

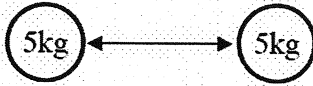
Gravity, Gears, and Review

Gravity

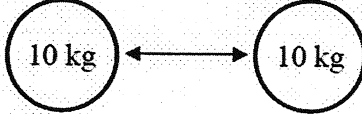
Gravity is a force that pulls any two masses towards each other. Nothing can stop gravity.

Gravity increases with mass.

Less mass: less gravity



More mass: more gravity

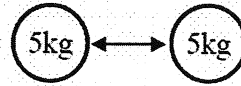


Heavier things have more gravitational force (weight) because they have more mass.

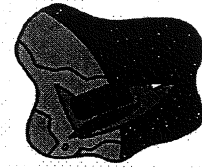
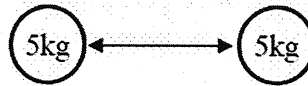


Gravity decreases with distance.

Less distance: more gravity



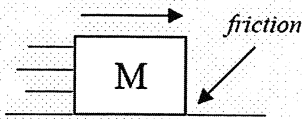
More distance: less gravity



As a spaceship gets closer to a planet, the gravity between the planet and the ship gets stronger.

Friction

Friction is a force that opposes moving objects and occurs any time objects touch. Friction causes heat and takes energy away from moving objects and machines.



The object and the table heat up as the two object rub against each other.

Rough surfaces have more friction than smooth surface.

An object must be touching something to have friction.



Air friction (air resistance) occurs when objects move thru air. Air friction increases with speed.



Friction can be helpful. A car use the friction of its tires to turn corners.

All sections marked with a ⚡ are considered essential concepts and must be completed to receive full credit on WS.

<p>What is gravity? ⚡ <i>The attraction between 2 objects</i></p> <p>Does gravity increase or decrease? <u>I</u> If you increase the mass of one of the objects? <u>I</u> If you decrease the distance between the two objects? <u>D</u> If you decrease one of the masses? <u>D</u> If the objects are farther apart?</p>	<p>Give an example of good friction. <i>Answers Vary</i></p> <p>Give an example of bad friction. <i>Answers Vary</i></p>
<p>If an object is not touching a table is there friction between them? <i>No, friction requires contact</i></p> <p>What is another name for air friction? <i>air resistance</i></p> <p>Friction always causes what? <i>Heat</i></p>	<div style="text-align: center;"> </div> <p>A. What is the normal force acting on the object? $F_w = mg = 8.5 \text{ kg} \cdot 10 \text{ m/s}^2 = 85 \text{ N}$ $F_N = 85 \text{ N}$</p> <p>B. How do static and kinetic friction compare? $F_s > F_k$ Always</p> <p>C. Will this object start to move? <i>Yes</i></p> <p>D. Why? $F_s < F$</p> <p>E. Calculate its acceleration. $a = \frac{F_{\text{net}}}{m} = \frac{20 \text{ N} - 8 \text{ N}}{8.5 \text{ kg}} = 1.4 \text{ m/s}^2$</p>


Two very small people are pulling a box. Identify the four shown forces as F_{Applied} ; T; F_w ; F_N .


- I F_1 — the two men pulling WITH A ROPE.
- F_N F_2 — the force pushing up by the floor.
- F_w F_3 — the force pulling down on the mass.
- F_s F_4 — the force trying to stop the mass from moving.

E. F_s Which force is in the negative x-direction?
 F. F_N Which force is in the positive y-direction?
 G. I Which force is in the positive x-direction?
 H. F_w Which force is in the negative y-direction?

I. Which forces would be used in this equation: $\Sigma F_y = ma_y$? *F_w & F_N*
 J. Which forces would be used in this equation: $\Sigma F_x = ma_x$? *F_s & T*


Balanced or unbalanced forces?

U 10 N left and 5 N right? B If $a = 0$? 

U An object accelerating? B If $\Delta v = 0$? 

B An object at constant speed? U When an object turns a corner?


B An object at rest?

Which has more inertia: 

A 50 kg object or a 10 kg object?

A 30 kg object on the earth or in space? *Same*

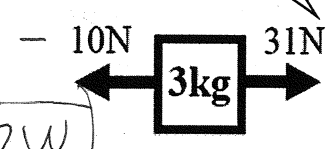
A 20 kg object going 50 m/s, or a 30 kg object at rest.


