilogram block is sliding down a 25° incline at a constant speed.



- a. Sketch the three primary vectors (weight, normal force, and friction force) acting on the block.

[Sketch]

- b. Determine the weight of the block.

$$F_g = m \cdot g = 3 \text{ kg} \cdot 9.81 \text{ m/s}^2$$

$$F_g = 29.4 \text{ N}$$

[29.4N]

- c. Determine the magnitude of the normal force acting on the block.

$$F_N = F_{g\perp} = F_g \cos \theta$$

$$F_N = 29.4 \text{ N} \cdot \cos 25^\circ$$

$$F_N = 26.6 \text{ N}$$

[26.6N]

- d. Calculate the friction force acting on the block.

$$F_f = F_{g\parallel} = F_g \sin \theta$$

$$F_f = 12.4 \text{ N}$$

[12.4N]

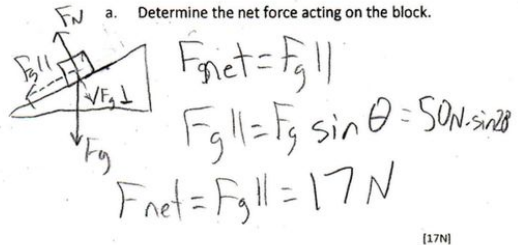
- e. Determine the coefficient of friction between the block and the incline.

$$F_f = \mu F_N$$

$$\mu = \frac{F_f}{F_N} = \frac{12.4 \text{ N}}{26.6 \text{ N}} = 0.47$$

[0.47]

2. A 50 newton block is placed on a frictionless 20° incline.



- a. Determine the net force acting on the block.

$$F_{\text{net}} = F_{g\parallel}$$

$$F_{g\parallel} = F_g \sin \theta = 50 \text{ N} \cdot \sin 20^\circ$$

$$F_{\text{net}} = F_{g\parallel} = 17 \text{ N}$$

[17N]

- b. Calculate the block's rate of acceleration down the plane.

$$a = \frac{F_{\text{net}}}{m}$$

$$a = \frac{17 \text{ N}}{5.1 \text{ kg}}$$

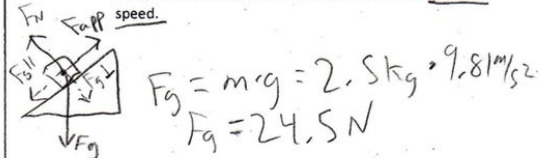
$$g = \frac{F_g}{m} \quad m = \frac{F_g}{g} = \frac{50 \text{ N}}{9.81 \text{ m/s}^2}$$

$$m = 5.1 \text{ kg}$$

[3.3 m/s²]

$$a = 3.3 \text{ m/s}^2$$

3. Calculate the amount of force needed to move a 2.5 kilogram object up a 30° frictionless incline at a constant speed.



$$F_g = m \cdot g = 2.5 \text{ kg} \cdot 9.81 \text{ m/s}^2$$

$$F_g = 24.5 \text{ N}$$

$$F_{g\parallel} = F_g \sin 30^\circ = 12.3 \text{ N}$$

$$F_{\text{app}} = F_{g\parallel} = 12.3 \text{ N}$$

[12.3 N]

Assessment

Find the net force of the object below when it starts moving.