Balanced or unbalanced forces? 

Calculate the net force and acceleration of the object.

$F_{net} = F_1 + F_2$

$3N + -10N = 2N$




What is the difference between mass and weight? 

Mass is amount of matter in an object

Weight is gravity acting on mass


Which changes in space? *weight*

Mass or Weight: W 20 N; M 30 kg?

Which falls faster: heavy or light objects? 

Why? *Same Speed*

g acts on all objects equally

A 4 kg object accelerates 12 m/s^2 to the left, find the force on it. 

$a = -12 \text{ m/s}^2$

$F = ma$


$F = 4 \text{ kg} \cdot -12 \text{ m/s}^2 = -48 \text{ N}$

A 30 N net force pulls to the right on a 5 kg object. Find its acceleration.

$F = 30 \text{ N}$

$F = ma$

$a = \frac{F}{m} = \frac{30 \text{ N}}{5 \text{ kg}} = 6 \text{ m/s}^2$

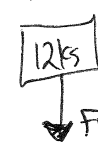
Will it accelerate faster or slower? 

S If you increase an object's mass.

F If you increase the force on the object.

Calculate the weight of a 12 kg object.

$F_w = mg = 12 \text{ kg} \cdot 10 \text{ m/s}^2 = 120 \text{ N}$



A 2 kg object is thrown into the air going 5 m/s.

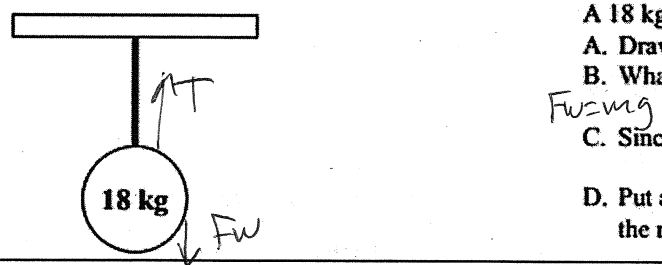
A. Is the object's initial velocity $+$ or $-$?


B. Is the object's acceleration $+$ or $-$?

C. What is the force pulling down on the object (give a number).

$g = -10 \text{ m/s}^2$

Notice that an object can be moving the opposite way of the acceleration.



A 18 kg object is suspended by a rope. 

A. Draw and label all of the forces acting on the object.

B. What is the weight of the object?


$F_w = mg = 18 \text{ kg} \cdot 10 \text{ m/s}^2 = 180 \text{ N}$

C. Since it is hanging at rest, what is the acceleration of the object?

$a = 0 \text{ m/s}^2$

D. Put all of the above into $\Sigma F = ma$ and calculate the force exerted by the rope.


$T + F_w = ma$ $T - 180 \text{ N} = 18 \text{ kg} \cdot 0 \text{ m/s}^2$ $T = 180 \text{ N}$

Which has more inertia? 

A) A 10 m/s car or a 20 m/s car? *Same*

B) A heavy rock or a light rock?

C) An astronaut on the earth or in space? *Same*

Balanced or unbalanced forces? 


A) U When an object is changing motion?


B) U When an elevator starts to move up?

C) B When an elevator is between floors?

D) B When a car is using cruise control?

E) U When a car is coming to a stop?

If there is friction on the table, draw and label all of the forces acting on the two masses at the left. 

Suzie the slouch is sitting on the school bus. When the bus accelerates forward, 

A. Which way does Suzie move relative to the bus? *Backwards*

B. Which way does Suzie move relative to the ground? *stays same*

C. Which of Newton's Laws does this show? *1st*


What is Newton's 1st Law? *Inertia*

What is Newton's 2nd Law? $F = ma$

What is Newton's 3rd Law? *Equal + opposite*

An unbalanced or net force causes an object to change Speed or direction. (Use this for the next question.)

A car has three ways to accelerate. What are they? *speed up, slow down, change direction*

Which of Newton's Laws applies? 

A) 2 A racing car needs to accelerate faster, so they make the car lighter.

B) 3 You push your knuckles into a table and your knuckles start to hurt.

C) 1 For a sky diver to fall thru the air at a constant speed, the force of gravity and the force of air friction must be equal.

Which of Newton's Laws applies?

A. 3 To walk forward, your foot has to push backwards.

B. 2 Your car will accelerate faster if you don't have extra weight in the trunk.

C. 1 Without a seat belt, you would be launched forward if your car stops suddenly.